CHAPTER 3

AFFECTED ENVIRONMENT

MONTANA

CHAPTER 3: AFFECTED ENVIRONMENT

Introduction

This chapter contains a description of the natural resources, economic and social conditions found in the Planning Area, including the two Indian reservations that lie within the Planning Area boundary.

Air Quality and Climate

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

Topography

The SEIS Planning Area is located in the northern portion of the Powder River Basin of the northwestern Great Plains Steppe in southeastern Montana. The Great Plains Steppe is a large physiographic province extending throughout most of eastern Montana, Wyoming and Colorado, as well as portions of western North and South Dakota, Nebraska, Kansas and the Oklahoma panhandle. The topography of the Planning Area varies from moderately steep to steep mountains and canyons in the western portions, to rolling plains and tablelands of moderate relief (with occasional valleys, canyons and buttes) in the eastern regions. Elevations generally range from about 3,000 to 7,000 feet above mean sea level, with mountain peaks rising to over 10,000 feet in the southwestern portion of the Planning Area.

Climate and Meteorology

Because of the variation in elevation and topography throughout the Planning Area, climatic conditions will vary considerably. Most of the area is classified as a semiarid cool steppe, where evaporation exceeds precipitation, with relatively short warm summers and longer cold winters. On the plains, average daily temperatures typically range between 5 to 10 (low) and 30 to 35 (high) degrees Fahrenheit in mid-winter and between 55 to 60 (low) and 85 to 90 (high) degrees Fahrenheit in mid-summer. The frost-free period (at 32 degrees Fahrenheit) generally occurs for 120 days between late May and mid-September. The annual average total precipitation is nearly 12 to 16 inches, with 36 to 60 inches of total annual snowfall. Temperatures will generally be cooler, frost-free periods shorter and both precipitation and snowfall greater at the higher elevations, including the mountains in the southwest portion of the Planning Area.

Prevailing surface winds occur from the southwest, but local wind conditions will reflect channeling (mountain and valley flows) due to complex terrain. Nighttime cooling will enhance stable air, inhibiting air pollutant mixing and enhancing transport along the valley drainages. Dispersion potential will improve along ridge and mountain tops, especially during winter-spring weather transition periods and summer convective heating periods.

Existing Air Quality

Although site-specific air quality monitoring is not conducted throughout most of the Planning Area, air quality conditions are generally good and well within existing air quality standards, as characterized by limited air pollution emission sources (few industrial facilities and residential emissions in the relatively small communities and isolated ranches). Existing air quality throughout most of the analysis area is in attainment with all ambient air quality standards, as demonstrated by the data presented in Table 3-1.

However, three areas have been designated as federal nonattainment areas where the applicable standards have been exceeded in the past: Lame Deer (PM_{10}—moderate) and Laurel (SO_2—primary), Montana; and Sheridan, Wyoming (PM_{10}—moderate). Anticipated existing contributors of pollutants within the region include the following:

- Emissions from conventional oil and gas developments, e.g., natural gas-fired compressor engines (primarily carbon monoxide [CO] and oxides of nitrogen [NO_x])

What has Changed in Chapter 3 Since the Draft SEIS?

Chapter 3 describes the affected environment. The BLM Planning Area did not change between the Draft and Final SEIS; it remains the Powder River and Billings RMP areas. Changes to this chapter include grammatical clarifications and additional information regarding air quality analyses, climate, black footed ferret release, wolfs and sage-grouse data that have become available since publication of the Draft SEIS.

- Coal mining activities (i.e., $PM_{2.5}$ and PM_{10})
- Coal-fired power plants (primarily NO_X, SO_2 and CO)
- Gasoline and diesel vehicle tailpipe emissions of combustion pollutants (volatile organic compounds [VOC], CO, NO_x, fine particulate matter less than 2.5 microns in effective diameter [$PM_{2.5}$], inhalable particulate matter less than 10 microns in effective diameter [PM_{10}] and sulfur dioxide [SO_2]).
- Dust (particulate matter) generated by vehicle travel on unpaved roads, windblown dust from neighboring areas, including tilled agricultural fields, construction activities and road sanding during the winter months.
- Transport of air pollutants from emission sources located outside the region.

As part of the Air Quality Impact Assessment – Technical Support Document (Argonne 2002) and during the Draft Task 1A Report for the Powder River Basin Coal Review Current Air Quality Conditions (ENSR July 2005a) monitoring data measured throughout southeastern Montana and northeastern Wyoming were assembled and reviewed. Although monitoring is primarily conducted in urban or industrial areas and may be relatively higher than expected in the rural areas of the state, the data is considered representative of existing background air pollutant concentrations throughout the Planning Area.

These values, presented in Table 3-1, reflect conditions where existing air pollutant sources (e.g., industrial sources, range fires, agricultural operations, etc.) may be impacting ambient air concentrations and so were deemed to be reasonable for use to define existing background conditions in the air quality impact analysis. Although deemed representative, background values were not inserted into the modeling results for this study (ENSR July 2005a) because the purpose of this effort was to model a baseline of current conditions and evaluate potential changes due to sources in the study area. Existing air quality conditions were developed from the State and Local Air Quality Monitoring System (SLAMS) database. The assumed background pollutant concentrations are below applicable National Ambient Air Quality Standards (NAAQS) and applicable Montana Ambient Air Quality Standards (MAAQS) and Wyoming Ambient Air Quality Standards (WAAQS) for all pollutants and averaging times, as shown in Table 3-1.

Additional Air Quality Modeling Studies

Two additional air quality modeling efforts have recently been conducted and can be reviewed to provide additional information on current regional air quality. These are the Wyoming Powder River Basin Coal Review modeling being conducted by the Wyoming BLM; and the MDEQ cumulative modeling prepared as part of the Badger Hills POD. These efforts were initiated in 2005 and 2004, respectively.

Wyoming Powder River Basin Coal Review Model

BLM identified a need to prepare a cumulative study of future development activities in the Powder River Basin (PRB) in northeastern Wyoming (the PRB Coal Review). The study area encompasses all of Campbell County, all of Johnson and Sheridan Counties (except land managed by the U.S. Department of Agriculture [USDA] Forest Service [USFS]) and a major portion of northern Converse County. A portion of the PRB in south central Montana is also included. It touches on portions of Rosebud, Custer, Powder River, Big Horn and Treasure counties.

The PRB Coal Review is an assessment of potential impacts on ambient air and air quality related values (AQRVs) associated with coal activities and future development using the CALPUFF modeling system. The project domain modeled includes most of Wyoming and portions of adjacent states (Montana, South Dakota and Nebraska). The domain refers to the area analyzed in the model.

Accurate, up-to-date (mid 2004) emissions inventories are not available; thus, for purposes of this study, “current” is defined as the most recent year, 2002, for which accurate emissions data are available. Some of the potential development included in the analysis for the 2003 Final EIS is no longer planned; therefore, the PRB Coal Review Study does not include such sources. The 2003 Final EIS suggested that impacts from coal development (including CBNG) could be substantial; indicating that there would be several additional days of haze in the region and that some thresholds might be exceeded. Therefore, the PRB Coal Review Study included modeling current (2002) emissions (modeled baseline) from all sources and comparing those results with current ambient monitoring data. Anticipated changes in emissions subsequent to a base year were modeled for the PRB Coal Review analysis.

TABLE 3-1

BACKGROUND CONCENTRATIONS OF REGULATED AIR POLLUTANTS (μg/m³)

Pollutant	Averaging Time	Background Concentrations[1]		National Ambient Air Quality Standards	Montana Ambient Air Quality Standards[2]	Wyoming Ambient Air Quality Standards[2]
		MDEQ	WDEQ			
Carbon monoxide (CO)	8 hour	6,600	1,381	10,000	10,300	10,000
	1 hour	15,000	3,336	40,000	26,340	40,000
Nitrogen dioxide (NO_2)	Annual	11	5	100	94	100
	1 hour	117	-	n/a	564	n/a
Sulfur dioxide (SO_2)	Annual	16	13	80	53	60
	24 hour	89	62	365	260	260
	3 hour	325	181	1,300	n/a	1,300
	1 hour	666	-	n/a	1,300	n/a
Hydrogen Sulfide (H_2S)	1 hour	-	-	n/a	70	70[3]
Ozone (O_3)	8 hour	-	-	157	n/a	n/a
	1 hour[5]	-	-	235	200	n/a
$PM_{2.5}$	Annual	8	-	15	15	15
	24 hour	20	-	35	35	65
PM_{10}	Annual	30	13	Revoked[4]	50	50
	24 hour	105	54	150	150	150

Source: Argonne (2002), ENSR (2005), Wyoming DEQ (www.deq.state.wy.us/aqd/standards.asp), USEPA (www.epa.gov/air/criteria.html)

[1] Background numbers are from Montana DEQ (MDEQ 2002), Wyoming DEQ, Modeling protocol (Argonne 2002 and ENSR 2005a)

[2] The Montana and Wyoming Ambient Air Quality Standards apply equally across their respective states. Conversions from state standards in ppm were calculated using standard pressure (1 atmosphere) and temperature (298K).

[3] The 0.5-hour standard is not to be exceeded more than twice per year.

[4] Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, EPA revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).

[5] The ozone 1-hour standard applies only to areas that were designated nonattainment when the ozone 8-hour standard was adopted in July 1997. The 1-hour standard does not apply to Wyoming.

μg/m³ = micrograms per cubic meter

n/a = not applicable

PM_{10} fine particulate matter less than 10 microns in effective diameter

$PM_{2.5}$ fine particulate matter less than 2.5 microns in effective diameter

This approach of comparing the modeled baseline with the study's findings provided a more accurate assessment of the sensitivity of the region to future development, as well as a qualitative measure of how well the CALPUFF model emulates near- and far-field transport of source emissions characteristic of those in the PRB.

The 2005 PRB Coal Review cumulative modeled air quality impacts for 2010 indicated that potential concentrations of all criteria pollutants would be below NAAQS and Montana and Wyoming AAQS, except near-field PM_{10}. Hazardous air pollutants (HAPs) would be lower than reference exposure levels and reference concentrations for chronic inhalation, except for benzene. Far-field visibility modeled impacts showed three Class I areas (Badlands National Park, Northern Cheyenne Reservation and Wind Cave National Park) with more than 200 days of greater than 1 deciview, increasing with development based the All Sources emissions group. Atmospheric deposition of the sulfur level of concern (LOC) was below the established threshold of 5 kilograms per hectare per year and atmospheric deposition of the nitrogen LOC was below the established threshold of 3 kilograms per hectare per year. In addition, atmospheric deposition effects on lake chemistry, as determined through modeled impacts on the acid neutralizing capacity, showed raised impacts above the level of acceptable impact for two lakes (Upper Frozen Lake in Bridger Wilderness Area and Florence Lake in Cloud Peak Wilderness Area). No significant impacts were predicted for the identified lakes.

The coal study also contained projected air quality impacts for 2015 and 2020. The impacts were evaluated qualitatively for those periods by using comparative development levels for each of the source groups. Coal production in general was anticipated to contribute substantially to impacts on the near-field receptor grid in the project area, particularly PM_{10} impacts. The potential PM_{10} impacts were of greatest concern in the near-field and the projected increase in coal production likely would continue to affect the PM_{10} air quality levels. The 2010 modeling predicted potential exceedances of the 24-hour PM_{10} standard likely would be adversely affected by increased coal operations in 2015 and 2020. Increased development in 2015 and 2020 might lead to further visibility impacts at the Class I and identified Class II areas. In 2010, impacts on the non-affected lakes were well below the thresholds and expected increases in development likely would not lead to impacts beyond those noted in the model. The projected levels of increased coal production in 2015 and 2020 would not lead to a change in the impacts of HAP emissions for the near-field receptors in Montana or Wyoming. Furthermore, the qualitative results for 2015 and 2020 showed that no other NAAQS or state AAQS would be exceeded.

MDEQ Cumulative Model

The most recent cumulative impact modeling conducted by MDEQ was part of its review of the Badger Hills POD in 2004.

MDEQ conducted the recent cumulative impact modeling using EPA's approved Industrial Complex Short Term Version (ISCST3) model, Version 02035. This refined dispersion model uses detailed information regarding the region's meteorology, terrain and local emissions sources to estimate ambient air pollutant concentrations. The modeling analyses used the ISCST3 model in the regulatory default mode and EPA-approved modeling options.

Each emission source identified at all of the CBNG compressor stations was included in the air dispersion model as a point source. The model input data included stack exit height, temperature, velocity and stack diameter for each of the modeled emission sources. The permitted allowable emissions were used in the model for all Montana and Wyoming sources, rather than actual emissions. Typically, NAAQS/MAAQS demonstrations are conducted using permitted allowable emissions, whereas PSD increment analyses are conducted using actual emissions. Since all emission sources represented in this modeling study were permitted allowable emissions, the Class I/Class II increment analysis was conducted using permitted allowable emissions instead of actual emission estimates. Therefore, the Class I/Class II increment analysis results must be considered conservative, because not all emissions would be expected to operate continuously at maximum permitted levels.

This MDEQ cumulative modeling analysis demonstrated that CBNG development currently complies with the MAAQS/NAAQS and the PSD Class I/Class II increments. The peak modeled concentrations are located close to sources (John Coefield, personal communication, MDEQ 11/18/05).

Additionally MDEQ, EPA and the Northern Cheyenne Tribe are conducting a cumulative analysis of the Northern Cheyenne's Class I airshed increment. This study is intended to determine the definitive increment for the reservation for NO_X, SO_2 and PM_{10}. MDEQ anticipates this study will be completed by the end of summer 2008.

Existing Monitoring Network

MDEQ operates various types of equipment to measure pollutants and meteorological parameters at monitoring sites across Montana. Within the Planning Area, MDEQ presently maintains five monitoring facilities in the Billings metropolitan area and has additional, permit-required monitoring facilities in and around Colstrip. These additional facilities are operated by Pennsylvania Power and Light (PPL), formerly Montana Power Company (MPC). MPC/PPL also supports a tribal air monitoring program on the Northern Cheyenne Reservation.

Billings

The five monitoring stations currently operating in the Billings area are the Bridal Shop, Coburn Road, Lockwood Park, Lower Coburn Road and Mount Olive Stations. These monitoring stations conduct ambient sampling for various parameters and at various frequencies. Each is discussed below:

The Bridal Shop site has been collecting data since December 1997. It is a continuous (hourly) carbon monoxide (CO) monitoring site, but it has also previously collected meteorological (wind speed, wind direction and standard deviation of wind direction) data. The Aerometric Information Retrieval System (AIRS) reference number for this site is 30-111-0082. The Bridal Shop site is located at 8 Grand Avenue, Billings, Montana.

The Coburn Road site is a continuous (hourly) and 5-minute sulfur dioxide (SO_2) monitoring site. It has been collecting data since January 1981. It also collects meteorological data (wind speed, wind direction, standard deviation of wind direction and temperature). The AIRS reference number for this site is 30-111-0066. The Coburn Road site is located on Coburn Road south of Billings, Montana.

The Lockwood Park monitoring site has been collecting PM_{10} data since January 1996, $PM_{2.5}$ data since January 1999 and SO_2 and meteorological data since November 1987. The AIRS reference number for this site is 30-111-1065. The Lockwood Park site is located on Old Hardin Road, Billings, Montana.

The Lower Coburn Road site has been collecting data since August 1999. It is a continuous (hourly) and 5-minute SO_2 monitoring site. The AIRS reference number for Lower Coburn Road is 30-111-0083. The Lower Coburn Road site is located on Coburn Road south of Billings and north of the Coburn Road site.

The Mount Olive site is a continuous (hourly) CO and SO_2 monitoring site. The AIRS reference number for this site is 30-111-0079. The Mount Olive site is located at Mount Olive Lutheran Church, 7 24th Street West, Billings, Montana.

Particulate monitoring has been conducted in Billings since 1971. Although there have been several total suspended particulate (TSP) sites in Yellowstone County, only those in the central part of Billings recorded elevated concentrations. PM_{10} monitoring in Billings started in December 1986 and continues today at the Lockwood Park (30-111-1065) site. There has never been a recorded PM_{10} exceedance in Billings.

The sulfur dioxide issue in Billings has focused on emissions from industrial facilities since the early 1980s. The monitoring network was scaled down in 1996 when low sulfur coal was introduced and a dramatic drop in ambient levels was observed. Today, four of the five monitoring stations collect SO_2 data.

Billings is in an area where sources emit fairly large quantities of VOC and NO_x. Billings is also an area where hot summer days may promote photochemical reactions. EPA defines the ozone monitoring season for Montana as June 1 to September 30. Ozone data collected at monitoring sites showed higher concentrations in the summer months, but all were within the NAAQS. The ozone monitoring was discontinued in September 1989 because the readings were low. Since then, MDEQ has not conducted ozone monitoring.

Monitoring of CO is limited to two stations in the Billings area. NO_2 monitoring is not conducted at any of the stations.

Colstrip

The air quality concern for particulate in Rosebud County (population 9,383) centers around the cities of Colstrip and Ashland. Five coal-fired power generating plants and two large coal mines are near Colstrip. Montana Power Company, Western Energy Company, Colstrip Energy Limited Partnership (CELP) and Big Sky Coal Company have operated particulate sampling networks around their facilities as conditions of their permits. In Ashland, there have been recent concerns due to area sources, including wood- and coal-burning stoves.

MDEQ asked MPC/PPL to install and operate a PM_{10} site at its MPC Site 3 in Colstrip. Two samplers (reporting and collocated) were installed in December 1989 and the data were submitted to MDEQ. The TSP samplers at MPC Sites 1 and 2 were replaced with PM_{10} samplers in July 1992. At that time, MDEQ required MPC/PPL to operate the PM_{10} samplers at all sites on an every-third-day sampling schedule. In July 1994, MPC/PPL requested that MDEQ review its Colstrip PM_{10} network. As a result of that review, changes were allowed, starting on July 1, 1995. The PM_{10} sampling frequency at Site 1 was reduced to once every sixth day and the PM_{10} sampling at Site 2 was terminated. The long history of low values led to termination of Site 1 in 2002.

MPC/PPL maintains an ambient network around the facility and supports a tribal air monitoring program on the Northern Cheyenne Reservation. The tribal network consists of three sites: Morning Star, Garfield Peak and Badger Peak. MPC/PPL also operates three SO_2 sites. These are at MPC 1, MPC 2 and MPC 3. Years of data from the sites around the MPC/PPL facility revealed little to no accumulation and SO_2 monitoring at the facility was discontinued at the end of 2001.

MPC/PPL also maintained an ambient network for NO_2 around the facility through 2001. It continues to support a tribal air monitoring program on the Northern Cheyenne Reservation. Nearly 20 years of data collection around the facility revealed no significant NO_2 in the area. As a result of these findings, NO_2 monitoring around the MPC facility was terminated in 2001.

MDEQ conducted ozone monitoring in Colstrip from 1975 through 1977 at the BN monitoring site. MDEQ also conducted ozone monitoring in Colstrip at the McRae monitoring site in 1974 and 1975. Many exceedances of the NAAQS (1-hour concentrations) were recorded at the BN site, while no exceedances of the NAAQS or MAAQS were recorded at the McRae monitor.

Regulatory Framework

The NAAQS and MAAQS set the absolute upper limits for specific air pollutant concentrations at all locations where the public has access. The analysis of the proposed Alternatives must demonstrate continued compliance with all applicable local, state, tribal and federal air quality standards. Montana's ambient standards are not applicable within the reservation but apply to adjacent areas off the reservation. The EPA recently revised both the ozone (8-hour) and $PM_{2.5}$ NAAQS; these revised limits will not be effective until the Montana State Implementation Plan (SIP) is formally approved by EPA. On November 9, 2005, EPA issued a final rule to take the next steps to protect the American public from ground-level ozone pollution. This rule, often called the Phase 2 Ozone

Rule, describes the plans states must make to reduce ground level ozone. These plans, known as state implementation plans or SIPs, were to be submitted to EPA by June 2007.

Although EPA promulgated the NAAQS for $PM_{2.5}$ in July 1997, it lacked the necessary data to make designations. Therefore, the $PM_{2.5}$ designations were not finalized until April 5, 2005. The Clean Air Act requires states with designated nonattainment areas to develop a state implementation plan and submit it to the EPA within 3 years (April 2008).

Given that most of the Planning Area is in attainment with the NAAQS, future development projects (including any proposed Alternative) which have the potential to emit more than 250 tons per year of any criteria pollutant (or certain listed sources that have the potential to emit more than 100 tons per year) would be required to undergo a regulatory Prevention of Significant Deterioration (PSD) Increment Consumption analysis under the federal New Source Review and permitting regulations. Development projects subject to the PSD regulations must also demonstrate the use of Best Available Control Technology (BACT) and show that the combined impacts of all PSD sources will not exceed the allowable incremental air quality impacts for NO_2, SO_2 and PM_{10}. A regulatory PSD Increment Consumption analysis may be conducted as part of a major New Source Review, or independently. The determination of PSD increment consumption is a legal responsibility of the applicable air quality regulatory agencies, with EPA oversight. Finally, an analysis of cumulative impacts due to all existing sources and the permit applicant's sources, is also required during New Source Review to demonstrate that applicable ambient air quality standards will be met during the operational lifetime of the permit applicant's operations.

MDEQ requires that ambient air quality modeling be conducted for CBNG facilities that exceed the 25-ton-per-year Montana Air Quality Permit (MAQP) threshold, regardless of the potential to emit (PTE) of the facility. This is required to demonstrate compliance with the MAAQS/NAAQS. In addition, MDEQ requires that the modeling include an NO_X PSD increment analysis to demonstrate compliance with the Class I NO_X increment and the Class II NO_X increment, regardless of whether PSD applies to the facility.

The permit writer also provides a list of sources to be included in the modeling effort and recommends the appropriate near-field model to be used i.e. AERMOD, CALPUFF, SCREEN3. In addition an evaluation of cumulative effects is required.

MDEQ will continue to require MAQP applicants to model NO_X emitting units that locate in the area defined by the MT FEIS to ensure that the MAAQS and NAAQS, as well as the Class I and Class II NO_X PSD increments, are not exceeded. In addition, as CBNG development continues, or as CBNG facilities are proposed on properties closer to the Northern Cheyenne Indian Reservation, MDEQ intends to continue to require applicants to conduct NO_X PSD Class II increment analyses, as well as NO_X PSD Class I increment analyses. As CBNG development becomes more prevalent in Montana, MDEQ intends to require applicants conducting ambient air quality modeling for CBNG facilities to perform a cumulative impact modeling study. That is, MDEQ intends to require applicants conducting modeling for CBNG facilities to include the receptors that showed the highest impacts from previous models.

In 2005, MDEQ approved a new air permitting program that requires oil and gas facilities with a PTE greater than 25 tons per year to apply for an air permit before initiating operation of a new facility. The agency also initiated a new air registration program in 2006 to further regulate oil and gas activities across the state. Together, these new air permitting programs provide enforceable conditions that ensure both existing and future oil and gas activities are in compliance with state and federal regulatory requirements.

Mandatory federal Class I areas were designated by the U.S. Congress on August 7, 1977. These areas included wilderness areas greater than 5,000 acres in size and national parks greater than 6,000 acres in size on that date. In addition, the Fort Peck and Northern Cheyenne tribes have designated their lands as PSD Class I areas. The allowable incremental impacts for NO_2, SO_2 and PM_{10} within these PSD Class I areas are limited to ensure these areas remain pristine. In other locations of the country that are designated as PSD Class II areas, the requirements on future development are less stringent. Table 3-2 shows the relevant ambient air quality standards and PSD increment values.

This NEPA analysis compares potential air quality impacts from the proposed Alternatives to applicable ambient air quality standards and PSD increments. The comparisons to the PSD Class I and II increments are only intended to evaluate a threshold of concern for potential impacts and do not represent a regulatory PSD increment consumption analysis. Even though most of the development activities would occur within areas designated PSD Class II, the potential impacts on regional Class I areas are to be evaluated. MDEQ is responsible for performing any required regulatory PSD increment analysis as a part of the new source review process. The MDEQ's formal regulatory process would include an analysis of impacts on Class I and II air quality areas by emission sources following a triggered baseline date. Future development activities are not allowed to consume more of the increment than is available within that PSD Class I or II area. To ensure compliance, stringent emission controls (BACT) and emission limits may be stipulated by state agencies in air quality permits as a result of their increment review. In more radical circumstances, a permit could be denied due to the lack of available increment.

In addition, sources subject to the PSD permit review procedure are required to demonstrate impacts on Air Quality Related Values (AQRV) will be below Federal Land Managers' "Limits of Acceptable Change." The AQRVs to be evaluated include potential reduction of the acid neutralizing capability in mountain lakes from atmospheric deposition (acid rain), visibility impacts and effects on sensitive flora and fauna in the Class I areas. The Clean Air Act (CAA) also provides specific visibility protection procedures for the mandatory federal Class I areas designated by the U.S. Congress. Although the Fort Peck and Northern Cheyenne Tribes have also designated their lands as voluntary PSD Class I areas, national visibility regulations do not apply in these areas. Finally, the CAA directs the EPA to promulgate the Tribal Authority Rule, establishing tribal jurisdiction over air emission sources on both trust and private lands within the exterior boundaries of tribal lands. Pursuant to this rule, Native American tribes may submit a "Treatment as a State" application to the EPA, requesting that they be treated in the same manner as a state under the CAA, including Section 105 grants and formal recognition as an affected "state" when permits are written for sources within 50 miles of tribal land boundaries (per 40 CFR 70.8 and 71.2). Also, the tribes can be delegated authority to establish an Operating Permits Program under Title V of the CAA, in order to issue permits for air pollutant major emission sources located within the exterior boundaries of tribal lands.

The Northern Cheyenne Tribe has held "Treatment as a State" status since 1999. Under EPA Program Section 105, the tribe conducts air quality monitoring for PM_{10} to support PSD increment studies. According to the MDEQ 2003 Air Monitoring Network Report (MDEQ AQ 2003) the MPC/PPL has been supporting the air quality monitoring on the Northern Cheyenne Reservation for a number of years. However, the Montana Power Company recently terminated its last PM_{10} monitoring site outside the coal fired power plants near Colstrip in 2002 due "to a long history of low values," as stated in the report.

TABLE 3-2

APPLICABLE AMBIENT AIR QUALITY STANDARDS AND PSD INCREMENT VALUES ($\mu g/m^3$)

Pollutant	Averaging Time [1]	National Primary	National Secondary	Montana	PSD Class I Increments	PSD Class II Increments
Carbon monoxide	8-hours	10,000	10,000	10,300	n/a	n/a
	1-hour	40,000	40,000	26,340	n/a	n/a
Nitrogen dioxide	Annual	100	100	94	2.5	25
	1-hour	n/a	n/a	564	n/a	n/a
Ozone	8-hours	157	157	n/a	n/a	n/a
	1-hour	235	235	200	n/a	n/a
Sulfur dioxide	Annual	80	n/a	53	2	20
	24-hours	365	n/a	260	5	91
	3-hours	n/a	1300	n/a	25	512
	1-hour	n/a	n/a	1300	n/a	n/a
$PM_{2.5}$	Annual	15	15	15	n/a	n/a
	24-hours	35	35	35	n/a	n/a
PM_{10}	Annual	revoked	50	50	4	17
	24-hours	150	150	150	8	30
Lead	Quarterly	1.5	1.5	1.5	n/a	n/a

Source: Argonne (2002).

[1] Annual standards are not to be exceeded; short-term standards are not to be exceeded more than once per year.

n/a = not applicable.

$\mu g/m^3$ = micrograms per cubic meter

Climate Change

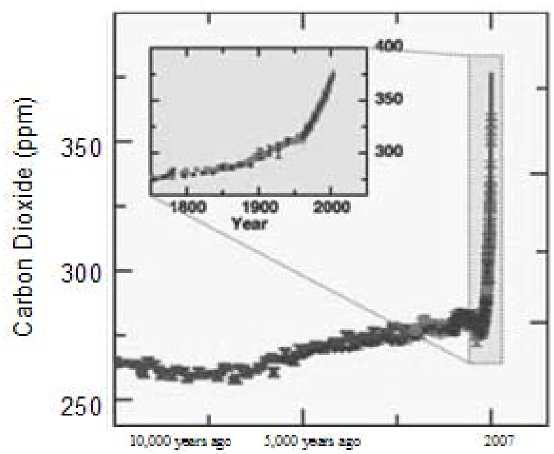
The National Academy of Sciences has noted that "Most scientists agree that the warming in recent decades has been caused primarily by human activities that have increased the amount of greenhouse gases in the atmosphere." The National Academy of Sciences has also indicated that "There is no doubt that climate will continue to change throughout the 21st century and beyond, but there are still important questions regarding how large and how fast these changes will be, and what effects they will have in different regions." (NAS, 2008). It has also been noted that "[a]s with any field of scientific study, there are uncertainties associated with the science of climate change. This does not imply that scientists do not have confidence in many aspects of climate science. Some aspects of the science are known with virtual certainty, because they are based on well-known physical laws and documented trends" (EPA, 2007a).

The primary gas associated with climate change is carbon dioxide (CO_2). Methane (CH_4), nitrous oxide, sulfur hexafluoride, hydrofluorocarbons, and perfluorocarbons are also associated with climate change. Together these gases are typically referred to as greenhouse gases (GHGs). Emissions of GHGs are typically reported as CO_2 equivalents (CO_2e), which is the amount of the gas emitted, multiplied by its warming potential relative to CO_2. Through complex interactions on a regional and global scale, these emissions cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the Earth back into space (NAS, 2008).

Although GHG levels and corresponding variations in climatic conditions have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2 concentrations in the atmosphere to increase dramatically, and these increases may contribute to overall climatic changes, typically referred to as global warming. Over the past three centuries the concentration of CO_2 has been increasing in the earth's atmosphere. In the early 1700s CO_2 concentrations have been estimated to be approximately 280 parts per million (ppm), while in 2005 the concentration was approximately 381 ppm (*See* Figure 3-CC-1) (Neftel et al., 1994; Keeling & Whorf, 2006).

The Center for Climate Strategies (CCS) prepared a report under contract to the Montana Department of Environment Quality (MDEQ) (CCS, 2007). The report contains an inventory of the State's GHG emissions. Activities in Montana accounted for approximately 36.8 million metric tons (MMT) of CO_2e emissions in 2005. This report also projects that in Montana there will be 38.5 MMT of CO_2e emitted in 2010, and 41.7 MMT of CO_2e emitted 2020. These figures are for the reference case scenario which "[a]ssumes very limited CBM activity" (CCS, 2007). Therefore, this scenario is comparable to that assumed for Alternative A (Existing Management).

Figure 3-CC-1: IPCC ESTIMATED CHANGE IN CO_2 OVER TIME



(Figure obtained from IPCC, 2007)

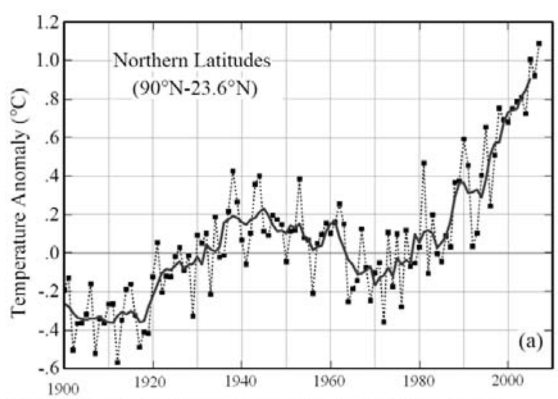
National and global carbon dioxide emissions for 2004 were tabulated by Energy Information Administration (EIA) in their Emissions of Greenhouse Gases Report (EIA, 2007). This information indicates that in 2005 there were approximately 7181 MMT of CO_2e emissions in the US. From the data in this report it can be extrapolated that U.S. CO_2e emissions in 2010 and 2020 will be approximately 7405 and 8275 MMT CO_2e respectively; assuming that the mix of GHGs remains constant. The data in this report can also be combined with data from the EPA (2006) for global non-CO_2 GHG emissions to estimate current and future CO_2e emission values. This analysis shows that in 2004 total global CO_2e emissions would have been approximately 36,510 MMT. It can also be projected that in 2010 global CO_2e emissions will be approximately 41,851 MMT, and in 2020 global CO_2e emissions will be approximately 49,750 MMT.

Human influences believed to have contributed to this rise include the combustion of fossil fuels, conversion of natural prairie to farmland, and deforestation (EPA, 2008a). In 2006 the primary GHG emitted by human activities in the U.S. was CO_2, representing approximately 84.8 percent of total GHG emissions, with the largest source of CO_2 being fossil fuel combustion. Conversely, U.S. GHG emissions are partly offset by carbon sequestration in forests, trees, in urban areas, and agricultural soils, which in aggregate, offset 12.5 percent of total emissions in 2006 (EPA 2008b).

Global mean surface temperatures have increased nearly 1.8°F (1.0°C) from 1890 to 2006 (Goddard Institute for Space Studies, 2008), but observations and predictive models indicate that average temperature changes are likely to be greatest in the Northern Hemisphere. Figure 3-CC-2 demonstrates that northern latitudes (above 24° N – which includes all of the United States) have exhibited temperature increases of over 2.3°F (1.3°C) since 1900, with approximately a 2.2°F (1.2°C) increase since 1970. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHG are likely to accelerate the rate of climate change.

The Intergovernmental Panel on Climate Change (IPCC) has recently completed a comprehensive report assessing the current state of knowledge on climate change, its potential impacts, and options for adaptation and mitigation (IPCC, 2007). The IPCC has reported that "[g]lobal mean surface temperatures have risen by 0.74°C ± 0.18°C [1.3± 0.3°F] when estimated by a linear trend over the last 100 years (1906–2005)". The IPCC has also determined that "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic (man-made) greenhouse gas concentrations" (IPCC, 2007). The National Academy of Sciences (NAS, 2008) has also noted that "model simulations of temperature changes during the past century only match the observed temperature increase when greenhouse gas increases and other human causes are included".

Figure 3-CC-2: Annual Mean Temperature Change for Northern Latitudes



Annual and five-year running mean temperature change for northern latitudes. Uncertainty bars (95% confidence limits) are based on spatial sampling analysis. [This is an update of Figure 5 in Hansen et al. (1999).]
Source: Goddard Institute for Space Studies (2008)

The National Assessment Synthesis Team (NAST, 2000) has determined that "Across the Northern and Central Great Plains, temperatures have risen more than 2ºF (1ºC) in the past century, with increases up to 5.5ºF (3ºC) in parts of Montana, North Dakota, and South Dakota. In the southern Great Plains, the 20th century temperature record shows no trend. Over the last 100 years, annual precipitation has decreased by 10% in eastern Montana, North Dakota, eastern Wyoming, and Colorado. In the eastern portion of the Great Plains, precipitation has increased by more than 10%. Texas has experienced significantly more high intensity rainfall. The snow season ends earlier in the spring, reflecting the greater seasonal warming in winter and spring."

It is difficult to attribute any particular weather event to global climate change; however a comparison can be made between the anticipated impacts from global warming and recent observations. The EPA (2008a) has made several projections of cumulative effects for Region 8 (including the Planning Area) which can be compared to observed conditions. For this comparison the most recent 10 years is compared to the historical record for several parameters in order to evaluate recent trends relative to historic trends. These are discussed below.

Projection: *The region will experience warmer temperatures overall…*

Observed conditions:

Data from the Western Regional Climate Center (WRCC, 2008a) indicate that for the Miles City Airport the average annual temperature from 1937-1997 was 45.8°F (7.7°C). From 1998-2007 (the last 10 years of record) the average annual temperature has been 47.5°F (8.6°C), for an overall increase of 1.7°F (0.9°C). The five warmest years in the record (from warmest to coolest) are 2007, 1987, 1999, 1981, and 1998 (See Fig 3-CC-3). These results appear to be in line with the EPA (2008a) projection.

Figure 3-CC-3

(Data from http://www.wrcc.dri.edu/summary/Climsmemt.html)

Projection: *Temperatures are expected to increase more in the winter than in the summer…*

Observed conditions:

As discussed above, there has been an overall increase of 1.7°F (0.9°C) when average annual temperature records at Miles City from 1937-1997 are compared to 1998-2007. The monthly mean temperatures can also be grouped by season. For this analysis temperatures from December, January, February and March are considered "Winter" and temperatures from June, July, August and September are considered "Summer". Following this approach the mean winter temperature at Miles City from 1937-1997 was 23.1°F (-4.9°C), while the mean winter temperature from 1998-2007 was 27.0°F (-2.8°C). This represents a difference of 3.9°F (2.1°C). The mean summer temperature at Miles City from 1937-1997 was 68.3°F (20.2°C), while the mean summer temperature from 1998-2007 was 69.4°F (20.8°C). This represents a difference of 1.1°F (0.6°C). These results appear to be in line with the EPA (2008a) projection.

Projection: *The region will experience … less snowfall.*

Observed conditions:

Snowfall records are not available from the WRCC for Miles City; however there is data from Burgess Junction, WY (in the Bighorn Mountains). While the values from this station are not directly applicable to the Powder River Basin, the trends should be meaningful, particularly since the Tongue and Powder Rivers obtain a significant portion of their flow from snowmelt in the Bighorn Mountains. Data from the WRCC (2008b) indicate that for Burgess Junction the average annual snowfall from 1960-1997 was 233 inches. From 1998-2007 the average annual snowfall was 255 inches. The five winters with the least snowfall (from least to most) were 1965-66, 1978-79, 1980-81, 1966-67, and 1968-69. These results do not support the EPA (2008a) projection.

Projection: *Earlier snowmelt means peak stream flows will be earlier…*

Observed conditions:

Average Mean Daily Discharge data from the Tongue River at Miles City can be compared from 1937-1997, and from 1998-2007. The average date of the peak stream flow from 1937-1997 occurred on May 28th. From 1998-2007 the average date of the peak stream occurred on June 3rd. Peak stream flows are thus occurring, on average, seven days later. This result does not support the EPA (2008a) projection.

Projection: *In late summer, rivers…will be drier.*

Observed conditions:

Minimum observed flows during August and September (late summer) can be compared from 1937-1997 and from 1998-2007. The average minimum late summer flow from 1937-1997 was 86 cfs. From 1998-2007 the average minimum late summer flow was 49 cfs. This represents a 37 cfs (43%) decrease in late summer flows. These results appear to be in line with the EPA (2008a) projection.

BLM recognizes the importance of climate change and the potential effects it may have on the natural environment. Several activities associated with the decisions in the MT SEIS/Proposed Amendments regarding CBNG development may generate emissions of climate changing pollutants. GHG emissions from CBNG development are anticipated to result from the burning of fossil fuels in compressor engines, and from methane emissions during processing. Wind erosion from disturbed areas and fugitive dust from roads along with entrained atmospheric dust have the potential to darken glacial surfaces and snow packs resulting in faster snowmelt.

Cultural and Historical

Cultural resources consist of the material remains of—or the locations of—past human activities, including traditional cultural properties (TCP) to both past and contemporary Native American Communities. Cultural resources within the Planning Area represent human occupation throughout two broad periods: the prehistoric and the historic. The prehistoric period is separated into the Paleo-Indian Period (circa 10,000 B.C. to 5,500 B.C.), the Archaic Period (circa 5,500 B.C. to A.D. 500), the Late Prehistoric Period (circa A.D. 500 to 1750) and the Proto-historic Period (circa 1750 to 1805+). The prehistoric period began with the arrival of humans to the area around 12,000 years ago and is generally considered to have ended in 1805 when the Lewis and Clark Expedition passed through the area. Cultural resources relating to the prehistoric period may consist of scatters of flaked and ground stone tools and debris, stone quarry locations, hearths and other camp debris, stone circles, wooden lodges and other evidence of domestic structures, occupied or utilized rock shelters and caves, game traps and kill sites and petroglyphs, pictographs, stone cairns and alignments and other features associated with past human activities. Some of these sites contain cultural resource features that are in buried deposits.

The historic period is characterized by the arrival of fur traders and explorers to the area and is the start of the period for which written records exist. Cultural resources within the Planning Area that are associated with the historic period consist of fur trading posts, homesteads, settlements, historic emigrant and stage trails, Indian war period battle sites, ranch development, railroad installations, mining operations, oil and gas fields and Native American sites.

The following areas are designated cultural Areas of Critical Environmental Concern (ACECs):

- Powder River Resource Management Plan (RMP) area—Battle Butte ACEC is a 120-acre site in Rosebud County. Reynolds Battlefield ACEC is a 336-acre site in Powder River County.
- Billings RMP area—Pompeys Pillar is a 470-acre site in Yellowstone County. Castle Butte ACEC is a 185-acre site in Yellowstone County. Petroglyph Canyon is a 240-acre in Carbon County. The Stark Site is an 800-acre site in western Musselshell County. Weatherman Draw is a 4,268-acre site in Carbon County.

Each of these ACECs has their own management plans that include restrictions on activities and development (BLM 1999a). Two additional cultural resource sites, the Mill Iron and Powers-Yonkee sites in the Powder River RMP area, have been designated Special Management Areas (SMAs) that also have their own management plans that include restrictions on activities and development.

TCPs in southeastern Montana that are currently important to Native Americans, include ceremonial, homestead, burial, cairn, rock art, fasting, medicine wheel, medicine lodges, settlements, stone rings, Sun Dance lodges, communal kills and battle/raiding sites as well as rivers, springs, spirit homes and vision quest spiritual locations and landscapes that include plant collecting areas, fossil and mineral locations, paint sources and water. For the Northern Cheyenne these include TCPs in or near Deer Medicine Rocks, Little Bighorn Battlefield, Medicine Rock Site, Chalk Buttes, locations in and around Custer National Forest and the Tongue River Valley. Detailed descriptions of these locations and their importance to the Northern Cheyenne can be found in the “The Northern Cheyenne Tribe and its Reservation” (Northern Cheyenne Tribe 2002). Crow TCPs include the west slopes of the Pryor Mountains, Tongue River Valley, Chalk Buttes, Broadus and Bighorn mountains (Crow Tribe 2002). Other TCPs exist in the Planning Area for tribes such as the Lower Brule Sioux and the Turtle Mountain Band of Chippewa, but they have not been specifically identified.

The existence of cultural resources within a specific location is determined through examination of existing records, on-the-ground surveys and subsurface testing of areas that are proposed for disturbance on federal, state and private lands. Cultural resources are evaluated if federal or state minerals are involved and, for traditional cultural properties, consultation with appointed tribal government representatives who have knowledge of and can address issues of traditional cultural significance. Section 106 of the National Historic Preservation Act (NHPA) requires an inventory of cultural resources if federal involvement is present either in terms of surface or mineral estate, federal funds, federal grant, or federal license. Consultation with federally recognized Native American tribes must also be conducted to evaluate TCPs. The Montana State Historical Preservation Officer (SHPO) maintains a register of all identified sites within each of Montana’s counties as well as all sites that are listed or eligible for listing on the National Register of Historic Places (NRHP).
Table 3-3 contains information about the number of cultural resource sites that have been identified to date by SHPO for each of the counties within the Planning Area. Also included in this exhibit is information about the number and density of sites that are known to be located within the current area of CBNG production. This table has been updated based on 67,158 acres of

TABLE 3-3

CULTURAL RESOURCE SITES IDENTIFIED BY SHPO WITHIN EACH COUNTY OF THE PLANNING AREA

RMP Area County	Number of Cultural Resource Sites Identified in Surveys	Number of Acres Surveyed	Number of Sites Per Surveyed 1,000 Acres	Acres Within the County	Percent of County Surveyed	Extrapolated Number of Sites In the County	Number of NRHP Sites Listed
Powder River RMP Area							
Carter	1,007	135,233	7.45	2,132,128	6.3	15,877	0
Powder River	1,807	94,468	19.13	2,109,880	4.5	40,358	1
Custer	812	44,346	18.31	2,425,137	1.8	44,406	15
Rosebud	1,689	200,413	8.43	3,213,997	6.2	27,086	16
Treasure	109	16,356	6.66	629,224	2.6	4,193	2
Subtotal	*5,424*	*490,816*	*11.05*	*10,510,366*	*4.7*	*131,920*	*34*
Billings RMP Area							
Wheatland	235	8,086	29.06	913,079	0.9	26,536	2
Sweet Grass	272	27,591	9.86	1,190,833	2.3	11,740	8
Stillwater	302	10,770	28.04	1,154,243	0.9	32,366	8
Carbon	1,367	41,469	32.96	1,319,367	3.1	43,492	64
Golden Valley	126	9,997	12.62	752,094	1.3	9,489	3
Musselshell	568	39,608	14.34	1,196,032	3.3	17,152	1
Yellowstone	918	48,087	19.09	1,693,991	2.8	32,339	22
Big Horn**	2,061	293,115	7.03	3,208,115	9.1	22,557	40
Subtotal	*5,849*	*478,723*	*12.22*	*11,427,754*	*4.2*	*195,671*	*148*
Total for SEIS Planning Area*	11,273	969,529	11.63	21,938,120	4.4	327,591	182
CBNG Area Above Known Coal Reserves			11.53	7,286,144		84,009	

* CBNG Production Area includes portions of Big Horn, Rosebud and Powder River counties where active coal mining is currently conducted and where federal and non-federal CBNG production wells currently exist.

**Also includes portion of Powder River RMP area.

Note: Information obtained from SHPO current as of November 2, 2004.

additional surveying done since the completion of the Statewide Document.

A complete listing of SHPO recorded sites can be found in "An Ethnographic Overview of Southeast Montana" (Peterson and Deaver 2002) along with a listing of sites mentioned in literary sources, potential homestead locations and spring locations.

The SEIS predicts 36,944 fewer cultural resource sites than the BLM 2003 Statewide Plan. This difference reflects improvements to eliminate duplication in the SHPO database and the exclusion of Blaine, Gallatin and Park counties from the SEIS planning area.

Approximately 4.4 percent of the SEIS Planning Area has been surveyed for cultural resources resulting in a total of 11,273 cultural resource properties or sites being identified. This represents an average density of 11.6 sites per 1,000 surveyed acres or, assuming an equal distribution of sites, one site per 86 surveyed acres. Assuming this data across the total acreage contained within the counties of the Planning Area yields a total of 327,591 cultural resource properties or sites that might be expected. A total of 3,744 sites have been identified in those portions of Big Horn, Rosebud and Powder River counties that represent the area with the greatest potential for CBNG production, with an average density of 11.5 sites per 1,000 surveyed acres or, assuming an equal distribution of sites, one site per 87 acres. Extrapolated data yields a total of 84,009 sites that might be expected within the CBNG production area.

The site densities estimated above are, of course, extrapolated assuming a consistent distribution within each county. This analysis is only valid for general site number estimates and not for site location or type of site. Sites cluster based on a host of additional site location information such as geographical location, access to water, plant, animal and other resources, view and visibility, exposure, etc. The type of site is directly related to site location depending on the activity conducted at the site. Easily accessible geographical classification and other associated site data did not exist at the time this report was prepared and the estimates provided are the best that can be made at this time.

The data used for this analysis were based, in part, on surveys conducted more than 20 years ago and on recent surveys conducted for CBNG development projects. Standards for survey and recordation have changed and it is likely that the actual number of sites and their relative density is higher than indicated on Table 3-3. Despite these anticipated differences the general findings of this analysis are still valid.

Two reviews were prepared: the Class I Literature Review for the Miles City Field Office (MCFO) RMP Revision and the Landscape Level Overview for CBNG development areas in Montana. The Class I literature review for cultural resources was prepared to construct an overview of the cultural resources in the area. This document was prepared in concert with the State Historic Preservation Office to identify ongoing efforts and expand the knowledge of traditional uses within the Planning Area.

The Landscape Level Overview was prepared to provide a clear understanding of the cultural resources present within the CBNG development area and to identify any additional measures needed to protect these sites. A summary of the recent survey activity conducted for PODs is presented in Table 3-4.

Preservation projects within the Planning Area include the Rosebud Battle Field State Park Preservation Plan and the Tongue River Digital Archive Project (ACRS, 2006). Both projects were conducted by the Montana Preservation Alliance (MPA) through grants by the National Park Service.

The Rosebud Battlefield State Park Preservation Plan is being funded by the NPS American Battlefield Protection Program (ABPP) and is designed to create a broad and effective preservation plan to protect Rosebud Battlefield. MPA is working with Montana Fish, Wildlife and Parks (MFWP), leaders of tribes who share this history and other interested parties to produce a preservation plan for Rosebud Battlefield State Park and surrounding lands. The developers of the plan will strive to identify threats, lay out clear strategies for limiting the impacts of development and develop a design for long-term stewardship of the park's important historic and prehistoric cultural resources.

There are three existing National Historic Landmarks within the planning area. These include the Chief Plenty Coups Home, Pompey's Pillar and Pictograph Cave. Pictograph Cave and Chief Plenty Coups Home are state parks, while Pompey's Pillar is a National Monument/ACEC. Development is prohibited within state parks and National Monuments.

The Tongue River Digital Archive Project will create a digital archive of the rich cultural landscape that is the Tongue River Valley. The digital archive will integrate Native American and rural ranching traditions with rigorous historic sites recordation practices to create a lasting record of the history and cultural significance of valley resources.

The Tongue River Digital Archive project builds upon years of inquiry into the area's people, heritage resources and the land. MPA will visit historic places throughout the valley with Native American traditionalists and members of rural families to record important culture sites and stories. The information collected will be tagged to GIS cadastral maps, enabling photos and site forms to be called up from mapped points. The data will also be integrated into a statewide historic records database maintained by Montana's State Historic Preservation Office and the University of Montana.

TABLE 3-4

CULTURAL RESOURCE INVENTORIES FOR COAL BED NATURAL GAS and OTTER CREEK COAL TRACTS

Plan of Development (POD) Name	Sponsor	Cultural Resource Contractor	Total Acres	Acres BLM	Acres Private	Acres State	Total Sites	State Sites	Private Sites	BLM Sites	Previously. Recorded Sites – Not Relocated
Badger Hills	Fidelity E&P	Foothills Arch. Con[i]	604.0	0				Pre: 0 Hist: 0 Old: 0 New: 0 Isolates: 0	Pre: 0 Hist: 0 Old: 0 New: 0 Isolates: 1	Pre: 0 Hist: 0 Old: 0 New: 0 Isolates: 0	0
Badger Hills Infill	Fidelity E&P	Ethnoscience	3,544	123	2,810	611	18	Pre: 1 Hist: 0 Old: 0 New: 1 Isolates: 0	Pre: 12 Hist: 5 Old: 5 New: 12 Isolates: 2	Pre: 0 Hist: 0 Old: 0 New: 0 Isolates: 0	0
Coal Creek A	Powder River Gas	Western Land Services	736.40	0	736.40[ii]	0	3	Pre: 0 Hist: 0 New: 0 Old: 0 Isolates: 0	Pre: 2 Hist: 1 New: 3 Old: 0 Isolates: 6	Pre: 0 Hist: 0 New: 0 Old: 0 Isolates 0	0
Coal Creek 2	Powder River Gas	Western Land Services[iii]	1,720	160	1,560	0	22	Pre:0 Hist: 0 Old: 0 New: 0 Isolates: 0	Pre: 18 Hist: 3 New: 21 Old: 0 Isolates: 8	Pre: 1 Hist: 0 New: 1 Old: 0 Isolates: 1	0
Coal Creek South [viii]	Fidelity E&P	Ethnoscience Foothills Arch.	3,606[iv]	726.58	2,591.97	395.87	4	Pre: 1 Hist: 0 Old: 1 New: 0 Isolates: 0	Pre: 0 Hist: 2 Old: 1 New: 1 Isolates: 0	Pre: 0 Hist: 1 Old: 0 New: 0 Isolates: 0	1[v]
Coal Creek South -Infill	Fidelity E&P	Ethnoscience	4,943	1,292.0	3,375.0	276	4	Pre: 1 Hist: 0 Old: 0 New: 1 Isolates: 0	Pre: 1 Hist: 0 Old: 0 New: 1 Isolates: 1	Pre: 2 Hist: 0 Old: 0 New: 0 Isolates: 1	0
Dry Creek [vii]	Fidelity E&P	Ethnoscience	685.58	68	538.08	70	20	Pre: 2 Hist: 0 New: 0 Old: 2 Isolates: 0	Pre: 14 Hist: 1 New: 3 Old: 12 Isolates: 8	Pre:3 Hist: 0 New: 0 Old:3 Isolates: 0	0

TABLE 3-4

CULTURAL RESOURCE INVENTORIES FOR COAL BED NATURAL GAS and OTTER CREEK COAL TRACTS

Plan of Development (POD) Name	Sponsor	Cultural Resource Contractor	Total Acres	Acres BLM	Acres Private	Acres State	Total Sites	State Sites	Private Sites	BLM Sites	Previously. Recorded Sites – Not Relocated
Deer Creek North	Fidelity E&P	Ethnoscience	9,780.83	836.6	8,750.74	193.49	57	Pre: 2 Hist: 0 Old: 0 New: 2 Isolates: 0	Pre: 24 Hist: 29 Old: 17 New: 36 Isolates: 42	Pre: 2 Hist: 0 Old: 0 New: 2 Isolates: 1	5
Pond Creek	Fidelity E&P	Ethnoscience	9,945.77	911.03	8,394.74	640.0	147	Pre: 6 Hist: 0 Old: 1 New: 5 Isolates: 4	Pre: 111 Hist: 14 Old: 46 New: 86 Isolates: 56	Pre: 5 Hist: 0 Old: 0 New: 5 Isolates: 2	5
Deer Creek South (POD Not Yet Submitted)	Fidelity E&P	Ethnoscience	4,479	854	2,717	588	8(11)[vi]	Pre: 0 Hist: 0 Old: 0 New: 0 Isolates: 0	Pre: 4 Hist: 3 Old: 1 New: 6 Isolates: 7	Pre: 1 Hist: 0 Old: 1 New: 0 Isolates: 3	0
Dietz North-State Only [ix]	Pinnacle Gas Resources, Inc.	Western Land Services	640	0	0	640	11	Pre: 11 Hist. 0 Old: 0 New: 0 Isolates: 22	Pre: 0 Hist: 0 Old: 0 New: 0 Isolates: 0	Pre: 0 Hist: 0 Old: 0 New: 0 Isolates: 0	1
Totals			**37,115.18**	**4,903.29**	**28,797.53**	**3,414.36**	**294**	**25**	**255**	**14**	**12**

TABLE 3-4

CULTURAL RESOURCE INVENTORIES FOR COAL BED NATURAL GAS and OTTER CREEK COAL TRACTS

Plan of Development (POD) Name	Sponsor	Cultural Resource Contractor	Total Acres	Acres BLM	Acres Private	Acres State	Total Sites	State Sites	Private Sites	BLM Sites	Previously. Recorded Sites – Not Relocated
Pending CBNG Projects and Otter Creek Inventory											
Dietz South – POD and Reports Not Yet Submitted [x]	Pinnacle Gas Resources, Inc.	Western Land Services/Aaberg Cultural Resources Consulting Services-1999	5,040.00 (estimate)	1,160.00	3,880.00	0	18	Pre: 0 Hist.: 0 Old: 0 New: 0 Isolates: 0	Pre: 6 Hist.: 3 Old: 0 New: 9 Isolates: ?	Pre: 4 Hist.: 5 Old: 9 New: 0 Isolates: 1	0
Otter Creek Coal Tracts Inventory [xi]	State of Montana	GCM Services, Inc.	7,720.00	1,770.00	4,030.00	1,920.00	139	Pre: 22 Hist: 2 Old: 3 New: 21 Isolates: 19	Pre: 55 Hist. 7 Old: 22 New: 40 Isolates: 57	Pre: 37 Hist.: 0 Old: 14 New: 23 Isolates: 12	15
Sub-Total			**12,760**	**2,930**	**7,910**	**1,920**	**157**	**24**	**62**	**37**	**15**
Final Total			**49,875.18**	**7,833.29**	**36,707.53**	**5,334.36**	**451**	**49**	**317**	**51**	**27**

i Not Done as Block Inventory (10 acres – 40 acres around wells and 100 foot Access Road/Infrastructure Corridors)
ii Includes Multiple Reports 1 for block, 1 for inventory of site and 1 monitor
iii Draft Report Only
iv Includes multiple reports done in small blocks and corridors
v Prehistoric Site On State Lands Not Relocated
vi 3 Sites recorded as part of Deer Creek North POD
vii Based on 3 Reports
viii Partially overlaps with Deer Creek North POD
ix Includes 2 sites recorded as part of Deer Creek North POD
x 580 acres previously inventoried for Pennaco Prospect in 1999
xi Some sites in this project are made of multiple previously recorded sites

Geology and Minerals

Montana is the site of the juxtaposition of the Great Plains with the Rocky Mountains. The rocks at the surface vary from the ancient metamorphic and igneous complexes forming the cores of some mountains to recent sediments in the major river valleys of the state. The Geology of Montana plays an indispensable role in forming the mineral resources, visual resources and water resources of the state. The geologic history of the state has been a series of major structural events in the tectonics, or continent building of North America.

Map 3-1 is the Tectonic Element Map of the state of Montana. The map shows the locations of important basins such as the Bighorn and Williston that have trapped sediment containing coal, oil and natural gas. The map also locates mountain ranges such as the Crazy Mountains and Black Hills that served as sources for some of the sedimentary units. Several tectonic elements will be discussed in detail including those features that affect the state's resources – The Powder River Basin, The Bighorn Basin, Bighorn Mountains, the Bull Mountains Basin and others. These major tectonic elements influence the porous reservoirs that hold the usable water, oil and natural gas. They also influence the impermeable barriers to fluid movement. These elements influence the local folds and faults that form the oil and gas fields of the state.

Montana's basins have accumulated sediments several miles in thickness; these sands, shales, coals and limestones form the source and reservoirs of Montana's fossil energy reserves – crude oil, natural gas, coal and coal bed natural gas (CBNG). In these basins, ancient sediments were buried to great depths within the earth where heating and increased pressure formed the fuels from the raw organic materials trapped in the sediments. The sedimentary basins also hold a significant portion of the water resources of the state; in the deep parts of these basins the water is generally salty while the shallower parts of these basins there is fresh water of meteoric origin.

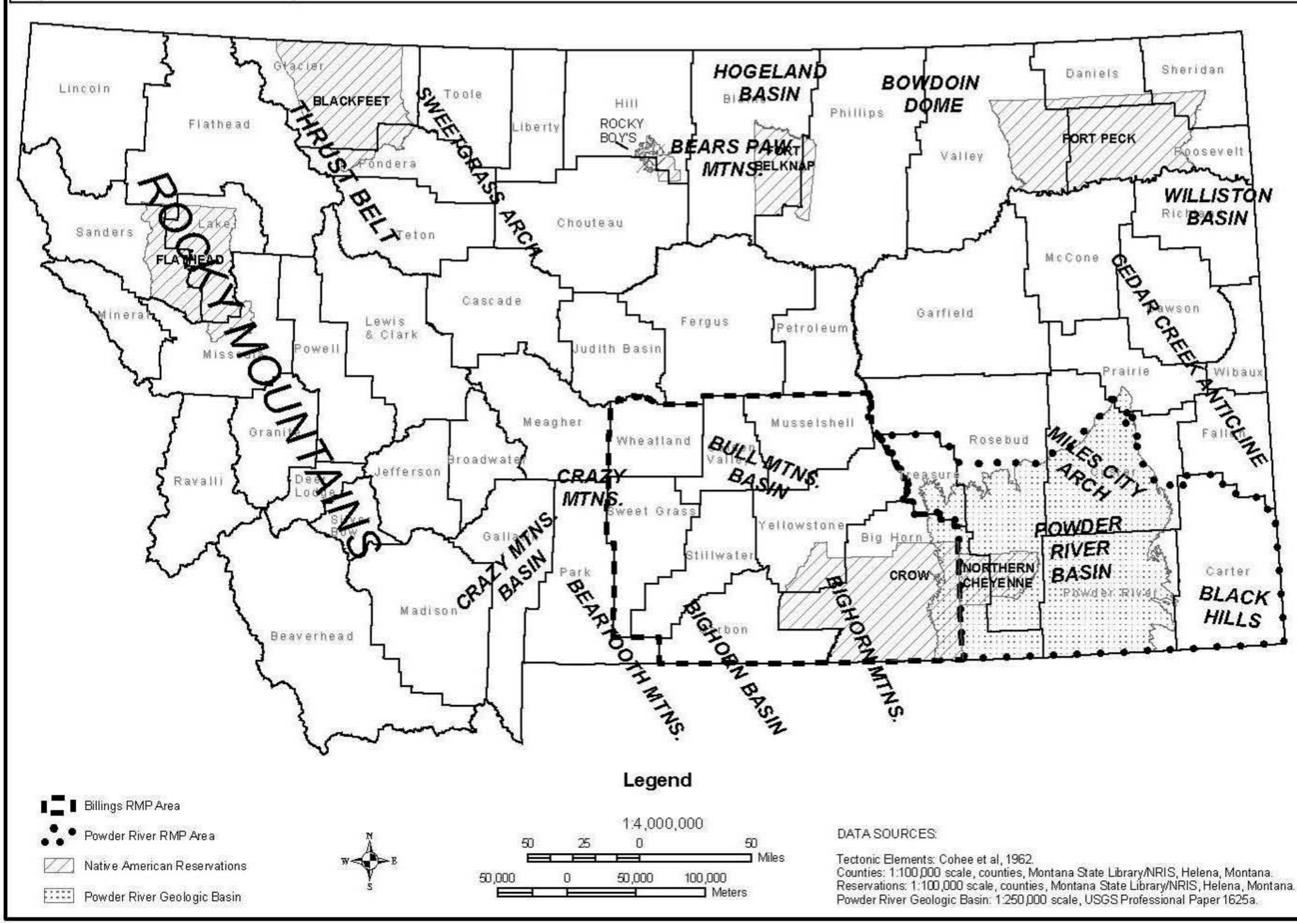
Map 3-2 presents the statewide outcrop geology. The map emphasizes broad basin features underlying the Great Plains in contrast to the intensely contorted structures under the many mountain areas. The basins mentioned above as likely to contain CBNG resources, such as the Powder River Basin, can be seen as broad expanses of similar outcrop. In the case of the Powder River Basin, rocks at the surface are all coal-bearing Tertiary formations except for the scattered Quaternary age alluvium in stream and river valleys. Other basins contain coal-bearing sediments of Cretaceous age. The presence of large volumes of suitable coal is vital for predicting CBNG development.

CBNG is the focus of this SEIS; it is important to recognize the resource is intimately associated with coal deposits. The natural gas is generated by the coal deposit both under thermogenic (heat-driven) and biogenic (microbe-driven) conditions. At the same time, the natural gas is trapped in the coal seams by the pressure of groundwater. Releasing the pressure of groundwater from the coal aquifers liberates the natural gas, allowing it to be produced and sold. The magnitude of the CBNG resource is determined by gas content, coal type and volume; the location of coal reserves can be used to predict the location of Montana's CBNG resources.

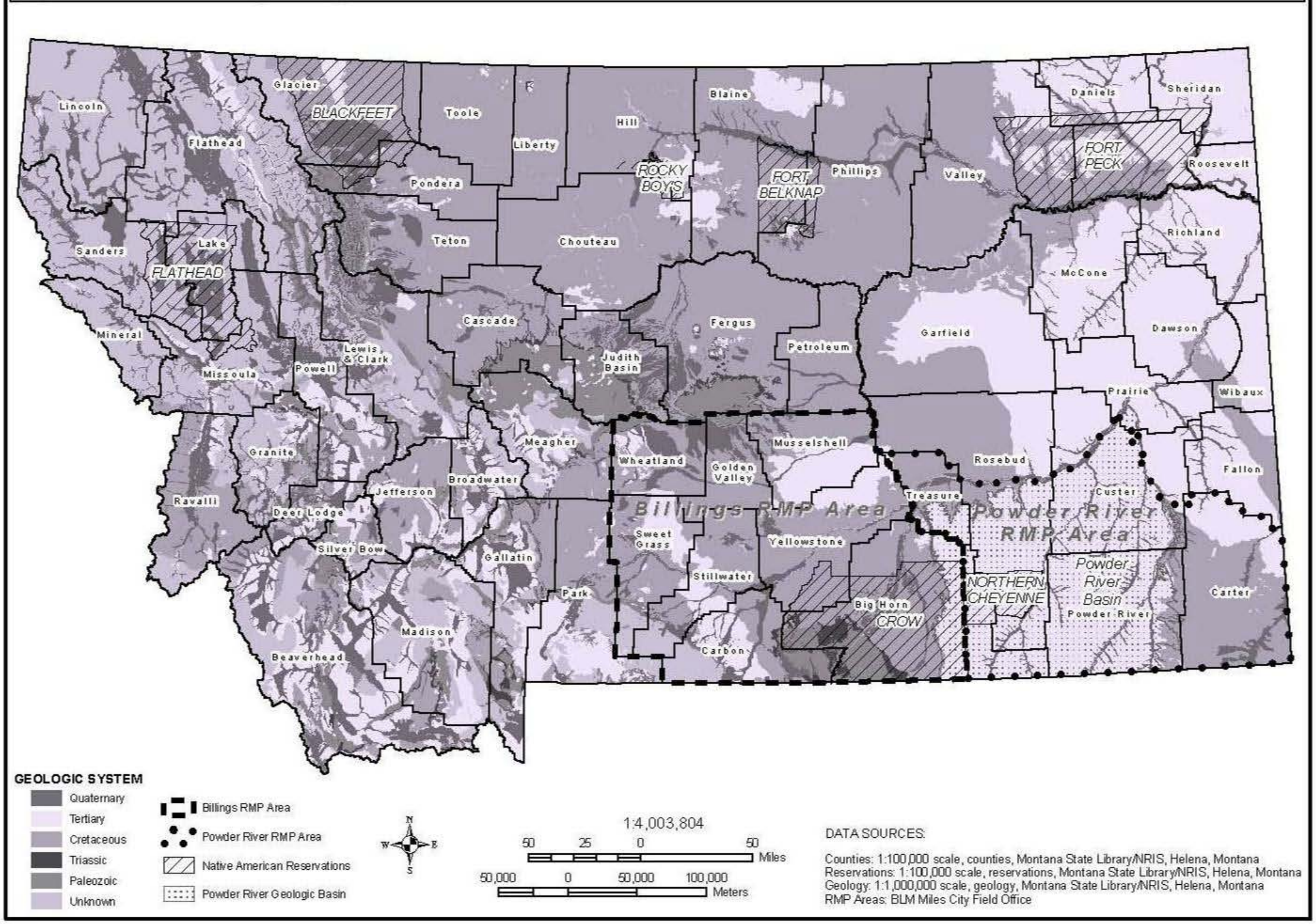
Map 3-3 is the statewide coal occurrence map. The map displays the extent of coal deposits that support mines and are expected to support projected CBNG development. The geology of Montana has given rise to several different kinds of coal; the most important differentiator is coal rank or thermal maturity. As coal is buried or otherwise heated, the raw plant material is gradually converted from complex carbon compounds to simple compounds and elemental carbon. Map 3-3 highlights coal rank or maturation ranging from lignite, sub-bituminous, high-volatile bituminous, medium-volatile bituminous, low-volatile bituminous and anthracite coals (Leythenhaeuser and Welte 1969). The major areas of interest are the Powder River Basin and Bull Mountain Basin, which contain mostly sub-bituminous coal that has not reached a high degree of maturation. Also of interest for CBNG is the Bighorn Basin which contains medium and high volatile bituminous coal of slightly higher maturity.

According to the Montana Board of Oil and Gas Conservation (MBOGC) records, CBNG has been produced only in the CX Ranch field in the Montana portion of the Powder River Basin since April 1999. Exploration solely for CBNG first happened in the Montana Powder River Basin in December 1990 in the area of CX Ranch. However, the first CBNG exploration in the state was in August 1990 in the Bighorn Basin where CBNG was tested but never sold. In many parts of the state, coals are aquifers that contain significant amounts of groundwater and are used by residents for water needs. In order to produce the CBNG in the Montana part of the Powder River Basin, groundwater must be drawn off the coal aquifer. Unless groundwater is produced from the coals, CBNG will not be produced; water production

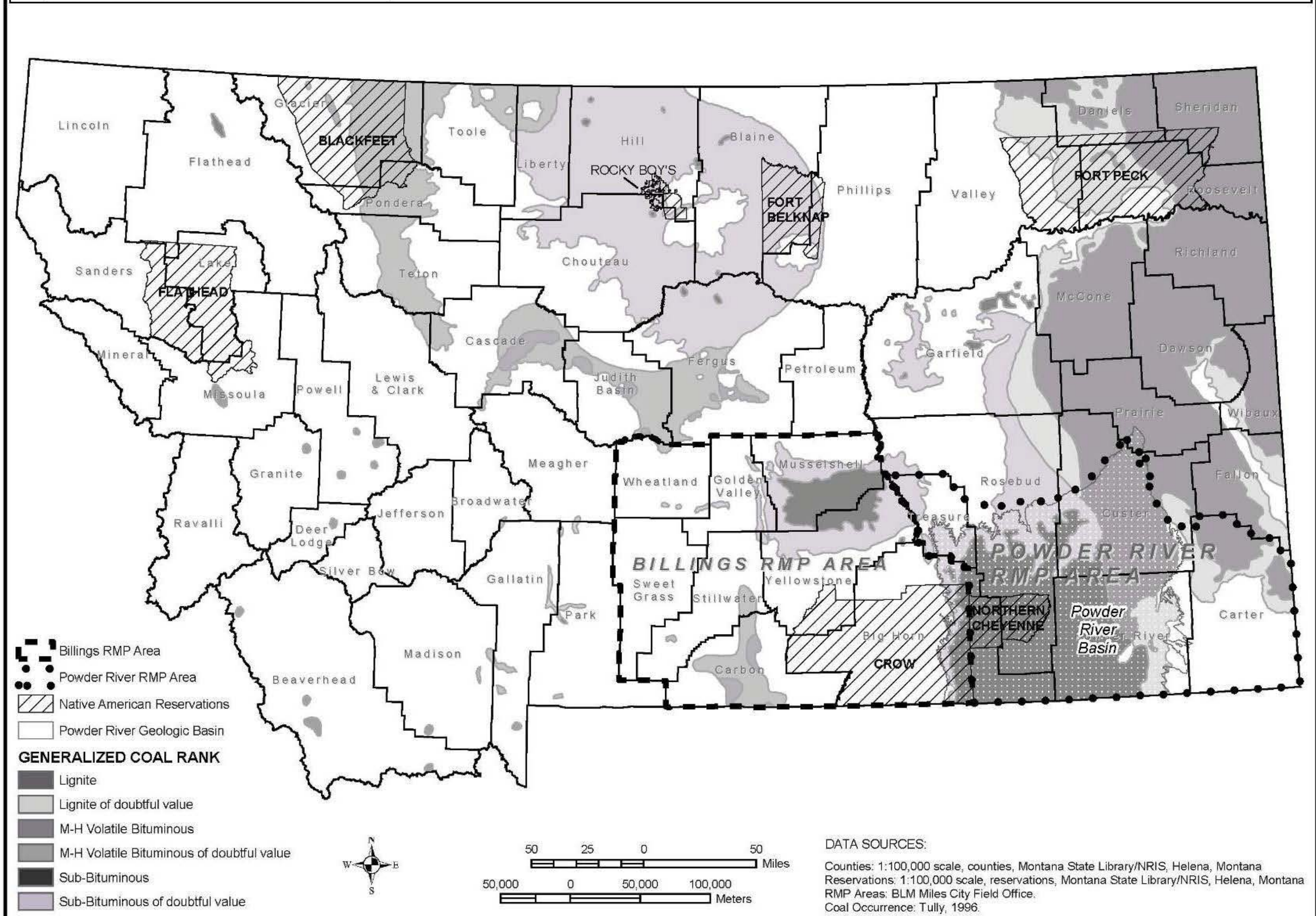
Map 3-1: Tectonic Element Map of the State of Montana



Map 3-2: Statewide Outcrop Geology



Map 3-3: Statewide Coal Occurrence Map



cannot be avoided during CBNG development. This is the central conflict between CBNG and traditional uses of the land; when CBNG is produced, local coal aquifers must be depressurized. Depending on the area, this depressurization may extend beyond the CBNG producing field boundaries.

Regional Geology

The Planning Area of the SEIS consists of the Powder River RMP area and the Billings RMP area. The Planning Area contains three major basinal features – Powder River, Bighorn and Bull Mountains basins – and surrounding uplifted areas. All three basins were formerly broad shelves until Laramide tectonics caused uplift in the surrounding areas. This era of uplift and mountain building contributed to sedimentary deposition and subsidence within the basins during the Late Cretaceous and Early Tertiary. The Bull Mountains Basin and Powder River Basin were one continuous basin during the depositional periods of the Cretaceous and Early Tertiary. It was post-depositional tectonics that divided the two (Stricker, 1999). The asymmetric basins are the result of a combination of sedimentary and structural subsidence with most of the fill consisting of the Fort Union Formation. The Fort Union Formation also contains most of the coals occurring in these three basins.

The Powder River Basin in its entirety covers approximately 12,000 square miles with the smaller portion in Montana (Ellis et al., 1998). The Powder River Basin is bounded to the west by the Bighorn Uplift, to the southwest and south by the Casper Arch, Laramie Mountains and Hartville Uplift; and to the east by the Black Hills Uplift. The Miles City Arch and the Cedar Creek Anticline to the north essentially separate the Powder River Basin from the Williston Basin (ibid).

Coal has been mined in the Powder River Basin since 1865 and large-scale strip-mining has been underway since the mid-1960s when demand increased for relatively clean-burning coals (Flores and Bader 1999). Conventional oil and gas have been exploited in the Powder River Basin for more than 50 years while CBNG has been only lately developed with major activity beginning in 1997 (Rice et al. 2000).

Map 3-4 depicts the outcrop geology of the Montana portion of the Powder River Basin. The map illustrates the broad geometry of the basin with the youngest Tertiary strata (Wasatch Formation) preserved in the deepest part of the basin just north of the Wyoming-Montana state line. The broad bands of the Tongue River and Lebo/Tullock members throughout most of the basin attest to the shallow dips to the east and north edges of the basin. The narrow outcrop bands on the west limb of the basin indicate that the basin is somewhat asymmetrical with steeper dips on the western side.

Map 3-5 portrays the distribution of water wells, the prospective CBNG areas and existing CBNG production within the Montana portion of the Powder River Basin. The map was constructed from information in the MBMG Map 60 (Van Voast and Thale, 2001) and emphasizes those areas with thick, sub-bituminous and bituminous coal reserves. Coals are both water reservoirs and gas reservoirs and as such, CBNG production will affect local aquifers and even surface water. CBNG development is expected to be concentrated in the southern portion of the Powder River RMP area although coals exist over most of the basin and CBNG coverage could prove to be greater. The water wells shown in the map could be at risk to drawdown impact from CBNG development, especially those water wells completed in coal aquifers. Those aquifers at risk to CBNG impact are described in the Hydrology section.

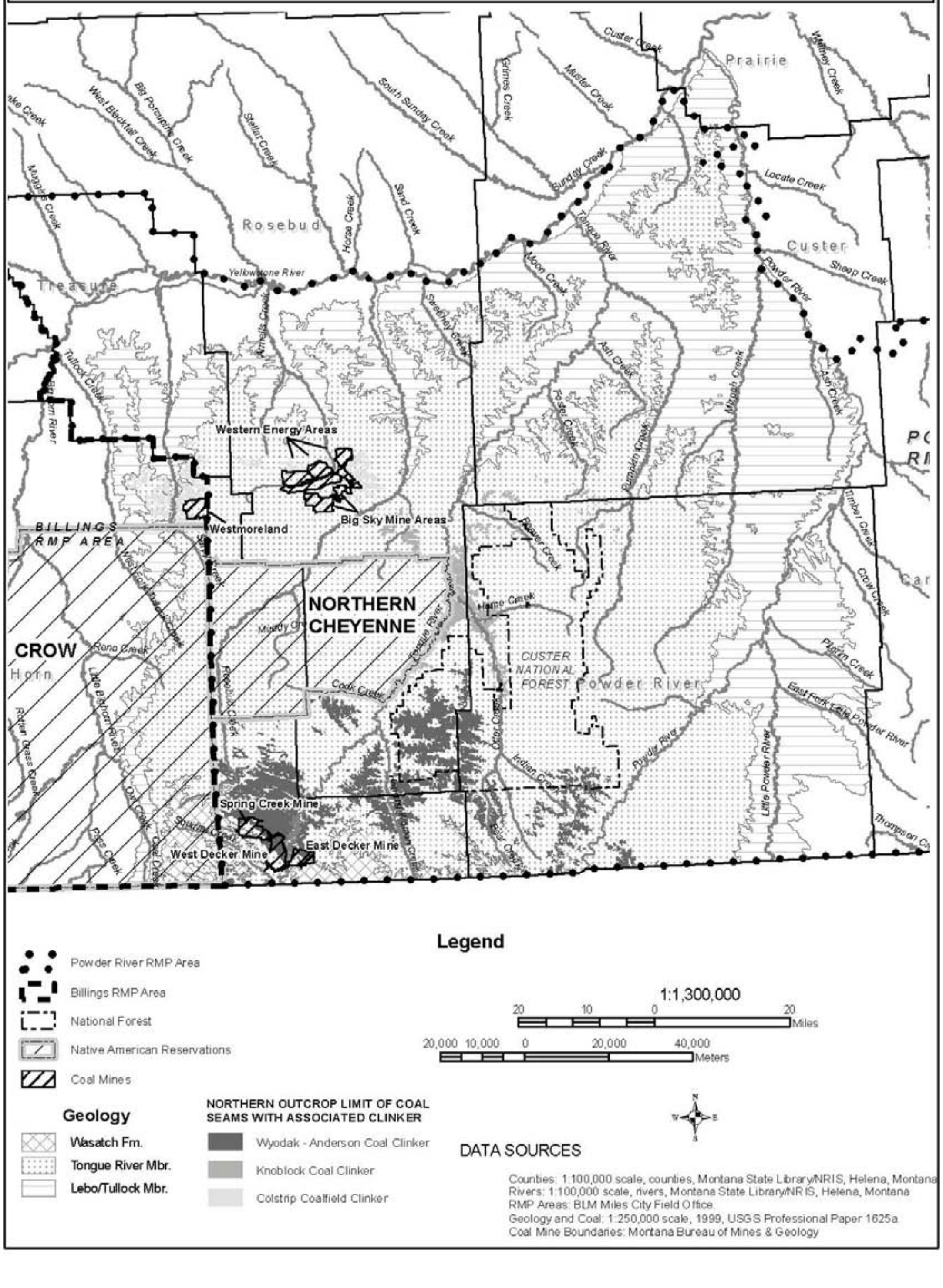
Stratigraphy

The stratigraphy of the Planning Area describes the age, composition and continuity of sedimentary rocks. The sedimentary strata of the Planning Area extend backward in time from Recent-age alluvium found in stream valleys, to strata at the surface that is largely Tertiary and Cretaceous. These older formations were deposited during the Laramide orogeny that gave rise to most of the uplifted areas in Montana. Though the area contains significant thicknesses of older formations, the Tertiary Age basin fills are of particular interest for coal, CBNG and groundwater production (Ellis et al. 1998). Conventional oil and natural gas occur in the older, pre-Laramide section but most coals of interest in the Powder River Basin are found in the Early Tertiary Age units. See Figure 3-1 for a stratigraphic interpretation of the regional geology of the Powder River Basin.

Figure 3-2 is a stratigraphic column of Upper Cretaceous and Lower Tertiary sediments in the Montana Powder River Basin. The stratigraphic column shows the continuous development of several thousand feet of sediments that include widespread sands, coals and fluvial, fine-grained sediments. The major formations are named along with major coal seams that are discussed in greater detail elsewhere.

Geologic formations found at the surface of the Powder River Basin consist largely of the several members of the Paleocene Fort Union Formation, as well as the overlying Wasatch Formation in a small corner of the basin (Rice et al. 2000). The Tongue River member of the Fort Union Formation contains

Map 3-4: Outcrop Geology and Clinker Deposits of the Montana Portion of Powder River Basin



Map 3-5: Water Well Use, Current CBM Production, and CBM Likelihood in Powder River Basin

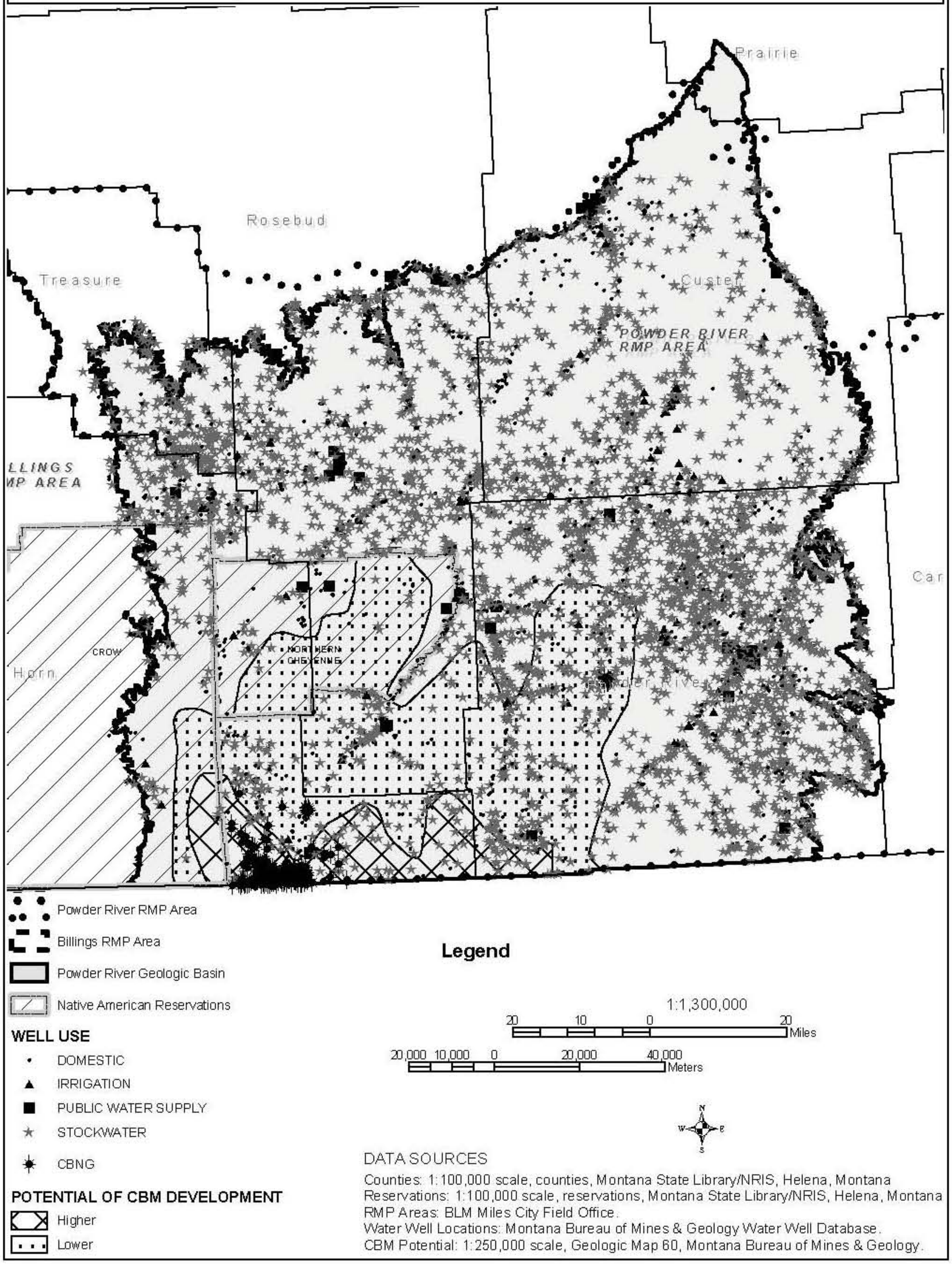


FIGURE 3-1 - STRATIGRAPHIC COLUMN OF THE TERIARY, MESOZOIC AND PART OF THE PAELOZOIC SEDIMENTS IN THE MONTANA AND WYOMING PORTIONS OF THE POWDER RIVER BASIN

The column includes formations that make up CBNG reservoirs and sources of water in the basin.

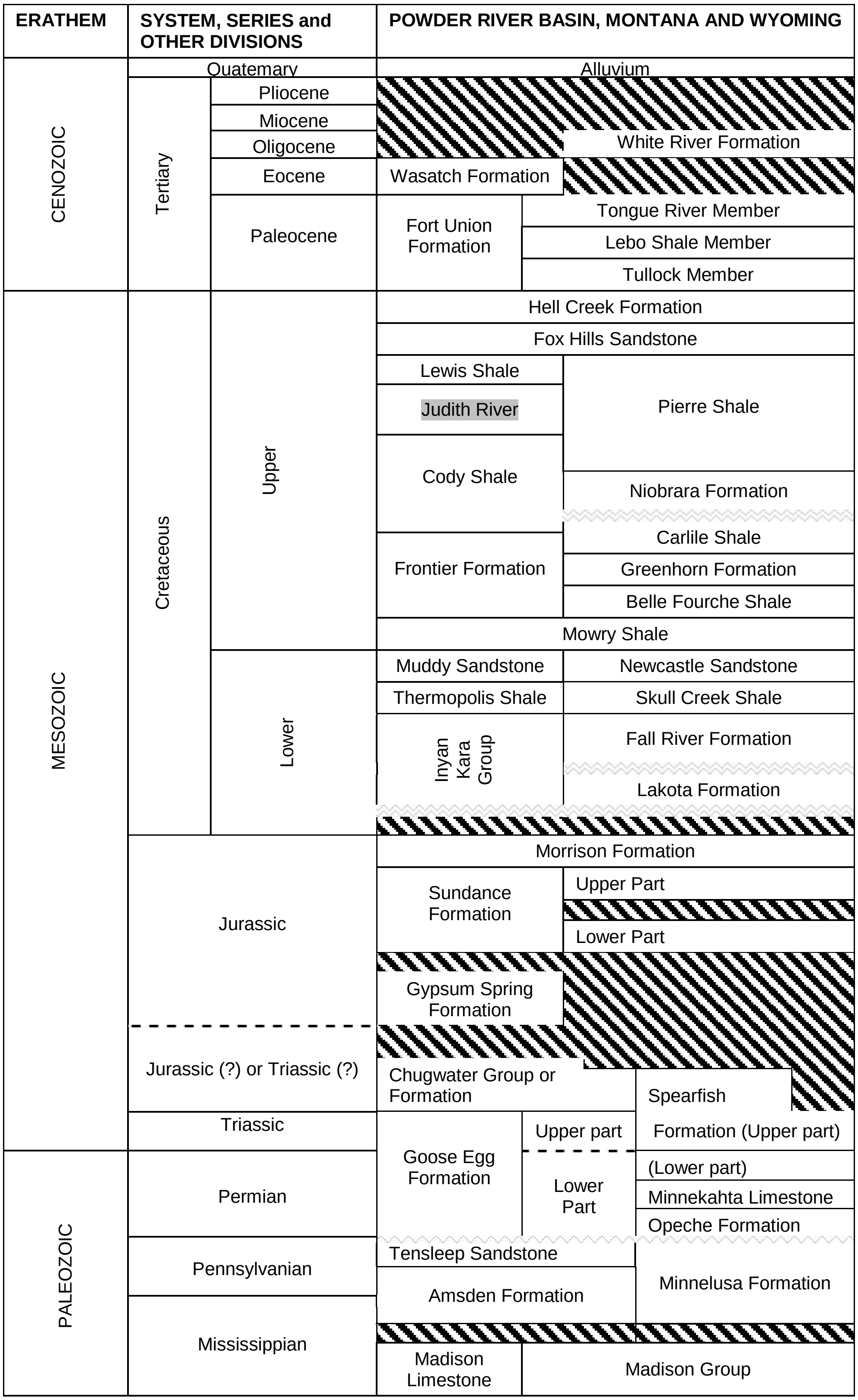
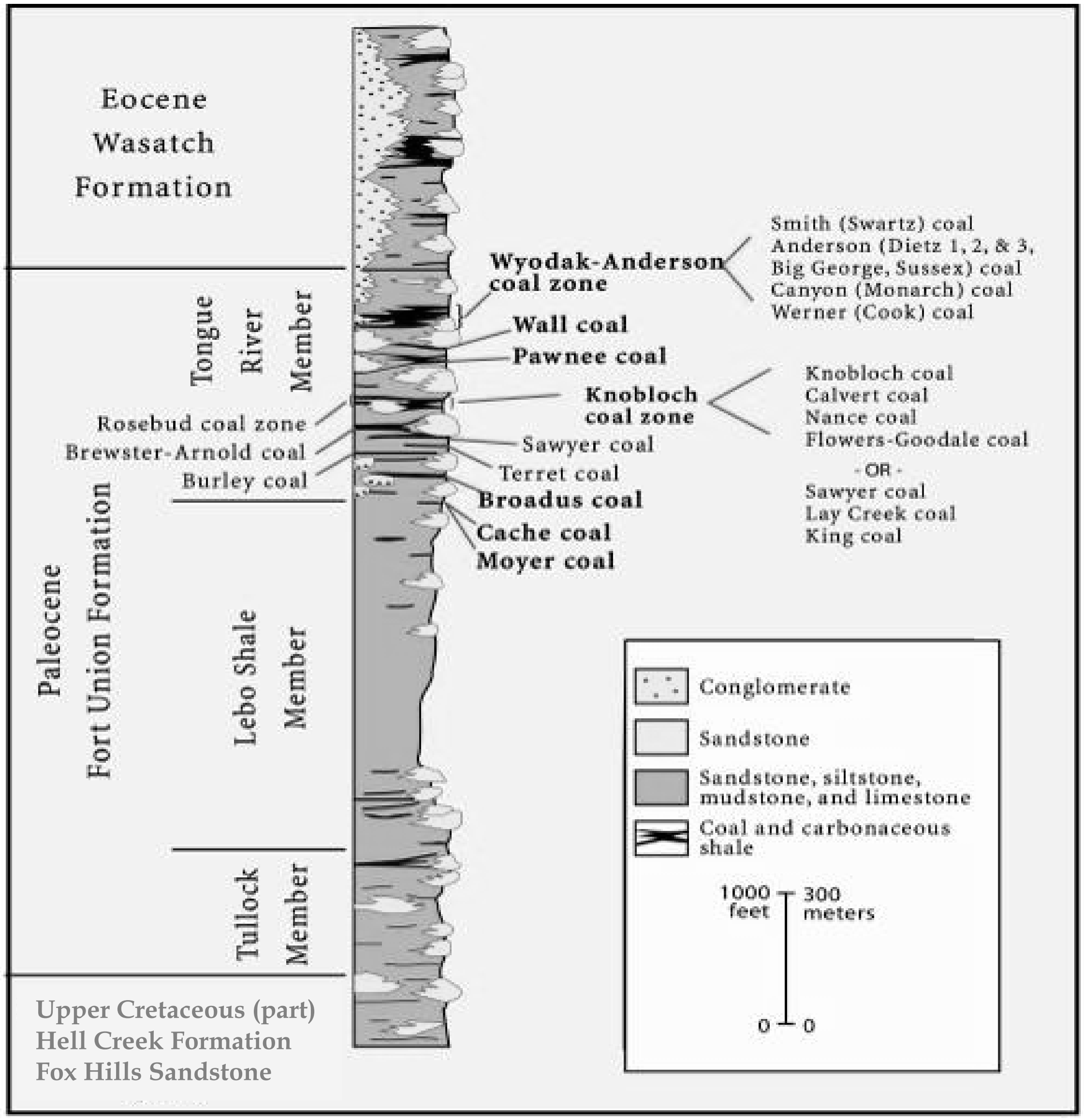


FIGURE 3-2 - STRATIGRAPHIC COLUMN OF UPPER CRETACEOUS AND LOWER TERTIARY SEDIMENTS IN THE POWDER RIVER BASIN

BEDROCK UNITS THAT FILL THE POWDER RIVER BASIN INCLUDE THE HELLCREEK, FORT UNION AND WASATCH FORMATIONS (MODIFIED FROM RICE ET AL. 2000).



the coal seams of interest within the Montana portion of the Powder River Basin. These coal seams function as the source of the CBNG, as well as aquifers carrying groundwater of varying quantity and quality. In the Powder River Basin coal seams range in depth from the surface to approximately 900 feet deep. Individual coal beds can be up to 50 feet thick and can form aggregate thicknesses over 100 feet. Coal seams in the Tongue River member do not have significant matrix porosity and permeability (Gray 1987); they can act as aquifers because fluids such as water and CBNG are contained within the coal's fracture system, known as cleat (Montgomery et al. 2001). The fractures accumulate the fluids and allow the fluids to move horizontally and vertically within the coal. Coals typically are bounded above and below by low permeability shale units (Wheaton and Donato, 2004).

Sediments in the Powder River Basin

Deep Formations

A number of regional geologic formations occur beneath the major basin fill units within the Powder River Basin. These formations as shown on the regional stratigraphic column in Figure 3-1 are broadly present across Montana including the Powder River Basin. Penetrations of these formations by conventional oil and gas wells have been few in the Montana Powder River Basin and hydrocarbon production is scattered. The Cretaceous age Judith River, Shannon, Eagle and Dakota/Lakota Formations are present in the subsurface between approximately 2,200 feet below ground surface (bgs) and 9,000 feet bgs. These four sandy formations are encased and overlain by thick Cretaceous shales of the Colorado and Pierre Formations (Noble et al, 1982). Reservoir quality sands are not present everywhere within each of these formations but each could locally be a suitable disposal zone for produced CBNG water. Only the Shannon Formation produces gas within the Powder River Basin (Nobel et al. 1982).

Upper Cretaceous Fox Hills and Hell Creek Formations

The Fox Hills Sandstone and Hell Creek Formations are Late Cretaceous in age and underlie the Fort Union in the Montana portion of the Powder River Basin. The formations are difficult to separate in outcrop and can be very difficult to separate in the subsurface, depending on the area and appear to be in hydrologic continuity. Together, the Hell Creek and Fox Hills total approximately 500 feet of non-marine coastal plain sediments that have been shed from the mountains to the east and west (Perry, 1962). They are made up of variable, shaley sands that contain some of the youngest dinosaur fossils in the world. The sands are scattered over most of Eastern Montana but are not present everywhere in the Powder River Basin; the formations crop out at the edges of the basin and are found as deep as 3,700 feet bgs near the axis of the basin in Montana (Miller 1981). The Fox Hills Formation lies conformably upon approximately 2,000 feet of Upper Cretaceous Pierre Shale. The Hell Creek is overlain by the thick Tertiary Fort Union Formation.

Paleocene Fort Union Formation

The Fort Union forms most of the sedimentary fill within the Montana Powder River Basin. It consists of approximately 3,500 feet of non-marine interbedded, sandstones, siltstones, shales and coal beds (Roberts et al, 1999a). The Fort Union also contains clinker deposits, formed by the natural burning of coal beds and the resultant baking or fusing of strata overlying the burning coal, which are present throughout much of the area and can be more than 125 feet thick (Tudor, 1975).

The Fort Union is split into three stratigraphic members: the lowest and oldest is the Tullock Member, overlain by the Lebo Shale Member, overlain by the Tongue River Member (McLellan et al. 1990). In the Montana portion of the Powder River Basin, the bulk of the coals are confined to the Tongue River Member, while the Lebo and Tullock Members are predominantly shale and shaley sand (McLellan et al. 1990). The Members are discussed in detail below:

The Tullock Member

This is the stratigraphically lowest part of the Fort Union, consisting of approximately 300 feet to more than 500 feet of interbedded sands and shales with minor coals near the base (Tudor 1975). The Tullock rests unconformably upon the Upper Cretaceous Hell Creek Formation throughout the Powder River Basin. While generally sandier, the Tullock is difficult to separate in outcrop and in the subsurface from the overlying Lebo Member. The Tullock and Lebo Members are combined into the Ludlow Member on the east side of the Powder River.

The Lebo Member

This middle member ranges from 75 feet to more than 200 feet of claystones, limestones and mudstones with the Big Dirty coal (3 to 13 feet of thickness) at the very base (Tudor 1975). The Lebo Member forms an effective barrier to vertical flow.

As such, any drawdown-related impacts associated with CBNG development in the Tongue River Member would be limited to that member.

The Tongue River Member

The thickness of the Tongue River Member varies from zero at the outcrop edge near the fringe of the basin to 3,000 feet near the axis of the basin (Williams 2001). The total aggregate thickness of all the coal seams ranges up to approximately 150 feet (Ellis et al. 1999b). The Tongue River Member can be locally divided into three units. The lower unit includes that portion below the Sawyer coal seam. The middle unit includes the Sawyer through the Wall coal seam. The upper unit includes that portion above the Wall coal seam (Ellis et al. 1999b).

The Lower Tongue River unit is present across most of the Montana portion of the basin. It includes, from the base up, the Stag, Terret, Witham, Robinson, Rosebud-McKay, Flowers-Goodale, Nance, Calvert and Knoblach coals. In the Ashland coalfield, the Lower Tongue River unit is up to 1,660 feet in thickness (Roberts et al. 1999b).

The Middle Tongue River unit is present over a large part of the Montana portion of the Powder River Basin. It includes, from the base up, the Sawyer, Mackin -Walker, Cache, Odell, Brewster-Arnold, Pawnee and Wall coals.

The Upper Tongue River unit is present only in the southern part of the Montana portion of the Powder River Basin. It includes, from the base up, the Otter, Cook, Carney, Canyon, Dietz anderson and Smith coals. At the Decker mine, the Upper Tongue River is up to 1,500 feet thick; coals can attain an aggregate thickness up to 111 feet (Roberts et al. 1999a).

Although coals are the most economically significant part of the Tongue River Member, they form a small portion of the sedimentary volume. They are also extremely variable stratigraphically, as shown in the cross-section depicted in Figure 3-3. Figure 3-3 shows stratigraphic variation of the Anderson-Canyon Coals in the area of the Decker Mine, Powder River Basin, Montana.

The cross-section illustrates the continuity or lack of continuity within the stratigraphic units. Coal aquifers can be seen to have local continuity but lack regional continuity. A local coal seam such as Dietz 1 can persist for several miles but the entire Anderson-Dietz package is eroded from the Colstrip area. The stratigraphic complications documented in Figure 3-2 suggest that even thinly separated coal seams may be very dissimilar. The cross-section illustrates the pinch-outs of coal seams, bifurcating coal seams and erosional cut-off of coal seams by Paleocene and Recent stream erosion. All of these factors can play a role in complicating the production of water and CBNG from the Fort Union Formation.

Fort Union coals are also present in the Bighorn Basin and the Bull Mountain Basin, where they are prospective for CBNG resources.

Wasatch Formation

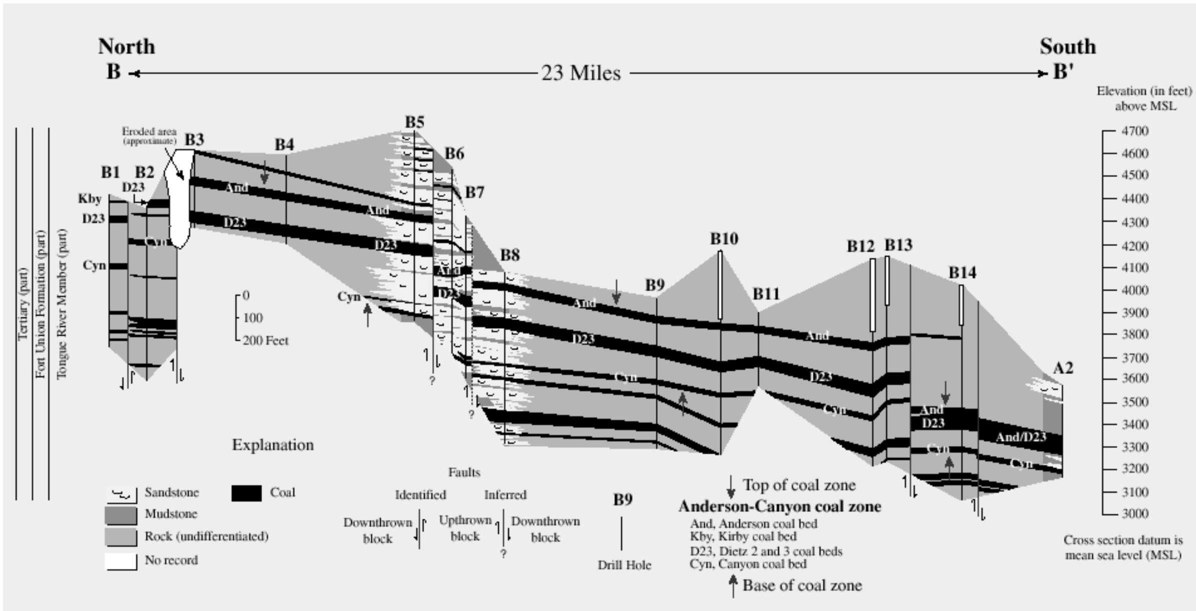
The Eocene Age Wasatch Formation is present in the Montana portion of the Powder River Basin as fine-to medium-grained sandstone lenses and channel-fill interbedded with siltstones, shales and minor coal. The thickness of the Wasatch Formation ranges from near zero at the outcrop edge to 400 feet near the southern state boundary (Roberts et al. 1999a). It is present in outcrop in the extreme southwest corner of the basin where it overlies the Fort Union.

Quaternary Alluvium

Quaternary age sediments are those that are Pleistocene (the latest glacial episode) and Recent (post-glacial episode) in age; the sequence is dominated by events and effects associated with continental glaciation, including glacial till and exaggerated peri-glacial valley fill. Quaternary sediments in the Powder River Basin and most of the state are present as variable fill in stream and river valleys. Quaternary alluvium consists of unconsolidated sand, silt and gravel that make up the floodplains and stream terraces of river and creek valleys in the Powder River Basin (BLM 1999b). Thickness is highly variable, but maximum thickness is not expected to exceed 90 feet. Lithology is somewhat dependent on bedrock outcrop; alluvium overlying the Tertiary strata are mostly fine-grained to medium-grained sands and silts. Coarser-grained alluvium may be associated with some of the larger rivers where provenance has been outside the Powder River Basin (Hodson et al. 1973). Alluvial aquifers are largely unconfined and connected to active river flow. Because alluvial aquifers can deliver large quantities of water to wells, they are important stratigraphic features. They are also important because they are vulnerable to impact from produced water management and are often connected to surface water resources.

FIGURE 3-3 - STRATIGRAPHIC VARIATION OF THE ANDERSON-CANYON COALS IN THE AREA OF THE DECKER MINE, POWDER RIVER BASIN, MONTANA (ROBERTS ET AL. 1999A)

CROSS-SECTION OF LOCALIZED STRATIGRAPHY OVER A SMALL PORTION OF THE POWDER RIVER BASIN NEAR DECKER, MONTANA.



Note: this cross-section reflects localized stratigraphy over a small portion of the Powder River Basin and is not intended to be a regional reflection of the entire Montana portion of the basin.

Powder River RMP Area

The Powder River RMP area is centered over the broad, flat-lying Powder River Basin, with basin margins rising up to the Black Hills (South Dakota) on the southeast and the Bighorn Mountains to the west. Oil production has occurred in The Powder River Basin since 1954. During 2004, 24 conventional oil and natural gas fields were active in the RMP area (MBOGC 2005). Production trends summarized in Figure MIN-1 of the Minerals Appendix (ALL 2001b) shows a sharp decline of oil production during the past 15 years caused by the aging of the several Muddy Formation fields on the edge of the basin. During the same time, conventional natural gas production from shallow Cretaceous reservoirs has increased, although it has remained at minor levels.

Billings RMP Area

The Billings RMP area centers on the Montana portion of the Bighorn Basin, the largest structural element in the area. The RMP area also includes the Big and Little Snowy and Little Belt mountains to the north that combine to make up the Central Montana Uplift. Oil and gas is produced from the Bighorn Basin and oil is also produced from the Central Montana Uplift. Natural gas and oil were produced from 55 fields in the year 2004. Production statistics for 2000 show a 50 percent decline of both natural gas and oil production in the past 15 years, although significant quantities of both commodities are still being produced in the area (ALL 2001b).

Conventional Oil and Gas

Conventional oil and gas resources are scattered across Tertiary and older basins of the state, as well as in faulted and thrusted sedimentary rocks at the edges of some of the basins. The type of hydrocarbon fluids that are produced (oil, natural gas, or both) varies with the local geology and position in the field. Natural gas can be produced along with oil in some reservoirs or it can be produced “dry”—without associated oil. Most oil and gas reservoirs will also produce associated water. Produced water is mostly injected under UIC permits, back into the producing formations to maintain reservoir energy or into non-productive, salt-water bearing reservoirs although there are currently 24 surface water discharge permits that have been issued for producing conventional oil and gas fields.

- The Williston Basin produces the majority of the oil for the state of Montana and small amounts of natural gas associated with the oil; except for shallow gas fields along the Cedar Creek Anticline, little dry gas is produced.
- North-central Montana produces mainly dry natural gas from shallow fields.
- Northwestern Montana produces shallow oil with little associated natural gas.
- Central Montana produces oil with virtually no natural gas.
- The Bighorn Basin produces small amounts of both oil and natural gas.
- The Powder River Basin produces small amounts of oil at the eastern edge of the basin and very small amounts of conventional natural gas from shallow reservoirs (MBOGC 2000).

Conventional oil and gas production for the RMP areas is summarized in the Minerals Appendix of this volume.

Coal Bed Natural Gas

CBNG is a naturally occurring resource becoming very important throughout the U.S. CBNG is natural gas that is generated during the geological process of converting plant material into coal through the action of burial and geothermal temperatures and during the natural process of biogenic transformation of organic matter into methane through the action of microbes in the coal. Several thousand CBNG wells have been completed in the Wyoming portion of the Powder River Basin while only approximately 950 CBNG wells exist in the Montana portion. CBNG is discussed in more detail in the Minerals Appendix of this volume and in the Water Resources Technical report (ALL 2001b) that includes numerous important references.

Table 3-5 contains the CBNG Plans of Development for Montana submitted since the ROD was signed in the spring of 2003. Figures 3-4 and 3-5 show the POD locations within the Upper and Lower Tongue Watersheds and the Middle Powder Watershed.

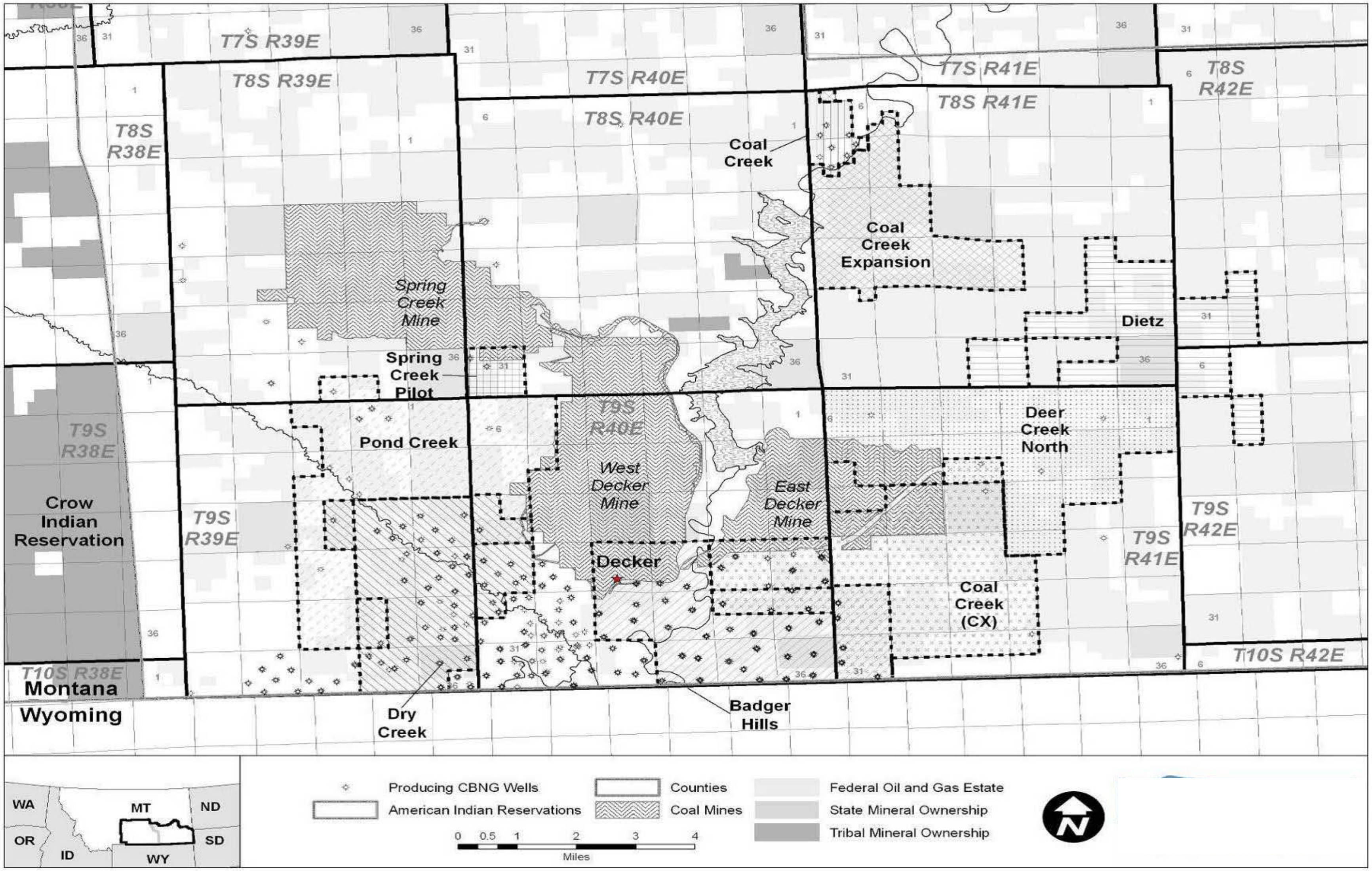
TABLE 3-5

CBNG PLAN OF DEVELOPMENT PROPOSED AND APPROVED APDS

Plan of Development (POD)	Company	Date Approved BLM	Date Approved MBOGC	Proposed Federal	Proposed State	Proposed Private	Total
Badger Hills	Fidelity Exploration & Production Co.	9/03-2/04	7/03	86	72	20	178
Coal Creek	Powder River Gas/Pinnacle Gas Resources, Inc.	11/04	11/04	8	0	8	16
Dry Creek	Fidelity Exploration & Production Co.	12/04	5/04	24	11	3	38
Coal Creek (CX) (Original)	Fidelity Exploration & Production Co.	1/05	2/05	132	16	62	210
Coal Creek Expansion	Pinnacle Gas Resources, Inc.		8/05	0	0	48	48
Pond Creek	Fidelity Exploration & Production Co.		9/05	55	0	23	78
Dietz	Pinnacle Gas Resources, Inc.		9/05	0	0	132	132
Deer Creek North (Original)	Fidelity Exploration & Production Co.		9/05	71	0	99	170
Castle Rock – Stevens	Powder River Gas, LLC		11/05	0	0	284	284
Deer Creek North POD Amendment	Fidelity Exploration & Production Co.		1/06	68	4	112	184
Coal Creek (CX) Amendment	Fidelity Exploration & Production Co.		3/06[1]	173	20	43	236
Black Eagle Butte	Pinnacle Gas Resources, Inc.		3/06	0	100	0	100
Badger Hills Amendment	Fidelity Exploration & Production Co.		6/06	36	29	38	103
			Totals:	**653**	**252**	**872**	**1,777**
			Total Approved	**250**	**252**	**872**	**1,374**

[1] Pending approval tentative date

FIGURE 3-4: UPPER TONGUE WATERSHED POD LOCATION MAP



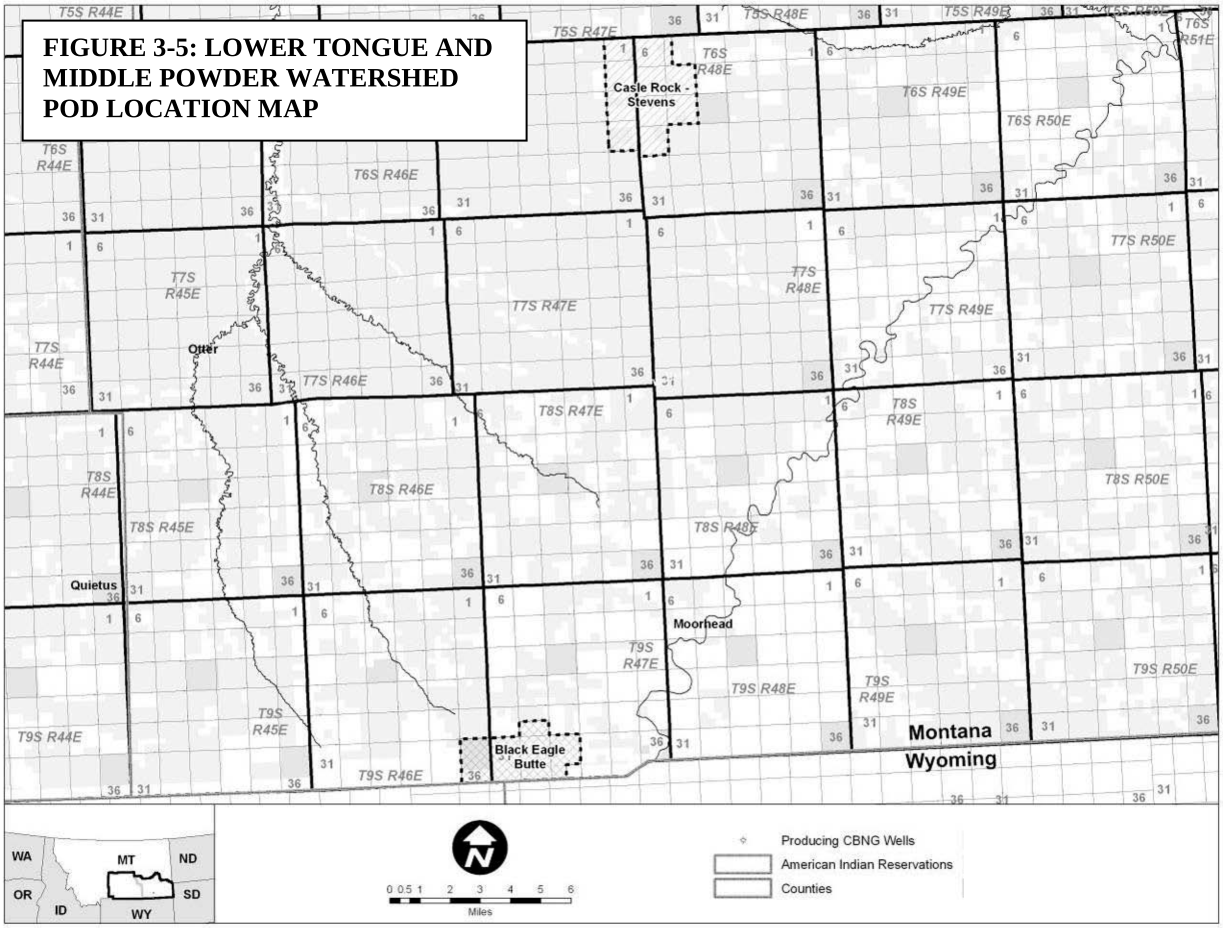


FIGURE 3-5: LOWER TONGUE AND MIDDLE POWDER WATERSHED POD LOCATION MAP

Coal

Coal occurs in all of the RMP areas discussed in this SEIS (Roberts 1966 and Calvert 1912a and 1912b). Coal mining is underway at five mines in the Powder River RMP area and has historically been conducted in the Billings RMP area (USDL 1999). A more detailed description is included in the *Final Environmental Impact Statement, Resource Management Plan, Powder River Resource Area* (BLM 1984b). Coal resources are discussed in more detail in the Minerals Appendix of this volume.

Mineral Materials

Construction materials that are classified as saleable minerals are found in the RMP areas. These include sand and gravel, scoria, common clay and crushed common stone not subject to regulation under the 1872 Mining Law. Descriptions of these materials are given under Mineral Materials and Locatable Minerals in the *Final Oil and Gas RMP/EIS Amendment* (BLM 1992) and in the *Final Environmental Impact Statement, Resource Management Plan, Billings Resource Area* (BLM 1983) as well as the Final EIS Amendment for the Billings, Powder River and South Dakota Resource Management Plans of the Miles City District (BLM 1992).

Locatable Minerals

Locatable minerals are subject to provisions of the 1872 Mining Law. Minerals such as vanadium, uranium, gold, silver, gypsum and uncommon varieties of bentonite are found in the various Planning Areas. Detailed descriptions of management practices for locatable minerals on federally managed lands are given in the *Final RMP/EIS* for the Billings and Powder River Resource Management Plans of the Miles City District (BLM 1983, 1984b).

Geologic Hazards

Seismic activity, rock falls and abandoned mines are all geologic hazards that occur in the Planning Area. Rock falls are common in road cuts, stream cuts and cliff faces. Hazards are associated with abandoned underground mines; these include adits and shafts, as well as subsidence holes over the mines. Landslides and avalanches can result from activities in surface mines; even small gravel pits can present a hazard.

Current management restricts activities in areas of known geologic hazards. Geologic hazard information is considered during the environmental analysis of individual proposals. When necessary, the MCFO develops appropriate mitigation measures.

The Surface Mining Control and Reclamation Act of 1977 provided the authority and funding to reclaim abandoned mines, as administered through MDEQ. Additional information on geologic hazards is generated through ongoing inventories conducted by the Montana Bureau of Mines and Geology and the MDEQ Abandoned Mine Lands Division.

Geologic hazards in eastern Montana consist primarily of threats from earthquakes; although even these are rare. Most strong earthquakes in Montana have occurred in the western third of the state. The only significant shock outside this area was an intensity VI earthquake on June 24, 1943, in southern Sheridan County, in the northeastern corner of the state. A well-constructed granary at Froid cracked so severely that wheat spilled out. Plaster cracks and minor chimney damage were reported at Homestead, Redstone and Reserve.

Methane Seepage, Migration and Venting

Methane seeps usually occur where coal beds are extremely close to the surface. Natural cracks or passageways for the gas to flow usually do not exist where the coal is deeper. The methane contained in Fort Union coals is present in a free state, adsorbed on interior pore surfaces and micropores of the coal matrix and dissolved in water contained within the coal seam.

Gas migration and seepage can be increased by coal mining or CBNG development. Reducing the hydrostatic pressure on the coal seam by pumping the water enhances the release of methane that was previously trapped in the coal matrix, as well as gas dissolved in the water. This free gas typically will flow towards the low pressure created by the pumping well. The objective is to extract the CBNG before it flows into areas of lower pressure.

Methane migration and seepage in the PRB have been associated with the escape of methane from coal mines located along the coal outcrops. Experience in the PRB has shown that seeps that involve potentially explosive concentrations of methane have occurred in coal seams near the surface. Escaping methane has created hazardous conditions. Examples are those documented in 1987, before CBNG development at the Rawhide Village subdivision 10 miles north of Gillette, Wyoming (Flores et al. 2001). The impacts of methane migration and concentration in a populated area can be serious. Rawhide Village was abandoned after explosive concentrations of methane were found to underlie the entire subdivision (Flores et al. 2001).

Methane seepage also can occur naturally in near-surface coal seams (Glass et al. 1987, Jones et al. 1987). The potential for methane migration within the PRB is not limited to areas that contain near-surface coal seams or areas where dewatering has occurred. Methane migration could occur at widespread locations within the PRB, as it can migrate long distances along joints or fractures in rocks. Gas generated in coal beds has also migrated into adjoining sandstone beds (Rice and Finn 1995).

Methane can escape due to inadequate well control procedures and faulty casing or plugging. Water wells frequently are screened over multiple aquifer zones, which would facilitate migration of methane through the well bore. Older, conventional oil and gas wells may not have had surface casing installed across all the coal seams, which could allow migration of methane from a lower seam to a formation that is closer to the surface. Conventional oil and gas wells could provide a conduit for methane migration if faulty cement was present behind casing or if the cement plugs placed in the well during abandonment developed a micro annulus. Numerous uncased boreholes were drilled in the PRB to evaluate the potential for uranium, as coal “strat” test wells or as monitoring wells. They were not properly plugged, which could allow methane, if present, to move through the formations penetrated.

Areas near coal outcrops and areas of coal or CBNG production where substantial dewatering has occurred or is occurring represent possible migration or seepage areas. Methane could emerge from water wells near CBNG production areas, affecting stock and residential wells. Other potential migration or seepage areas include areas with existing well bores and areas where faults, fractures, or sandstone layers occur in an orientation that provides a conduit for movement of methane. Methane hazard areas have not been mapped or compiled within the Planning Area. Furthermore, the integrity of existing wells within the Planning Area has not been comprehensively evaluated. No estimate of the total volume of seepage is available for the PRB.

Methane Seepage Study

Wyoming BLM has been conducting a methane seepage monitoring program for the past 5 years. The study is being conducted out of the Buffalo Office by using soil-gas probes. The study was initiated by the Wyoming BLM state office and included installation of numerous soil-gas monitoring wells (each about 3 feet deep with a rubber septum on top) around the CBNG producing areas. BLM has gone back to these and newer wells several times to sample (pierce septum, evacuate well casing and replace septum,) and analyze the gas. The gas is analyzed for O_2, CO_2 and CO. Low values of O_2 and high values of CO_2 indicate seepage and oxidation of the gas. To date, this BLM study has not found indications of surface seepage. BLM continues to install these soil gas monitoring wells, but has observed no changes in gas content. They are currently proposing to put wells around the western side of the basin where shallow coals outcrop in clinker ridges. The Buffalo Office will be preparing a methane seepage report documenting the study and findings for release (personal communication, Dan Leeman, Mike McKinley and Ed Heffern, November 2005).

Comparison with Methane Migration and Seepage in the San Juan Basin

Methane migration and seepage associated with CBNG development in the San Juan Basin (SJB) of southwest Colorado are specific to local conditions in that area. Geologic conditions differ significantly between the PRB and the SJB. Most experience from the SJB is, therefore, not directly applicable to the PRB.

Basin pressurization and groundwater flow systems are not comparable between the two basins. The coals are found at a deeper depth and higher pressure in the SJB as compared to the PRB. The SJB is more deformed than the PRB and contains more faults and fractures that could serve as conduits for methane migration. In addition, coals are higher grade within the SJB, with a significantly higher gas content (400 scf/ton) and have cleats and fractures that are better developed than the lower-grade coals (25 to 100 scf/ton) within the PRB (GRI 2000). The PRB is not characterized by naturally occurring gas seeps, as is the SJB.

Naturally occurring gas seeps existed throughout the SJB before the earliest oil and gas drilling operations or CBNG development. Shallow water wells that penetrate coals in the SJB produced methane. Intensified seepage was reported as CBNG development progressed (BLM 2000c). Some residents noticed an apparent increase in the occurrence of methane in domestic wells as CBNG development progressed. Others noted the presence of gas seeps and dead vegetation in pastures. Stands of stressed and dying trees were discovered aligned with coal beds beneath the surface. Explosive accumulations of methane were discovered in wells and residences (BLM 2000c). As of early 2000, seepage was estimated (by a computer model) to have increased by at least 3 million cubic feet per day (MMcfd) and possibly by as much as 10 MMcfd over predevelopment levels (Questa 2000).

In the SJB, agencies recognized that older gas wells may have been acting as conduits for migration of gas into groundwater and implemented aggressive procedures to test existing wells, remediate problem wells and ensure that new and future wells could not act as conduits Colorado Oil & Gas Conservation Commission (COGCC 2000). Through May 2000, 269 repair procedures were completed on gas wells in La Plata County. The repairs were performed to eliminate the possibility that these wells would serve as conduits for migration of methane. Most of these repairs (except 36) were completed on conventional gas wells (COGCC 2000).

Reports of Montana Methane Seepage

Methane production from Montana wells has been an historical issue. In the 1970's, shallow wells drilled for coal exploration often produced methane (Wheaton, 2006). MBMG has compiled a list of monitoring wells impacted by methane production in the PRB. These include monitoring wells used by Spring Creek Coal Mine, Decker Coal Mine and MBMG. Most of the gas wells are located within areas depressurized by coal mines and CBNG production; however, some of the wells are located considerably outside areas of CBNG production and coal mining.

Reports of increased methane production led to plugging several water wells near the CX Ranch Field (Williams 2006). Montana Department of Fish, Wildlife and Parks reports increased methane production in two water wells on the Tongue River Reservoir State Park, as well as increased seepage under the reservoir.

Methane Seepage and the Use of Water Mitigation Agreements

Water mitigation agreements currently in use in the PRB were reviewed to evaluate their potential to alleviate the impacts of methane migration and seepage. Typical agreements indicated that all water wells within a specified vicinity (1 mile) and for which the agreement was enacted, would be sampled for gas content as a means of measuring change once CBNG operations were initiated. The agreements define an impaired water well as one that experiences reduced capacity to deliver water in quantity and/or quality sufficient to support the ordinary and customary use of the well. In a discussion with Fidelity Exploration & Production Company, it was confirmed that the agreement would cover a well rendered unusable by methane migration (Williams, personal communication, March 2006).

The agreement states an affected well could be reconfigured, redrilled, or replaced; access to water could also be provided by other means as a method to offset such impairment. The agreement, however, did not necessarily indicate that anything would be done to mitigate or eliminate impacts related to methane gas creating either a safety or environmental hazard. Discussions with J.M. Huber Corporation (Huber) have revealed that it installs cisterns at local ranches where it suspects that the water wells might start venting natural gas. The cisterns function as de-gassing vessels that are open to the atmosphere and allow the natural gas to vent before the water is piped into the house or barn (DeLapp, personal communication, March 2006). Huber stated that it considers any water well with elevated natural gas as covered by its mitigation agreement.

Hydrological Resources

Hydrology within the Planning Area consists of surface water flow from several rivers and their associated tributaries and the production of groundwater from a variety of geological formations—the combination of which comprises the aquifer systems within any specific portion of the Planning Area. Of particular importance to residents is the protection of surface water and groundwater in the vicinity of CBNG development. CBNG development typically involves the necessary and unavoidable production of large volumes of water from coal aquifers and the appropriate use or disposal of this produced water. Continuous CBNG water production and disposal has the ability to impact both groundwater and surface water. As such, it is the subject of the Montana Department of Natural Resources and Conservation (DNRC) Final Order: In the Matter of the Designation of the Powder River Basin Controlled Groundwater Area. This order describes the authorities that pertain to CBNG development. A copy of the order is included as an appendix to the Water Resources Technical Report (ALL 2001b). The order outlines water rights issues, mitigation, monitoring plans and jurisdiction. Jurisdiction is summed up by this paragraph of the Order:

> “With this designation of a controlled groundwater area the withdrawal of groundwater associated with coal bed methane production will be under the prior jurisdiction of the Montana Board of Oil and Gas. However, water rights matters and hydrogeologic issues are not within the ordinary technical expertise and area of concern to the Board. These are matters ordinarily dealt with by the Montana Department of Natural Resources and Conservation and the Montana Bureau of Mines and Geology.
>
> The Montana Department of Natural Resources may petition the Board for hearings in regard to the production, use and disposal of water from coal bed methane development wells that could affect existing water rights in the area based upon information gathered concerning water withdrawals.”

Protection of groundwater will focus on maintaining beneficial uses. The coal seams are the primary aquifers for the agricultural community in southeastern Montana. In many areas, the coal aquifers supply water for livestock, wildlife and domestic use. In the Bull Mountain coalfield, the coal seams are also used as aquifers, though to a lesser degree than in southeastern Montana. In other coal bearing areas of the state, coal seams are not used as aquifers, or that use is limited and not well documented.

Surface Water

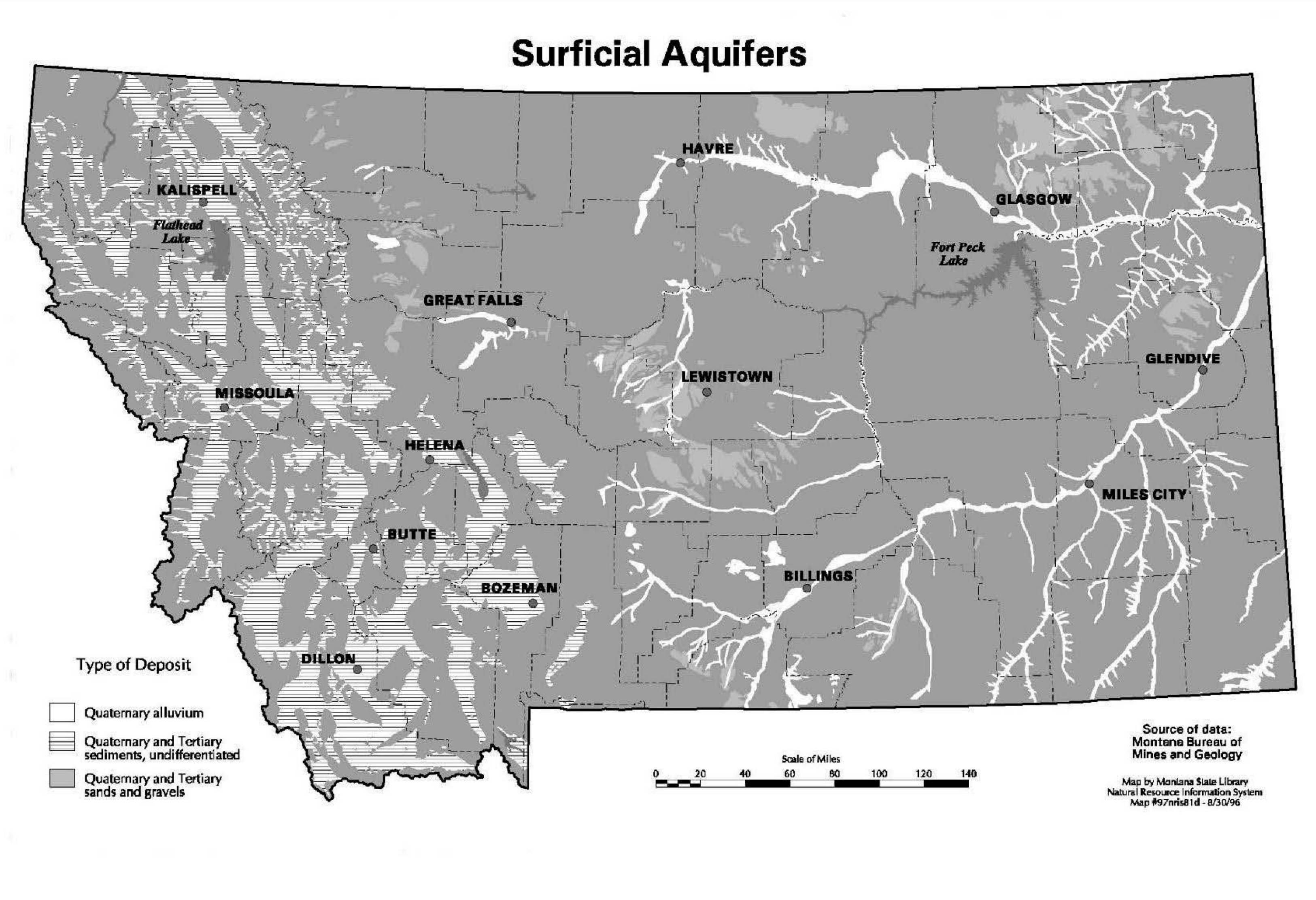
Surface water is the primary source of water for all uses in Montana, representing 97 percent of the water used throughout the state (Solley et al. 1995). The quality of groundwater from near-surface aquifers within the west half of the Billings RMP area is usually very good. Maps 3-6 and 3-7 show the occurrence of surficial aquifers as well as the quality of the groundwater produced from these aquifers.

Map 3-8 shows PRB fourth order watersheds and the locations of selected USGS monitoring stations. The map emphasizes those watersheds most likely to experience CBNG development. The volume and quality of surface water can best be interpreted on a watershed basis.

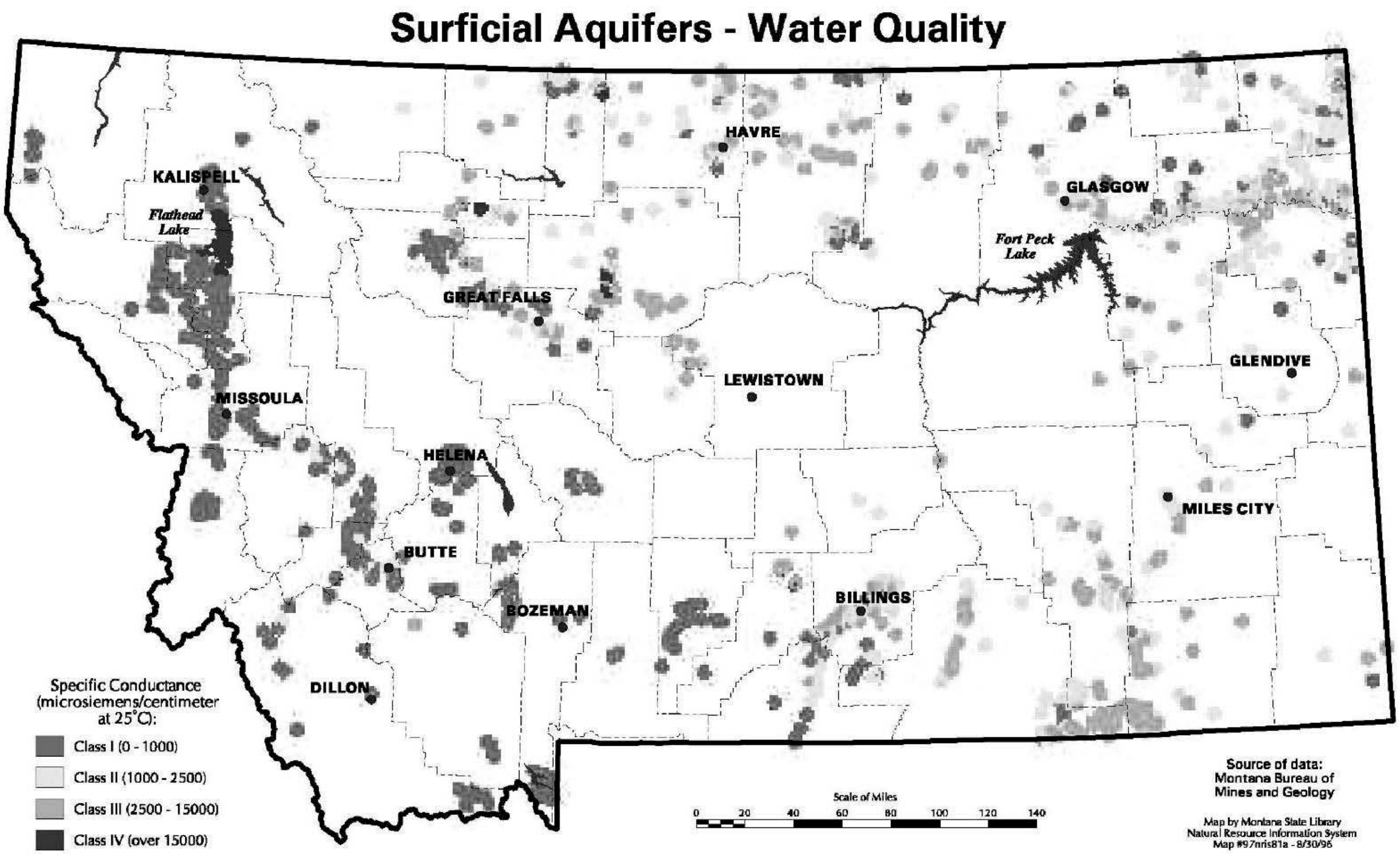
Electrical conductivity (EC) and sodium adsorption ratio (SAR) are the primary constituents of concern with CBNG discharges (MDEQ 2003); therefore, the surface water analysis in this document will focus on these parameters. EC is the ease with which electric current will pass through a water sample and it is proportional to the salinity of the sample. The units used for EC of a water sample are microSiemens per centimeter (μS/cm). SAR is a complex ratio of sodium to calcium and magnesium and it is an important parameter for determining the utility of water for irrigation due to the potential impacts of sodium on clay rich soils. Since SAR is a ratio, it is unitless. EC and SAR are the primary factors that determine the usability of water for irrigation (Suarez, 2006) and irrigation is the use that has been determined to be most sensitive to CBNG inputs (MDEQ 2003). Although EPA has no recommended 304(a) criteria for SAR and EC, states may choose to adopt criteria for SAR and EC to protect agricultural crops.

Effective April 25, 2003, the Montana Board of Environmental Review (MT-BER) adopted standards for EC and SAR for PRB streams. These standards are displayed in Table 3-6. The irrigation-season standards for the Tongue River apply year-round for the Tongue River Reservoir and that part of the river above the reservoir. These standards have been reviewed and approved by EPA and, therefore, have Clean Water Act standing (see Volume II, Hydrology Appendix, pages HYD-10 and HYD-11).

Map 3-6


Surficial Aquifers
KALISPELL
Flathead Lake
GREAT FALLS
HAVRE
GLASGOW
Fort Peck Lake
LEWISTOWN
GLENDIVE
MISSOULA
HELENA
MILES CITY
BUTTE
BILLINGS
BOZEMAN
DILLON
Type of Deposit
Quaternary alluvium
Quaternary and Tertiary sediments, undifferentiated
Quaternary and Tertiary sands and gravels
Scale of Miles
0 20 40 60 80 100 120 140
Source of data:
Montana Bureau of Mines and Geology
Map by Montana State Library
Natural Resource Information System
Map #97nris81d - 8/30/96

Map 3-7


Surficial Aquifers - Water Quality
HAVRE
KALISPELL
Flathead Lake
GLASGOW
Fort Peck Lake
GREAT FALLS
GLENDIVE
LEWISTOWN
MISSOULA
HELENA
MILES CITY
BUTTE
BILLINGS
BOZEMAN
DILLON
Specific Conductance (microsiemens/centimeter at 25°C):
Class I (0 - 1000)
Class II (1000 - 2500)
Class III (2500 - 15000)
Class IV (over 15000)
Scale of Miles
0 20 40 60 80 100 120 140
Source of data: Montana Bureau of Mines and Geology
Map by Montana State Library
Natural Resource Information System
Map #97nris81a - 8/30/96

Map 3-8: Powder River Basin Watersheds and Area USGS Gauging Stations.

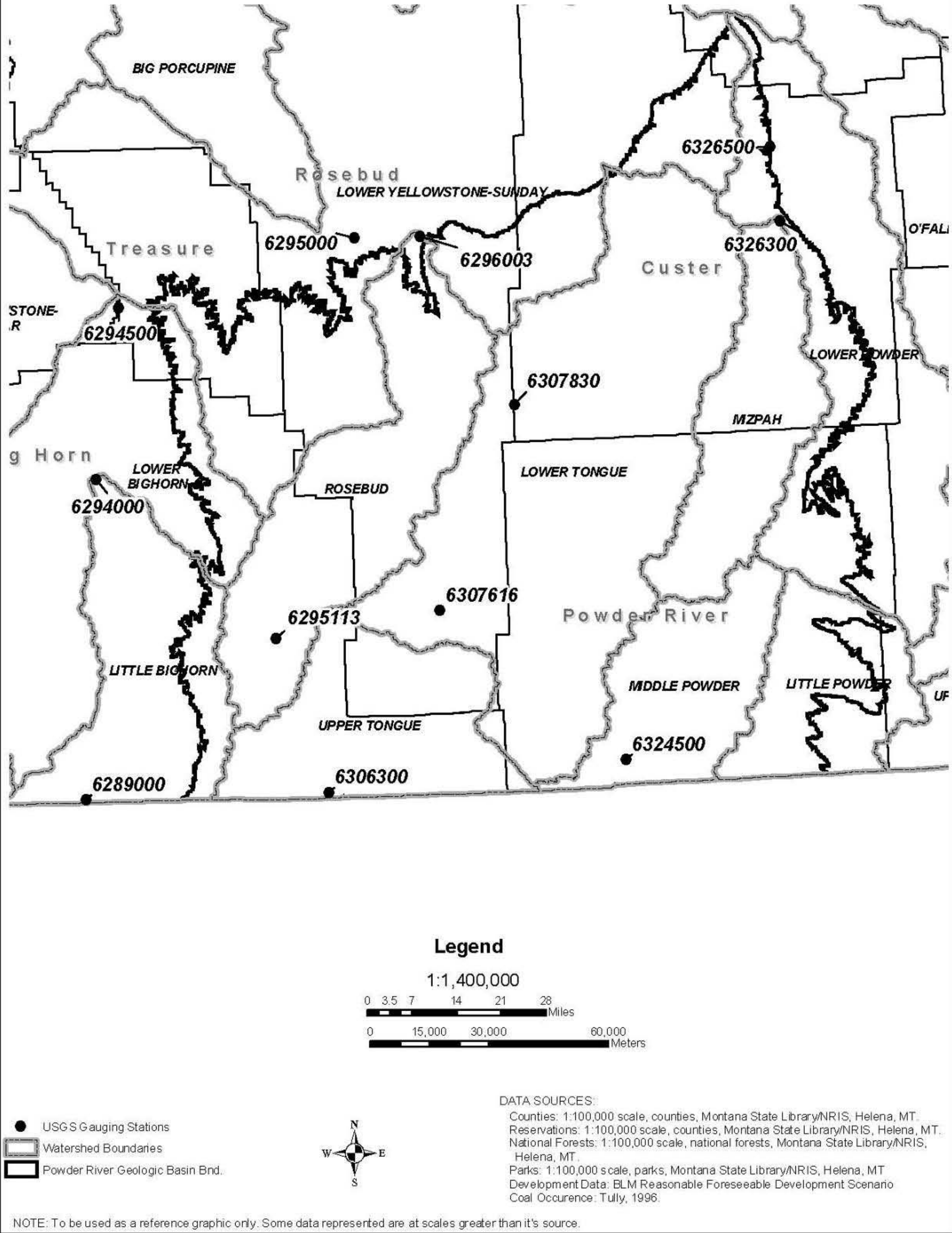


TABLE 3-6

MONTANA STATE NUMERICAL STANDARDS FOR PRB WATERSHEDS.

	Irrigation Season				Non-Irrigation Season			
Stream	**Mean Monthly EC**	**Not-to-Exceed EC**	**Mean Monthly SAR**	**Not-to-Exceed SAR**	**Mean Monthly EC**	**Not-to-Exceed EC**	**Mean Monthly SAR**	**Not-to-Exceed SAR**
Tongue	1,000	1,500	3.0	4.5	1,500	2,500	5.0	7.5
Tongue River Reservoir	1,000	1,500	3.0	4.5	1,000	1,500	3.0	4.5
Rosebud	1,000	1,500	3.0	4.5	1,500	2,500	5.0	7.5
Powder	2,000	2,500	5.0	7.5	2,500	2,500	6.5	9.75
Little Powder	2,000	2,500	5.0	7.5	2,500	2,500	6.5	9.75
Tributaries	500	500	3.0	4.5	500	500	5.0	7.5

On March 23, 2006 Montana BER amended portions of ARM 17.30.670, the EC and SAR standards pertaining to the non-degradation category of EC and SAR. This ruling changed EC and SAR to “harmful parameters,” which modified the non-degradation non-significance threshold criteria. The essence of non-degradation is to protect high-quality state waters by limiting changes of water quality to non-significant changes or to require an “authorization to degrade” when a resultant change would be greater than the threshold. The intention of the rule is to establish a threshold where small changes (10 percent of the standard) are considered not significant. A change in water quality greater than approximately 40 percent of the standard would require additional review by MDEQ. The numerical standards for EC and SAR shown in Table 3-6 are the same under Montana’s 2003 and 2006 standards.

The Northern Cheyenne Tribe has also adopted surface water quality standards for EC and SAR. The Northern Cheyenne Tribe was granted treatment as a state (TAS) status by EPA as of 8/11/2006; however, EPA has not yet reviewed these standards. As such, the Northern Cheyenne numerical standards do not have Clean Water Act standing. They do, however, set out the tribe’s considered determination of the water quality needed to accomplish the following:

- Protect irrigated agriculture on the reservation.
- Protect native plant species with cultural significance and those that are integral in ceremonial and traditional aspects of the Northern Cheyenne Tribe.

These standards are summarized on Table 3-24 in the Native American Concerns Section.

By law, discharges to surface waters must be covered by a National Pollutant Discharge Elimination System (NPDES) permit. In Montana, the NPDES program is administered by MDEQ through its Montana Pollutant Discharge Elimination System (MPDES) program. Before issuing MPDES permits, MDEQ must analyze the potential for a discharge to cause exceedance of applicable numeric or narrative surface water quality standards (including non-degradation criteria).

Table 3-7 lists basic data during minimum mean monthly flows on volume and quality for the USGS stations used in the analysis of impacts to surface water in the Surface Water Quality Analysis Technical Report (SWQATR). Data for 7Q10 and maximum mean monthly flow are included in the SWQATR. Generally, water quality at a particular station varies inversely with flow volume. High-flow periods (Maximum Mean Monthly Flows) correspond to the seasonal influx of relatively low salinity, low SAR, meteoric waters, during spring snowmelt and early summer rains. Low-flow periods (Minimum Mean Monthly Flows) correspond to periods of scarce surface water, typically during the winter when streams are fed only by the influx of naturally occurring more saline, higher SAR groundwaters. Thus, high flows correspond to times of high water quality and low flows correspond to times of low surface water quality. The Tongue River near Decker illustrates this variation with a discharge rate as seen in Figure 3-6.

TABLE 3-7

SURFACE WATER DISCHARGE AND WATER QUALITY FOR MINIMUM MEAN MONTHLY FLOWS AT SELECTED USGS STATIONS

		Minimum Mean Monthly Flow		
USGS Station	**USGS Station #**	**Flow (cfs)**	**SAR**	**EC µS/cm**
Little Bighorn near Wyola	06289000	110	0.5	548
Little Bighorn near Hardin	06294000	123	1.0	768
Bighorn near Bighorn	06294500	1523	2.1	952
Rosebud near Kirby	06295113	1.8	0.8	1016
Rosebud near Rosebud	06296003	8.4	4.8	1780
Tongue near Decker (stateline)	06306300	178	0.9	731
Tongue near Birney Day School	06307616	183	1.1	863
Tongue at Brandenburg Bridge	06307830	207	1.4	1016
Powder at Moorhead (stateline)	06324500	145	4.7	2154
Powder near Locate	06326500	143	4.6	2287
Little Powder near Weston, WY	06324970	3.0	6.9	3300
Mizpah near Mizpah	06326300	0.3	16.6	3503
Yellowstone at Forsyth	06295000	5820	2.0	745
Yellowstone near Sidney	06329500	5764	2.0	870

Minimum Mean Monthly Flow = The lowest mean monthly flow of the station based on historical data.

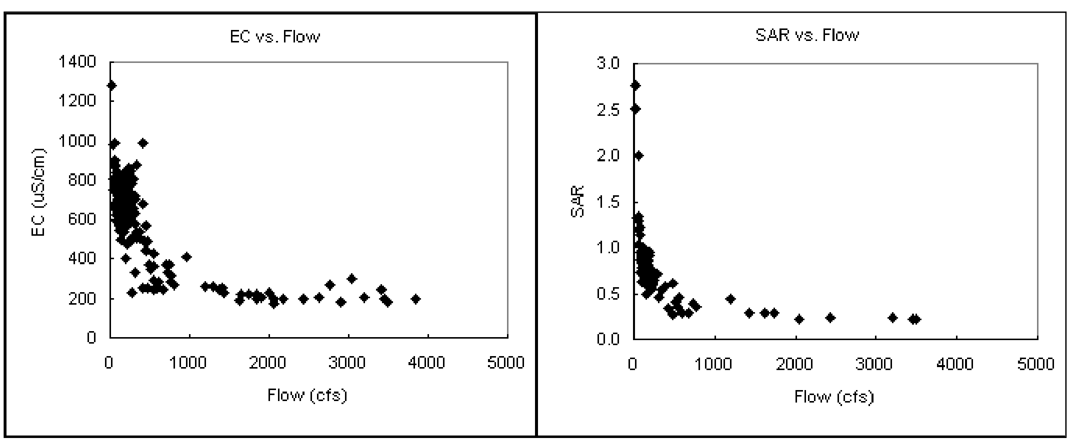
EC = Electrical Conductance; SAR = Sodium Absorption Ratio; cfs = cubic feet per second

µS/cm = microseimens per centimeter

Values calculated bases upon USGS data collected through 2002

All water quality values have been determined from historical data obtained from the USGS for the flow volume in question.

FIGURE 3-6 - VARIATION IN SURFACE WATER QUALITY WITH FLOW AT USGS STATION 06306300 ON THE TONGUE RIVER NEAR DECKER, BASED UPON USGS DATA FROM NOVEMBER 1985 TO SEPTEMBER 2004



Drainage within the Powder River Basin study area is to the Little Bighorn River, Rosebud Creek, the Tongue River and the Powder River. All of these streams flow generally north to join the Yellowstone River. The central and southern portions of the Billings RMP area are drained by a series of tributaries that also flow north-northeast into the Yellowstone River; these tributaries are the Boulder, Stillwater, Rock/Red Lodge Creeks, Clarks Fork, Bighorn and Little Bighorn. Drainage within the northern portion of the Billings RMP area is to the Musselshell River, which flows eastward until it meets the boundary between Musselshell and Rosebud counties—at which point it turns northward and flows into the Missouri River.

Surface water can be impacted by cultural activity such as agriculture and industry. When groundcover is broken it exposes soil to wind and water erosion, leading to suspended sediment being brought to bodies of surface water. Artificial impoundments can cause infiltration into the soil and migration into surface water. Accidental releases of wastes can migrate into water bodies.

Watershed water-use statistics in Table 3-8 apply to those watersheds shown in Map 3-8. Table 3-8 presents data about the quantity of surface water and groundwater used in each water-use category. These data cover the area projected to have maximum CBNG potential but similar data is available for other areas of the state (USGS 1995). Surface water in these watersheds is the dominate source of water, however locally groundwater use is important for public and domestic drinking water and for stock water.

The Clean Water Act of 1972 and amendments require states to adopt standards for the protection of surface water quality. These standards are designed to maintain water quality sufficient to support the beneficial uses of the water body. Montana water bodies are classified according to the present and future beneficial uses that they normally would be capable of supporting (75-5-301 MCA). The state Water-Use Classification System (ARM 17.30.621-629) identifies the following beneficial uses:

- Drinking, culinary use and food processing
- Aquatic life support for fishes and associated aquatic life, waterfowl and furbearers
- Bathing, swimming, recreation and aesthetics
- Agriculture (crop irrigation, stock watering, etc.) water supply
- Industrial (coal mining, electrical power generation, etc.) water supply

TABLE 3-8

WATER USE (IN MILLIONS OF GALLONS PER DAY [gpd]) STATISTICS IN 1995 BY WATERSHED SURFACE AND/OR GROUNDWATER USE

Watershed	Public Supply	Domestic	Industrial	Thermo-Electric	Mining	Livestock	Irrigation	Total Ground-water	Total Surface Water
Little Bighorn	0.01/0.15	0.0/0.12	0.0/0.0	0.0/0.0	0.0/0.0	0.9/0.37	84.01/1.46	2.1	84.24
Lower Bighorn	0.61/0.02	0.0/0.25	0.0/0.01	0.0/0.0	0.0/0.44	0.3/0.73	221.6/3.67	5.12	222.51
Lower Yellowstone	2.37/0.19	0.0/0.17	0.0/0.12	16.1/0.0	0.45/0.0	1.48/0.4	250/2.56	3.44	270.4
Rosebud	0.01/0.43	0.0/0.08	0.0/0.0	0.0/0.0	0.0/1.04	0.2/0.25	8.04/0.1	1.90	8.25
Upper Tongue	0.0/0.06	0.0/0.09	0.0/0.0	0.0/0.0	0.0/0.0	0.11/0.27	23.75/0.34	0.76	23.86
Lower Tongue	0.01/0.11	0.0/0.17	0.0/0.0	0.0/0.0	0.0/1.18	0.45/0.61	36.29/0.36	2.43	39.75
Middle Powder	0.01/0.12	0.0/0.04	0.0/0.0	0.0/0.0	0.0/0.0	0.02/0.24	3.18/0.04	0.44	3.21
Mizpah	0.0/0.0	0.0/0.03	0.0/0.0	0.0/0.0	0.0/0.0	0.1/0.19	6.41/0.06	0.28	6.51
Little Powder	0.0/0.12	0.0/0.04	0.0/0.0	0.0/0.0	0.0/0.0	0.05/0.24	2.18/0.03	0.43	2.23
Lower Powder	0.0/0.0	0.0/0.06	0.0/0.0	0.0/0.0	0.0/0.0	0.5/0.24	9.65/0.09	0.39	10.15

Source: USGS 1995.

The current use classification of each water body in Montana was assigned on the basis of its actual or anticipated uses in the early 1970s. Water bodies are classified primarily by: 1) the level of protection that they require; 2) the type of fisheries that they support (warm water or cold water) or; 3) their natural ability to support use for drinking water, agriculture, etc. The water quality standards employed to maintain these uses address changes from natural conditions for such parameters as coliform bacteria, dissolved oxygen, pH, turbidity, temperature, color, toxics and other harmful substances.

When streams and other water bodies are impacted by outside agents, their support of beneficial uses can become impaired. In Montana, surface water quality is tracked by the MDEQ. Table 3-9 provides a summary of the 2004 compilation of impaired and threatened water bodies in need of water quality restoration (MDEQ 2004). Water bodies included in this list do not currently support their identified beneficial uses.

In accordance with Section 303(d) of the Federal Clean Water Act, the Montana Department of Environmental Quality (MDEQ) has prepared a list of impaired and threatened waters every 2 years since 1992. This so called "303(d) list" identifies lakes, rivers and streams that are not meeting water quality standards and establishes priorities for Total Maximum Daily Load (TMDL) development.

However, Montana, like the rest of the nation, was slow to develop TMDLs. On June 21, 2000, the U.S. District Court of Montana ordered EPA to work with the state of Montana to develop and adopt a schedule that would result in developing all necessary TMDLs for water bodies on Montana's 1996 Section 303(d) list by May 5, 2007; however a settlement agreement has extended that deadline until 2012 (Friends of the Wild Swan et al., v. EPA et al., CV 97-35-M-DWM).

TABLE 3-9
IMPAIRED WATER BODIES IN AREA OF MAXIMUM CBNG POTENTIAL

Watershed	Impaired Water body	Probable Causes of Impairment	Probable Sources of Impairment
Lower Yellowstone-Sunday	Yellowstone River (MT42K001_020) from the Bighorn River to the Carterville Diversion Dam	Other habitat alterations	Dam construction Hydro-modification
Lower Yellowstone	Yellowstone River (MT42M001_012) from the Powder River to the Lower Yellowstone Diversion Dam	Other habitat alterations	Dam construction Hydro-modification
Lower Bighorn	Bighorn River (MT43R001_010) Crow Reservation Boundary to the Mouth (Yellowstone R)	Lead Mercury Metals	Source unknown
	Bighorn River (MT43R001_020) from Yellowtail Dam to Crow Indian Res. Boundary	Nitrogen Nutrients	Other
Upper Tongue	Hanging Woman Creek (MT42B002_031from Stroud Creek to the mouth (Tongue R)	Siltation	Grazing-related sources Agriculture
	Tongue River Reservoir (MT42B003_010)	Algal growth Chlorophyll a	Domestic wastewater lagoon Agriculture
Lower Tongue	Tongue River (MT42C001_011) from diversion dam just above Pumpkin Creek to the mouth (Yellowstone River)	Flow alteration	Dam construction Flow regulation/modification Hydromodification
Rosebud	Rosebud Creek (MT42A001_011) from the mouth 3.8 miles upstream to an irrigation dam	Bank erosion Other habitat alteration	Removal of riparian vegetation Habitat modification (other than hydromodification)
	Rosebud Creek (MT42A001_012) Northern Cheyenne Reservation Boundary to an irrigation dam 3.8 miles above the mouth	Bank erosion Other habitat alteration	Removal of riparian vegetation Habitat modification (other than hydromodification)

Source: Water Quality Integrated Report for Montana, 2004. Prepared By the MDEQ Water Quality Planning Bureau (http://nris.state.mt.us/wis/environet/2004Home.html).

Based upon concern due to proposed CBNG development plans, the MDEQ and EPA are currently developing TMDLs for the Tongue, Powder and Rosebud watersheds. Impacted water bodies and TMDL issues are discussed in detail in the Hydrology Appendix.

Several of the above watersheds and impaired water bodies are shared jurisdictionally among the state of Montana, the state of Wyoming, the Northern Cheyenne Tribe and the Crow Tribe. For example, while the Rosebud watershed is located entirely within the state of Montana, it includes most of the Northern Cheyenne Reservation and part of the Crow Reservation.

CBNG Discharges in Montana

Fidelity has been discharging untreated CBNG water into the Tongue River upstream of the Tongue River Reservoir since September 1999 under MPDES permit MT-0030457. Discharge under this permit is currently occurring at a rate of approximately 820 gallons per minute (gpm) upstream of the Tongue River Reservoir (Pond Creek POD WMP). This permit originally allowed for the discharge of up to 1,600 gpm. This untreated discharge has an EC of approximately 2,145 µS/cm and a SAR of approximately 57. During Water Year 2005, the average volume discharged under this permit was 1,067 gpm (MBMG 2005). This permit was revised to comply with the requirement that permits that are limited by EC and SAR be flow-based. DEQ approved the new permit on February 3, 2006 (prior to elimination of the flow-based requirement). It has an effective duration of 5 years from April 1, 2006, to March 31, 2011. The revised permit allows Fidelity to discharge untreated CBNG-produced water from 15 outfalls. The allowed discharge rates vary seasonally, as expressed on the following list.

Annual Period	Total Flow (gpm)
Nov. 01 – Feb. 28	2,500
Mar. 01 – Jun. 30	2,375
Jul. 01 – Oct. 31*	1,600

Other effluent limits include pH (between 6.5 and 9.0), oil and grease (10 mg/l) and total suspended solids (average monthly [25 mg/l] and daily maximum [30 mg/l)] and they apply to all periods during the year.
* Total discharges to the upper reach of the Tongue River would be limited to 1,000 gpm. The remainder of permitted flows may be discharged below the final crossing of the Wyoming border.

Flow restrictions for specific conductivity are based on daily stream flow values recorded at USGS gauging station 06306300 (Tongue River at State Line near Decker). Fidelity has to conduct daily instream monitoring for specific conductivity when daily stream flow values are lower than 35 cubic feet per second (cfs). Fidelity would cease discharging to the Tongue River if the measured instream specific conductance exceeded the following values on any two consecutive calendar days:

November 1 through March 1: 2,500 µS/cm

March 2 through October 31: 1,500 µS/cm

If Fidelity ceased discharge due to these conditions, discharges could recommence until the flow in the Tongue River at the gauge station exceeded 35 cfs.

Fidelity has also received a permit (MT0030724) to discharge treated, CBNG-produced water into the Tongue River. MDEQ approved this permit on February 3, 2006, with an effective duration of 5 years from April 1, 2006, through March 31, 2011. The use of this permit began in the summer of 2006. The effluent quality limitations for this permit depend on the season of the year; however, the discharge rate is fixed at 1,700 gpm. The numerical effluent limits for average monthly discharges are presented in the list below.

Annual Period	SAR	Specific Conductivity µS/cm	Total Nitrogen (mg/l)
Nov. 01 – Mar. 01	5.0	1,500	1.2
Mar. 02 – Jun. 30	3.0	1,000	1.3
Jul. 01 – Oct. 31	3.0	1,000	1.1

Total suspended solids average monthly (25 mg/l) and daily maximum (30 mg/l) quantity applies to all periods during the year.

Powder River Gas has also been granted an MPDES permit to discharge up to 1,122 gpm of treated CBNG water immediately downstream of the Tongue River Reservoir (MT-0030660). This discharge averaged 200 gpm from April to September of 2005 (Bobst 2006). This permit requires that EC be lower than 1,000µS/cm and SAR be lower than 3.

Results of Surface Water Monitoring

Since approximately 1999, the PRB has been in an extended drought. This pattern of precipitation has affected the fundamental surface water resource of several watersheds within the PRB. The changes are documented in various publications (Bobst 2005a, Bobst 2005b, Bobst 2006, USGS 2005) as well as the hydrological reports that accompanied various plans of development submitted by CBNG developers to BLM and the state of Montana (Fidelity 2003, Fidelity 2004, Fidelity 2005a, Fidelity 2005b, PRG

2004, Pinnacle 2005a, Pinnacle 2005b). Within the Tongue, Powder, Little Powder and Rosebud Watersheds, spring runoff has diminished or vanished at times during recent years due to meager snow-pack. Flow rates observed at USGS gauging stations have been substantially lower than historical averages and many tributary gauging stations routinely exceed Montana State Numerical Standards, including not-to-exceed (NTE) limits (see Table 3-6). When current EC and SAR values are measured against historical values at similar flows, they appear to be comparable. As such it does not appear that CBNG development had a measurable effect on EC and SAR through 2005.

Groundwater

Groundwater represents less than 3 percent of the total water use in the state (Solley et al. 1995). Aside from surface water sources, however, groundwater use is locally important for domestic drinking water and stock water. Groundwater sources include wells and springs.

CBNG development has the potential to impact groundwater by decreasing the pressure within the coal aquifers (drawdown). As such, it is the subject of Montana Code Annotated 82-11-175, which was enacted by the Montana Legislature in 2003 and MBOGC Order 99-99. This order describes the authorities that pertain to CBNG development. A copy of the order is included as an appendix to the Water Resources Technical Report (ALL 2001b). The order outlines water rights issues, mitigation, monitoring plans and jurisdiction.

MCA 82-11-175 requires that CBNG operators offer a reasonable mitigation agreement to each appropriator of water who holds an appropriation right or a permit to appropriate groundwater. The point of diversion has to be within 1 mile of the CBNG well, or 0.5 mile of a water source that is adversely affected by the CBNG well.

Mitigation agreements must address reduction or loss of water resources and must provide for prompt supplementation or replacement of water from any natural spring or water well adversely affected by the coal bed natural gas well. An example water mitigation agreement is included in the Hydrology Appendix.

Groundwater within the Planning Area is found within a variety of aquifers, ranging from shallow unconsolidated alluvial aquifers associated with modern rivers to deep bedrock aquifers consisting of consolidated sandstone, limestone, or coal. Known wells within Montana's PRB are shown on Map 3-5.

Water quality and quantity vary within the Planning Area. Table 3-8 presents data about the quantity of groundwater taken on a watershed basis in each water-use category. Although groundwater only represents a small percentage of the total water use, it is critical because it provides almost 100 percent of the domestic water for farmsteads throughout the PRB. It also constitutes the largest percentage of dependable stock water, because the groundwater experiences fewer seasonal or drought effects than surface water.

Surficial aquifers within the Planning Area consist of Quaternary and Tertiary alluvium, Tertiary fluvial sand and gravel deposits and Tertiary terrace deposits. These surficial aquifers are located within the floodplains and along the channels of larger streams, tributaries and rivers. They are among the most productive sources of groundwater within the Planning Area and the quality of groundwater from surficial aquifers varies highly; the water is, however, typically a calcium-sulfate type. The quality of groundwater from alluvial aquifers within the west half of the Billings RMP area is usually good (Class I aquifers) and is suitable for human consumption. The quality of alluvial groundwater within the PRB is relatively low (Class II and III aquifers). Maps 3-6 and 3-7 show the occurrence of surficial aquifers, as well as the quality of the groundwater produced from these aquifers.

The major bedrock aquifers within the Planning Area include the coals and sands of the Fort Union Formation and the Lower Hell Creek-Fox Hills. Most CBNG is produced from coals within the Tongue River Member of the Fort Union Formation, as shown in Figures 3-1, 3-2 and 3-7. Table 3-10 contains information about the general depth, yield, geologic materials and water quality of aquifers in the PRB study area.

The Lebo Shale Member of the Fort Union formation is a regional barrier to groundwater flow (aquitard). As such, drawdown-related CBNG impacts would be limited to the Tongue River Member of the Fort Union Formation.

FIGURE 3-7

MAJOR BEDROCK AQUIFERS WITH THE PLANNING AREAS

ERA	Period	Principal Aquifers	Age:
CENOZOIC	Quaternary	Alluvium and Fluvial-Glacial Gravels	**10,000 Years**
	Tertiary	Alluvium Fluvial-Glacial Gravels (and equivalents) Terraces Fort Union Formation	**1.6 million years before present (MYBP)**
MESOZOIC	Cretaceous	Lower Hell Creek-Fox Hills Formation Judith River Formation Eagle Formation Kootenai Formation	**66.4 MYBP**
	Jurassic	Ellis Group	
	Triassic	No Principal Aquifers	
PALEOZOIC	Permian	No Principal Aquifers	**245 MYBP**
	Pennsylvanian	No Principal Aquifers	
	Mississippian	Madison Group	
	Devonian Silurian Ordovician Cambrian	No Principal Aquifers	**570 MYBP**

TABLE 3-10

PLANNING AREA AQUIFERS AND THEIR GENERAL CHARACTERISTICS

Aquifer	Common Drilling Depth	Geologic Materials	Aquifer Type	Production or Yield	Total Dissolved Solids	General Comments
AQUIFERS IN SURFICIAL DEPOSITS						
Alluvium, Fluvial-Glacial Gravels, Terrace Gravels and Flaxville Formation Gravels and equivalents.	20 to 40 ft. May exceed 250 ft.	Unconsolidated clay, silt, sand and gravel.	Commonly unconfined	Typically 5 to 50 gpm.	Range 300 to 2,200 milligrams/ liter (mg/l).	Widely used aquifer systems. Alluvial aquifers are most often used because they lie near the surface and are accessible via shallow wells and water yield is routinely quite good. They can be partially confined to completely confined with yields that may exceed 1,500 gpm in some areas. Yields from gravel deposits are more variable but water quality is usually quite good. Alluvial aquifers are vulnerable to human-caused contamination in a variety of settings.
AQUIFERS IN CENOZOIC ROCKS						
Fort Union Formation	50 to 300 ft. May exceed 1,000 ft.	Interbedded shale, siltstone, sandstone and coal.	Commonly confined, except near surface.	Typically 5 to 50 gpm.	Range 500 to 5,000 mg/l.	The Fort Union is a major source of groundwater for eastern Montana. Water is suitable for watering stock but may not be suitable for irrigation.
AQUIFERS IN MESOZOIC ROCKS						
Lower Hell Creek-Fox Hills Formations	150 to 500 ft. May exceed 1,000 ft.	Mainly sandstone with some siltstone and shale.	Confined	5 to 20 gpm. May exceed 200 gpm.	Range 500 to 1,800 mg/l.	Although the Fort Union overlies the Hell Creek-Fox Hills, the latter is often the target for water well drilling as a result of its higher quality of water.
Judith River Formation	200 to 600 ft. May exceed 1,000 ft.	Sandstone, siltstone, with some coal.	Confined	5 to 15 gpm. May exceed 100 gpm.	Range 160 to 27,000 mg/l.	
Eagle Formation	100 to 800 ft. May exceed 2,000 ft.	Interbedded sandstone and shale.	Confined	10 to 20 gpm. May exceed 200 gpm.	Range 800 to 1,500 mg/l.	Water quality is best in central Montana, poorer in eastern Montana.

TABLE 3-10

PLANNING AREA AQUIFERS AND THEIR GENERAL CHARACTERISTICS

Aquifer	Common Drilling Depth	Geologic Materials	Aquifer Type	Production or Yield	Total Dissolved Solids	General Comments
AQUIFERS IN MESOZOIC ROCKS (CONTINUED)						
Kootenai Formation	100 to 1,000 ft. May exceed 3,000 ft.	Interbedded sandstone, siltstone and shale.	Confined	10 to 30 gpm. May exceed 100 gpm.	Range 200 to 500 mg/l. May exceed 14,000 mg/l.	Used heavily near the Belt Mountains where water quality is good.
Ellis Group	300 to 2,000 ft. May exceed 5000 ft.	Sandstone, shale, limestone and dolomite.	Confined	No Data.	Generally less than 600 mg/l.	Water quality is best near outcrop areas.
AQUIFERS IN PALEOZOIC ROCKS						
Madison Group	500 to 3,000 ft. May exceed 7,000 ft.	Limestone, dolomite, anhydrite and halite.	Confined	20 to 6,000 gpm. Higher in karst areas.	Range 500 to 300,000 mg/l.	Very extensive aquifer, it underlies a large portion of the Great Plains. Water quality can be very high near recharge areas and is poorest in northeastern Montana.

The occurrence of specific bedrock aquifers and the quality of groundwater produced from these aquifers vary throughout the Planning Area. Maps 3-9 and 3-10 are maps that show the occurrence of bedrock aquifers and the quality as well as quantity of groundwater produced from these aquifers.

Water enters the aquifers during deposition of the sedimentary unit as formation water that can be salty or fresh. Later, meteoric water can enter the aquifer through outcropping recharge zones where runoff water infiltrates and is conducted into the subsurface. A small amount of water also reaches the aquifers via migration through adjacent aquitards.

Aquifer pressure can be measured in pounds per square inch (psi) or in feet of head and can vary from a low-pressure reservoir where water stands below the top of the reservoir, to an artesian aquifer where water stands above the top of the reservoir, sometimes being above ground surface and flowing from wells. Aquifer pressure can be measured in a monitoring well where water is not normally produced except for testing and sampling. Groundwater can be produced through water wells that pump or convey water from aquifers to the surface. Groundwater also comes to the surface by way of natural springs that occur where the aquifer outcrops. Springs may conduct groundwater onto the surface or into bodies of surface water.

Groundwater near an aquifer's recharge zone has been in contact with the rocks and minerals in the aquifer material for a relatively short period. As a result, the water has not had time to dissolve substantial amounts of soluble salts and minerals, so it remains fresh. The longer the water is in the aquifer, the more time it has to dissolve salts and minerals. In general, the concentration of total dissolved solids increases with distance from an aquifer's recharge or outcrop zone.

The coals within the Tongue River Member of the Fort Union Formation are the primary CBNG targets in Montana. Groundwater within the Tongue River Member of the Fort Union Formation has been shown to evolve in a predicable manner along its flow path (Van Voast and Reiten 1988). Cation exchange is one of the normal processes that increase salinity, where calcium and magnesium are replaced by sodium, as the groundwater comes into contact with sodium-rich shale. In deeper portions of the aquifers, sulfate is removed by reduction reactions. This reduction causes the salinity of the water to decrease, while increasing the ratio of sodium to calcium and magnesium. The result is a moderately saline (EC of ~1,800 to 2,500 µS/cm), sodium-bicarbonate-rich water in the coal seam aquifers where CBNG is expected to be produced.

The sands and coals of the Tongue River Member of the Fort Union Formation are important aquifers in the Powder River and Billings RMP areas. The Tongue River Member of the Fort Union formation contains substantial laterally continuous layers of low permeability shale interbedded with coals and sands. The coal units are typically overlain and underlain by shale units (Wheaton and Donato 2004). As such, most of the impacts from CBNG-related drawdown will be to the coal aquifers.

Observed CBNG Related Groundwater Drawdown

Groundwater is being produced from many PRB water wells. Known wells are shown on Map 3-5. Since 1999, CBNG production has drawn down the pressure within the coal seam aquifers. This drawdown can extend beyond the field's boundaries. The present state of the groundwater resource in PRB coal seams can be addressed by examining existing monitoring well conditions.

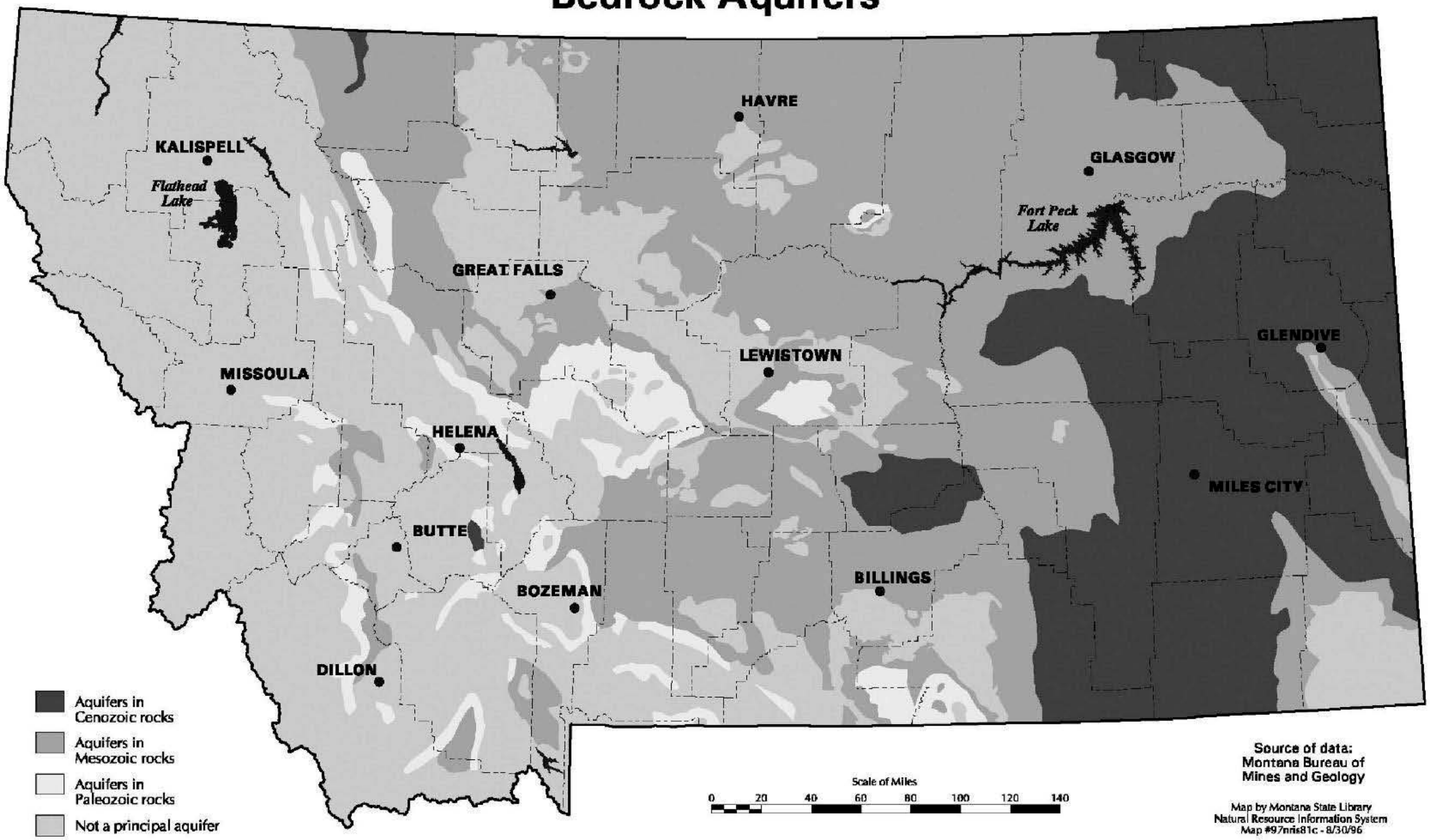
One hundred sixty-two wells were used to monitor regional groundwater levels in the area of Montana's CBNG production. After 6 years of CBNG production, the 20-foot drawdown contour has been interpreted to extend about 1.5 miles beyond the edges of the CX field (Wheaton et al. 2006). This drawdown is in line with, but somewhat less than, the Statewide EIS predictions for this period of development. No drawdown has been observed within units other than the developed coals. Drawdown is sensitive to the presence and orientation of faults, which are flow barriers (Wheaton and Donato 2004).

Within and next to Montana's CX Ranch field, Fidelity Exploration & Production Company used water-level readings from approximately 250 wells to derive water drawdown maps (Fidelity 2005a, Fidelity 2006). The Fidelity Exploration & Production Company maps showed in-field drawdowns up to 594 feet, with the interpreted 20-foot drawdown extending up to 2 miles away from production. This drawdown is in line with the Statewide EIS predictions for this period of development.

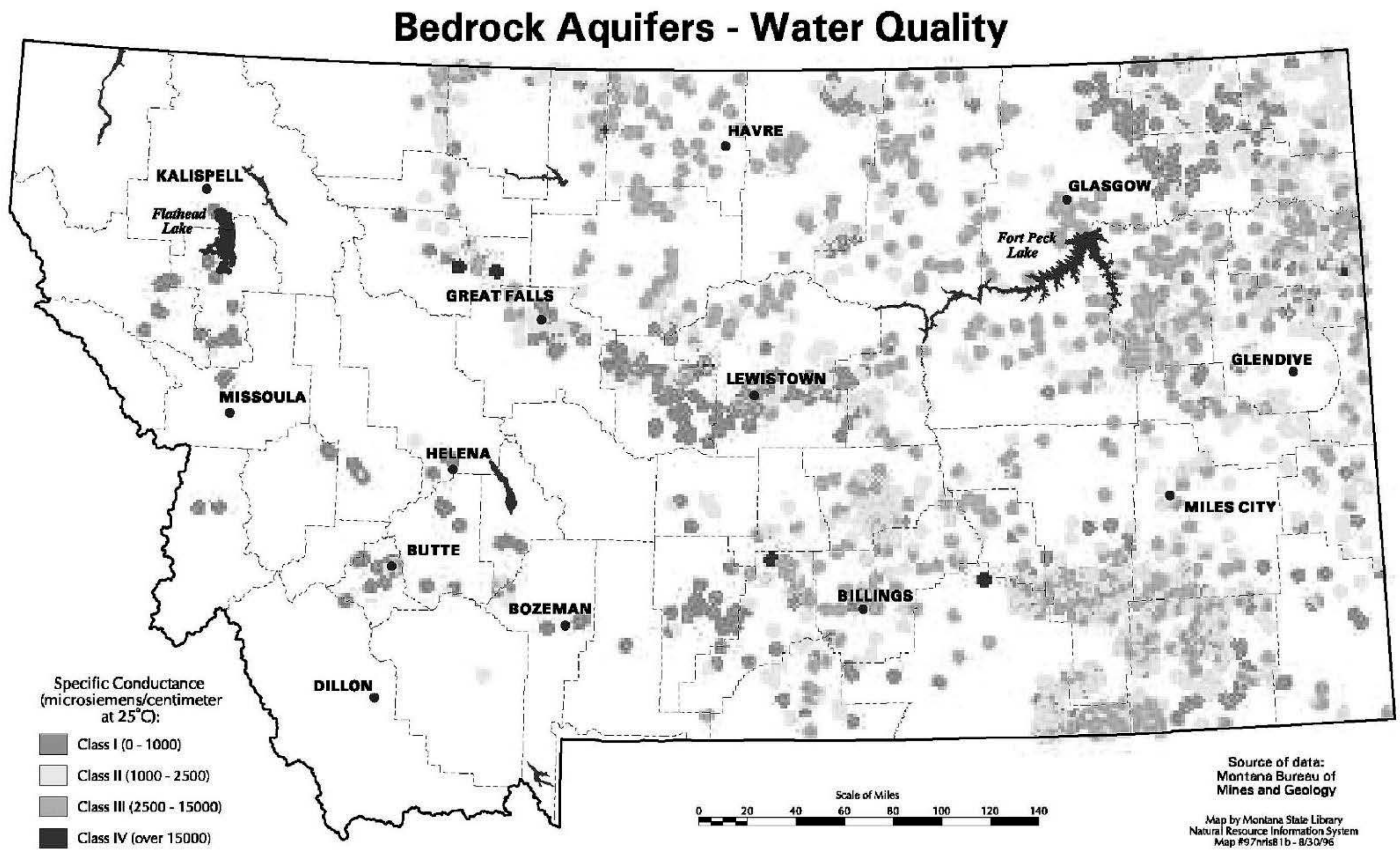
Several Montana CBNG operators were contacted to discuss use of water mitigation agreements and their experiences using them. Fidelity Exploration & Production Company, J.M. Huber Corporation and Pinnacle Gas Resources, Inc., responded to the inquiry. Fidelity reports that its CBNG production since 1999 has resulted in impacts to six water wells near CX Ranch field (Williams 2006). Fidelity Exploration & Production Company drilled new wells to replace these six wells. The company has not

Map 3-9

Bedrock Aquifers



Map 3-10


Bedrock Aquifers - Water Quality
HAVRE
KALISPELL
Flathead Lake
GLASGOW
Fort Peck Lake
GREAT FALLS
GLENDIVE
LEWISTOWN
MISSOULA
HELENA
MILES CITY
BUTTE
BILLINGS
BOZEMAN
DILLON
Specific Conductance (microsiemens/centimeter at 25°C):
Class I (0 - 1000)
Class II (1000 - 2500)
Class III (2500 - 15000)
Class IV (over 15000)
Scale of Miles
0 20 40 60 80 100 120 140
Source of data: Montana Bureau of Mines and Geology
Map by Montana State Library
Natural Resource Information System
Map #97nris81b - 8/30/96

received any complaints regarding springs that may have been impacted (Williams 2006). Furthermore, Fidelity reports that it has not had any formal complaints of gas in wells. The company, however, indicated if there were any, its mitigation agreement would be used (personal communication, Williams, 2006). A copy of a typical water mitigation agreement can be reviewed in the Hydrology Appendix.

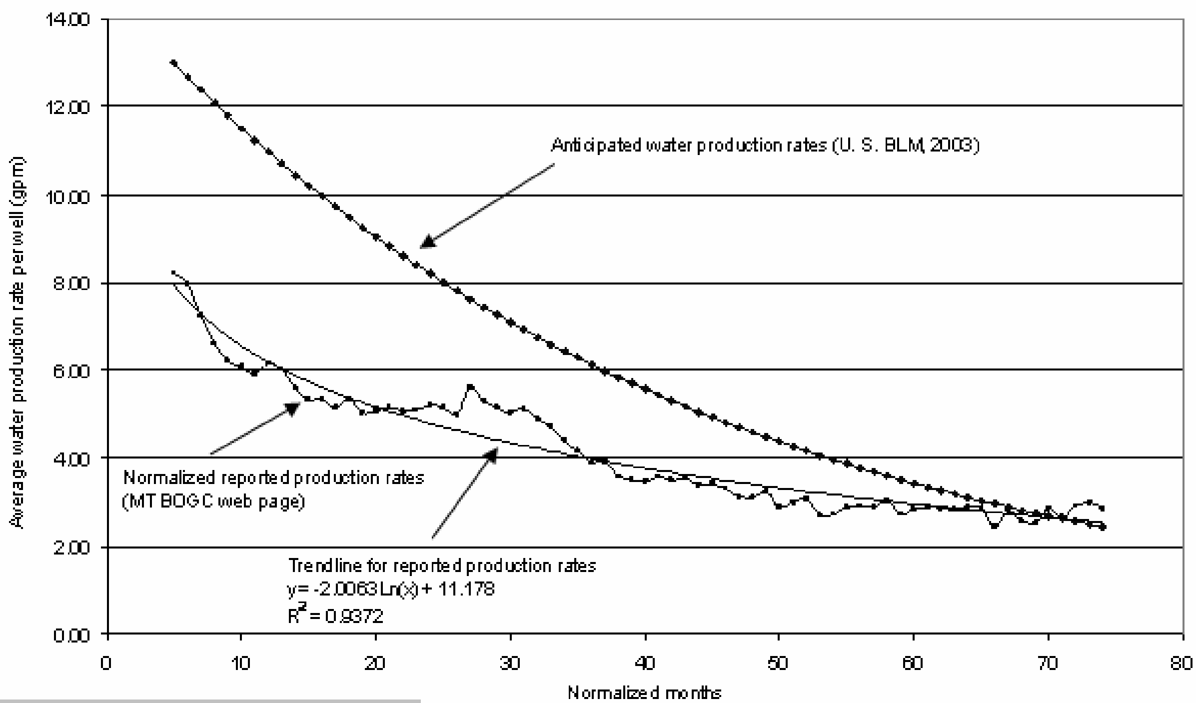
Huber reported receiving complaints from 12 well owners about reduced water pressure in Wyoming. Huber has drilled six new wells so far and is trying to settle with the other six well owners in a small subdivision where the wells have been impacted. The company has offered to install a small domestic water supply system, but the residents have so far refused. Huber also received one complaint regarding a spring going dry, but upon investigation it was determined, with concurrence from the owner, that the drought was probably responsible because of the shallow nature of the spring. With regards to natural gas in wells, Huber stated it had had some problems a few years ago; there were two wells with elevated levels of natural gas. Huber replaced the wells. The company also installed three cisterns at local ranches where it suspected the water wells might start venting natural gas. The cisterns function as degassing vessels that are open to the atmosphere and allow natural gas to vent before water is piped into the house or barn. The company is not aware whether these water wells are experiencing increasing methane, but the wells are completed in a coal seam being produced. Huber stated it considers any water well with elevated natural gas as covered by its mitigation agreement.

Pinnacle reported one complaint from a prominent ranch family that filed suit for “future water shortage.” Pinnacle has had no specific complaints about reduced water pressure in wells, springs drying up, or elevated natural gas in domestic wells.

The Montana Bureau of Mines and Geology (MBMG) issued a 2005 Draft Groundwater Monitoring Report indicating the observed production rate for water is somewhat lower than the assumption used in the statewide CBNG EIS. Figure 3-8 is a graphic that depicts the assumed water production rate versus the normalized observed rate of production.

FIGURE 3-8

OBSERVED WATER PRODUCTION VERSUS CBNG FEIS ASSUMED WATER PRODUCTION RATE FOR THE MONTANA PORTION OF THE POWDER RIVER BASIN



Source: MBMG 2005 Draft Groundwater Monitoring Report.

The pumping rates BLM estimated for early years (which determined the peak rates and drove the analysis) are somewhat greater than observed. However, most of the new wells have been installed in areas near existing development, so initial head would have been less than the wells used to extrapolate the trend. In areas of virgin pressure, the original curve is probably more reasonable. Also, basin-wide, some of the coals are substantially thicker and would, therefore, yield more water and would be expected to have higher pumping rates.

MBMG's Draft 2005 Groundwater Report also indicates that drawdown associated with CBNG development appears to be causing a slight increase in the volume of water drawn from the Tongue River Reservoir to the Upper Dietz coal seam. This coal seam sub-crops in the reservoir, so the reservoir has historically recharged it. Assuming the faults in this area function as flow barriers and regional aquifer characteristics can be applied, the volume of water being drawn from the reservoir can be estimated using Darcy's Law (Fetter 1994). This analysis indicates CBNG-related drawdown has increased the flow from the reservoir to the coal seam by approximately 2.4 acre-feet per year (from 19.2 ac-feet/year to 21.6 ac-feet/year). This is equivalent to an increase of 1.5 gpm.

Observed Infiltration Effects

Storage ponds have often been used to manage CBNG-produced water. Those ponds that are not lined and are located on permeable materials can infiltrate water and create saturated flow to the subsoil or bedrock beneath the ponds. New publications have provided some additional information on this management process (Wheaton and Brown 2005, Brinck et al. 2004). Three infiltration ponds were selected for research: one in the CX Ranch field of Montana and two south of the CX Field in Wyoming, but still in the PRB. These reports documented downward infiltrating waters beneath CBNG ponds, but impacts were highly site-specific. The Montana pond has impacted a monitoring well located approximately 200 feet downgradient from the pond; the well documented a water-level rise of 25 feet in overburden, an increase of TDS from 2,566 to 3,548 mg/L and a decrease in SAR from 43 to 14. An off-channel infiltration pond in the Coal Creek area of Wyoming apparently impacted bedrock aquifers beneath the pond; both TDS and SAR were affected near the pond. Farther south in the PRB, in the Beaver Creek area, two on-channel ponds have received CBNG-produced water. After a year, information on the effect from discharge into these ponds is lacking and there is no indication of what has happened to groundwater near the pond.

In general, it appears infiltrated CBNG water dissolves soluble minerals in the subsurface along its flow path. This results in water with a higher TDS and lower SAR than the original CBNG water (Table 3-11). The resultant water is dominated by ions of Mg and SO_4 (Wheaton and Brown 2005). It appears salts are flushed from the system over time (Wheaton et al. 2005). The duration and geographic extent of effects to the underlying groundwater are poorly defined. Impoundments that are lined, or are located on low-permeability materials, do not have the potential to infiltrate at a rate that will result in saturated flow. If saturated flow does not occur, impacts to underlying groundwater are unlikely, since the salts would be "parked" in the unsaturated zone and the water would migrate as vapor.

Water Rights

Water rights in Montana are the subject of The Montana Water Use Act (Title 85, Chapter 2, MCA) of 1973, which became effective July 1, 1973. Water rights existing prior to that date are to be finalized by state courts. Water rights applications since that date are secured through a MDNRC permit system. In addition, some water rights are protected under federal and state statutes.

Water rights on some BLM-administered lands are protected by the Federally Reserved Water Rights for Public Springs and Water Holes, Public Water Reserve 107, pursuant to Executive Order dated April 17, 1926. Compacts between the state of Montana and Northern Cheyenne Tribe have placed moratoria on new water use developments on Tribal Lands within the Rosebud, Lower Bighorn and Pryor watersheds. Native American water rights are discussed in detail in the Indian Trust Assets section of this chapter.

Watershed water-use statistics in Table 3-8 apply to those watersheds shown in Map 3-8. Table 3-8 presents data about the quantity of surface water and groundwater used in each water-use category. These data cover the area projected to have the maximum CBNG potential, but similar data are available for other areas of the state (USGS 1995).

Water rights are being adjudicated on a watershed basis. The Tongue River and Little Bighorn have not yet been fully adjudicated, Rosebud is 78 percent examined prior to being adjudicated, Lower Yellowstone is 90 percent examined. Table 3-12 lists water rights developments by watershed in the area of main potential for CBNG production. Native American Water Rights are discussed in detail in the Indian Trust Assets section of this chapter.

TABLE 3-11

GROUNDWATER QUALITY FOR THE MONTANA PORTION OF THE POWDER RIVER BASIN - SELECTED GROUNDWATER QUALITY DATA COLLECTED FROM WATER SUPPLY WELLS LOCATED THROUGHOUT MONTANA POWDER RIVER BASIN

	Judith River Formation		Hell Creek /Fox Hills Formation		Fort Union Formation		Quaternary Alluvium	
County	Avg. TDS (mg/l)	Avg. SAR	Avg. TDS (mg/l)	Avg. SAR	Avg. TDS (mg/l)	Avg. SAR	Avg. TDS (mg/l)	Avg. SAR
Big Horn	936	54	1,440	14	1,658	8	2,118	5
Rosebud	2,465	31	1,376	35	1,595	16	1,516	9
Powder River	No data	No data	890	35	1,882	15	2,783	5
Custer	No data	No data	896	37	1,810	31	1,665	8
Treasure	2,312	64	1,985	56	1,782	32	2,437	10
Weighted Average	2,100	42	1,148	37	1,892	18	2,014	7

Avg. TDS = Average Total Dissolved Solids
Avg. SAR = Average Sodium Adsorption Ratio
Source: MBMG 2001.

TABLE 3-12

WATER RIGHTS DEVELOPMENT SUMMARY BY WATERSHED

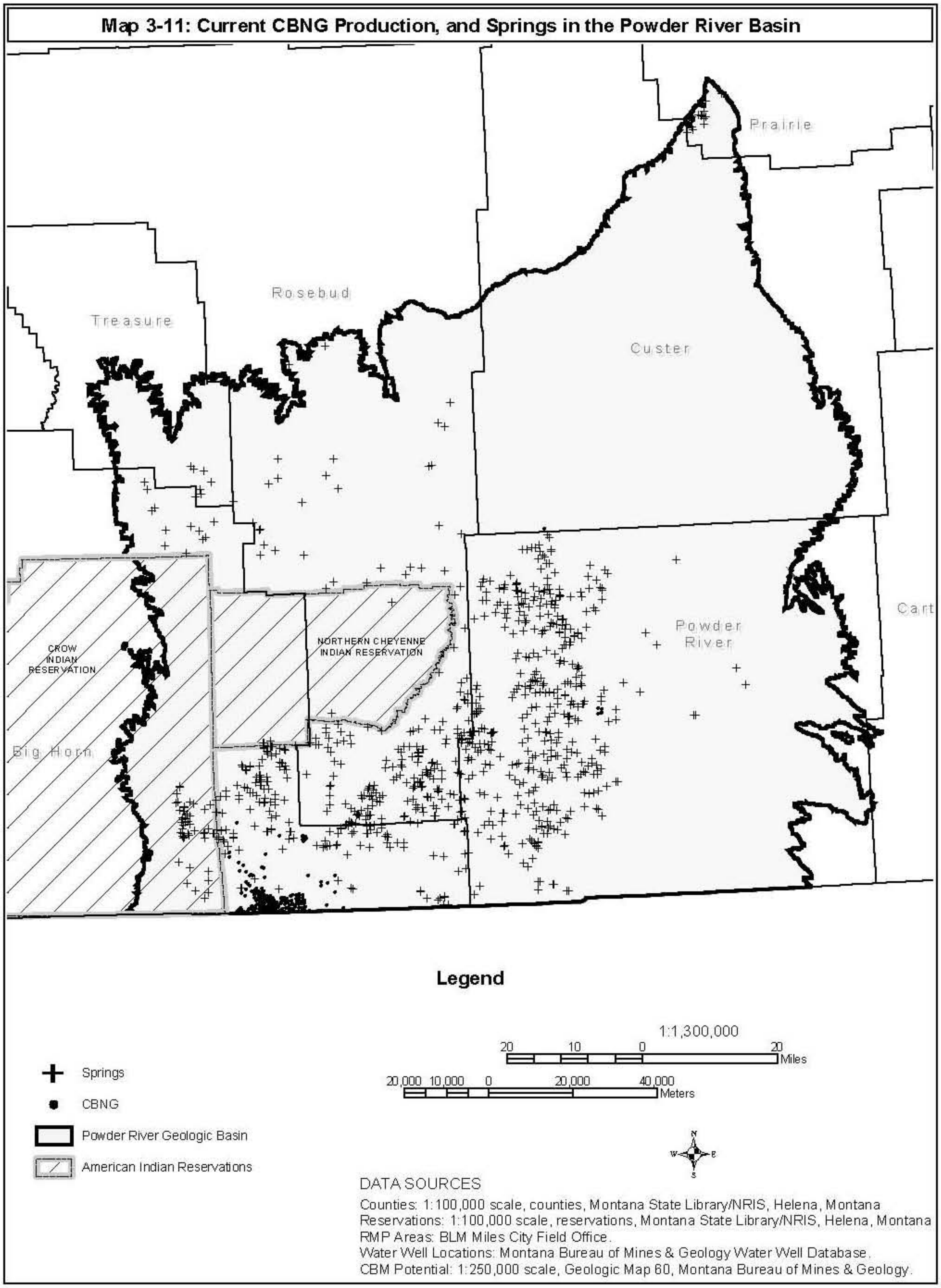
	Number of Pre-1973 Developments		Number of Post-1973 Developments		
Watershed	Surface	Ground-water	Surface	Ground-water	Number of Pending Water Rights Permits
Rosebud	765	408	27	210	1
Upper Tongue River	820	504	35	136	3
Lower Tongue River	2,407	2,278	98	662	1
Little Powder	1,320	741	66	166	3
Lower and Middle Powder and Mizpah	5,204	2,816	314	4	7
Lower Yellowstone	3,398	1,330	278	804	4
Little Bighorn	786	387	35	96	0
Lower Bighorn	1,522	596	105	419	3

Source: DNRC 2001.

The Montana Water Use Act (85-2-506) established the designation of the Powder River Basin Controlled Groundwater Area. The MDNRC established in the Controlled Groundwater Area in anticipation of the withdrawal of groundwater associated with CBNG development. Two issues relating to water rights were addressed as part of the order. First, CBNG operators must offer water mitigation agreements to owners, as discussed above. Second, beneficial uses of CBNG -produced water require water rights issued by MDNRC as established by law.

Existing Wells and Springs

Map 3-11 shows the existing springs in the Montana portion of the PRB and existing CBNG wells. Spring locations, as supplied by MBMG (2002), are widely scattered across the basin. As noted above, Fidelity Exploration & Production Company, operator of most CBNG wells in the CX Ranch field, has received no complaints of impacted springs. Furthermore, it is unlikely that CBNG production would impact springs, because if subsurface coal seams were in direct contact with surface springs, water and methane gas would have long ago leaked to the surface, leaving the coal seam depleted.


Map 3-11: Current CBNG Production, and Springs in the Powder River Basin
Prairie
Rosebud
Treasure
Custer
Powder River
Cart
CROW INDIAN RESERVATION
NORTHERN CHEYENNE INDIAN RESERVATION
Big Horn
Legend
1:1,300,000
20 10 0 20 Miles
20,000 10,000 0 20,000 40,000 Meters
Springs
CBNG
Powder River Geologic Basin
American Indian Reservations
DATA SOURCES
Counties: 1:100,000 scale, counties, Montana State Library/NRIS, Helena, Montana
Reservations: 1:100,000 scale, reservations, Montana State Library/NRIS, Helena, Montana
RMP Areas: BLM Miles City Field Office.
Water Well Locations: Montana Bureau of Mines & Geology Water Well Database.
CBM Potential: 1:250,000 scale, Geologic Map 60, Montana Bureau of Mines & Geology.

The fact that a coal seam produces gas strongly suggests it is isolated from a surface outlet.

Water Management

The management of produced water associated with CBNG development is one of the primary issues relating to existing, as well as future, CBNG development and production operations. These issues develop from both the volume and the quality of the water produced. Initial water production rates common to CBNG wells in the Montana portion of the PRB range from approximately 15 to 20 gpm. Over time, water production rates decline, with average water production rates ranging from 2 to 5 gpm over the life of a well. As of July 2005, CBNG water production within the CX Ranch Field in Montana averaged approximately 3 gpm per well.

In addition to the overall volume of water produced, the quality of CBNG-produced water has characteristics that make managing it challenging and complex. The quality of CBNG-produced water is generally good, but, depending on the area of the basin where it is produced, it may have a SAR ranging from 30 to 60 and TDS ranging from 500 to 2,500 mg/L. Both the quantity and quality of CBNG-produced water can also vary based on the specific coal seam(s) being developed. The combination of CBNG-produced water quantity and quality and the variation of these parameters found from one site to the next, as well as between producing coal seams, may require having a variety of water management options available for use.

While initial CBNG development depended almost exclusively on untreated discharge to surface waters, a number of other CBNG-produced water management options are currently being used or considered within both the Montana and Wyoming portions of the PRB. Numerous water management options have been discussed in recent reports, including Kuipers, et al. (2004) and CDM (2004). The following list includes the major water management options being used, or proposed for use, in the PRB:

- Class V—injection into shallow sands
- Class V—reinjection into coal seams
- Class IID—injection into deep underground non-drinking water sources reservoirs
- Class IIR—injection into secondary recovery projects
- Treatment and beneficial use or discharge
- Industrial uses
- Managed irrigation
- Livestock watering – cattle feedlots
- Public water supply
- Impoundments

A brief discussion of these water management options is provided in the following paragraphs. The water management options discussed are not intended to be all-inclusive. Rather they demonstrate a variety of options, including beneficial uses, that have to be considered and their implementation is largely site-specific, depending on the quality and quantity of water produced from a particular area or coal seam.

Class V Injection into Shallow Sands

Underground injection into shallow sand aquifers offers a potential way to manage some quantity of water produced from CBNG wells. This type of injection uses boreholes drilled into shallow sands classified as USDWs and then involves pumping the produced water into those aquifers. Injection would be limited to permeable sands, either between or below, producing Fort Union coals. Implementation of this option would depend on the quality of the produced water and groundwater within the shallow sand injection zone, as well as current and future beneficial uses of the shallow sand injection zone. Beneficial uses could include, but would not be limited to, public drinking water, agriculture, aquifer recharge, storage and industrial uses. When injection is considered using Class V type wells for beneficial uses, pretreatment of the produced water may be required before it is injected into an aquifer for either recharge or storage.

The feasibility of underground injection as a tool for managing produced water involves several technical considerations, including geology, economics and engineering. These considerations can vary considerably based on site-specific conditions. Within particular study areas, it has been shown that suitable sand injection targets underlie approximately 9 percent of the site (Wheaton and Reddish 2005).

Class V Reinjection into Coal Seams

This alternative includes the option of reinjecting CBNG-produced water into an underground coal seam. At the present time, there appear to be no PRB wells actively injecting produced water into coals. There are, however, records of at least nine wells that historically injected into shallow nonproductive coals in the PRB. These wells gave varying results from less than 100 barrels per day (bpd) to more than 2,000 bpd. The receiving coals ranged in depth from 45 to 400 feet below land surface. There are no records of operators attempting to inject into depleted coal seams (Likwartz, 2005).

The alternative has, however, been tested on a very limited basis. There are several reasons why reinjection of produced water into coal seams has not been widely used. These include the following:

1) The reintroduction of water into a producing coal seam increases the hydrostatic pressure and slows the natural gas production.
2) 2) Non-produced coal seams are saturated and cannot receive the volumes of water produced.
3) 3) The financial investment to construct a pipeline to bring the produced water to a suitable coal seam is high.
4) 4) Not all produced water has to be treated or disposed of, but it can be and is used for beneficial purposes.
5) 5) The possibility of causing vertical fractures in the coal seam exists, thereby causing the injected water to be injected not only into the target seam but into another seam of formation.
6) 6) The possibility exists of causing the pressure in the seam to increase and thereby increase the water pressure in any domestic water well or stock well to such an extent that the affected well would no longer be useable.

Coal seams serve as water supply aquifers throughout many PRB areas. Many of the shallow coals in the basin are unconfined and open to the surface, often via clinker zones. Under unconfined conditions, the coal seams do not usually produce CBNG, as any gas that was present has escaped into the atmosphere. Coals can also be present as confined aquifers isolated from the surface by formations such as shales and claystones. Confined coals can often produce water and CBNG. When fluids no longer can be produced from these coals, they are depleted. Injection may be possible into non-productive coals as well as depleted coals, but each has its own drawbacks and barriers to use.

Coal is designated nonproductive because the methane either was never generated or has leaked off. If it has leaked off, then the coal seam is an unconfined aquifer and its fluids can reach the surface and discharge, although the time required to do so may be a few days or many hundreds of years.

A depleted coal seam well may have been produced for a number of months or years and it may no longer produce CBNG in economic quantities. Such a well would have a lower reservoir pressure than when it began producing. If the reservoir pressure has been reduced, the reservoir may accept large volumes of fluid at relatively low injection pressures.

A coal seam that is depleted in one well or one project area may still be productive in an adjacent CBNG project area. If an operator applies for a Class V injection permit in a depleted well, an offsetting operator may protest this application by arguing that any injection by the other operator will retard adjacent production, thereby reducing the mineral estate under lease. For this reason, successful injection applications will have to be sufficiently separated, either geographically or stratigraphically, from active CBNG production from the same coal seam.

Technical parameters relating to the feasibility of injection into coal seams are site-specific. They primarily include the porosity and permeability of the injection coal seam and injection pressures required to inject the proposed volume of CBNG-produced water.

Class IID Injection into Deep Non-USDW Reservoirs

Class II injection wells, typically used for conventional oil and gas operations, have the potential to be used for CBNG water disposal. EPA classifies deep injection wells used for disposal below any USDW as Class II wells. Class II injection wells are subdivided as either IID (for disposal) or IIR (for secondary oil recovery).

Class IID permits are issued for injection into an underground formation that contains water with a TDS greater than 10,000 mg/L or is an exempted aquifer. These deep Class IID wells may be able to accept large volumes of water in an environmentally safe manner; however, success with these wells in the PRB has been limited, with only ~30 percent being successful (Sattler et al., 2006). Class IID injection zones typically are very deep and are isolated from drinking water sources by thick, impermeable, confining zones.

Technical parameters relating to the feasibility of deep well injection are site-specific. They primarily include a high enough porosity and permeability and low enough pressure within the deep injection zone to allow for injecting large volumes of water. Water quality of the injection zone with respect to TDS is also a factor. The distance and cost of running pipelines to injection wells and the cost of drilling the injection wells would also be factors.

Class IIR Injection into Secondary Recovery Projects

CBNG-produced water could be used to supply water for injection into Class IIR wells as part of secondary oil recovery (water-flood) projects. Class IIR injection is done by oil producers to more efficiently produce oil from conventional oil fields. Under this option, CBNG operators could pipeline their produced water to oilfields being flooded by other operators in an effort to produce additional oil. Water floods could inject large volumes of water up to 50,000 bpd.

Technical issues relating to the feasibility of using CBNG water in a water flood would include its chemical compatibility with the particular oil reservoir. Injected water that is chemically incompatible with water already in the oil reservoir could result in precipitation of solids. This could reduce permeability of the reservoir, resulting in lower production. The distance and cost of running pipelines to water-flood fields would also be a factor.

Treatment and Beneficial Use or Discharge

In general, CBNG-produced water is characterized by elevated levels of salinity, SAR and TDS. The concentrations of each of these parameters would vary based on location and the coal seam being developed and might require treatment before beneficial use or discharge. A variety of treatment technologies could be used to improve the quality of this water and allow for increased beneficial use or discharge. Ion exchange and reverse osmosis are two common examples.

Treatment processes would depend both on treatment goals and influent water quality. Continual adjustments to treatment processes might be required if influent water quality varied from the expected quality. Recent and proposed changes in discharge standards might require upsizing or modifying treatment equipment to meet the new standards. The costs associated with treatment systems might be a factor.

Industrial Uses

Coal mines in the PRB use large volumes of water for dust control. CBNG-produced water is currently used at local coal mines to control dust and for equipment washing, as well as for other uses. CBNG-produced water has to be transported to the active mines for this option to be feasible.

Another potential industrial use of CBNG-produced water would be at electric generating power plants, which have a considerable need for cooling water. Nationally, water availability has been a limiting factor in the development of new power plants. With the current and projected volume of produced water from CBNG development, consideration of using CBNG-produced water beneficially would be reasonable for cooling at power plants.

Technical aspects of this option would involve variations in the quality and quantity of CBNG-produced water relative to location and coal seam(s) developed. Electric generating plants generally are designed to accommodate cooling water of a relatively high and consistent quality. Additionally, CBNG-produced water would have to be available to the power plant for a long enough time to make it worth the power plant’s effort to treat or install piping to access the water.

Managed Irrigation

Irrigation is one of the more common and proven beneficial uses of CBNG-produced water in the PRB. Good sources of water for irrigation are only abundant near rivers and reservoirs; therefore, good sources of usable, CBNG-produced water are desirable for farmers and ranchers. The problems associated with using CBNG-produced water for typical surface irrigation would result from its high EC and SAR values. These problems might include soil crusting on the surface, dispersion and salt accumulation in the root zone.

With any irrigation project, a user must ensure that saturated flow to outcrop or to groundwater would not occur. Once the water infiltrated, it would dissolve naturally occurring salts along its flow path. Saturated flow to outcrop would result in development of a potentially low-quality surface discharge (seep). Saturated flow to groundwater would cause the salts from the CBNG-produced water and those dissolved along the flow path to discharge to groundwater; potentially affecting groundwater quality. This could be avoided by ensuring that the water application occurred at agronomic rates.

Soil amendments (typically gypsum and native sulfur) have been used to offset the high SAR of the CBNG-produced water. This keeps the soil permeable and leaching fractions sufficient to keep the root zone salinity at an acceptable level.

Systems where amendments are added to the water rather than the soil (gypsum beds and sulfur burners) are also used. These function in essentially the same way as the soil amendments, only the constituents are added through a different path.

Subsurface drip irrigation (SDI) supplies water to crops by a system of hoses and pipes buried in a network of trenches under the field. The water interacts with the salts, which have naturally accumulated in the subsurface (Ca-Mg sulfates), to reduce the SAR. Again, the reduced SAR allows for acceptable root zone salinity within the root zone to be maintained by using a sufficient leaching fraction. Technical aspects of this option relate to the salinity of CBNG-produced water, which may be a problem in arid and semiarid areas since any leaching above the subsurface irrigation tubing would occur only as the result of rain. Thus, salts may accumulate in this area during the season as the plants extract water and leave the salts behind.

Livestock Watering - Feedlots

Livestock watering is another common and proven beneficial use of CBNG-produced water in the PRB. Livestock watering would require relatively small quantities compared to the amounts of water produced in the basin; however they may result in better livestock distribution. Selected CBNG wells could also be left unplugged for livestock watering purposes, if the surface owner consented.

CBNG-produced water could also be used to support feedlots. Water uses at a feedlot could include consumption by cattle, irrigation of forage crops and waste management. CBNG-produced water in the PRB is typically of sufficient quality for livestock watering without any treatment.

Public Water Supply

Public water supplies can be limiting factors in both residential and industrial development. CBNG-produced water could be used as input for a public water supply; the water could be used to ensure continued growth and development. No towns at present are known to use CBNG-produced water as part of their water supply.

Technical aspects of this option would involve the quality of CBNG-produced water. CBNG-produced water might not be high enough quality to use in a public water supply without treatment. Additionally, the cost of piping CBNG-produced water to towns for use, as well as the continued long-term supply of the resource, would also be factors.

Impoundments

Impoundment construction in connection with oil and gas development must be permitted by MBOGC and might also require permits from DEQ, DNRC and other agencies. Surface storage is sometimes appropriate for produced water, depending on water quality and the availability of beneficial use. An impoundment for storing and managing produced water can be constructed as either an on-channel or off-channel facility. On-channel impoundments are defined as any impoundment constructed by building an embankment or dam across a stream, intermittent channel, or watercourse where the stream valley is depressed enough to permit storing 5 or more feet of water (USDA, NRCS, 1982). The land slope may range from gentle to steep.

Off-channel impoundments are defined as any impoundment constructed by digging a pit or dugout in a nearly level area (USDA, NRCS, 1982) outside an existing stream channel or intermittent watercourse. Off-channel impoundments can be built in gently to moderately sloping areas where their capacity is obtained both by excavating and by building a dam (USDA, NRCS, 1982).

One important difference between the two types of impoundments is the potential for stored produced water to infiltrate and discharge to surface waters. Due to the nature of the alluvium present in most on-channel impoundments in Montana, the path to surface discharge is essentially direct; that is, water infiltrated into the alluvium can communicate directly with the water in the river or stream. This situation can lead to regulatory issues. On channel impoundments may also intercept surface flows unless a by-pass is constructed.

General siting criteria for constructing an impoundment can include geomorphology, surface soil type, stratigraphy, presence and nature of both shallow and deep groundwater, hydrogeology, regional geology and vegetation. These factors, plus produced water quantity and quality, would all have to be considered when determining the use of impoundments for managing produced water.

Indian Trust Assets

The U.S. Department of the Interior (DOI) Departmental Manual 303 DM 2 defines Indian Trust Assets (ITAs) as lands, natural resources, money, or other assets held by the federal government in trust or that are restricted against alienation for Indian tribes and individual Indians. DOI Departmental Manual 512 DM 2 requires all of its bureaus and offices to explicitly address anticipated effects on ITAs in planning, decision and operating documents.

Beyond the maintenance of tangible assets, the federal government also has a trust responsibility to be considerate of the general well being of the tribes. This responsibility includes recognizing the Indian culture as an important value and to carefully consider Indian cultural values when conducting planning efforts. Indian cultural values include their unique way of life, ceremonial practices, spiritual beliefs, family values and worldview. The DOI Department Manual 512 DM 2 also asserts an affirmative responsibility to ensure the tribal health and safety, to consult on a government-to-government basis with tribes who may be affected by proposed actions, to disclose all applicable information and to fully incorporate tribal views in its decision-making processes.

Background

Lands associated with a reservation or public domain allotments are examples of ITAs. Natural resources that exist within Indian reservations such as standing timber, minerals and oil and gas are ITAs. Treaty rights, water rights and hunting and fishing rights may also be ITAs. Other ITAs may consist of financial assets held in trust accounts or intangible items such as Indian cultural values, ITAs are a product of the unique history and relationship of the U.S. government with various American Indian tribes. There is no similar relationship between the Montana State government agencies and sovereign dependent Indian tribal nations (like the Northern Cheyenne and Crow Tribes). See Map 1-1 for the general location and boundaries of the reservations and Table 3-13 for ITA acreages.

Identification Methods

The BIA is required to develop inventories of ITAs for all Indian tribes. The only ITAs in the Planning Area are the actual Indian reservation lands, natural resources and rights belonging to the Northern Cheyenne, Crow and the Turtle Mountain Band of Chippewa.

Applicable Laws

Federal

The DOI Department Manual 512 DM 2 requires all DOI Bureaus and offices to explicitly address anticipated effects on ITAs in planning, decision and operating documents. This order also requires descriptions of how decisions will conform to the DOI's trust responsibilities. Furthermore, DOI Department Manual 303 DM 2 outlines the principals for managing ITAs.

TABLE 3-13

INDIAN TRUST ASSETS

Tribe	Acreage of Reservation	Trust Acres	Tribal Surface Acres	Individually Allotted Surface Acres	Tribal Mineral Acres	Individually Allotted Mineral Acres	Private Acreage
The Northern Cheyenne	445,000	442,193	444,000	138,211	444,000	138,211	2,087
The Crow	2,296,000	1,491,569	455,719	1,035,850	405,888	824,427	804,431
Turtle Mountain Public Domain Allotments*	N/A	61,520	N/A	61,520	N/A	61,520	N/A

Source: Madison 2001.

*Not all of these acres lie within the Planning Area.

The Crow Tribe

The Crow Reservation is located in south-central Montana and comprises nearly 2,296,000 acres. Access is via Interstate 90 or U.S. Highway 87. The reservation is bordered on the south by the state of Wyoming, on the east by the Northern Cheyenne Reservation and on the northwest by the city of Billings, which is Montana's largest metropolitan area. The reservation encompasses the Little Bighorn Battlefield and approximately 3,600 square miles of rolling prairie and rugged foothills drained by the Bighorn River. The BIA Realty Office indicated that the tribe has some 455,719 surface acres and 405,888 acres of mineral rights. There are another 1,035,850 acres that have been individually allotted and 824,427 acres of allotted mineral rights.

There are about 10,083 Crow tribal members, the majority of which live on the reservation. The Crow language is spoken by more than 80 percent of the tribe. Headquarters are at Crow Agency, Montana, just south of Hardin, Montana. The total labor force on the Crow Reservation is 3,902. The unemployment rate is 61 percent. The average per capita income is $4,243.

Water Rights

The Crow have existing water rights held in trust by the United States. The Crow Tribe has not negotiated a water rights compact with the state of Montana.

Mineral Rights

The BIA Realty Office has stated that the Crow have mineral right assets totaling some 405,888 subsurface acres and another 824,427 allotted mineral acres.

Cultural Resources

The Crow also considers cultural and prehistoric resources located within their reservation to be ITAs. At present, an unknown number of archaeological resources are on the reservation. Sites are known to exist on the reservation, but the tribe reserves the information. These sites can consist of burials, trails, rock features, lithic scatters, house pits/rings, rock-shelters, caves, bison kills and petroglyphs.

The Northern Cheyenne Tribe

The Northern Cheyenne Indian Reservation occupies about 445,000 acres in eastern Big Horn and southern Rosebud counties, Montana. Access is provided by U.S. Highway 212. The reservation covers nearly 695 square miles and is bordered on the east by the Tongue River and on the west by the Crow Reservation. According to the BIA Realty Office, the tribe has 442,193 trust acres and 444,000 of surface and mineral estate lands. There are 138,211 individual allotted acres on the reservation.

The Northern Cheyenne Tribe also has trust lands located off the reservation. The tribe acquired two tracts of land immediately west of the Tongue River Reservoir. These tracts are approximately 160 acres each and include the mineral estates.

The tribe also has two larger tracts immediately south of the reservation and north and west of the Zook Creek Wilderness Study Area (WSA), respectively. The tribe obtained these tracts under an agreement with Consolidated Coal Company in 1981. The tribe acquired the surface rights, but the mineral rights were retained by the company. One of these tracts, known as the Moreland Ranch, is where the tribe pastures its buffalo herd.

The total tribal population is 7,473, of which approximately 4,212 Northern Cheyenne live on or near the reservation. The tribal headquarters are in the town of Lame Deer. The total work force of the tribe is approximately 2,437 and the unemployment rate is 71 percent according to the BIA Indian Labor Force Report (U.S. BIA 1999). According to the U.S. Bureau of the Census (Census 2000), the per capita income is estimated at $7,736 and the poverty status as of 1999 was 46.1 percent.

Water Rights

The Northern Cheyenne Tribe has existing water rights held in trust by the U.S. The 1908 U.S. Supreme Court ruling in *Winters v. U.S.* (207 US 564) ruled that water rights needed to develop Indian reservations were reserved and this includes both groundwater and surface water rights.

The Northern Cheyenne have a water rights compact with the state of Montana and own a significant amount of water in the Tongue River Basin, including a principal portion of the Tongue River Reservoir.

The Northern Cheyenne Tribe has developed draft water quality standards and is currently discussing an agreement with the state of Montana and the BLM regarding preservation of beneficial uses. The draft water quality standards have been submitted to the EPA for approval.

Mineral Rights

The Indian Minerals Development Act (PL 97-382, 25 USC 2101) and the Federal Oil and Gas Royalty Management Act of 1982 (PL 97-451) provide that information about mineral development of Indian Trust lands are proprietary to the individual tribe and may not be disclosed without consent. The BIA Realty Office has stated that the Northern Cheyenne have mineral right assets totaling some 444,000 subsurface acres.

Cultural Resources

The Northern Cheyenne Tribe considers cultural resources located within their reservation to be ITAs. Sites are known to exist on the reservation, but the information is reserved by the tribe. These sites can consist of burials, trails, rock features, lithic scatters, house pits/rings, rock-shelters, caves, bison kills and petroglyphs.

The Turtle Mountain Public Domain Allotments

There are approximately 61,520 acres (Madison 2001) of trust lands allotted to the members of the North Dakota Turtle Mountain Tribe scattered throughout 2,000 square miles of Montana.

In 1906, the Burke Act provided that individual tribe members could receive allotments of reservation land. At that time, parcels of 160 acres each were allotted to individuals of the Turtle Mountain Tribe in Montana. These allotments, although not grouped as a reservation, are within the Planning Area. These Trust lands are subject to the same leasing and development procedures as for the reservations.

Lands and Realty

A variety of land uses exist throughout the Planning Area, including agricultural (crops and grazing); roads and highways; railroads; utility rights-of-way (ROW) for electrical power lines and telephone; communication sites; oil and gas production and pipelines; residential; commercial and light industrial uses; mining; municipalities; and recreation.

Table 3-14, *Land Administration*, shows surface ownership in acres by county for federal, state, tribal and private lands. It also shows that approximately 69 percent of the land is private land. The majority of the private land is agriculturally based (grazing and crops). The next largest ownership is federal lands at 15 percent. Federal lands include lands managed by the BLM, USFS, National Park Service, U.S. Bureau of Reclamation (USBR), U.S. Fish and Wildlife Service (USFWS)) and USDA. BLM and USFS lands are used for grazing, timber production, mineral production (except for the Custer National Forest, which is excluded from surface coal mining by Section 522 of the SMCA of 1977) and year-round recreation activities. USBR lands are used for water storage and recreation. National Park Service lands are used for recreation. USFWS lands are used for wildlife refuges and recreation. USDA lands are used for livestock and range research (Fort Keogh Livestock and Range Research Laboratory).

Since completion of the Statewide Document, BLM has managed two land exchanges within the Planning Area (both in Carter County). The Johnston Exchange resulted in trading 454 acres of private land for 480 acres of BLM land to be used for recreation and grazing access. The Higgins Exchange resulted in trading 551 acres of private land for 560 acres of BLM land, also designated for recreation and grazing access.

Tribal lands comprise 10 percent of the land in the Planning Area. They are used for cattle production, mining, logging and lumber production, residential and recreation on the Northern Cheyenne Reservation. Major land uses on the Crow Reservation include agriculture, mining and recreation (Madison 2001).

State lands comprise the least amount of land in the Planning Area at 5 percent. This land is used for grazing, mining, timber production, oil and gas production, state parks and recreation activities. State lands are composed of school trust land administered by DNRC Trust Land Management Division, land owned by DNRC Water Resources Division and land owned by other state agencies. Uses vary by agency. School trust land uses include agriculture, grazing, mineral exploration and mining, aggregate production, recreational activities, oil and gas exploration and production, timber production and special uses, for example, wind turbines for energy production. School trust lands also have pipelines, power lines, telephone lines, roads and highways, home site leases and cabin site leases, depending on the situation.

Roads and highways include interstate, U.S., state and off-system roads open to the public—county, local and private roads open to public use. Table 3-15 lists the number of miles of each type within the Planning Area.

Railroad ROW crisscross the counties in the Planning Area. Railroads in the Planning Area transport goods such as grains, intermodal containers and coal. Table 3-16 indicates the approximate miles of railroad ROW within the Planning Area for each county, by railroad.

There are existing gas pipelines in all the counties being studied. Some existing roads, utilities and gas lines could be used as part of the network for new CBNG installations.

TABLE 3-14

LAND ADMINISTRATION

		Federal										
County	**Total Acres**	**BLM**	**Forest Service**	**National Park Service**	**Bureau of Reclamation**	**U.S. Fish & Wildlife Service**	**U.S. Department of Agriculture**	**State Lands**	**County Lands**	**Tribal Lands**	**Private**	**Water**
Big Horn	3,209,390	27,301		2,497				64,305		1,611,968	1,492,196	11,122
Carbon	1,319,798	217,469	325,674	26,798		261		44,061		192	700,492	4,850
Carter	2,134,533	503,915	90,620					143,994	329	531	1,394,517	627
Custer*	1,557,683	183,975	9				46,522	93,684	346		1,233,147	
Golden Valley	752,882	8,073	23,547			304		48,866			671,135	958
Musselshell	1,197,365	100,514				11,427		76,093			1,007,178	2,153
Powder River	2,110,643	257,147	340,415					143,339			1,369,699	43
Rosebud*	1,503,407	77,986	95,613					64,920		242,194	1,020,141	2,553
Stillwater	1,154,939	5,412	192,526			4,055		56,308			896,637	
Sweetgrass	1,191,687	15,496	279,860					48,539			844,077	3,716
Treasure	629,822	840						39,058		10,666	576,006	3,252
Wheatland	914,081	1,418	65,035					75,976			768,725	2,927
Yellowstone	1,695,363	76,864			1,666	284		73,638		142,997	1,392,373	7,540
Total	19,371,593	1,476,411	1,413,299	29,296	1,666	16,331	46,522	972,781	675	2,008,017	13,366,433	39,774

Sources: Land Ownership, Montana State Library/NRIS, Helena, Montana, 2005. Created from GIS intersection of 1:100,000 scale county boundaries with 1:100,000 scale Land Ownership.

*Acreage reflects only that portion of this county included in the Planning Area.

Note: Acreage changes from the Statewide Document reflect actual changes in ownership, as well as changes to GIS source data from ongoing maintenance of the data layer and/or NRIS Library.

TABLE 3-15

MILES OF ROAD/HIGHWAY

County	Interstate	U.S.	State	Off-System
Big Horn	88.3	63.1	23.0	4,625.9
Carbon		106.9	60.6	1,310.4
Carter		38.3	84.3	906.9
Custer	42.8	25.8	57.8	1,636.6
Golden Valley		29.0	12.5	1,453.4
Musselshell		99.6		1,952.4
Powder River		64.6	55.1	1,925.7
Rosebud	41.9	26.6	51.3	2,296.2
Stillwater	46.0		23.1	1,625.6
Sweetgrass	39.3	52.6	0.1	1,386.4
Treasure	26.2			742.9
Wheatland		79.9		1,278.3
Yellowstone	101.4	88.1	41.8	3,290.6
Total	385.8	674.5	409.4	24,430.7

Sources: 2000 Census roads, Montana State Library/NRIS, Helena, Montana, 2005. Created from GIS intersection of 1:100,000 scale county boundaries with 1:100,000 scale 2000 Census roads.

Note: Road/highway mile changes from the Statewide Document reflect actual changes, as well as changes to GIS source data from ongoing maintenance of the data layer and/or the NRIS Library.

TABLE 3-16
MILES OF RAILROAD ROW

	Railroad		
County	BNSF[1]	Montana Rail Link	Tongue River Railroad (Proposed)
Big Horn	119		19
Carbon	55		
Custer	44		44
Golden Valley	38		
Musselshell			
Rosebud	104		64
Stillwater		46	
Sweetgrass		44	
Treasure	61		
Wheatland	28		
Yellowstone	124	57	
Total	573	146	127 (proposed)

Sources: Railroads, Montana State Library/NRIS, Helena, Montana, 2005. Created from GIS intersection of 1:100,000 scale county boundaries with 1:100,000 scale Railroads.
[1]BNSF—Burlington, Northern and Santa Fe Railroad.

Note: Railroad mile changes from the Statewide Document reflect actual changes, as well as changes to GIS source data from ongoing maintenance of the data layer and/or NRIS Library.

Livestock Grazing

Most BLM grazing allotments involve only one permittee; however, there are several multi-permittee allotments. There are no other uses or control of public lands granted by issuance of a grazing permit. The length of grazing periods varies from seasonal to year-long use. Most ranch operators using the allotments are cow-calf operations with sheep operations coming in second. Most allotments have several range improvements such as fences, stock ponds, pipelines, springs, windmills, seedings, wells and access roads for better control of livestock for management purposes (BLM 1992).

In the Planning Area, approximately 1,066 allotments cover 1.4 million acres of BLM-administered lands, including 351 allotments covering approximately 0.4 million acres in the Billings RMP area and 715 allotments covering approximately 1.0 million acres in the Powder River RMP area.

These allotments are used to graze cattle, sheep and horses. The main class of livestock using public lands is cattle (93 percent). Current BLM data indicates authorized livestock use on BLM-administered grazing allotments totals about 260,000 animal unit months. These allotments include active-use, non-use and exchange-of-use options (Tribby 2001; Padden 2001; Haas 2001). An AUM is the amount of forage necessary to support one cow and her calf, or five sheep, for one month.

Native American Concerns

There are seven federally recognized Indian tribal organizations in Montana. They are the Assiniboine and Sioux Tribes of Fort Peck (Sioux Division of Sisseton/Wahpetons, the Yantonias, the Teton Hunkpapa and the Assiniboine bands of Canoe Paddler and Red Bottoms), the Blackfeet Tribe, the Chippewa Cree Tribe, the Confederated Salish and Kootenai, the Crow Tribe of Montana, the Fort Belknap Indian Community (the Assiniboine and the Gros Ventre) and the Northern Cheyenne Tribe. Non-federally recognized tribes also reside in Montana: the Little Shell Band of Chippewa of Montana and the Métis.

Tribal enrollment within these organizations is recorded as 61,203 individuals or nearly 6.6 percent of the state's population. Within this population there is an average unemployment rate of 61 percent and a high level of poverty (U.S. BIA 1999).

The majority of these native people reside on seven Indian reservations throughout Montana. The reservations are the Crow, Northern Cheyenne, Fort Peck, Fort Belknap, Rocky Boys, Blackfeet and the Flathead. Two reservations are within the SEIS Planning Area: the Crow and Northern Cheyenne.

The Crow Reservation

Much of the information in this section has been summarized from the Crow Indian Reservation's *Natural, Socio-Economic and Cultural Resources Assessment and Conditions Report* (Crow Tribe 2002). Readers should refer to that document for more detailed information. This document can be downloaded from the MDEQ CBNG web page at http://www.mt.blm.gov/mcfo/cbm/eis/CrowTribeNarrativeReport/index.html.

The Crow Reservation is located in south-central Montana and comprises nearly 2,296,000 acres. Access is via Interstate 90 or U.S. Highway 87. The reservation is bordered on the south by the state of Wyoming, on the east by the Northern Cheyenne Reservation and on the northwest by the city of Billings, which is Montana's largest metropolitan area. The reservation encompasses the Little Bighorn Battlefield and approximately 3,600 square miles of rolling prairie and rugged foothills drained by the Bighorn River. The BIA Realty Office indicated that the tribe has some 455,719 surface acres and 405,888 acres of mineral rights. There are another 1,035,850 acres that have been individually allotted and 824,427 acres of allotted mineral rights.

Mountains, residual uplands and alluvial bottoms make up the topography of the Crow Reservation. The three principle mountain areas are the Wolf Mountains (CHEETIISH) to the east and the Bighorn (BASAWAXAAWUUA) and Pryor Mountains (BAAHPUUO ISAWAXAAWUUA) to the south. Sloping downward to the north from the mountains are rolling upland plains. The plains constitute the bulk of the reservation and vary in altitude from 3,000 to 4,500 feet. The alluvial bottomlands are located along the Bighorn River, Little Bighorn River and Pryor Creek drainage systems.

Reservation communities include Crow Agency, Saint Xavier, Yellowtail (Fort Smith), Lodge Grass, Wyola and Pryor. The Crow Tribe recognizes six districts within the reservation. The six districts are Bighorn, Black Lodge, Lodge Grass, Pryor, Reno and Wyola. (Crow Tribe 2002).

Tribal Government

The U.S. signed treaties in 1825, 1851 and 1868 with the Crow Tribe. These legal documents define the tribe's relationship with the U.S., recognized their rights as a sovereign government and established reservation boundaries. The U.S. first recognized the Crow Tribe by Treaty in 1825 (ratified August 4, 1825. 7 Stat. 266, proclaimed February 6, 1826) and this recognition has continued through today as evidenced by the Federal Register notice of July 12, 2002. The Treaty of 1851 established the Crow Reservation. The Tribal government has authority within the boundaries of the reservation for all ROW, waterways, watercourses and streams, running through any part of the reservation.

The Crow Tribe of Indians repealed its 1948 constitution and By-Laws in July 2001. The Crow Constitution of 2001 established a three-branch government, Executive, Legislative and Judicial. Each branch possesses separate and distinct power. Elected Executive, Legislative and Judicial branch officials hold 4-year terms. Judgeships consist of a Chief and two Associate Judges. The Crow Tribal Law and Order Code governs the structure of the Tribal Court.

The Legislature consists of 18 representatives from six Legislative Districts (three representatives from each district) in the reservation. The Legislative Branch promulgates and adopts laws, resolutions, ordinances, codes, regulations and guidelines in accordance with the 2001 Constitution and federal laws. These legislative measures include taxes and licensing to protect and preserve property, wildlife and natural resources.

The Executive Branch includes a Chairman, Vice-Chairman, Secretary and Vice-Secretary. The Executive Branch is empowered to administer funds and to enforce laws, ordinances, resolutions, regulations, or guidelines passed by the Legislative Branch.

Demographics

As of 2000, 69 percent of the 10,220 enrolled members of the Crow Tribe were living on the Crow Indian Reservation (reservation). The off-reservation population of enrolled members included 850 (8 percent) in Hardin and 2,340 (23 percent) in other areas, primarily Big Horn County, Billings (Yellowstone County) and other Montana and Wyoming counties near the reservation. In the 2000 Census, the reservation's population was 6,890, an increase of 15 percent from 1980. Native Americans made up 75 percent of the reservation's population. Ninety-four percent of the reservation's population was in Big Horn County and the other 6 percent in Yellowstone County.

Between 1990 and 2000, the population of the Crow Indian Reservation increased by 520 (8 percent) compared to an 11.8 percent increase for all of Big Horn County. Average annual population growth has been less than 1 percent since 1980. The median age on the reservation is 27.6, compared to 37.5 for Montana as a whole. The population is distributed between the reservation communities of Crow Agency, Dunmore, Garryowen, Lodge Grass, Wyola, Pryor, Saint Xavier and Yellowtail and rural areas outside of the communities.

In the 1990 Census, 41.7 percent of persons on the Crow Indian Reservation were living below the poverty level. Poverty status on the reservation as determined by the BIA for 1999 was 38 percent (Table 3-17).

Social Organization

As of 2000, there were 2,280 housing units on the reservation. Of these, 1,320 (58 percent) were owner-occupied, 24 percent were rented-occupied and 18 percent were vacant (presumably due to substandard conditions). Household size in 2002 was 3.5 for owner-occupied and 3.9 for renter-occupied. The reservation has a shortage of adequate housing for the needs of the population. The Crow Tribal Housing Authority identified 250 homes with more than one family in the households in 2002 and a waiting list of 300 families in need of housing. In 1997, the BIA identified a need for 1,040 new housing units on the reservation and 890 families in need of housing. Temporary housing off the reservation is available in Hardin, just north of the reservation in Montana and in Sheridan, Wyoming, about 25 miles south of the reservation.

The Crow Indian Reservation Natural, Socio-Economic and Cultural Resources Assessment and Conditions Report describes in detail the public facilities and services in five of the larger communities on the Crow reservation. Telephone, gas and electric utilities are provided by a variety of county and other utility companies. Educational facilities include elementary, junior high and high schools and Little Big Horn Community College. Varying levels of public water and sewer systems are provided, depending on the community. Some of these systems are in need of maintenance and repair. The communities also have varying levels of medical, police and fire protection services.

The reservation has eight elementary schools, three high schools and the Little Big Horn Community College. The three high schools are located in Lodge Grass, Pryor and Hardin. From coal mining revenues, the schools at Hardin and Lodge Grass have become two of the wealthiest in the state. Public schools are also available in both Billings and Hardin. Approximately 70 percent of members have a high school diploma and more than 6 percent have a Bachelor's Degree or higher.

TABLE 3-17

TRIBAL POVERTY RATES AMONG THOSE EMPLOYED (1999)

Tribe	County	Total Tribal Enrollment	Percent Employed but Below Poverty Guideline
Crow Tribe of Montana	Big Horn County, Yellowstone County	10,083	38%
Northern Cheyenne Tribe	Big Horn County, Rosebud County	7,473	26%
Montana (all tribes)		61,203	33%

Source: BIA 1999.

Economics

The most recent employment information for the reservation is from the 1990 Census. In 1990, total employment on the reservation was 1,660. The tribal and federal governments are the largest employers. The Crow tribal government employed 400 persons in 2002. Agriculture (330, 20 percent), education (240, 15 percent) and retail trade (230, 14 percent) were the largest industry sectors. Private wage and salary (780, 47 percent) and government (590, 36 percent) were the largest classes of employment. According to the 1990 Census, the reservation's labor force (persons 16 years and older) was 2,380, with an unemployment rate of 30.4 percent. Much higher rates (61 percent) are reported by BIA statistics from 1999 (Table 3-18).

Page 3-38 of the Statewide Draft Oil and Gas EIS states that tribal members' 1999 per capita income was $4,243. By comparison, per capita income for Big Horn County was $13,329 and the state of Montana was $21,229. In the 1990 Census, median household income for the reservation was $17,270, compared with $19,900 for Big Horn County and $22,988 for the state.

Agriculture has been the historic base of the reservation economy. Agricultural crops include livestock, wheat, barley, oats, corn, sugar beets, alfalfa and hay. In 2000, the Montana State University/Big Horn County Agricultural Extension Service estimated the values of crops and livestock on the reservation were $20.9 and $35.5 million, respectively.

Natural resources (land, water, coal, oil and gas, timber and sand and gravel) also contribute to the employment base and income on the reservation. The Absaloka Mine is located within five miles of the reservation's northern boundary and employs between 40 and 75 Crow tribal members. The Statewide Draft Oil and Gas EIS (p. 3-40) states there have been 172 conventional oil and gas wells drilled on the reservation. These wells have been drilled by non-Indian interests through leases with the Crow Tribe. In 1985, 20 companies had 709 oil and gas leases with the Crow Tribe. The reservation has about 36,000 acres of commercial forest in the Wolf and Pryor mountains; timber units are generally leased to non-Indian interests for harvesting.

The Crow Tribe receives government revenue from its natural resources through numerous land leases, boundary settlement allotments and income-producing trusts generated through coal, mineral, oil, gas and timber reserves. The majority of these trusts are administered by the U.S. Government's Office of Trust Fund Management.

The Crow Tribe's economic development plans incorporate the reservation's resources such as agriculture, energy, tourism and recreation and commercial enterprises. The tribe is currently working with programs from federal agencies to prepare a strategy for comprehensive economic development. As part of the federal Economic Development Administration's community economic development strategy (CEDS), the tribe is preparing an economic development plan to balance development and protection of the reservation's resources.

Air Quality

The air quality and climate of the Crow Reservation is similar to that of the regions described earlier in Chapter 3. The Crow Reservation is classified as a PSD Class II area.

The reservation is located in a part of Montana that has a moderate climate relative to its latitude. Snow rarely accrues for long periods of time because of the warm Chinook winds, which originate from the mountains in the West. This portion of Montana is also known for its "Indian Summers" which frequently extend into November. The mean annual temperature is 45.5^{o}F with a summer high of 110^{o}F and a winter low of -48^{o}F. The bulk of the reservation varies from 12 to 18 inches annual precipitation, depending on the elevation.

The tribe is currently in the process of developing and rewriting its codes and standards for air quality.

TABLE 3-18

AVERAGE ANNUAL UNEMPLOYMENT RATES BY RESERVATION

	1996 Rate (%)	1999 Rate (%)	Change 1996-1999
Crow Reservation	15.5	14.9	0.6
Northern Cheyenne Reservation	26.0	18.7	7.3

Source: Montana Department of Labor & Industry, Research & Analysis Bureau, Local Area Unemployment Statistics (2001a).

Culture and History

The Crow Tribe's native name is the Apsalooke, literally translated, "children of the large beaked bird." Early explorers mistook the signing for Apsalooke, the flapping of one's hands like the wings of a bird in flight and called them the Crow. The Crow were historically recognized as matrilineal and their social system was clan based. The original 13 clans of the Crow Tribe are as follows:

- Ashilaaliio—Newly Made Lodges
- Ashshitchite—Big (husky) Lodges
- Ashiiooshe—Sore (burnt) Lip Lodge
- Uuwuutashshe—Greasy Mouths
- Uussaawaachia—Brings Game Home Without Shooting
- Xuhkaalaxche—Ties Things Into a Bundle
- Ashpeennuushe—Filth Eaters
- Ashkapkawia—Bad War Deeds
- Bilikooshe—Whistling Water
- Ashxache—Hair Left on the Hide Lodge
- Ishaashkapaaleete—Cropped Ear Pets Lodge
- Ishaashkakaawia—Furious Pets Lodge
- Ashbatshua—Traitorous Lodge

Of these three are extinct and the remaining 10 recognized clans have been consolidated into the following six; Bad War Deeds, Big Lodges, Greasy Mouths, Ties Things Into a Bundle, Traitorous Lodge and Whistling Water (Reed, G. 2002).

The Crow people were originally part of the Hidatsa Tribe, which originated in the upper mid-west of the present U.S. Their subsistence and lifestyle was agriculture based. The Mountain Crow separated from the Hidatsa in North Dakota in the 1550s into eastern Montana and during the 1600s expanded along the Yellowstone River drainage. The River Crow moved into central Montana in 1670 and by 1720 were concentrated in the Yellowstone and Bighorn River drainages.

With the introduction of the horse, people in the Plains tribes became more mobile and began intruding on each other's hunting grounds. The Crow became known for their skill with horses. By 1800 the Powder, Bighorn, Yellowstone and Wind River drainages became areas of continuing conflict between the Lakota, Northern Cheyenne, Arapaho, Blackfeet, Gros Ventre, Assiniboine and Crow.

In 1806, the Lewis and Clark expedition spent one month in the Crow Territory, which aided in the Crow developing good relations with fur traders. Fur trading posts were established and fostered the development of the Crow as middlemen in the regional transfer of goods and the Crow prospered. The 1840s saw a period of massive small pox and flu epidemics in which, along with battles between native peoples, the majority of Crow died.

Treaties were signed with the U.S. in 1825, 1851 and 1868. The 1825 Treaty, a treaty of friendship, established a relationship with the U.S. Government. In the Fort Laramie Treaty of 1851, the Crow lost control of the Powder River Basin but gained a promise of peace and annuities that were to be supplied for 50 years. The treaty resulted in some gains but friction continued from tribes who were attracted to the game in the region and by wagon trains of gold seekers making their way to the California or other gold fields. The Crow were busy protecting their territorial boundaries.

Continued conflict in the region led the U.S. government to propose the Fort Laramie Treaty of 1868, which provided territories for individual tribes and closed the Bozeman trail and its forts. In this treaty, the Crow lost lands north of Yellowstone, south of the Montana territorial border and east of the 107th Meridian.

In 1869, the U.S. government established the Crow Agency near present-day Livingston, Montana. Conditions became sufficiently bad on the reservation that by 1872 the River Crow returned to their Missouri River hunting grounds while the Mountain Crow attempted farming on the reservation. In 1876, the Crow joined the U.S. in a war against the Sioux, Cheyenne and Arapaho.

The Crow struggled against tradition and the elements to develop farming on the reservation and at times obtained permission to leave the reservation to hunt. White settlers and miners continued to place pressure on the Crow lands. The Crow ceded the western boundaries of their land, one-quarter of their reservation, in the How-How Treaty of 1882 in exchange for houses and livestock. In the 1891 Act, the Crow ceded the western third of their reservation and in 1905 more land was ceded.

In the Crow perception of the world there is not a clear distinction between the western perception of spiritual and physical. All things in the universe are living entities: animals, plants, forces of nature, topographic features. The Supreme Force (First Maker) designed the universe and the Crow show their respect for these blessings through their daily life (customs, traditions and practices). First Maker instilled the universe with baxpe or spiritualness. They maintain an intimate personal relationship with all things in the world around them and the spiritualness that they possess. By treating all things in a respectful fashion, the Crow can continue to survive.

The Crow historical perspective sees time as interlinked so that there is an intimate relationship between the individual and the past. The past (tradition or time) provides the template for the appropriate way to live. The Crow live in constant presence with the past that truly transcends the western concept of time. There are five qualities of time; sacred time, ancient Indian time, historic time, the present and the future, which have some sequential qualities but for the Crow the spiritualness of these times is most important.

In this world perception many landscapes and places are sacred. They are sacred because they represent why and how things are done. Sacred sites include cultural material scatters, petroglyphs, tipi rings, homesteads, burial areas, cairns, communal kills, fasting beds, medicine lodges, rock art, stone rings and settlements. Sacred locations and places include water (springs and rivers), spirit homes (springs, rivers, hills and mountains), landscapes (mountains and topographic features), plant and animal procurement areas, fossil areas and mineral locations.

Geology and Minerals

The reservation contains a varied geology, as does the state of Montana (see earlier Geology and Minerals description). Of particular interest to this SEIS are the deposits of subbituminous coal within the reservation. The known coal occurrences in the Powder River Basin are generally located in the Paleocene Fort Union Formation. Coal on the reservation is produced primarily from nine coal beds:

1. Roland: Top of Tongue River Member; average thickness 9 feet; resources 0.3 billion short tons; ranges in calorific value from 7,021 to 9,114 BTU, the sulfur content is 0.2 to 0.7 percent and ash content 3.8 to 9.7 percent.

2. Smith: Tongue River Member; average thickness 7 feet; resources 0.3 billion short tons; ranges in calorific value from 7,607 to 8,272 BTU, the sulfur content is 0.6 to 1.0 percent and ash content 6.8 to 30.2 percent.

3. Anderson: Tongue River Member; average thickness 20 feet; resources 1.9 billion short tons; ranges in calorific value from 8,705 to 9,850 BTU, the sulfur content is 0.2 to 0.6 percent and ash content 2.9 to 6.2 percent.

4. Dietz: Tongue River Member; two coal beds; average thickness 35 feet; resources 5.6 billion short tons; ranges in calorific value from 6,019 to 9,373 BTU, the sulfur content is 0.3 to 0.4 percent and ash content 2.9 to 6.3 percent.

5. Canyon: Tongue River Member; average thickness 20 feet; resources 3.7 billion short tons; ranges in calorific value from 8,446 to 9,113 BTU, the sulfur content is 0.2 to 0.3 percent and ash content 3.2 to 10.7 percent.

6. Wall: Tongue River Member; average thickness 20 feet; resources 4.9 billion short tons; ranges in calorific value from 7,637 to 10,079 BTU, the sulfur content is 0.1 to 1.1 percent and ash content 3.1 to 12.5 percent.

7. Rosebud: Tongue River Member; average thickness 10 feet; resources 0.1 billion short tons; ranges in calorific value from 7,810 to 9,090 BTU, the sulfur content is 0.5 to 1.1 percent and ash content 8.1 to 12.6 percent.

8. McKay: Tongue River Member; average thickness 10 feet; resources 0.1 billion short tons.

9. Robison: Tongue River Member; average thickness 10 feet; resources 0.05 billion short tons.

The coals occur on the east side of the reservation in a 12 to 15 mile wide area, extending from the Wyoming border to the north border of the reservation.

These deposits have been estimated to contain 17.1 billion short tons of coal of which 16.1 billion tons may be prospective for CBNG development (Crow Tribe 2002). The aggregate thickness of these coals may be as thick as 100 feet in places (Admin. Report BIA-7, 1975). Geology and stratigraphy of the Planning Area are discussed at length in the Minerals Appendix.

The Absaloka coal mine produces coal from a strip of land the Crow Tribe ceded in 1904 to the U.S. for settlement by non-Indians. The U.S. holds rights to minerals underlying the ceded strip in trust for the tribe. In 1972, with the approval of the Department of the Interior and pursuant to the Indian Mineral Leasing Act of 1938, Westmoreland Resources, Inc., a non-Indian company, entered into a mining lease with the tribe for coal underlying the ceded strip (U.S. Supreme Court May 1998). Today the Absaloka mine annually produces an average of 5,500,000 short tons of coal from its 5,400-acre permitted facility.

The reservation also includes the Soap Creek, Lodge Grass, Gray Blanket, Hardin and Ash Creek oil and gas fields. There have been 172 conventional wells drilled to date on the reservation. Production occurs from the Fort

Union, Shannon, Tensleep, Amsden and Madison formations within the reservation (Crow Tribe 2002).

Protecting the Indian lessors from loss of royalty as a result of conventional oil and gas drainage is a prime responsibility of the BLM. Under the terms of both federal and Indian leases, the lessee has the obligation to protect the leased land from drainage by drilling and producing any well(s) that are necessary to protect the lease from drainage, or in lieu thereof and with the consent of the authorized officer, by paying compensatory royalty. Drainage analysis, on the basis of a production screen or other criteria, is required by BLM document H-3160-2, Drainage Protection Guidelines Instruction Memorandum. Under this memorandum, federal or Indian mineral interests determined to be in danger of drainage will be subject to geologic, engineering and economic analyses in order to define the presence and magnitude of resource drainage.

Hydrology

Hydrological resources on the reservation consist of surface water flow from several rivers and their associated tributaries and the production of groundwater from a variety of geological formations. A detailed explanation of the regional hydrology including that of the reservations is included in an earlier section of this chapter under Hydrology.

The Crow Indian Reservation is within the Billings RMP area. The three major drainages on the Crow Reservation are the Bighorn River, Little Bighorn River and Pryor Creek (Crow Tribe 2002). Three additional drainage basins partially headwatered on the reservation are Bighorn Lake (on the Bighorn River), the upper Tongue River and Rosebud Creek. Collectively, these drainages are part of the Yellowstone River Basin (Crow Tribe 2002).

Water quality in the rivers and streams on the reservation is reported to be generally good, with levels of dissolved solids naturally high (Crow Tribe 2002). Pollution problems (primarily high sediment and salinity levels) are primarily related to non-point source agricultural practices and return flows. Table WIL-2 in the Wildlife Appendix summarizes aquatic resources characteristics and resource values from the Montana State Library NRIS (2001) Internet database for several representative drainages on the Crow Reservation, including the upper and lower Bighorn River, the Little Bighorn River, the upper Tongue River and Rosebud Creek.

According to the 2004 303d list, several watersheds and impaired water bodies are adjacent to the Crow Reservation. These include the Rosebud watershed which crosses a part of the Crow Reservation; The Lower Bighorn watershed includes a large part of the Crow Reservation, which contacts both impaired portions of the Bighorn River; and the Little Bighorn watershed that includes a large part of the Crow Reservation, but no water bodies are determined to be impaired on the 2004 303d list.

Most streams experience an increase in concentrations of dissolved solids downstream because of irrigation return flow, increased base flow contributions and pollution from human activities. Water contributed as base flow water has been in contact with soil and rocks for long periods of time. It therefore contains larger concentrations of dissolved solids than surface runoff water (Crow Tribe 2002).

Surface water quality in the Little Bighorn River Basin is affected by high-quality Bighorn Mountain snowmelt, surface- and ground-water inflow and irrigation in Montana. As in most semi-arid areas, the concentration of dissolved materials in effluent streams generally increases with distance downstream. The total sediment load is large, ranging between 158 and 16,200 tons/day for the Little Bighorn below Pass Creek. Other than its high suspended sediment concentrations, water in the Little Bighorn River can be characterized as very good water that is suitable for most uses.

Snowmelt, ground- and surface-water inflow, geology and irrigation affect water quality in the creeks draining into the Tongue River. The chemical quality of these creeks is suitable for most uses, although the high hardness and alkalinity values might require treatment for some industrial uses. Again, water quality in these creeks degrades with increasing distance downstream. Based on an analysis for the referenced document, water in Squirrel Creek failed to meet the Secondary Drinking Water Standards for Total Dissolved Solids. Surface and groundwater inflows, as well as evaporation, degrade water quality in Rosebud Creek (Crow Tribe 2002).

The groundwater resources for the reservation are more diverse than to those described for the Powder River Basin in the previous Hydrology section of this chapter. The potential for groundwater resources underlies most of the Crow Reservation. The stratigraphy varies from Pre-Cambrian age granitic gneiss and schist in the Bighorn and Pryor mountains on the west to the Eocene deposits of the Wasatch Formation in the Wolf Mountains and Powder River Basin on the east. The pronounced geologic structures, semi-arid climate and sculptured terrain lead to highly varied, but often prolific, groundwater resources within the reservation. Regional aquifers located on the reservation include the following:

- Alluvial sand and gravel (Holocene)
- Terrace gravel (Pleistocene)
- Clinker deposits (Holocene, Pleistocene and Pliocene)

- Fort Union Formation (Paleocene)
- Fox Hills—Hell Creek sandstone (Upper Cretaceous)
- Eagle Sandstone (Upper Cretaceous)
- Parkman Sandstone (Upper Cretaceous)
- Pryor Conglomerate (Lower Cretaceous)
- Tensleep Formation (Pennsylvanian)
- Mission Canyon limestone of the Madison Group (Mississippian)
- Jefferson limestone (Ordovician)

Locally many other water-bearing zones may occur in isolated sandstone and siltstone beds and in fractured bedrock of any type (Crow Tribe 2002). A total of 2,237 wells have been registered with the MBMG. The majority of the wells are producing at depths less than 200 feet bgs and only 30 wells have been drilled deeper than 700 feet bgs. The majority of the wells are used for stock water, irrigation and domestic consumption (Crow Tribe 2002).

Groundwater quality under the reservation is summarized on Table 3-19.

Land Use and Realty

The Crow Reservation comprises approximately 9 percent of the land in the Planning Area. Of the approximately 1.5 million acres of tribal or allotted trust ownership, 68 percent is grazing rangeland, 12 percent is dry cropland, 3 percent is irrigated cropland, 1 percent is forested, 1 percent is wildland and 1 percent is developed area (Crow Tribe 2002). The Crow maintain almost 1.2 million acres of leased grazing lands, 150,000 acres leased dry-farming land and the nearly 30,000 acres leased irrigated farming land. Most lands are leased to large non-Indian interests by Allottees (U.S. Department of Commerce 1996).

The principal communities located on the Crow Reservation are as follows:

- Crow Agency—The Crow Tribal Government administration, the BIA and the Crow Hospital are located in the town of Crow Agency. There are approximately 3,245 Indian people residing in Crow Agency. A 16-bed hospital is located in Hardin, Montana, approximately 12 miles from Crow Agency. Two larger hospitals (250+ bed facilities) are located in Billings, Montana, 65 miles from Crow Agency. Billings is recognized as the major medical referral center for east-central Montana and northern Wyoming.

- Lodge Grass—The Lodge Grass is located approximately 22 miles south of Crow Agency and houses the Lodge Grass Health Center. Approximately 2,125 Indian people live in Lodge Grass.

TABLE 3-19
GROUNDWATER SODIUM ADSORPTION RATIO AND TOTAL DISSOLVED SOLIDS VALUES CROW INDIAN RESERVATION

Study Area	Formation	# Wells	Avg. SAR	SAR Range	Avg. TDS	TDS Range
Hardin 3 (NE)	Fort Union	22/2	4.7/43	55 – 0.4		
		36			1,794	405 – 4,672
	Quaternary	16	4.36	32 – 0.1	1,487	184 – 3,920
	Judith River	1		0.7		405
Hardin 4 (NW)	Quaternary	15	7.3	15 – 1	2,859	6,570 – 724
	Unknown	9	9	47 – 0.1	2,223	4,770 – 606
	Pre Judith River	2		0.5 – 0.4		3,170 – 2790
Hardin 5 (SW)	Quaternary	6	4	7 – 2	2,871	806 – 5,850
	Unknown	1		12		614
	Pre Judith River	2		52 – 0.4		4,990 – 2,065
Hardin 6 (SE)	Quaternary	14	1.9	11 – 0.7	1,318	7,720 – 400
	Judith River	3	54	64 – 47	1,107	1180 – 1,000
	Pre Judith River	3	50	82 – 23	3,126	8,060 – 452

Source: Miller et al. 1977, Crow Tribe 2002.
SAR is sodium adsorption ratio
TDS is total dissolved solids
Avg. is average

- Pryor—The Pryor Health Station is located here, approximately 69 miles northwest of Crow Agency. The Indian population of Pryor is estimated at 1,018.
- Wyola—This community is located approximately 13 miles from Lodge Grass and approximately 35 miles from Crow Agency. There are nearly 450 Indian people residing in Wyola.

Paleontological Resources

The Crow Reservation includes bedrock deposited during the Late Cretaceous to Early Tertiary time. These geologic formations were deposited in a broad, epicontinental seaway that extended through the western interior from the Arctic Ocean to the Gulf of Mexico during Late Cretaceous. The cyclic transgression and regression of the shallow seas and the final withdrawal during the Late Tertiary time resulted in a wide variety of environments of deposition. The depositional environments of marine and nonmarine sedimentation resulted in a rich fossil record including dinosaurs, mammals and other vertebrate and paleobotanical remains. The great abundance, diversity and generally excellent fossil preservation in the region present significant scientific research opportunities.

Detailed paleontological field surveys have not been conducted within the reservation. The formations listed below are known to yield paleontological material across Montana:

- Wasatch—has yielded mammals and plant fossils
- Fort Union—various non-marine animals and plants
- Fox Hills-Hell Creek—marine and non-marine animals including dinosaurs
- Bearpaw, Judith River, Claggett—marine animals and dinosaurs
- Morrison—dinosaurs and early mammals
- Swift and Rierdon—marine invertebrates
- Madison—marine invertebrates
- Cloverly Formation-early cretaceous fossils

Site-specific studies would need to be conducted prior to bedrock disturbance (Crow Tribe 2002).

Recreation

The Crow Indian Reservation is a large contiguous tract of land that provides dispersed outdoor recreation for tribal members. This includes hunting, fishing, picnicking, camping, hiking, horseback riding, snowmobiling and off-road vehicle use. Yellowtail Dam at Bighorn Canyon provides some of the finest fishing, water sports and camping in the state of Montana. Non-tribal members are not allowed to hunt on the reservation except for spouses of tribal members. Crow Agency recreational facilities are provided at three city parks, the school gymnasium, playground areas and the Crow Tribal Fairgrounds. Within the town of Lodge Grass on the reservation, there is a city park with landscaped open space and picnic facilities. Outdoor sports and playground equipment are available on the school grounds in Lodge Grass.

The Crow Tribe hosts one of the largest powwows held in the U.S. The Crow Fair takes place at the Crow Agency every August. There is spirited competition dancing, drumming and singing, as well as food and craft concessions. Crow Agency is also near the Battle of the Little Bighorn National Monument, a popular tourist site. Once each year the tribe does a brilliant re-enactment of the battle.

Soils

Soils in the reservation, just like soils in the surrounding area, are derived mainly from sedimentary bedrock and alluvium. The soils generally range from loams to clays, but are principally loams to silty clay loams. For more information on soil types, see the Soils Appendix.

Vegetation

The major native plant communities on Crow Lands include grass and shrub rangelands, forestlands, riparian areas and barren lands. These classifications are discussed in detail in the Vegetation section.

Rangelands on the reservations are mostly mixed grass prairie in the lowlands and mixed grass, ponderosa pine (*Pinus ponderosa*), Rocky Mountain juniper (*Juniperus scopulorum*) and Douglas fir (*Pseudostuga menziesii*) in foothill and mountain areas (Crow Tribe et al. 1997). Predominant rangeland species are bluebunch wheatgrass (*Pseudoroegneria/Agropyron spicata*), western wheatgrass (*Pascopynum smithii*), Idaho fescue (*Festuca idahoensis*), green needlegrass (*Stipa viridula*), needle and thread (*Stipa comata*), little bluestem (*Schizachyrium scoparium*), blue grama (*Bouteloua gracilis*) and sideoats grama (*B. curtipendula*). Other species of grass such as switchgrass (*Panicum virgatum*), Indian ricegrass (*Oryzopsis hymenoides*), big bluestem (*Andropogon gerardii*), prairie sandreed (*Calamovilfa longifolia*) and little bluestem are found on sandy sites.

Riparian species include prairie cordgrass, rushes and sedges. Forbs include lupine (*Lupinus* spp.), Hood's phlox (*Phlox hoodii*), green sagewort (*Artemisia campestris*), cudweed sagewort (*Artemisia ludoviciana*), fringed sagewort (*Artemisia frigida*), white loco (*Oxytropis lambertii*), povertyweed (*Monolepis* sp.) and scurf pea (*Psoralea tenuiflora*). Shrubs include big sagebrush (*Artemisia tridentata*), rabbitbrush (*Chysothamnus* spp.), snowberry (*Symphoricarpus albus*), greasewood (*Sarcobatus vermiculatus*) and snakeweed (*Gutierrezia sarothrae*) (Crow Tribe 2002).

Forestlands on tribal lands are mainly in the higher elevations in the Wolf Mountains, Bighorn Mountains and Pryor Mountains. Ponderosa pine is the dominant tree with aspen (*Populus tremuloides*) stands also present in some drainages.

Riparian zones are the smallest land cover type on the Crow Reservation (Crow Tribe et al. 1997). Dominant vegetation in these linear strands along rivers and streams are cottonwood (*Populus* spp.), boxelder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), sandbar willow (*Salix interior*) and American plum (*Prunus americana*). These areas can also have a thick understory of shrubs, if livestock access to them is limited.

Special Status Species

Four plant species of special concern to the state of Montana that occur on tribal lands are sweetwater milkvetch (*Astragalus areetioides*), Joe Pye weed (*Eupatorium maculatum* var. *bruneri*), Purpus' sullivantia (*Sullivantia hapemanii* var. *hapemanii*) and tall centaury (*Centaurium exaltatum*). See the Vegetation Appendix Table VEG-6 for habitat information for these species.

There are certain other plant species that are sacred to the Crow Nation for traditional and/or therapeutic reasons. These special status plants are in addition to those listed under the Vegetation section for the total project area.

Noxious weeds are similar on the Crow Reservation to the rest of the project area and are discussed under the main Vegetation section in this SEIS.

Wildlife

According to the Crow Indian Reservation Natural, Socio-Economic and Cultural Resources Assessment and Conditions Report there are an estimated 79 species of mammals, 260 species of birds, five species of amphibians and 14 species of reptiles found on the Crow Reservation some time during the year. Big game species include pronghorn antelope, elk, white-tailed deer, buffalo and black bear. Small game animals include white-tailed jackrabbit, snowshoe hare and mountain cottontail. Upland game birds include Merriam's turkey, mourning dove, blue grouse, ruffed grouse, sharp-tailed grouse, sage-grouse, chukar partridge, ring-necked pheasant and gray partridge.

Fur bearers on the reservation include: beaver, muskrat, lynx, bobcat, raccoon, red fox, coyote, badger, striped skunk, western spotted skunk, mink, ermine and long tailed weasel. Many species of rodents are found on the reservation, of these the prairie dog is the most important because of its relationship as prey.

Several raptorial birds are common throughout the area and nest on the reservation. Some of these include the American kestrel, northern harrier, red-tailed hawk, bald eagle and golden eagle. Prairie falcons may also reside on the reservation but are considered uncommon.

Special Status Species

Five endangered species may at times be found on the reservation (Crow Tribe of Indians 2002). These are the grizzly bear, gray wolf, black-footed ferret, whooping crane and peregrine falcon. It is unlikely that any of the endangered mammals reside on the reservation. Whooping cranes and peregrine falcons may migrate through the Crow Reservation in the spring and fall months.

Aquatic Resources

The Crow Tribe (2002) reported that 19 species of fish occur on the Crow Reservation at some time during the year. The tribe also stated that Bighorn Lake (impounded by Yellowtail Dam), which begins in Wyoming and runs into the Crow Reservation in Montana, provides some of the finest fishing in the state. The tribe noted that a nationally famous fishery for huge rainbow trout and brown trout occurs in a 12-mile reach of the Bighorn River downstream of Yellowtail Dam.

Water discharged from Bighorn Lake to the river is cool and nutrient-rich and supports a blue-ribbon trout fishery reported to be the premier tail-water fishery in North America (Crow Tribe 2002). Table WIL-3 (in the Wildlife Appendix) summarizes fish species composition and abundance information from the Montana State Library Natural Resource Information System (Montana NRIS 2001) Internet data base for the same representative drainages on the Crow Reservation that were listed in the preceding paragraph for Table WIL-2 (in the Wildlife Appendix). In addition to these drainages, Pryor Creek in the western portion of the Crow Reservation provides some habitat for rainbow, Yellowstone cutthroat and brook trout and is rated as having a moderate fisheries resource value (Montana NRIS 2001).

Northern Cheyenne Reservation

Much of the information in this section was summarized from The Northern Cheyenne Tribe and Its Reservation: A Report to the U.S. Bureau of Land Management and the state of Montana Department of Natural Resources and Conservation (Northern Cheyenne Tribe April 2002). Readers should refer to that document for more detailed information. This document can be downloaded from the BLM web site at http://www.mt.blm.gov/mcfo/cbm/eis/NCheyenneNarrativeReport/index.html.

The Northern Cheyenne Indian Reservation occupies about 445,000 acres in eastern Big Horn and southern Rosebud counties, Montana. U.S. Highway 212 provides access. The reservation covers nearly 695 square miles and is bordered on the east by the Tongue River and on the west by the Crow Reservation. According to the BIA Realty Office, the tribe has 442,193 trust acres and 444,000 of surface and mineral estate lands. There are 138,211 individual allotted acres on the reservation.

President Arthur issued an Executive Order establishing the reservation in November of 1884 with a land trust of about 271,000 acres. In 1900, President McKinley issued a second Executive Order on behalf of the Northern Cheyenne that shifted the eastern boundary to the Tongue River, expanding the reservation to its current size. The topography deviates from low, grass-covered hills to high, steep outcroppings and narrow valleys. Elevations range from approximately 3,000 to 5,000 feet.

Tribal Government

The tribe ratified a constitution and bylaws in 1936 according to Indian Reorganization Act rules. The Tribal Constitution was amended in 1960 and 1996. The 1996 amendment initiated a three branch system: Executive Branch, consisting of the Tribal President, Vice President, Secretary and Treasurer; Legislative Branch consisting of the Tribal Council and it committees and Judicial Branch consisting of the courts. The Tribal Council consists of 11 full-time members, a seat held by the Vice President, five seats each representing one of the districts (Ashland, Birney, Busby, Muddy and Lame Deer) and five seats allocated among the five districts based on the percentage of Tribal membership. The Tribal President presides over the Tribal Council. The Tribal Council powers include representative, proprietary, fiscal, police and economic.

In the Executive Branch, the Tribal President and Vice President are elected by the Tribal membership and the Tribal Council appoints the Secretary and Treasurer. The Tribal President oversees the Executive Branch and appoints persons to all Tribal Boards, commissions, departments and agencies (Culture Committee, Economic Development Committee, Enrollment Committee, Gaming Commission, Land Committee, St. Labre Task Force, Newsletter Committee, Grazing Board, Natural Resource Board, Housing Authority, Utilities Commission, TERO Commission, Board of Health, Ad Hoc Committee and Credit Committee) and oversees a host of tribal programs.

The reservation court system was updated in 1998 providing for the election of at least two full-time trained court judges and at least three part-time appellate judges appointed by the Tribal President. A Constitutional Court was established to review the constitutionality of Tribal Council ordinances and has the exclusive power to remove a Tribal judge.

Demographics

According to the 2000 Census, the population of the Northern Cheyenne Reservation (reservation) is 4,470 persons, of whom 4,029 are Native Americans. The Northern Cheyenne Tribe report indicates that this number likely underestimates the actual population. Although the Census does not provide estimates of undercounts, the report estimates the actual reservation population could be about 5,000, based on past Census adjustment methods. Tribal enrollment is 8,008 persons, of whom 4,343 live on or near the reservation.

Geographically, the Northern Cheyenne Reservation’s most immediate social environment consists of Big Horn and Rosebud counties, the Crow Reservation on the west and Powder River County to the east. The reservation has a much higher population density than the surrounding counties. According to the 2000 Census, the reservation had 6.4 persons per square mile, several times greater than the surrounding counties, which had 1.4 persons per square mile. The age distribution on the reservation is more heavily weighted toward the young than the surrounding counties. The median age on the reservation is 22.7 years compared to an average of 39.2 years in the three surrounding counties.

According to the 1990 Census, the poverty rate on the reservation was 47 percent. This compares to an average poverty rate of 12 percent for the non-reservation portions of Rosebud and Powder River counties. Additional information on poverty rates, including rates calculated by the BIA, is provided in the Socioeconomics section of Chapter 3.

Social Organization

There is a housing shortage on the reservation. The Northern Cheyenne Report estimates that there are about 1,200 housing units on the reservation to serve a population of about 5,000. As a result, most reservation housing is overcrowded and a number of tribal members commute from off-reservation housing to jobs on the reservation. Of the 1,200 housing units, about 800 are public housing managed by the Northern Cheyenne Housing Authority, about 20 units are employer-owned housing and about 300 units are privately owned. In addition, there are an unknown number of mobile homes and trailers. Overall, the housing on the reservation is in poor condition, due to a number of factors including age, poor construction and lack of financial resources to maintain it. A significant number of the housing units do not have regular electrical service.

The tribe operates two programs intended to address the housing situation on the reservation—the Northern Cheyenne Housing Authority, which is responsible for new public housing construction and renovation projects and the Housing Improvement Program, which provides funding for the renovation of private homes on the reservation.

The report provides a detailed description of public services and facilities, including utilities, education, social services, police, fire and medical services, employment and job training and transportation. A common theme with a number of the services is their inadequacy due to maintenance or capacity issues. A number of basic programs and services on the reservation are still administered by the federal government. The BIA is directly responsible for providing law enforcement services and also manages the reservation's forests and range lands. The BIA is responsible for the reservation's road network and oversees all real estate transactions.

Public schools are available for pre-school grades and K-12 in Lame Deer. Ashland houses the St. Labre Indian High School or students may decide to attend public high school in Colstrip, Montana. In Colstrip there are three public elementary schools, a middle school and a transportation system, which serves all grade levels. For college, students may choose to attend the Dull Knife Community College in Lame Deer. The institution offers several associate degrees and certified programs. Dull Knife Community College also offers courses on the Cheyenne language. Approximately 62 percent of the tribal members have a high school diploma and 5.6 percent have a Bachelor's Degree or higher.

Economics

The current economy is primarily based on livestock; individual tribal members own an estimated 12 to 15 thousand head of cattle, which are presently worth about $12 million on the open market. The tribe has approximately 27,000 acres of reservation lands presently under cultivation, the vast majority of which is dryland farming. This primarily entails hay, wheat, barley and small grains. Annual revenues generated by farming are estimated at about $2.5 million (U.S. Department of Commerce 1996).

In addition to this agricultural-based income, the tribe has developed several secondary routes of income including construction, timber sales, small business and casino gaming.

There are several skilled construction contractors and subcontractors amongst the tribe, one of which is reported to have a contract for construction of the new Community Center (the old one having burned down in 1989). Additionally, new tribal housing units are planned; tribally based contractors are bidding for this project. In general, the construction industry generates sizable employment and revenues for the tribe.

One third of the reservation or approximately 147,000 acres is composed of forested land, the majority of which is comprised of Ponderosa Pine forests. The commercially available portion of these forested lands is estimated at 70 percent. The tribe's sawmill was closed; since then, little if any timber has been sold. The Northern Cheyenne Pine Company is the lead forest product company using reservation timber resources.

There are currently 44 small businesses on the reservation, the majority Indian-owned. These businesses include laundromats, restaurants, gas stations, grocery stores, construction contractors, drilling companies, a lumber mill, a clothing designer and Indian arts and crafts outlets.

The tribe operates the Northern Cheyenne Bingo facility, a moderate-sized casino operation, offering bingo, pull tabs and video poker. The casino generates no net revenues for the tribe; however it employs a number of tribal members (letter from Northern Cheyenne Tribe dated October 18, 2005).

Additional Detail

The information that follows was summarized from a report by the Northern Cheyenne Tribe (April 2002). Readers should refer to that document for more detailed information.

According to the 1999 BIA Labor Force Report, only 29 percent of the potential 2,437-person labor force on the reservation is employed; the unemployment rate is 71 percent. For further discussion, see Table 3-31 and the text in the Social and Economic Values section under the heading of Unemployment.

A detailed discussion of the history of reservation employment and economics in relation to energy production is provided in the Northern Cheyenne report. The report reviews the energy development between 1970 and 1990 and the associated rise and then fall of wages, employment and property taxes in the reservation area. The primary local economic impact of the mineral development during that time was in the creation of jobs and payment of wages, in addition to state and local taxes collected on mineral extraction. Energy and extraction provided some of the highest-paying jobs available in Montana.

Despite the new wealth and jobs created, the energy boom from 1970 to 1990 generally did not support improved prosperity on the reservation. On the reservation, a number of indicators of economic health declined during this period. Reasons cited for this deterioration of economic conditions include lack of access by Northern Cheyenne to the high-paid energy jobs, limited local commercial infrastructure on the reservation and lack of access to the energy-related revenues to support public services and infrastructure on the reservation.

The federal government plays a major role in tribal economics. Direct federal funding in the form of grants, contracts and funding agreements and indirect costs recovery make up the lion's share of the tribe's total revenues and expenditures. Between 1976 and 1997, the Northern Cheyenne Tribe entered into contracts with the BIA assuming responsibility for more than 20 BIA programs with a total budget in fiscal year 2002 of $3.7 million. The tribe also enters into funding agreements with the Indian Health Service and federal housing, welfare and employment programs. In all, the tribe administers about 70 federal grants and programs with a combined value in fiscal year 2002 of about $21.3 million. In fiscal year 2002, federal funding for direct and indirect program expenditures is projected to exceed the tribe's general fund revenues by a factor of 10.

Sources of tribal government fiscal resources include the general fund, indirect cost reimbursement, fiduciary funds and special revenue funds. The general fund is used to finance the basic operations of tribal government. The fund is also used to provide matching funds for federal programs and to subsidize under-funded federal programs. General fund revenues are derived from income from tribal natural resources (primarily timber sales and grazing leases), earnings distributed from the permanent fund, interest on other funds and federal payments in lieu of taxes. Because the reservation tax base is limited, the tribe imposes no taxes and derives no revenues from taxation. The general fund budget for fiscal year 2002 is $2.03 million, which represents a 40 percent decline from 2001, primarily due to decreased earnings distribution from the permanent fund and declining income from natural resources. Tribal discretionary funds—those funds available to fund the operations of the tribal government and discretionary programs and services—are limited.

Air Quality

The air quality and climate of the Northern Cheyenne Reservation is similar to that of the regions described earlier in Chapter 3. The Northern Cheyenne Reservation is classified as a PSD Class I area. Additionally, the community of Lame Deer, Montana, is classified as a moderate PM_{10} nonattainment area.

The tribe is under contract with Pennsylvania Power and Light to maintain, calibrate and report data from three ambient air PSD stations. These stations are used to monitor SO_2, NO_2, wind speed and direction, precipitation, barometric pressure, solar radiation, temperature and dew point. Background data from two of these stations for the January 1999 through June 2000 period indicate the maximum hourly concentration for SO_2 was 0.021 ppm and for NO_2, 0.034 ppm. However, the annual averages remain very close to zero.

Particulate matter (PM_{10} and PM2.5) ambient air monitoring is conducted in the community of Lame Deer. No exceedances of the NAAQS were noted in the years 1999 to 2000. Daily PM_{10} values ranged from 1.6 ug/m^3 to 131.3 ug/m^3. The PM_{10}, 24-hour average "not to exceed" value is 150 ug/m^3.

The tribe is in the process of developing a Tribal Implementation Plan, which will allow for enforcement of Class I air quality standards.

The reservation is located in a part of Montana that has a moderate climate relative to its latitude. Snow rarely accrues for long periods of time because of the warm Chinook winds, which originate from the mountains in the West. This portion of Montana is also known for its "Indian Summers" which frequently extend into November. The mean annual temperature is 45.5^{o}F with a summer high of 110^{o}F and a winter low of -48^{o}F. The bulk of the reservation varies from 12 to 18 inches annual precipitation, depending on the elevation.

Culture and History

The Cheyenne are believed to descend from the Algonquian language people in the Great Lakes region, what the Northern Cheyenne call the northern homelands (Notum'histah'o'omih'nah). Western scientists believe that during the 1400s and 1500s they migrated southward into the Missouri River and the Black Hills country. The Northern Cheyenne believe that they left the Great Lakes region about 1600 to avoid contact with encroaching Europeans. They farmed corn and squash and practiced subsistence fishing and gathering and hunting small game. While in the Missouri River region they encountered a group of Suhtio and they later integrated their beliefs, traditions and customs into one culture.

After 1600 they adopted the horse and became reliant on large game hunting and following the buffalo herds. From around 1640 to 1830, the Cheyenne engaged in commerce with Europeans as part of the fur trade, encountering the Lewis and Clark expedition about 1804.

The first treaty with the U.S. government was signed by a small group of Cheyenne in 1825 (the Friendship Treaty). In the 1830s, the Cheyenne began to split into the Southern Cheyenne and the Northern Cheyenne, preferring to live close to their Lakota relatives in the Black Hills, Powder River, Yellowstone River and Tongue River regions.

European settlement, gold seekers and other Euroamerican activity increased in the region throughout the first half of the 1800s leading to increased conflict, between Native People and with Euroamericans. In an attempt to decrease conflict the U.S. government established military outposts and an Indian Agency in the Upper Platte River Valley. They convinced a number of Native nations to adopt the Fort Laramie Treaty of 1851, which assigned the Cheyenne and Arapaho to lands south of the North Platte River and north of the Arkansas River in present day Wyoming, Nebraska, Colorado and Kansas. However, some Cheyenne bands remained north of the South Platte River and became known as the Northern Cheyenne. The Northern Cheyenne continued to resist incursions into what they considered their territory. Tensions between Euroamericans and the Northern Cheyenne increased during the Civil War. The Colorado Volunteer Militia raided a peaceful Cheyenne Village culminating in the Sand Creek Massacre. From this point through the late 1870s, the Cheyenne were at war with the U.S. government. The Battle of the Little Bighorn is the most well-known incident of this long struggle.

There were many bands involved in these battles and struggles and their movements were complicated and read like any war story. The Cheyenne were eventually subdued and split into various groups. In 1881, all of the Northern Cheyenne were sent to Fort Keogh and were allowed, under the Indian Homestead Act of 1875, to move south near the Tongue River and along Rosebud and Muddy creeks. The Northern Cheyenne settled in the area practicing their traditional culture and making a livelihood practicing western farming and ranching.

Disputes arose between white ranchers and the Northern Cheyenne leading to a special investigation, the outcome of which was the establishment of the Northern Cheyenne Reservation in 1884. Disagreements over the reservation boundaries continued until 1900 when the current reservation boundaries were established.

The Northern Cheyenne are the people of The Morning Star. They are caretakers of the Sacred Buffalo Hat, a sacred covenant with *Maheo* (Creator). Life for the Northern Cheyenne is a holistic interrelationship of history, work, religion, language, sacred belongings, health, medicine and education. All of these work to maintain the environment and culture of the people. Their sacred ways, such as the Keeper of the Sacred Buffalo Hat Covenant greeting the grandfather morning star, maintain a connection to *Maheo* and the creative essence that caused the universe and life itself to exist. Ritual and diligence in daily life to follow tradition maintains the elemental arrangement of creation. In this arrangement, all elements of creation are like a family: Sun as Grandfather, Earth as Grandmother, Moon as Mother, Stars as Brothers and Sisters and to the four cardinal directions as the Sacred Spirit Helpers who watch over their way of life.

An excellent outline and illustration of the Cheyenne cosmology and interrelationships can be found in the report, The “Northern Cheyenne Tribe” and it’s Reservation (2002), which illustrates the universe as a renewable cycle with spiritual essence in constant interaction. *Maheo*, spiritual essence, is contrasted with *Heestoz*, substance or matter. Both are necessary for the continuation of the universe. Maleness, associated with *Maheo*, is the highest point in the universe and femaleness, associated with *Heestoz*, is the lowest point. The interaction of *Maheo*, Sun (Creator) and *Heh’voom*, earth (Grandmother) bring about all life. Between *Maheo* and *Heh’voom* are layers of space creating the structure of the universe is between. These layers are the Blue-Sky Space, the Nearer-Sky Space, the Atmosphere, the Earth Surface Dome and the Deep Earth. With this cosmology, birds and mountains are special sacred animals and places since they are closer to Blue-Sky Space containing the manifestation of *Maheo* (sun, moon, etc.). All things in this cosmology are animate.

Through sacred ways and ceremony, the Cheyenne believe that they can harness the spiritual essence as a power to benefit physical existence. If they do not practice traditional culture and beliefs to maintain the balance and cycle, the spiritual essence will not be available to benefit them or maintain the earth system.

With these belief systems natural resources become culturally and spiritually important, particularly water (with living spirits), plants (considered to be relatives), animals (also relatives), great birds (messengers to the spirits in Blue-Sky Space) and fossil and mineral sources (used in ceremony). Cultural resources such as burials, ceremonial sites (fasting locations, vision quest sites, sweet lodges and memorials), homes (tipi rings, historic depressions, foundations and cabins), community and commercial reservation-era sites, military and exploration-related sites and prehistoric sites (lithic scatters, cairns and petroglyphs) are considered sacred to the Northern Cheyenne.

Traditional Cultural Properties

The Northern Cheyenne have expressed concern regarding off-reservation TCPs and they have identified numerous such sites. These TCP sites are held as sacred or of high importance to the tribe. Two particular sites mentioned at tribal consultation meetings and in tribal correspondence are the Rosebud and Wolf Mountain Battlefields. The Northern Cheyenne Tribe voiced concern over Northern Cheyenne homestead sites in the Tongue River valley.

The Rosebud Battlefield is the site of the June 17, 1876, battle between the Sioux and Cheyenne Indians and General George Crook's cavalry and infantry. One of the biggest Indian battles ever waged in the United States, it set the stage for the Indian victory eight days later at the Little Bighorn against Lt. Col. George A. Custer. The battle ranged over 10 square miles and involved 2,500 combatants. General George Crook's Big Horn and Yellowstone expedition force had 1,000 men and there were 1,500 Sioux and Cheyenne warriors. MFWP has a final management plan for the battlefield available.

In 1972, the Montana Department of Fish Wildlife and Parks purchased the ranch from the Kobold family and it became a state park. The Rosebud Battlefield is on the list of National Register of Historic Places.

The Wolf Mountain Battlefield is located on the east side of the Tongue River, beneath Pyramid Butte, a spur of the Wolf Mountains. The battle fought at this site climaxed Col. Nelson A. Miles' winter drive of 1876 and 1877. He pursued the Sioux under Crazy Horse, who had defeated the Custer command the preceding summer on the Little Bighorn. In October, Miles captured and sent 2,000 Sioux and Cheyenne back to the reservation. On January 7, 1877, Miles camped beside the Tongue River on the southern flank of the Wolf Mountains. The next morning, Crazy Horse and 800 braves made a surprise attack. Miles, his howitzers disguised as wagons, repulsed the attack. The Indians took refuge on bluffs overlooking the camp. When the troops assaulted the bluffs, the warriors withdrew under cover of a snowstorm. Many of the warriors surrendered with Crazy Horse and Dull Knife's Cheyenne in the spring at Fort Robinson, Nebraska. Today a gravel road bridges the river from the west, crosses the valley where Miles camped, ascends the bluffs just south of Pyramid Butte (the final Indian position) and continues toward the town of Birney. Except for the road, the site has remained unchanged since 1877.

Geology and Minerals

The reservation contains a varied geology, as does the state of Montana (see earlier Geology and Minerals description). Of particular interest are the deposits of subbituminous coal within the reservation. The known coal occurrences in the Powder River Basin are generally located in the Paleocene Fort Union Formation. The coals on the reservation are known to be beneath the entire reservation and are estimated to contain 23 billion tons of coal of which 16.3 billion tons may be prospective for CBNG development (Admin Report BIA-3 1975). Five CBNG wells have been drilled prior to 1989 on the reservation with modest results (Northern Cheyenne Tribe 2002). In 1991, the tribe drilled and tested two CBNG exploratory wells (Northern Cheyenne Tribe 2002). Geology and stratigraphy of the Planning Area are discussed at length in Chapter 3, Geology and Minerals and in the Minerals Appendix.

The reservation does not have any known oil or gas fields. Twenty conventional wells have been drilled to date. Additionally, Atlantic Richfield (ARCO) has explored for oil and gas reserves on tribal lands but this data has not been released to state or federal agencies.

Non-metallic mineral resources on the reservation include bentonite, building and ornamental stone, claystone and shale, clinker and gravel (Northern Cheyenne Tribe 2002).

Protecting the Indian lessors from loss of royalty as a result of conventional oil and gas drainage is a prime responsibility of the BLM. Under the terms of both federal and Indian leases, the lessee has the obligation to protect the leased land from drainage by drilling and producing any well(s) that is necessary to protect the lease from drainage or, in lieu thereof and with the consent of the authorized officer, by paying compensatory royalty. Drainage analysis, on the basis of a production screen or other criteria, is required by BLM Handbook H-3160-2, Drainage Protection Guidelines. Federal or Indian mineral interests determined to be in danger of drainage are subject to geologic, engineering and economic analyses in order to define the presence and magnitude of resource drainage.

Hydrology

Hydrological resources on the reservation consist of surface water flow from the Rosebud Creek and the Tongue River and their associated tributaries and the production of groundwater from a variety of geological formations.

Surface Water

Surface water on the reservation is contained in the Rosebud and Tongue River watersheds. These two watersheds support natural flows as summarized in Tables 3-20 and 3-21.

These two watersheds contain water resources of variable quality as described in the Water Resources Technical Report (ALL 2001b). Table 3-22 summarizes the long-term average water quality for the Tongue River watershed.

According to the 2004 state of Montana 303(d) list, Rosebud Creek is listed as being impaired immediately downstream of the northern reservation boundary. The probable causes identified on the 303(d) list are nutrients and "other," with the probable sources being dam construction and hydro-modification. No other impaired stream segments are located next to the reservation.

Groundwater

The groundwater resources of the reservation are similar to those described for the Powder River Basin in the previous Hydrology section of this chapter. Formations of importance to the groundwater resources of the reservation include the Madison Group of Mississippian age; the Fox Hills Sandstone and Hell Creek Formation of Cretaceous age; the Fort Union Formation of Tertiary age and the valley fill-alluvium of Quaternary age. The geologic formations and associated aquifers are discussed below. (Northern Cheyenne Tribe, 2002).

TABLE 3-20

AVERAGE ANNUAL GAGE AND ESTIMATED NATURAL FLOWS FOR THE TONGUE RIVER NEAR THE NORTHERN CHEYENNE RESERVATION (STUDY PERIOD 1940-1982, HKM 1983)

Location	Flow Type	Acre-Feet/Year
Tongue River at Tongue River Dam	Gage Flow Est. Natural Flow	332,907 (St. Dev. = 112,406) 421,238 (St. Dev. = 102,464)
Southern Boundary of Reservation	Est. Natural Flow	439,253 (St. Dev. = 106,154)
Northern Boundary of Reservation	Est. Natural Flow	455,161 (St. Dev. = 103,255)
Tongue River at Brandenburg Bridge	Gage Flow Est. Natural Flow	362,614 (St. Dev. = 152,288) 461,019 (St. Dev. = 104,352)

Source: Northern Cheyenne Tribe 2002.

TABLE 3-21

AVERAGE ESTIMATED NATURAL FLOWS FOR ROSEBUD CREEK, NORTHERN CHEYENNE RESERVATION (STUDY PERIOD 1939-1981)

Estimated Natural Flow at Location	Acre-Feet/Year
Rosebud Creek at Southern Boundary	11,818 (St. Dev. = 6,417)
Rosebud Creek neat Colstrip, Near Northern Boundary	26,727 (St. Dev. = 14,172)
Rosebud Creek near Mouth, Near Rosebud	27,297 (St. Dev. = 18,439

Source: HKM, RCB Hydrology 1982, Northern Cheyenne Tribe 2002.

TABLE 3-22

COMPARISON OF PREVIOUSLY CITED WATER-QUALITY PARAMETERS WITH LONG-TERM AVERAGE FIGURES, TONGUE RIVER AT STATE LINE

Data Source	Range	Sulfate (mg/l)	Dissolved Magnesium (mg/l)	EC (µS/cm)	SAR	Boron (µg/l)
HKM (1972)	High	500	50	1,100	2.0	0.38
	Low			230		
USGS (1985-1999 average)	Mo. Average High	180	45	699	0.67[1]	<1
	Mo. Average Low	30	10	299		

[1]SAR = 0.67 reflects published USGS data for water year 1997 as parameter 00931. SAR is not included in the data set available on USGS website (Northern Cheyenne Tribe 2002).

Madison Group

The Madison Group is divided into the Lodgepole Limestone at the base, the Mission Canyon Limestone and the Charles Formation at the top. The Madison Group is estimated to average around 1,100 feet thick within the reservation and the depth to the top is estimated to range between 7,200 and 9,100 feet below land surface. The aquifer contained within the Madison Group reportedly consists of extensive limestone and dolomite with shale, evaporate and cherty zones. Yields from Madison wells in the area range from 94 gpm immediately NW of the reservation to a reported 2,382 gpm from a flowing well approximately 90 miles NW of the reservation. Better porosity and permeability in the Madison aquifer are mainly associated with oolitic to fragmental limestone and with coarsely crystalline dolomite in the lower part. Solution and collapse breccias occur in the outcrops off the reservation; the extent of these features in the subsurface within the reservation is unknown.

Fox Hills Sandstone

The Fox Hills Sandstone, in the central Powder River Basin east of the reservation, is a sequence of marine and continental sandstone and shale 20 to 200 feet thick. Limited information available from oil and gas test holes on the reservation indicates the thickness of this unit to range from 65 to 760 feet. Depth to the top of the Fox Hills in the reservation is estimated to range between 2,200 and 3,500 feet. The most extensively used aquifer in the Central Powder River Basin is called the Fox Hills-Lower Hell Creek aquifer and it consists of the Fox Hills Sandstone and the overlying lower part of the Hell Creek Formation. Well yields from the Fox Hills-Lower Hell Creek aquifer range from 0.5 to 20 gpm and commonly are about 5 gpm. Yields of as much as 200 gpm to industrial wells have been reported (Slagle et al. 1985).

Hell Creek Formation

The Hell Creek Formation consists of sandstones, interbedded shales and siltstones. Available data indicates this unit underlies the entire reservation with a thickness of between 600 and 650 feet. Depth to the top of the Hell Creek formation within the reservation is estimated to be greater than 600 feet. Only one well is known to be completed in the Hell Creek formation near the reservation. It was drilled in 1959 for Saint Labre Mission to a total depth of 980 feet. At the time the well was constructed, it was under artesian pressure and flowed at the land surface at a rate of 60 gpm.

Fort Union Formation

The Fort Union Formation consists of the Tullock, Lebo Shale and Tongue River Members. The total thickness of this formation within the reservation is estimated to range from 1,800 to 2,200 feet. The formation dips to the southeast at 1 to 2 degrees regionally.

Tullock Member

The Tullock Member of the Fort Union Formation is estimated to range between 100 and 250 feet thick on the reservation and consists of sandstone, coal and shale beds. This unit is not a known source of water on the reservation. Yields to wells completed off the reservation in the Tullock Member range from about 0.3 to 40 gpm and generally are about 15 gpm (Slagle et al. 1985).

Lebo Shale Member

The Lebo Shale Member of the Fort Union Formation consists of dark shale and reportedly contains some lignite beds but no coal. The thickness of this unit on the reservation is estimated to range between 100 and 300 feet. It is not a known source of water.

Tongue River Member

The Tongue River Member of the Fort Union Formation is the major source of water withdrawn from wells in the northern Powder River Basin (Slagle 1985). It is the most reliable and shallow aquifer underlying most of the area, including the Northern Cheyenne Reservation. There are more than 100 springs on the Northern Cheyenne Reservation. Many of these springs emanate from the base of a clinker-shale contact, very commonly in the Tongue River Member of the Fort Union Formation. Depending on the geologic location of the spring, yield can range from 1 to 92 gpm.

Lower Tongue River Aquifer

The Lower Tongue River aquifer consists of the sandstone, siltstone, shale, coal and clinker beds from the base of the Robinson coal seam to the shale beneath the Knobloch coal seam. The aquifer is generally around 500 feet thick, except in the major stream valleys where erosion has reduced the total thickness to between 300 and 450 feet thick. Drill hole data indicates beds of permeable sandstone and shale are discontinuous and occur primarily as lenses grading from shale to siltstones.

Several wells are known to be completed in the Lower Tongue River aquifer. Most of these domestic wells were completed in sandstone and yield between 8 and 20 gpm. Wells in Muddy Cluster and Busby finished in the sandstone reportedly yield 18 and 50 gpm, respectively.

Upper Tongue River Aquifer

The Tongue River Member is Tertiary in age and crops out at the surface over much of the reservation. The Upper Tongue River aquifer consists of the sandstone and clinker beds within the Knobloch, Wall and Anderson systems.

Knobloch System

This unit consists of sandstone, siltstone, shale, coal and clinker. The Knobloch system ranges from 0 to 366 feet in thickness. Depth to the top of the unit is generally less than 1,100 feet depending on location on the reservation. Many wells and springs obtain groundwater from this system. Yields of wells completed in the sandstone generally range between 8 and 10 gpm. Wells completed in the Knobloch clinker yield as much as 50 gpm. Springs associated with sandstone and coal outcrops of the Knobloch generally flow less than 3 gpm.

Wall System

The Wall system consists of sandstone, siltstone, shale, coal and clinker. It ranges in thickness from 0 to 790 feet. Beds of permeable sandstone are discontinuous and occur primarily as lenses between shale and siltstone layers. Depth to the top of the unit is generally less than 300 feet depending on location on the reservation. The Wall coal seam and its related clinker form the thickest most continuous unit of this system, ranging from 20 to 40 feet. The Canyon coal seam, within the Wall system, also forms a relatively thick and continuous unit (20 to 30 feet). Several wells and springs derive water from the Wall system. Well yield ranges from 10 to 15 gpm. Springs flow from sandstone, siltstone and clinker units and vary from 1 to 25 gpm within the reservation.

Anderson System

This system consists of fine sandstone, siltstone, shale, coal and clinker ranging in thickness from 0 to 300 feet. The Anderson coal seam and its related clinker deposits form the thickest single unit within this system. Thickness of the Anderson coal varies from 30 to 60 feet but thins to the west. Massive clinker related to the burning of the Anderson and thin upper coal seams is reported to vary from 100 to 200 feet in the central and northern portions of the reservation.

Several wells and springs are known to derive water from the Anderson aquifer system. No production data is available as all wells completed before 1977 were monitoring wells. Springs associated with sandstone and siltstone units above the Anderson coal seam generally yield less than 1 gpm within the reservation.

Valley Fill-Alluvium

Valley fill-alluvium is found underlying and bordering the principal drainages within the reservation. These deposits include the Rosebud Creek, Muddy Creek, Lame Deer Creek and Tongue River alluvium.

Rosebud Creek Alluvium

The Rosebud Creek alluvium consists of clay, silt, sand, gravel and clinker fragments. Silts and clays are usually found as thin beds separating sand and gravel deposits. According to driller’s logs, the Rosebud Creek alluvium ranges in thickness from 6 to 110 feet, with an average thickness of 52 feet. An aquifer test performed in 1978 indicated an average transmissivity of 6,243 ft^2/d for a saturated thickness of approximately 76 feet. This value is considered to be representative of the valley fill alluvium immediately adjacent to Rosebud Creek between the southern reservation boundary and Busby. For wells completed in the Rosebud Creek alluvium, yield ranges between 6 and 20 gpm.

Muddy Creek Alluvium

The Muddy Creek alluvium consists of a mixture of silt, sand, gravel and clinker fragments. Based on driller's logs, the thickness of these deposits range from 0 to 112 feet and average 52 feet thick. The average saturated thickness is 30 feet. Assuming the deposits are similar to the Rosebud Creek alluvium, a transmissivity of 2,463 ft^2/d is calculated. Several wells, known to be completed in the Muddy Creek alluvium, yield between 10 and 15 gpm for domestic supply.

Lame Deer Creek Alluvium

The Lame Deer Creek alluvium consists of silt, sand and relatively thick gravel and clinker wash as compared to that of Rosebud and Muddy Creek deposits. Driller's logs indicate that the thickness of this deposit ranges from 12 to 63 feet. Domestic wells completed in the Lame Deer Creek alluvium yield between 6 and 15 gpm.

Tongue River Alluvium

The Tongue River alluvium consists of sand and gravel-sized clinker fragments derived from the Tongue River Member of the Fort Union formation. The thickness of this deposit ranges from 34 to 100 feet and averages 66 feet (Northern Cheyenne Tribe 2002).

Groundwater Quality

A thorough evaluation of groundwater quality was performed by the Northern Cheyenne Research Project from 1973 through 1977 and published by HKM in 1983. The following descriptions are based on the data collected during that study period. The majority of water quality data on the reservation exists for the Fort Union and alluvial aquifers. Individual aquifers are discussed below (Northern Cheyenne Tribe 2002).

Fort Union Formation and Tongue River Member

Samples obtained from wells indicated water in these geologic units to be a mixed type with this dominant ions being sodium, magnesium, calcium, bicarbonate and sulfate. TDS concentration generally range from 232 to 3,774 mg/l in wells tapping sandstone, coal and clinker units. Water ranges from soft to very hard with calcium carbonate levels between 14 to 1,468 mg/l. Fluoride concentrations range from 0.1 to 9.1 mg/l and sulfate concentrations range from 0 to 2,119 mg/l. Adjusted SAR values for water samples obtained from the sandstone units of the Tongue River Member of the Fort Union formation ranged from 0 to 53. Water samples from the coal beds of the Fort Union had adjusted SAR values ranging from 2.6 to 101. Springs contained very hard water with calcium carbonate concentrations between 190 to 950 mg/l. Sulfate and fluoride concentrations ranged from 8.0 to 337 mg/l and 0.27 to 12.0 mg/l, respectively. The adjusted SAR ranged from 0.5 to 50.8.

Groundwater from sandstone and coal aquifers of the Tongue River Member is generally suitable to serve as a drinking water source; however, several samples from wells obtaining water from the coals did exceed the Primary Drinking Water Standards for chromium and fluoride. Water from the Tongue River aquifers is generally quite mineralized and not aesthetically pleasing. This water is generally undesirable for irrigation due to salinity problems; however, it is acceptable for livestock use.

Valley Fill—Alluvium

Water-quality for the valley fill-alluvium on the reservation appears to be a mixed-type, with the dominant ions being calcium, magnesium, sodium, bicarbonate and sulfate. A range of water-quality values in the alluvial systems is presented in Table 3-23.

Groundwater from the alluvium is generally suitable for drinking water with respect to the Primary Drinking Water Standards, although several samples taken from wells completed in the alluvium of Rosebud, Muddy, Lame Deer creeks and the Tongue River, equaled or exceeded the Primary Standards for cadmium. One sample from a well completed in the Rosebud Creek alluvium exceeded the limits for chromium and lead. The alluvial groundwater is quite mineralized with concentrations of TDS, sulfate, iron and manganese that often exceed Secondary Drinking Water Standards. Exceeding secondary standards does not represent a health hazard, but rather makes the water less desirable as a drinking water source for aesthetic reasons. The alluvial groundwater would probably be suitable for

TABLE 3-23

WATER-QUALITY OF THE ALLUVIUM ON THE NORTHERN CHEYENNE RESERVATION

Constituent	Rosebud Creek	Muddy Creek	Lame Deer Creek	Tongue River
TDS (mg/l)	374 - 2,048	1,082 - 1574	558 – 1,144	527 - 3,277
$CaCO_3$ (mg/l)	140 - 1,225	664 - 955	450 - 626	35 - 946
Sulfate (mg/l)	67 - 1,370	313 - 731	119 - 361	0 - 1,893
Nitrate (mg/l)	0 - 4.0	0 - 1.0	1.0 - 4.3	0.1 - 6.2
Fluoride (mg/l)	0 - 1.3	0.5 - 1.5	0.8 - 2.0	0.3 - 6.4
Adjusted SAR	0 - 34	5.2 - 6.0	5.2 - 6.0	4.3 - 51
No. wells tested	17	5 samples	4	12

Source: Northern Cheyenne Tribe 2002.

irrigation provided tolerant crops were used and special irrigation practices were instituted to prevent salinity and permeability problems. The water is acceptable for livestock use (Northern Cheyenne Tribe 2002).

Water Rights

The water rights of the Northern Cheyenne Tribe are set forth in the Northern Cheyenne-Montana Compact, which represents a statement of the federally reserved water rights held by the tribe. The Reserved Water Rights Compact Commission (RWRCC) of Montana describes Federal Reserved Water Rights as follows:

Federal Reserved Water Right

A federal reserved water right is a right to water that was created when Congress or the President of the U.S. reserved land out of public domain. The U.S. Supreme Court has ruled that enough water be reserved to meet the purposes for which the reserved lands were designated. The date that the land was withdrawn and the reservation created is the priority date of a federal reserved water right. Reserved water rights for Indian reservations, for instance, go back to the 1800s. Federal reserved water rights do not have the same restrictions placed on them as on state appropriative water rights. For example, a notice of appropriation or beneficial use is not required to maintain a federal reserved right and it is not lost due to non-use. The Tribe's reserved water right addresses three sources of water, the Tongue River, the Bighorn River and Rosebud Creek. The Compact entitles the Tribe to a priority date of October 1, 1884. This right provides for:

1. The diversion of 1,800 acre-feet per year, or the amount necessary to irrigate 600 acres, from Rosebud Creek.
2. The diversion of 30,000 acre-feet per year from the Bighorn Lake at Yellowtail Dam for any beneficial use.
3. The diversion of 32,500 acre-feet from the Tongue River for any beneficial use.
4. An additional 19,530 acre-feet from Rosebud Creek, for any beneficial use subject to the constraint that diversion and use do not adversely affect other water right holders of priority June 30, 1973 and earlier.

The extraction of alluvial groundwater by means of wells of less than 100 gallons per minute pumping capacity, exclusive of other water rights (Northern Cheyenne Tribe 2002).

History of Compact

In 1913, the state court of Montana initiated a proceeding to adjudicate water rights on Tongue River. In this proceeding, the federal government did not fully satisfy the Northern Cheyenne Tribe's *Winters v. U.S.* (207 US564) water rights claims to water in the Tongue River. Instead, the U.S. asserted a claim on behalf of the tribe only for the amount of water used by the Tribe at that time. In the Miles City Decree of 1914 (the Decree), the tribe was awarded only 30 cfs of water out of an available 425 cfs. The Decree established a priority date of 1909 for the Northern Cheyenne water claim: the next to last priority awarded in the Decree. The tribe's water right as set forth in the Decree was insufficient to irrigate the tribe's agricultural lands at the time and the late priority date established a high probability that the tribe would be out of water before the irrigation season began (Northern Cheyenne Tribe 2002).

The tribe has asserted that the failure to pursue the tribe's *Winters v. U.S.* (207 US564) rights claims constituted a breach of the federal trust responsibility. In 1975, the tribe filed an action in U.S. District Court to determine its water rights. The United States also filed suit on behalf of the tribe. In 1979, the state of Montana initiated proceedings for a general stream adjudication, which included the claims of the tribe. In that same year, the estate established the Montana Reserved Water Rights Compact Commission to negotiate a water rights settlement with the tribes of Montana. Negotiations with the Tribe began in 1980. Several years of negotiations yielded the Northern Cheyenne-Montana Water Rights Compact (the Compact). The Tribe formally approved the Compact on May 20, 1991, with Tribal Resolution #144. The Compact was ratified by the Montana State Legislature on June 11, 1991 and was re-ratified on December 16, 1993, by the 53rd Legislature Special Session (Northern Cheyenne Tribe 2002).

On September 30, 1992, the federal government ratified the Compact via "The Northern Cheyenne Indian Reserved Water Rights Settlement Act of 1992" (Pub. L. 102-374, 106 Stat. 1186) (Settlement Act). The purposes of the Settlement Act of 1992 are:

To achieve a fair, equitable and final settlement of all claims to Federal reserved water rights in the state of Montana of the Northern Cheyenne Tribe and its members and allottees and the U.S. on behalf of the Northern Cheyenne Tribe and its members and allottees. To approve, ratify and confirm the Water Rights Compact entered into by the Northern Cheyenne Tribe and the state of Montana on June 11, 1991. To direct the Secretary of the Interior to enter into a cooperative agreement with the state of Montana for the planning, environmental compliance, design and construction of the Tongue River Dam Project (P.L. 102-374, 106 Stat, 1186, Section 3(8)) in order to: implement the Compact's settlement of the Tribe's reserved water rights claims in the Tongue River Basin, protect existing Tribal contract water rights in the Tongue River Basin: provide [up to as per the Compact] 20,000 acre-feet per year of additional storage water for allocation to the tribe and allow the state to implement its responsibilities to correct identified Tongue River Dam safety inadequacies. To provide for the conservation and development of fish and wildlife resources in the Tongue River Basin. To provide for the enhancement of fish and wildlife habitat in the Tongue River Basin. To authorize certain modifications to the purposes and operation of the Bighorn Reservoir in order to implement the Compact's settlement of the Tribe's reserved water rights claims. To authorize the Secretary of the Interior to take such other actions as are necessary to implement the Compact.

Northern Cheyenne Tribal Water Policy and Management

Northern Cheyenne Water Code: The Northern Cheyenne Water Code sets the regulatory framework for the management of tribal water resources on the reservation. The purpose of the Water Code is to preserve and protect the quantity and quality of Tribal water resources through wise use, administration, management and enforcement. This includes, but is not limited to, permitting and prioritizing tribal water use, long-term planning to ensure the sustainability of resources, encouraging conservation practices and protecting traditional, religious and cultural uses of water (Northern Cheyenne Tribe 2002).

- Tribal Water Resources Board and Administrator: The administration of the Water Code will be the responsibility of a Tribal Water Administrator (TWA) and a Tribal Water Resources Board (Water Board). The Tribal Water Board is responsible for adopting new rules and regulations, approving or disapproving permits, reporting to the Tribal Council on relevant water-related issues, declaring critical management areas and water supply conditions, establishing and maintaining a technical staff to administer and enforce the Code and developing recommendations for long-term funding sources to support tribal water management.
- The TWA: The TWA issues citations and initiates enforcement proceedings for violations of the Code. The TWA administers water rights, monitors and enforces water use through inspections, responds to emergency situations, collects data and researches development possibilities and conducts educational programs. Recommendations are made to the Water Board on critical management areas and methods for improving water use and efficiency. The TWA develops and submits an annual budget and report to the Water Board.
- Water Management: The Water Code sets forth the primary physical, hydrologic and engineering principles guiding the management of surface and groundwater resources on the reservation. These procedures are required to effectively manage, fully utilize and protect the water rights of the Northern Cheyenne Tribe and to assure compliance with applicable laws and requirements of the Northern Cheyenne Montana Compact of 1991 and the Northern Cheyenne Water Rights Settlement Act of 1992. The Water Board will adopt a Comprehensive Water Management Plan at least every 5 years to guide water resource decisions, permitting and management. Surface water and groundwater is evaluated and no later than March 1 of each year, the condition of these resources is declared. Water

allocation procedures for both surface and groundwater are outlined in this section for use during drought conditions.

- Permitting: A water permit is required to divert or undertake any activity affecting or involving tribal water. This includes water diversions, discharge, injection, transfers, surface water alterations, groundwater recharge, storage impoundments, or hydropower generation. The Code clearly identifies the application process outlining the procedures, hearings and resolution of water disputes. The Water Board will preside over all hearings. The Tribal Court will enforce subpoenas issued by the Water Board.
- Enforcement: Prohibited acts and penalties are clearly outlined in the Water Code. Any person who commits prohibited acts shall be subject to civil proceedings before the Water Board on citation by the Tribal Water Administrator. All decisions of the Water Board shall be appealable directly and exclusively to the Tribal Courts.
- Summary: The Northern Cheyenne Water Code contains the provisions and guidelines to effectively manage the water resources of the reservation, however, with the fairly recent approval of the Water Code, the Tribal Water Resources Board has not yet been established. Currently, no permitting process or accounting for water resources exists on the reservation. Once underway, the Water Code will empower the Tribe by enabling them to control and protect the water resources on the reservation.
- Northern Cheyenne Tribe Draft Surface Water Quality Standards: A water quality standard defines the water quality goals for a water body, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses and by protecting water quality through antidegradation provisions. The Tribe has adopted these standards to protect public health and welfare, enhance the quality of water and serve the purposes of the Federal Clean Water Act. Currently, the Northern Cheyenne Tribe's Draft Surface Water Quality Standards have been submitted to the EPA and the public review process is near completion. In addition, the Tribe's application under Section 518 of the Clean Water Act for Treatment as a State for the purposes of implementing the Clean Water Act's water quality standards program is still pending before the EPA. The Tribe's Treatment as a State application and water quality standards are vital in the Tribe's water quality protection program and aid in evaluating potential impacts on water quality from a broad range of causes and sources.
- A primary purpose of the water quality standards is to guide efforts to monitor and assess surface water quality within the reservation. Any regulatory pollution controls established by the Tribe or the Federal Government must be developed to ensure a level of water quality that will satisfy these water quality standards. Surface water quality standards are adopted to establish maximum allowable levels or concentrations of pollutants and provide a basis for protecting water quality that is presently better than standards required for surface water quality. They serve to establish a basis for limiting the introduction of pollutants, which could affect existing or designated uses of reservation surface waters. The following surface water characteristics and policies are described in the Draft Water Quality Standards:
- Beneficial Uses: Beneficial use classifications are designated to all surface waters of the reservation in order to achieve national "fishable and swimmable" goals. Narrative water quality criteria and sampling methods are described along with the tribe's biological and radiological surface water standards.
- Antidegradation Policy: The tribe's antidegradation policy is consistent with the federal antidegradation policy found in EPA's water quality standards regulation. The purpose of the policy is to protect existing water quality where the quality of the water is better than required to support the designated uses.
- Mixing Zone and Dilution Policy: The mixing zone and dilution policy describes how dilution and mixing of point source discharges within receiving waters will be addressed in developing discharge limitations for point source discharges. Compliance requirements and 401 Certification procedures are also described. The requirements for standards implementation are outlined. Once approved and adopted by EPA, the Tribe's standards program will have the same legal standing as those adopted by states. The federal government will be responsible for the enforcement of the standards. EPA Region VIII will have the responsibility of enforcing requirements applicable to point source discharges, including those permit requirements that are based on the Tribe's water quality standards.

TABLE 3-24

NORTHERN CHEYENNE NUMERIC STANDARDS FOR EC AND SAR AND TDS INDICATOR VALUES

	Electrical Conductivity (EC) µS/cm[1]	Sodium Adsorption Ratio (SAR) [2]	Total[3] Dissolved Solids (TDS) mg/l
Southern Boundary			
Irrigation period 30-day average[4]	1,000	--	660
Year-round instantaneous maximum	2,000	2.0	1,320
Northern Boundary			
Irrigation period 30-day average	1,500	--	990
Year-round instantaneous maximum	2,000	3.0	1,320
Tributaries			
Irrigation period 30-day average	1,500	--	990
Year-round instantaneous maximum	2,000	3.0	1,320

Source: Northern Cheyenne Tribe 2002.

[1]The EC values are numerical water quality standards. EC is an expression of salinity as electrical conductance reported in microSiemens per meter at 25 degrees C (µS/cm). Note that 1,000 µS/cm = 1 deciSiemen per meter (dS/m).

[2]The SAR values are numerical water quality standards. SAR is an expression of the concentration of sodium relative to the square root of the average of the concentrations of calcium and magnesium in water where all constituents are in milliequivalants per liter (meq/l).

[3]The TDS values are indicator values and are not water quality standards. TDS is an expression of salinity as total dissolved solids in mg/L. The TDS values will be used to monitor conditions and trends in Tribal waters. If a TDS indicator value is exceeded, the tribe will evaluate the cause and, where appropriate, make necessary adjustments to the EC water quality standard(s). Any change to the EC standard will be made through the tribe's water quality standards-setting process.

[4]The irrigation period is defined by the tribe as April 1 through November 15 annually.

- SAR and EC. The Tribe is especially concerned about salinity and its impacts on riparian areas and irrigated lands. The Tribe has developed numeric criteria for the Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC) of waters of the reservation to address these concerns. The proposed numeric standards for EC and SAR are presented in Table 3-24. The rationale behind the numeric criteria for SAR is based on James Bauder's final report, "Recommended In-Stream Standards, Thresholds and Criteria for Irrigation or Water Spreading to Soils of Alluvial Channels, Ephemeral Streams, Floodplains and Potentially Irrigable Parcels of Land within the Boundaries of the Northern Cheyenne Reservation" (Bauder 2001).

In response and consideration of comments, concerns and objections received from various parties, modifications have been incorporated into the proposed surface water standards for EC and SAR of the Northern Cheyenne Reservation.

Table 3-24 shows revised numeric standards for EC and SAR and indicator values for TDS applicable to the mainstems of the Tongue River and Rosebud Creek and their tributaries.

Land Use and Realty

The Northern Cheyenne Reservation comprises approximately 2 percent of the land in the Planning Area. The Northern Cheyenne lands are used for cattle production, mining, logging and lumber production, residential and recreation (Madison 2001). About 27,000 acres of reservation lands are presently under cultivation; the vast majority of this is dry-land farming, an additional 105,000 acres is composed of forested land that is considered commercially harvestable (U.S. Dept. of Commerce 1996).

The principal communities located on the Northern Cheyenne Reservation are as follows:

- Lame Deer—Lame Deer is located in Rosebud County approximately 21 miles west of Ashland between Busby and Custer National Forest along Highway 212/39. Lame Deer is the tribal headquarters and home of the Northern Cheyenne Powwow. There are approximately 1,925 Indian people residing in Lame Deer.

- Ashland—Ashland is located in Rosebud County 70 miles south of Miles City between Birney and Brandenburg along Highway 212 on the banks of the Tongue River near the Custer National Forest. Approximately 500 Indian people live in Ashland.

Recreation

The Northern Cheyenne Reservation also provides dispersed outdoor recreation activities for tribal members. Activities include hunting, fishing, hiking, horseback riding and plant and berry gathering. Unrestricted hunting is limited to tribal members.

Developed recreation sites include Crazy Head Springs and Lost Leg Lake (fishing, camping, picnicking); Green Leaf, Red Nose, Parker and LaFerre ponds (fishing); and Morning Star Lookout. Undeveloped sites include Buffalo Jump and Badger Peak.

Camping facilities exist at the Northern Cheyenne Craft Center in Lame Deer and at the Morning Star View Campgrounds. Tribal buffalo herds are pastured near Lame Deer Ice Well Campgrounds. A museum/curio shop is under development; this will serve, in part, as an outlet for the work of numerous tribal artists and craftspeople. The tribe holds a 4th of July powwow each year, which is widely attended. Finally, many visitors on their way to Glacier and Yellowstone parks, the Little Bighorn Battlefield and other regional attractions find it convenient to stop by the reservation.

The only developed recreation area on the Northern Cheyenne Reservation is Crazy Head Springs. Picnic and camping facilities are available at the spring, which is used heavily. There are also several parks on the reservation including Birney Park, White Moon Park, Tongue River Park, Busby Park and Lame Deer Park.

The Northern Cheyenne Reservation has lost recreational facilities in recent years with the closure of a swimming pool at Lame Deer Park and the loss of other park facilities with the opening of a new health center. A public gym was also removed to make room for a tribal government center.

Soils

Soils in the reservation, just like soils in the surrounding RMP area, are derived mainly from sedimentary bedrock and alluvium. The soils generally range from loams to clays, but are principally loams to silty clay loams. For more information on soil types, see the Soils Appendix.

Vegetation

The same types of vegetative communities as described in this chapter are anticipated to be found on the reservation. It is understood that the Northern Cheyenne Tribe considers certain plants to be sacred for their medicinal or traditional values.

The major native plant communities on Northern Cheyenne Lands include grass and shrub rangelands, forestlands and riparian areas. These classifications are similar to those for the project area as a whole. These classifications are discussed in detail in the Vegetation section. Approximately 391,852 acres are classified as rangelands and 147,319 are classified as forestlands (Northern Cheyenne Tribe 2002). There are approximately 20,000 acres of riparian wetlands on Northern Cheyenne lands. Dominant species for these community types can be found under the Crow Reservation Vegetation section.

Special Status Species

The Northern Cheyenne have many sacred plants that are used for ceremonial and traditional uses. There are at least 170 plants with documented traditional or cultural uses (Northern Cheyenne Tribe 2002).

Wildlife

Wildlife habitat types and species occurring on the Northern Cheyenne Reservation are also generally the same as those described for the CBNG study area. Population estimates are not available because of a lack of population survey data. However, the limited available data suggest that big game populations are far below what the habitat can support (Northern Cheyenne Tribe 2002). Mule and white-tailed deer populations have declined recently because of year-round hunting. Mackie (2004) surveyed mule deer on the southern portion of the Northern Cheyenne Reservation and adjacent public and private lands from April 27 to April 29, 2004. The surveys covered approximately 250 square miles. Two hundred forty-seven mule deer were observed, 35 (14 percent) of which were recorded on the Northern Cheyenne Reservation. A second spring mule deer survey was conducted over two days in April 2005 on the southern portion of the Northern Cheyenne Reservation and adjacent public lands. Two hundred twenty-one mule deer were observed, while 20 white-tailed deer and 46 pronghorn were also observed. Most big game animals (mule deer and pronghorn) were observed on private and public lands south of the reservation boundary. As in other dry Western areas, riparian areas are the single most important wildlife habitat for many species. The riparian communities and mixed terrain of the Tongue River breaks have been identified as especially valuable wildlife habitat.

Sage-grouse are widely distributed in suitable habitat. However, their numbers have declined on the reservation over the last 20 years. Black-tailed prairie dogs, black-footed ferrets, swift fox, mountain plovers, bald eagles and peregrine falcon are species of concern found on the Northern Cheyenne Reservation (Northern Cheyenne Tribe 2002). Captive-bred black-footed ferrets were released in January of 2008 within the boundary of the Northern Cheyenne Indian

Reservation. With the exception of swift fox, these species of concern are considered under the Wildlife: Special Status Species section for the total project area. Swift fox (*Vulpes velox*) are one of the smallest foxes in the world and are only found in the Great Plains of North America. They were removed as a Candidate Species for Threatened Status by the USFWS on January 8, 2001. Their numbers are believed to be stable, but there is still concern for their future. They prefer short to mid-grass prairies, but they also sometimes inhabit mixed agricultural land (Egoscue 1979; Uresk and Sharps 1986).

The Northern Cheyenne Reservation is within that portion of the CBNG Planning Area associated with the Powder River RMP area. The Northern Cheyenne Tribe (2002) stated that the major streams of concern on the Northern Cheyenne Reservation are the Tongue River and Rosebud Creek. The Tribe reported that Rosebud Creek could support a game fish population if there were an assured flow and temperature control. The Tribe noted that Rosebud Creek is not suited for trout, but that it could support smallmouth bass—a species that prefers cool-water streams with clean bottoms and extensive riffles. Table WIL-2 (Wildlife Appendix) summarizes aquatic resources characteristics and resource values from the Montana NRIS (2001) Internet data base for the upper Tongue River and Rosebud Creek.

The Northern Cheyenne Tribe (2002) reported there is a diversity of aquatic resources on the Northern Cheyenne Reservation, including some 32 different fish species. The Tribe, citing fisheries studies conducted in the vicinity of the reservation in 1973 (HKM 1973), stated that a reproducing population of smallmouth bass had been established in the Tongue River. Other important species of sport fish that were collected in the Tongue River include walleye, sauger, northern pike and channel catfish. The Tribe also noted that the Tongue River is unique in supporting the only population of rock bass in Montana. Table WIL-3 in the Wildlife Appendix summarizes fish species composition and abundance information from the Montana NRIS (2001) Internet data base for the upper Tongue River and Rosebud Creek.

Lower Brule Sioux Tribe

The Lower Brule Sioux Tribe of South Dakota has expressed a concern to BLM regarding TCPs found within the SEIS Planning Area. The tribe's concerns center around the possible destruction or loss of its TCPs due to CBNG exploration and development. The MCFO has signed a Memorandum of Understanding (MOU) with the tribe to participate in the SEIS as a cooperating agency. The MCFO has also entered into government-to- government consultation with the tribe to address these concerns. At this time, the number and location of the TCPs in question are unknown. It is anticipated that this information will be transferred to BLM as the consultation process matures.

Paleontological Resources

Paleontological resources consist of fossil-bearing rock formations containing information that can be interpreted to provide a further understanding about Montana's past. Fossil-bearing rock units underlie the entire Planning Area. While fossils are relatively rare in most rock layers, there are seven geologic rock units within the Planning Area that do contain significant fossil material. Rock units that are known to contain fossils are the Tullock and Ludlow Members of the Fort Union Formation, the Judith River, Hell Creek, Morrison and Cloverly Formations, the Lakota Sandstone Formation and the White River Group. Figure 3-1 is a stratigraphic section showing the age and relative position of each of these fossil-bearing units.

The Morrison, Hell Creek, Cloverly and Lakota Sandstone formations are noted for the occurrence of dinosaur fossils. The Bridger Fossil ACEC, a 575-acre site located in Carbon County within the Billings RMP area, contains outcrops of both the Cretaceous Period Cloverly Formation and the Jurassic Period Morrison Formation. Outcrops of the Morrison Formation within the Bridger Fossil area have yielded the fossil remains of numerous juvenile and subadult sauropods. The Bridger Fossil Area is one of two listed National Natural Landmarks within the Billings RMP area, the other is the Cloverly Formation site in Bighorn County (Federal Register 48(41):8693 1983). There are other areas within the SEIS study areas that have been nominated for National Natural Landmarks for paleontological resources.

The Judith River Formation preserves the fossil record from ancient environments including shallow oceans, deltas, rivers, freshwater swamps and lakes. The Judith River Formation contains the fossil remains of plants as well as many animal species including mollusks, fish, amphibians, lizards, small mammals, dinosaurs and other reptiles.

The Cretaceous Period Hell Creek Formation preserves the fossil record of a subtropical to tropical environment that was characterized by low plains interrupted by broad swampy bottoms and deltaic areas. Fossil remains from the Hell Creek Formation include a wide variety of plants, mollusks, fish, amphibians, reptiles, birds, small mammals and dinosaurs. Fossil dinosaur remains include *Triceratops, Anatosaurus and Tyrannosaurus.* The fossil record of plant and animal communities found within the Hell Creek Formation varies between low moist areas and the drier, upland plains environments that were present in the past. The Castle Butte ACEC, located in Yellowstone County within the Billings RMP area, contains outcrops of the Hell Creek Formation, which are noted for their paleontological resources.

The contact between the Cretaceous Period Hell Creek Formation and the Paleocene Tullock/Ludlow Member of the Fort Union Formation marks an important event in time. This contact represents a time of worldwide extinction for many animals, most notably the dinosaurs and the beginning of the rapid evolution of mammals. The fossil record from the Fort Union Formation contains evidence of ancient environments that include streamside swamps, bottomlands and well-established river courses. Fill within ancient river channels contains fossils of fresh water clams and snails. The Tullock/Ludlow Member is the primary fossil-bearing unit of the Fort Union Formation and contains fossils of turtles, fish, reptiles and mammals.

The Tertiary Period White River Group is considered an important source of fossil mammals. Although the White River Group outcrops in the Planning Areas, the majority of the fossil-bearing areas are in the Dakotas.

Recreation

Montana's natural features, coupled with the large amount of state and federal lands, offer residents and vacationers a variety of year-round recreational opportunities. Montana has thousands of miles of streams, hundreds of lakes, reservoirs, mountainous areas, rolling hills and grassland prairies—many of which are available for recreational purposes.

The Planning Area, which includes the Billings and Powder River RMP areas, is replete with recreational opportunities that vary with seasonal changes. Spring and summer provide opportunities for fishing, hiking, photography, wildlife viewing, spring turkey hunting, water sports (powered and non-powered), off-road vehicle activities, camping, picnicking, touring (vehicle and bicycle) and caving. Early to late fall is hunting season. Winter brings the winter sports of skiing, snowshoeing and snowmobiling. The Planning Area provides vast areas for people to enjoy. Some of the benefits and experiences enjoyed by recreational users include opportunities for solitude, spending time with families, enhancing leisure time and improving sports skills.

Federal

There are three national forests in the Planning Area: Custer, Gallatin and Lewis and Clark. These forests provide a variety of yearlong, outdoor recreation. The Absaroka Beartooth Wilderness in the Gallatin National Forest provides unique wilderness opportunities for hiking, horseback riding, camping, fishing, hunting, wildlife viewing and photography. The Lewis and Clark Historic Trail and the Nez Perce National Historic Trail provide opportunities for hiking, photography, wildlife viewing and historic touring.

The Bighorn Canyon National Recreation Area is a popular area for camping, fishing, boating, hiking, wildlife viewing and photography. West of and adjacent to the Bighorn Canyon National Recreation Area is the Pryor Mountain Wild Horse Range where off-road vehicles are not allowed and skiing, caving, hiking and wildlife viewing occur.

The BLM has land holdings throughout the state. The majority of this land is not contiguous; it is fragmented and many times isolated by private holdings. Most of this land is managed for multiple uses. Recreational opportunities include hiking, horseback riding, off-road vehicle travel, fishing, hunting, wildlife viewing, camping, picnicking, caving, skiing and snowshoeing. Included in this land are the Pryor Mountain Wild Horse Range and the Pompey's Pillar National Monument.

There are seven National Wildlife Refuges in the Planning Area— one in Golden Valley County, four in Musselshell County and two in Stillwater County. They provide opportunities for wildlife viewing, hiking and photography.

According to 33 CFR Part 329, navigable waters of the U.S. are those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the water body and is not extinguished by later actions or events that impede or destroy navigable capacity. A determination whether a water body in the project area is a navigable water of the U.S. is made by the U.S. Army Corps of Engineers Omaha District's Division Engineer and is based on a report of findings prepared at the district level in accordance with the criteria set out in regulations. Tabulated lists of final determinations of navigability are maintained in the District office and are updated as necessitated by court decisions, jurisdictional inquiries, or other changed conditions.

State

There are nine state parks within the SEIS Planning Area that offer outdoor activities, Native American history and geological sites, wildlife preserves, water sports, photography, hiking, camping and fishing. These parks are Chief Plenty Coups, Cooney Reservoir, Greycliff Prairie Dog Town, Lake Elmo, Medicine Rocks, Natural Bridge, Pictograph Cave, Rosebud Battlefield and Tongue River Reservoir.

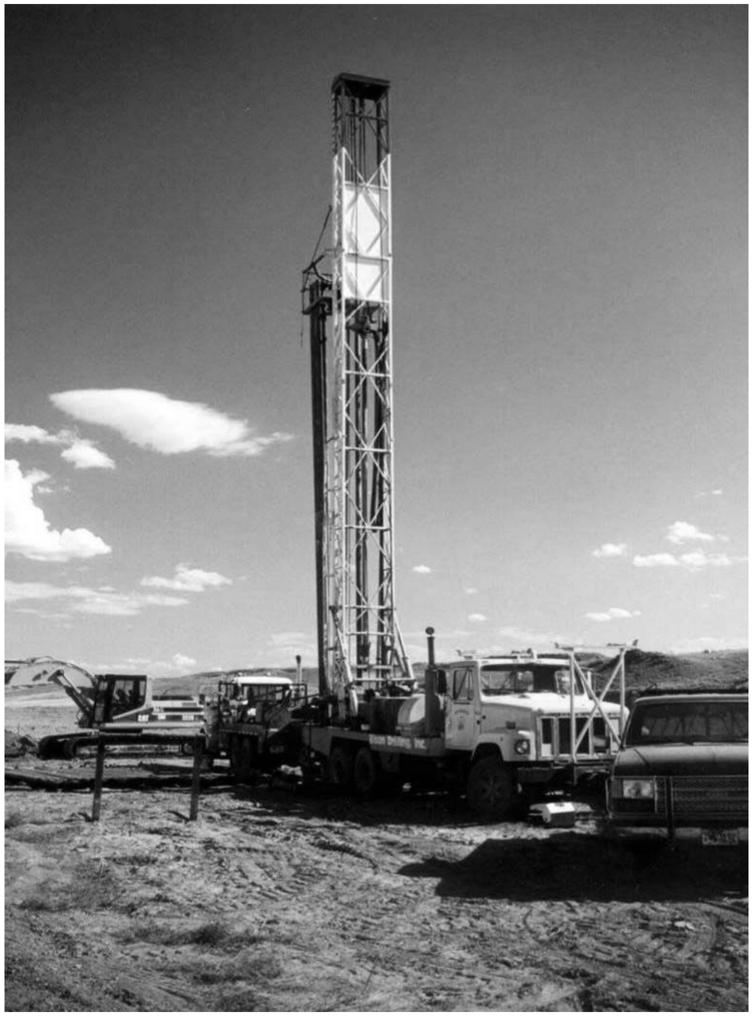
In addition, state-owned lands checkerboard the Planning Area. Much of this land is surrounded by private or federal land. Recreational opportunities include hunting, fishing, wildlife viewing, hiking, snowmobiling and skiing. Navigable waterways and islands owned by the state also provide additional recreational opportunities.

Local/City Recreation

Within the Planning Area, the larger municipalities of Billings, Laurel and Miles City, offer museums, parks, baseball fields, rodeo grounds/fairgrounds, walking/hiking/bike trails, water sports and other opportunities. The other municipalities in the Planning Area offer a city park, outdoor sports activities at the schools and, depending on the municipality, possibly a museum or rodeo grounds.

Private Lands

In addition to public lands, recreational opportunities also exist on privately owned lands, including private campgrounds, resorts and dude ranches. Activities such as hunting and backcountry trips also may be permitted on privately owned land with landowner consent. Recreational opportunities also arise on private lands as a result of Montana Fish, Wildlife and Parks (MFWP) actions, such as hunting opportunities through the block management program and conservation easements.



Typical mobile rig used to drill shallow CBNG wells

Social and Economic Values

This section examines social, economic and environmental justice information for the 13 counties in the SEIS Planning Area. The three counties with the most potential CBNG wells are Big Horn, Powder River and Rosebud counties. These counties are located adjacent to each other in southeastern Montana (see Map 1-1). The Crow and Northern Cheyenne Reservations are located predominantly in Big Horn and Rosebud counties. Information on these reservations is located in this section as well as the sections entitled *Indian Trust Assets and Native Americans* in this chapter. CBNG production in Montana may also affect Sheridan and Campbell Counties in Wyoming, the counties from which the CBNG workforce would likely commute. See the Wyoming Oil and Gas EIS for information on the affected environment for Sheridan and Campbell Counties (BLM 2005e).

Demographics

Population data for Montana and the 13-county Planning Area is presented in Table 3-25. Between 1990 and 2000, the population in Montana increased at an average annual rate of 1.2 percent to 902,195 persons. The 13-county Planning Area grew at a slightly slower rate of 1.1 percent over the same period. Two counties—Stillwater and Carbon—grew faster than the average for the Planning Area, with average annual rates of 2.5 percent and 1.8 percent, respectively. Four counties—Carter, Powder River, Rosebud and Treasure—had negative growth rates and lost population.

The forecasted population for the year 2020 is also shown in Table 3-25. For both the state and the Planning Area, the forecasts show compatible growth over the next 20 years compared to the last 10 years. State population is forecast to grow by 1.0 percent and the Planning Area is forecast to grow by 1.1 percent. Two counties—Rosebud and Stillwater— are projected to grow at equal or greater rates than the average for the Planning Area, with rates of 2.3 percent and 1.5 percent, respectively. Population in Treasure County is forecast to fall, with a rate of –0.4 percent. However, personal communication with the Montana Department of Labor and Industry indicates that the projected population of 13,720 for Rosebud County in the year 2020 is an overestimate and that a more likely future population is 12,200 or 12,500 (Montana Department of Labor and Industry 2001b). These numbers correspond to annual growth rates of 1.5 percent and 1.7 percent, respectively, which are more consistent with the average for the Planning Area and the state.

TABLE 3-25
HISTORICAL POPULATION AND POPULATION FORECASTS

	1990 (Census)	2000 (Census)	Percent Annual Average Growth 1990-2000	2020 (Forecast)	Percent Average Annual Growth 2000-2020[1]
Big Horn County	11,337	12,671	1.2%	14,880	0.9%
Carbon County	8,080	9,552	1.8%	11,390	1.0%
Carter County	1,503	1,360	-1.0%	1,470	0.4%
Custer County	11,697	11,696	0.0%	13,060	0.6%
Golden Valley County	912	1,042	1.4%	1,180	0.7%
Musselshell County	4,106	4,497	1.0%	5,390	1.0%
Powder River County	2,090	1,858	-1.1%	1,770	-0.2%
Rosebud County	10,505	9,383	-1.1%	13,720	2.3%
Stillwater County	6,536	8,195	2.5%	10,590	1.5%
Sweetgrass County	3,154	3,609	1.4%	3,870	0.4%
Treasure County	874	861	-0.1%	800	-0.4%
Wheatland County	2,246	2,259	0.1%	2,330	0.2%
Yellowstone County	113,419	129,352	1.4%	158,310	1.1%
Planning Area	176,459	196,335	1.1%	238,760	1.1%
State of Montana	799,065	902,195	1.3%	1,082,260	1.0%

Source: Montana Department of Commerce, 2001. Census and Economic Information Center. Projections by NPA Data Services, Inc.

[1] 1990 to 2000 percent average annual growth rates corrected for rounding from original calculations and 2000 to 2020 percent average annual growth calculations corrected to use a 20-year range.

Data on race and ethnicity from the 2000 U.S. Census are shown in Table 3-26. The data indicate that the Montana population is 90.6 percent white, similar to the 13-county Planning Area, which is 88.8 percent white. Statewide and in the Planning Area, Native Americans make up the largest non-white group, totaling 6.2 percent and 7.7 percent, respectively. Persons identified as Hispanic or Latino (of any race) compose 2.0 percent of the state population and 3.1 percent of the 13-county area population.

While 11 of the 13 counties are between 92.8 percent and 99.1 percent white, two of the counties—Big Horn and Rosebud—include Indian reservations with substantial Native American populations. Big Horn County, which includes most of the Crow Reservation and part of the Northern Cheyenne Reservation, has a Native American population of 59.7 percent. Rosebud County also includes part of the Northern Cheyenne Reservation and is 32.4 percent Native American.

TABLE 3-26

RACE/ETHNICITY AS PERCENT OF TOTAL POPULATION

Geographic Area	Total Population	Percent White	Percent Black or African American	Percent American Indian and Alaska Native	Percent Asian	Percent Native Hawaiian and Other Pacific Islander	Percent Some Other Race	Two or More Races	Percent Hispanic or Latino (of any race)[1]
Big Horn County	12,671	36.6%	0.0%	59.7%	0.2%	0.0%	0.7%	2.8%	3.7%
Carbon County	9,552	97.1%	0.3%	0.7%	0.4%	0.0%	0.6%	1.0%	1.8%
Carter County	1,360	98.6%	0.1%	0.4%	0.1%	0.0%	0.3%	0.5%	0.6%
Custer County	11,696	97.0%	0.1%	1.3%	0.3%	0.1%	0.3%	1.0%	1.5%
Golden Valley County	1,042	99.1%	0.0%	0.6%	0.1%	0.0%	0.0%	0.2%	1.2%
Musselshell County	4,497	96.9%	0.1%	1.3%	0.2%	0.0%	0.4%	1.2%	1.6%
Powder River County	1,858	97.4%	0.0%	1.8%	0.1%	0.0%	0.2%	0.5%	0.6%
Rosebud County	9,383	64.4%	0.2%	32.4%	0.3%	0.0%	0.7%	2.0%	2.3%
Stillwater County	8,195	96.8%	0.1%	0.7%	0.2%	0.0%	0.9%	1.2%	2.0%
Sweet Grass County	3,609	97.0%	0.1%	0.6%	0.3%	0.0%	0.7%	1.3%	1.5%
Treasure County	861	96.4%	0.1%	1.6%	0.3%	0.0%	0.9%	0.6%	1.5%
Wheatland County	2,259	97.0%	0.1%	0.6%	0.2%	0.2%	0.3%	1.6%	1.1%
Yellowstone County	129,352	92.8%	0.4%	3.1%	0.5%	0.0%	1.3%	1.9%	3.7%
Planning Area Total	**196,335**	**88.8%**	**0.3%**	**7.7%**	**0.4%**	**0.0%**	**1.1%**	**1.8%**	**3.1%**
MONTANA	902,195	90.6%	0.3%	6.2%	0.5%	0.1%	0.6%	1.7%	2.0%

Source: U.S. Census Bureau, Census 2001a Redistricting Data (Public Law 94-171) Summary File, Matrices PL1 and PL2.
[1]Percent numbers in this column are a subset of one or more of the other race/ethnicity designation percentages.

Table 3-27 shows the percentage of people below the poverty level (as defined by the U.S. Census Bureau, 2001b) for Montana and each of the 13 Planning Area counties (1997 data). The Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is poor. Compared to the state as a whole, the 13-county Planning Area has a somewhat greater percentage of people below the poverty level; some counties within the Planning Area have poverty rates that are much higher than average for the state.

In 1997, the percentage of the population of Montana below the U.S. Census Bureau poverty threshold was 15.5 percent; the average in the 13-county Planning Area was 17.3 percent. Nine of the 13 counties in the Planning Area have poverty rates greater than the state average. The county with the highest rate is Big Horn where more than one quarter of the population had an income below the poverty level in 1997. The total number of persons in the Planning Area below the poverty level was about 27,934. This represents about 20.6 percent of the state's total population below the poverty level.

Table 3-17 in the Native Americans section of Chapter 3 shows the percent of tribal members who are employed but below U.S. Health and Human Services poverty guidelines (similar to U.S. Census guidelines). These data indicate that the percent of tribal members who are employed but below the poverty guideline is greater than the total percent of persons below poverty for the respective counties where the tribes are located. It can be inferred that the total poverty rate for all tribal members (employed and unemployed) would be even greater than just for those who are employed, suggesting relatively large numbers of persons on the reservations living in poverty.

The three counties with the most potential CBNG wells, Big Horn, Powder River and Rosebud counties, have a combined 2000 population of 24,000, which is less than 10 percent of the total population of the Planning Area. Two of these counties, Powder River and Rosebud, lost population during the previous decade (both lost 11 percent), while Big Horn County grew 12 percent during the same time period. Big Horn and Rosebud counties are forecasted to grow 17 percent and 30 percent, respectively, between the years of 2000 and 2020. Powder River County, with its population of 1,858, is projected to continue to slowly lose population between 2000 and 2020. The county seats are in Hardin in Big Horn County with a 2000 population of 3,384, Broadus in Powder River County with a 2000 population of 451 and Forsyth in Rosebud County with a 2000 population of 1,944. There are numerous small reservation communities located in Big Horn and Rosebud counties. In 1990, Big Horn County, which includes most of the Crow Reservation

TABLE 3-27

POVERTY STATUS BY COUNTY (AS DEFINED BY U.S. CENSUS BUREAU) (1997)

	Number of Persons Below Poverty Level	Percent of Population Below Poverty
Big Horn County	3,768	29.6%
Carbon County	1,230	12.9%
Carter County	294	19.3%
Custer County	2,022	17.0%
Golden Valley County	216	21.2%
Musselshell County	893	19.4%
Powder River County	277	15.3%
Rosebud County	1,999	19.9%
Stillwater County	860	10.6%
Sweetgrass County	418	12.3%
Treasure County	141	15.8%
Wheatland County	453	19.8%
Yellowstone County	15,363	12.1%
Planning Area Total	**27,934**	**17.3%**
Montana	**135,691**	**15.5%**

Source: U.S. Census Bureau Small Area Income and Poverty Estimates Program 2001b.

and part of the Northern Cheyenne Reservation, had a population that was nearly 60% Native American. Rosebud County, which includes most of the Northern Cheyenne Reservation, had a 2000 population that was 32 percent Native American. The 1997 poverty rates for Big Horn, Powder River and Rosebud counties were 29.6 percent, 15.3 percent and 19.9 percent, respectively. These rates reflect the relatively large numbers of persons on the reservations living in poverty. For additional information on demographics for the Northern Cheyenne and Crow Tribes see Social and Economic Values in the Native Americans section of this Chapter.

Social Organization

Housing Units and Vacancy

Housing units and vacancy rates for Montana and the 13-county Planning Area are shown in Table 3-28. The latest available county-specific data on housing units is from the 2000 Census (U.S. Census Bureau 2001b). Although the vacancy rates reported here illustrate the averages in the counties in the Planning Area, sub-county variations may exist as a result of factors such as high population growth in a portion of the county.

In 2000, Montana had 412,633 housing units, 84,952 or 21 percent of these were in the 13-county Planning Area. Eleven percent (9,574) of the Planning Area housing units was located in Big Horn, Rosebud and Powder River counties.

Homeowner vacancy rates indicate the percent of total owner-occupied housing that is vacant. In Montana, the homeowner vacancy rate for 2000 was 2.2 percent, compared to 3.6 percent for the Planning Area. Four counties had home ownership vacancy rates higher than the Planning Area average, suggesting a surplus of vacant houses on the market. The three counties with the most potential for CBNG wells, Big Horn, Powder River and Rosebud, all had lower homeowner vacancy rates than the Planning Area average. Housing availability on the Northern Cheyenne and Crow Reservations is discussed under Social Organization in the Native Americans section of this chapter.

The rental vacancy rate in 2000 was 7.6 percent for the state and 14.0 percent for the Planning Area. Generally, rental vacancy rates between 5 percent and 10 percent are considered adequate. Rental vacancy rates below 5 percent can indicate potential rental shortages and above 10 percent can indicate potential surplus. The rental vacancy rates for the three counties with the most potential for CBNG wells, Big Horn, Powder River and Rosebud, were 6.3 percent, 13.1 percent and 11.7 percent, respectively.

TABLE 3-28
HOUSING UNITS

	2000 Housing Units	2000 Homeowner Vacancy Rate (%)	2000 Rental Vacancy Rate (%)
Big Horn County	4,655	2.2	6.3
Carbon County	5,494	3.0	8.1
Carter County	811	6.9	8.1
Custer County	5,360	2.6	11.6
Golden Valley County	450	6.3	8.8
Musselshell County	2,317	6.8	8.4
Powder River County	1,007	3.0	13.1
Rosebud County	3,912	1.9	11.7
Stillwater County	3,947	2.7	6.1
Sweetgrass County	1,860	2.1	10.3
Treasure County	422	2.3	6.4
Wheatland County	1,154	6.4	18.2
Yellowstone County	54,563	1.2	5.4
Planning Area Total	**85,952**	**3.6%**	**14.0%**
Montana	**412,633**	**2.2%**	**7.6%**

Source: U.S. Census Bureau 2001.

Temporary Housing

Temporary housing units are typically defined to include hotels and motels and recreational vehicle or camping sites. An inventory of temporary housing units is typically included in an environmental impacts analysis to use in determining potential impacts on the local housing supply from an influx of temporary population (such as construction workers or other employees). This data is typically gathered for a city, county, or small region. Because of the broad scope of this study, however, an inventory of accommodations by specific location was not attempted. A large number of hotels/motels and recreational vehicle and camping areas are available throughout the state and the 13-county Planning Area. These sites tend to be concentrated in and around the large cities, such as Billings, as well as major tourist or recreation areas, such as Yellowstone National Park. They are less likely to be available in the three counties with the most potential for CBNG wells.

Public Services and Utilities

Public services, typically provided by local governments (cities, counties and special service districts), include police and fire protection, emergency medical services, schools, public housing, parks and recreation facilities, water supply, sewage and solid waste disposal, libraries and roads and other transportation infrastructure. Other important community services include electric and communications utilities. The provision of public services and the ability of service providers to adapt to change over time, or resulting from specific development activities, depend on a number of factors, including financial ability and community leadership. Public services are generally funded by tax revenues, although there may be other sources of revenue such as user fees or utility franchise fees. The tax base of the county or community where public services are provided is often a key component of the funding of public services. Information on public services and facilities for the Northern Cheyenne and Crow Reservations is presented under Social Organization in the Native American section of this chapter.

Attitudes, Beliefs, Lifestyles and Values

Information on general attitudes, beliefs, lifestyles and values in Montana and the general Planning Area as they relate to CBNG development has been gathered from public comment letters received during the scoping process for this project and also from past summaries in several related documents. While the generalized characterizations are not likely to apply to all individuals, the intention is to provide an idea of the range of the attitudes and lifestyles of the population subgroups present in the study area. See the Socioeconomics Appendix for detailed information.

The study area population is largely rural, with strong ties to the land and to the many small towns. Residents generally value the rural character of their lifestyle. Specific aspects of this lifestyle might include appreciation of wide-open spaces, natural landscape, fresh air and solitude. The lifestyle of rural communities often offers the desirable qualities of neighbors knowing each other, lack of urban problems, relaxed pace, personal freedom and being a good place to raise children. Longtime residents often want to see continued control of the land at the local level without interference from outside agencies or groups.

A portion of the population in the study area are Native Americans, who generally desire to preserve many elements of their heritage, express strong connections with the natural environment and often do not wish to become homogenized into the non-Indian culture. At the same time, some tribal members or subgroups are pursuing the development of energy resources for the long-term social and economic betterment of tribal members.

A small but growing population is made up of professionals, craftspeople, retirees and others who have moved to small towns to enjoy the slower pace of life and various amenities. While the forested areas of western Montana tend to attract more of this group than eastern Montana, these people are present in the study area as well. They may participate in opposition to development proposals that appear to jeopardize the quality of their new lifestyles.

Areas where energy resources are developed often see the influx of people from other areas. Many of these people regard their employment as temporary, expect to move on to other areas and do not play an integral part in community affairs. Long-term local residents often resent these “outsiders” while at the same time realizing some economic benefits from the business and service demands of these newcomers.

The vast majority of public comments on the Statewide Document received during the scoping process in early 2001 relayed concerns about potential impacts on water quality and quantity. Those who commented were most concerned with the discharge of water of poor quality (e.g., saline) and the drawdown of groundwater aquifers. Other concerns include possible increases in traffic levels, noise, visual resource impacts and psychological stress associated with change to the surrounding built and natural environment.

The comments reflect a difference in attitudes toward CBNG development among those individuals and organizations that might profit directly from CBNG and those that would not. The comments reflect a tension between the desire for new development to support the often stagnant rural economies and the concern that such development could harm the environment and the lifestyle qualities for which Montana is known, including natural beauty, wide-open spaces and solitude. Concerns were also expressed about potential adverse affects on the lifestyles of Native Americans, particularly those on the reservations. The comments reflect the traditional high value placed on natural resources by these groups, the importance of existing water and other natural resources in tribal economies and cultures and the opinion that tribal members will be unduly burdened with the costs of development while not receiving many or any benefits.

Scoping comments received in the summer of 2005 for this SEIS reflect similar concerns about and support for, CBNG development as those discussed above. In addition, there was a concern that delayed or phased development would create economic impacts. Specifically, lessees and lessors would lose revenue due to leasing and permitting delays and the state would have a net present value loss in income and payroll taxes, as well as production taxes and royalties. There were also concerns about the displacement of wildlife to livestock grazing tracts, the subsequent interference with livestock grazing and the potential effect on subirrigated tracts.

The Northern Cheyenne Tribe and others expressed concern that unrestrained CBNG development could lead to a boom and bust cycle. The fear is that this type of development could lead to adverse, long-term social and economic effects within the region. These adverse effects have been expressed as increases in population on the reservation, resulting in stress on tribal infrastructure and social services, as well as increases in teenage pregnancy, drug and alcohol use and crime.

Economics

Employment

Table 3-29 displays state employment by sector for the years 1990 and 1998 and Table 3-30 shows 1998 employment by sector within the Planning Area. In 1998, an estimated 543,333 people were employed in Montana, with 122,209 in the 13-county Planning Area. In 1998, employment in the Planning Area represented about 22 percent of the jobs in the state. Between 1990 and 1998, total employment in the state grew by 106,759, an increase of 24.5 percent. Employment in the 13-county Planning Area grew by 20,444 people, or 20.1 percent, during the same period.

TABLE 3-29

MONTANA EMPLOYMENT TRENDS BY SECTOR

	1990	1998	Change, 1990-1998	Percentage Point Change, 1990-1998
Farm Employment	30,576	32,071	1,495	4.9%
Non-Farm Employment				
Agriculture, Forestry, Fishing and other	6,154	8,739	2,585	42.0%
Mining	7,824	6,730	-1,094	-14.0%
Construction	19,070	33,245	14,175	74.3%
Manufacturing	26,342	29,504	3,162	12.0%
Transportation and Public Utilities	23,858	26,759	2,901	12.2%
Wholesale Trade	17,449	20,693	3,244	18.6%
Retail Trade	78,715	106,202	27,487	34.9%
Finance, Insurance and Real Estate	27,693	34,673	6,980	25.2%
Services	118,623	161,740	43,117	36.3%
Government				
Federal, Civilian	13,771	12,647	-1,124	-8.2%
Military	10,516	8,474	-2,042	-19.4%
State	21,561	22,972	1,411	6.5%
Local	34,422	38,884	4,462	13.0%
Montana Total	436,574	543,333	106,759	24.5%

Source: U.S. Department of Commerce, BEA 2001.

TABLE 3-30

STATE EMPLOYMENT VERSUS PLANNING AREA EMPLOYMENT BY SECTOR (1998)

	Planning Area Employment by Sector	% of Planning Area Total by Sector	State Employment by Sector	% of State Total by Sector
Farm Employment	6,971	5.7%	32,071	5.9%
Non-Farm Employment				
Agriculture, Forestry, Fishing and other	1,476	1.2%	8,739	1.6%
Mining	1,996	1.6%	6,730	1.2%
Construction	6,776	5.5%	33,245	6.1%
Manufacturing	4,889	4.0%	29,504	5.4%
Transportation and Public Utilities	6,494	5.3%	26,759	4.9%
Wholesale Trade	7,107	5.8%	20,693	3.8%
Retail Trade	23,616	19.3%	106,202	19.5%
Finance, Insurance and Real Estate	7,654	6.3%	34,673	6.4%
Services	35,836	29.3%	161,740	29.8%
Government				
Federal, Civilian	2,902	2.4%	12,647	2.3%
Military	1,079	0.9%	8,474	1.6%
State	2,160	1.8%	22,972	4.2%
Local	10,675	8.7%	38,884	7.2%
Undisclosed or under 10 jobs	2,578	2.1%	N/A	N/A
Montana Total	122,209	100.0%	543,333	100.0%

Source: U.S. Department of Commerce, BEA 2001, 2005.

Montana's largest employment sectors in 1998 were services, retail trade and government; the smallest sector was mining. By far the fastest-growing sector between 1990 and 1998 was construction, which increased by 74.3 percent during the period. Other fast-growing sectors were agriculture, forestry and fishing services and retail trade.

Some sectors of state employment decreased between 1990 and 1998. Mining jobs decreased by 14 percent in the state, from 7,824 to 6,730. Overall, government jobs increased by only 3.4 percent; within that sector, military jobs decreased by 19.4 percent and federal civilian jobs decreased by 8.2 percent.

Tables 3-30 and 3-31 present state and Planning Area employment by sector. Table 3-30 shows that the economic base of the Planning Area by sector is very similar to the state as a whole. However, as indicated in Table 3-31, there is substantial variation among the sizes and strengths of the various economic sectors in the 13 Planning Area counties.

Unemployment

Table 3-32 presents the unemployment rate for Montana and each of the Planning Area counties in 1995 and 2000. In 1995, the average unemployment rates in Montana and in the Planning Area were essentially the same; 5.9 percent for the state and 5.8 percent for the Planning Area. In 2000, the average state unemployment rate had dropped to 4.9 percent while the average rate in the Planning Area decreased to 5.4 percent.

In 2000, unemployment rates in three of the Planning Area counties were higher than the 13-county average: Big Horn (14.4 percent); Musselshell (7.4 percent); and Rosebud (7.5 percent). Unemployment rates in each of the counties but Musselshell are explained in part by the high unemployment rates on the Indian reservations contained wholly or partly within these counties. As indicated in Table 3-18 (in the Native Americans section of Chapter 3), unemployment on the Crow and Northern Cheyenne Indian reservations in 1999 ranged between 14.9 percent and 18.7 percent. Consistent with trends in the rest of the state, the unemployment rate on each reservation fell between 1996 and 1999.

Unemployment rates on the reservations as measured by the Bureau of Indian Affairs are reported in Table 3-33. These rates are based on self-reported information from tribal leaders; 1999 is the latest year available. The rates calculated in this manner are substantially greater than those reported by the Montana Department of Labor and Industry (Table 3-32). They indicate unemployment at 61 percent for the Crow tribe and 71 percent for the Northern Cheyenne tribe. For all tribal members in Montana, the unemployment rate was 61 percent.

TABLE 3-31

PLANNING AREA EMPLOYMENT BY COUNTY AND SECTOR (1998)

Industry	Big Horn	Carbon	Carter	Custer	Golden Valley	Musselshell	Powder River	Rosebud	Stillwater	Sweet Grass	Treasure	Wheatland	Yellowstone
Farm Employment	13.2%	17.9%	44.4%	6.9%	41.7%	15.8%	33.8%	9.7%	14.3%	22.4%	40.6%	22.1%	1.6%
Non-Farm Employment													
Agriculture, Forestry, Fishing and other	3.0%	3.1%	a	1.5%	a	a	a	1.4%	2.5%	a	a	a	0.9%
Mining	8.7%	1.2%	a	b	0.0%	3.6%	1.7%	9.2%	a	b	0.0%	b	0.9%
Construction	3.3%	6.8%	a	a	a	6.5%	a	1.5%	5.1%	9.0%	a	a	6.4%
Manufacturing	1.2%	3.4%	1.9%	2.6%	a	5.8%	a	2.5%	8.9%	4.2%	0.0%	3.3%	4.3%
Transportation and public utilities	1.8%	2.2%	3.6%	a	b	4.3%	5.0%	12.0%	a	a	5.7%	2.7%	6.1%
Wholesale trade	1.5%	2.0%	0.0%	3.0%	a	a	1.0%	0.1%	1.6%	2.1%	a	a	7.6%
Retail trade	12.6%	18.6%	8.0%	22.6%	a	17.6%	13.1%	12.3%	14.5%	20.5%	12.2%	20.5%	21.1%
Finance, Insurance and Real Estate	3.7%	5.9%	2.2%	5.9%	0.0%	4.4%	1.7%	3.3%	3.8%	5.4%	a	3.9%	7.5%
Services	30.3%	27.0%	a	29.5%	a	23.9%	15.4%	34.0%	17.8%	16.3%	11.7%	22.5%	32.8%
Government													
Federal, Civilian	7.3%	1.4%	2.0%	4.7%	b	0.8%	1.4%	3.2%	0.8%	1.5%	1.1%	3.6%	2.0%
Military	1.2%	1.1%	1.0%	1.0%	b	1.3%	0.8%	1.0%	1.0%	0.9%	0.9%	1.1%	0.8%
State	0.8%	0.5%	0.3%	4.1%	b	0.8%	1.7%	0.6%	0.5%	0.8%	1.4%	0.7%	1.9%
Local	11.4%	8.9%	12.6%	7.7%	16.3%	10.8%	16.5%	9.3%	8.4%	12.2%	17.0%	12.7%	6.0%
Undisclosed or under 10 jobs	0	0	24.0%	10.4%	41.9%	4.2%	7.8%	0	20.9%	4.6%	9.4%	6.8%	0
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: U.S. Department of Commerce, BEA 2001.

a = Not shown to avoid disclosure of confidential information but the estimates for these items are included in the totals.

b = Less than 10 jobs but the estimates for these items are included in the totals.

TABLE 3-32

AVERAGE ANNUAL UNEMPLOYMENT RATES BY COUNTY

	1995 Rate (%)	2000 Rate (%)	Percentage Point Change, 1995-2000
Big Horn County	12.7	14.4	1.7
Carbon County	6.0	5.1	-0.9
Carter County	1.8	2.1	0.3
Custer County	4.6	4.3	-0.3
Golden Valley County	7.6	5.7	-1.9
Musselshell County	8.6	7.4	-1.2
Powder River County	2.4	3.0	0.6
Rosebud County	9.2	7.5	-1.7
Stillwater County	5.0	4.9	-0.1
Sweetgrass County	3.7	2.5	-1.2
Treasure County	3.5	5.0	1.5
Wheatland County	5.1	4.6	-0.5
Yellowstone County	4.8	3.8	-1.0
Planning Area Average	**5.8**	**5.4**	**-0.4**
Montana	**5.9**	**4.9**	**-1.0**

Source: Montana Department of Labor & Industry, Research & Analysis Bureau, Local Area. Unemployment Statistics (2001a).

TABLE 3-33

TRIBAL WORKFORCE AND UNEMPLOYMENT (1999)

Tribe	County	Total Tribal Enrollment	Available for Work of Total Work Force	Unemployed as % of Labor Force	Percent Employed but Below Poverty Guideline
Crow Tribe of Montana	Big Horn County	10,083	3,902	61%	38%
Northern Cheyenne Tribe	Big Horn County, Rosebud County	7,473	2,437	71%	26%
Montana (all tribes)		61,203	26,348	61%	33%

Source: U.S. BIA 1999.

Per Capita Income

Per capita income for the state of Montana and the counties in the Planning Area is shown in Table 3-34. In 1998, the average U.S. per capita income was $27,203 and the state average was $21,229. The average per capita income in the Planning Area was $17,715, only 83.4 percent of the state average. In 1998, per capita income in Yellowstone County was higher than the state average and incomes in Carbon, Custer and Stillwater counties were more than 90 percent of the state average. On the other hand, per capita income in three counties was substantially lower: Big Horn County (62.4 percent); Carter County (61.9 percent) and Musselshell County (67.6 percent).

TABLE 3-34
PER CAPITA INCOME, 1996-1998

	Dollars per Year			% Average Annual Increase (1996-1998)1	% of State Average (1998)
	1996	**1997**	**1998**		
Big Horn County	11,987	12,418	13,239	5.2%	62.4%
Carbon County	17,798	18,901	19,745	5.5%	93.0%
Carter County	11,793	12,480	13,139	5.7%	61.9%
Custer County	18,879	19,792	20,487	4.3%	96.5%
Golden Valley County	14,471	15,115	16,095	5.6%	75.8%
Musselshell County	13,087	14,047	14,351	4.8%	67.6%
Powder River County	13,593	15,061	16,314	10.0%	76.8%
Rosebud County	16,395	17,423	18,066	5.1%	85.1%
Stillwater County	18,114	18,726	19,736	4.5%	93.0%
Sweet Grass County	16,871	18,591	19,032	6.4%	89.7%
Treasure County	15,208	14,744	15,707	1.6%	74.0%
Wheatland County	14,784	16,695	16,217	4.8%	76.4%
Yellowstone County	22,173	23,168	24,425	5.1%	115.1%
Planning Area Average	**15,781**	**16,705**	**17,427**	**5.2%**	**82.1%**
Montana	**19,383**	**20,130**	**21,229**	**4.7%**	**100.0%**
U.S.	**24,651**	**25,924**	**27,203**	**5.0%**	

Source: U.S. Department of Commerce, Bureau of Economic Analysis 2001.
[1] 1996 to 1998 average annual increases corrected for rounding from original calculations.

Between 1996 and 1998, per capita income in the Planning Area increased by an average of 5.2 percent annually, slightly greater than in the state as a whole, in which per capita income increased by 4.7 percent. Per capita income increased in all of the Planning Area counties between 1996 and 1998.

Government Revenue Sources

Government revenues include taxes, royalties, fees and several other income sources. Please see the Socioeconomics Appendix for more information.

Taxes

Public finance mechanisms include taxes, royalties and other fees paid to local, state and federal governments. Taxes in Montana consist of property taxes, income taxes, natural resource taxes (coal, oil and natural gas) and selective sales taxes (cigarette and alcoholic beverages). There is no general sales tax in Montana. Table 3-35 shows total taxes collected in Montana. In 2004, more than $1 billion was collected in property taxes, accounting for 50.6 percent of the total state tax revenues collected. Income taxes were the second largest portion at 33.6 percent, followed by other taxes (8.4 percent) and natural resources (7.4 percent).

The taxes and royalties assessed on oil and gas development and production are an important source of revenue for local governments and the state of Montana. The oil and gas industry pays rents, royalties and bonuses on federal leases; production taxes on working and non-working interests in the state of Montana; and local property taxes on drilling and production equipment.

Generally, as county oil and gas production tax revenues increase (e.g., because of new oil and gas production), the property tax rate (mill levy) for the county is decreased accordingly. A percent of state-levied oil and gas production taxes are distributed to the counties based on the county where production occurred. For natural gas, 86 percent of the production taxes are distributed to the counties for local governments and schools. For oil, 60.7 percent of the production taxes are distributed to the counties. See the Socioeconomics Appendix for more information on taxes.

TABLE 3-35

TOTAL TAXES COLLECTED IN MONTANA (2004)

	2004 Tax Revenues Collected in Montana	Percent of Total
Property Taxes	$1,014,487,652	50.6%
Income Taxes	$673,071,361	33.6%
Natural Resource Taxes	$148,675,401	7.4%
Other Taxes	$168,133,456	8.4%
Montana Total	**$2,004,367,870**	**100.0%**

Source: Montana Department of Revenue (2004).

State Oil and Gas Lease Income

DNRC leases oil and gas, metalliferous and non-metalliferous, coal, sand and gravel mineral rights agreements on 6.2 million acres of school trust lands and more than 100,000 acres of other state-owned land throughout Montana. School trust lands are lands historically granted to the state of Montana to be used to support common schools and other educational and state institutions.

State mineral lease royalties are collected from production facilities located on state lands. Royalty payments are based on the volume of oil and gas produced and the price of the commodity. Rental and royalty revenues are either deposited into the appropriate permanent or distributable school trust or the state general fund. Table 3-36 presents the revenues received by the state in fiscal years (FY) 2000 and 2005 from minerals management, including leases (rents) and mineral production royalties on state trust lands. Oil and gas revenues in FY 2000 were $6.6 million, or 57.2 percent of total state mineral management revenues, while these revenues totaled $19 million, or 80.8 percent, in FY 2005. Oil and gas revenues comprised the largest share, with coal revenues the second largest, at 40.3 percent of the total for FY 2000 and 18.1 percent for FY 2005.

The state mineral leasing program includes 2,433 oil and gas leases, 534 of which are currently productive. From FY 1999 and FY 2000, the number of oil and gas leases increased by 8.1 percent and the number of productive leases increased by 14.3 percent. In FY 2000, state lands yielded 923,777 barrels of oil, 5,050,552 million cubic feet of gas and 375,113 gallons of condensate. Oil production declined 6.5 percent from FY 1999. However, the increase in average price from $10.50 per barrel in FY 1999 to $20.21 per barrel in FY 2000 accounted for the large increase in oil royalty revenue. Gas production in FY 2000 increased 19.6 percent, while price increased 36.0 percent compared to FY 1999, also resulting in a substantial increase in royalty revenue.

Federal Mineral Revenues

Oil and gas royalties are earned from production facilities on federal leases, units, or communitization agreements. Federal mineral lease royalties are collected on oil and gas produced based on the volume of product. Table 3-37 presents federal mineral revenue disbursements by county of origin for the 13 Planning Area counties and the state as a whole for FY 2000. Coal, gas and oil are the main mineral products. The totals reported do not include royalties and rents from leases on Native American tribal and allotted lands. For FY 2005, statewide revenue and disbursements are presented in Table 3-38. For the entire state of Montana, royalty values nearly doubled between FY 2000 and FY 2005 and disbursements to the state increased from $20 million to almost $36 million.

For FY 2000, mineral royalties from the 13 Planning Area counties totaled $29.8 million—approximately 69.5 percent of the $42.8 million collected in the state. Big Horn County accounted for a large share of the Planning Area revenues, with total royalties of $21.4 million, which were mostly from coal. Coal and oil revenues are far greater than gas revenues.

Formulas for disbursement of revenues from federal mineral leases are governed by legislation and regulations. Nationally, in fiscal year 2000, federal mineral lease revenues were disbursed as follows: 66.0 percent to the U.S. Treasury; 20.2 percent to special purpose funds, such as historic preservation, land and water conservation and reclamation; 10.8 percent to states; and 3.0 percent to Native

TABLE 3-36

REVENUES RECEIVED FROM MINERALS MANAGEMENT ON STATE LANDS IN FISCAL YEARS 2000 AND 2005

	FY 2000 Revenue (Dollars)	FY 2005 Revenue (Dollars)
Oil and Gas		
Rentals/Bonuses/Penalties	2,966,285	6,554,239
Royalties	3,684,595	12,546,646
Seismic Exploration	11,075	4,796
Subtotal	6,661,955	19,105,681
Percent	57.2%	80.8%
Aggregate Minerals		
Rentals	250	100
Royalties	245,693	227,171
Subtotal	245,943	227,271
Percent	2.1%	1.0%
Coal		
Rentals	44,371	40,057
Royalties	4,649,634	4,239,865
Subtotal	4,694,005	4,279,923
Percent	40.3%	18.1%
Other Minerals		
Subtotal	41,124	28,973
Percent	0.4%	0.1%
Rentals/Penalties	32,246	22,490
Royalties	8,878	6,483
TOTAL	11,643,027	23,641,848

Sources: MDNRC 2000 (http://www.dnrc.state.mt.us/trust/mmb.htm), MDNRC 2005 (http://dnrc.mt.gov/trust/MMB/Default.asp).

TABLE 3-37

ONSHORE FEDERAL MINERAL REVENUE DISBURSEMENTS IDENTIFIED BY COUNTY OF ORIGIN, FISCAL YEAR 2000, MONTANA[1]

	Product	Sales Volume	Royalty Value ($)	Disbursed to State ($)
Big Horn	Bonus		185,076	92,538
	Coal (ton)	20,416,210	20,912,616	10,456,308
	Gas (mcf)	44,411	4,028	2,014
	Other Revenues		16,562	8,281
	Rent		335,127	167,564
	Subtotal		21,453,409	10,726,705
Carbon	Gas (mcf)	166,547	45,722	22,861
	Gas Plant Products (gal)	2,789,164	89,617	44,809

TABLE 3-37

ONSHORE FEDERAL MINERAL REVENUE DISBURSEMENTS IDENTIFIED BY COUNTY OF ORIGIN, FISCAL YEAR 2000, MONTANA[1]

	Product	Sales Volume	Royalty Value ($)	Disbursed to State ($)
	Oil (bbl)	386,161	1,042,440	521,220
	Other Revenues		2,616,601	1,308,301
	Rent		76,892	38,446
	Sulfur (lton)	1,023	524	262
	Subtotal		3,871,797	1,935,899
Carter	Bonus		47,366	23,683
	Oil (bbl)	865	1,888	944
	Other Revenues		22,294	11,147
	Rent		90,429	45,214
	Subtotal		161,976	80,988
Custer	Bonus		51,904	25,952
	Gas (mcf)	56,563	11,875	5,938
	Other Revenues		1,135	568
	Rent		44,205	22,103
	Subtotal		109,119	54,560
Golden Valley			0	0
Musselshell	Bonus		594	297
	Oil (bbl)	5,378	2,394	1,197
	Other Revenues		1,077	539
	Rent		19,030	9,515
	Subtotal		23,095	11,547
Powder River	Bonus		39,028	19,514
	Gas (mcf)	14,352	4,076	2,038
	Oil (bbl)	74,079	172,508	86,254
	Other Revenues		6,796	3,398
	Rent		482,732	241,366
	Subtotal		705,139	352,569
Rosebud	Bonus		517,040	258,520
	Coal (ton)	1,612,516	1,852,468	926,234
	Oil (bbl)	21,613	42,355	21,178
	Other Revenues		690,601	345,301
	Rent		220,533	110,266
	Subtotal		3,322,997	1,661,499
Stillwater	Bonus		6,766	3,383
	Oil (bbl)	3,499	5,222	2,611
	Rent		26,077	13,039
	Subtotal		38,066	19,033
Sweet Grass	Bonus		8,928	4,464
	Rent		25,854	12,927
	Subtotal		34,782	17,391

TABLE 3-37

ONSHORE FEDERAL MINERAL REVENUE DISBURSEMENTS IDENTIFIED BY COUNTY OF ORIGIN, FISCAL YEAR 2000, MONTANA[1]

	Product	Sales Volume	Royalty Value ($)	Disbursed to State ($)
Treasure	Coal (ton)	97,143	118,745	59,372
	Rent		2,760	1,380
	Subtotal		121,505	60,752
Wheatland	Other Revenues		480	240
	Subtotal		480	240
Yellowstone	Oil (bbl)	1,648	2,494	1,247
	Other Revenues		516	258
	Rent		131	65
	Subtotal		3,140	1,570
Planning Area Total			**29,810,723**	**14,905,361**
% of State Total			**69.5%**	**73.1%**
Montana Total[2]			42,881,292	20,401,472

Source: U.S. Department of Interior, Minerals Management Service 2001.
[1]Does not include revenues collected from American Indian lands or offshore operations.
[2]Adjusted for net receipts sharing (less $1,039,174 disbursed to state).

mcf – thousand cubic feet
bbl – barrel
lton – long ton

TABLE 3-38

ONSHORE FEDERAL MINERAL REVENUE DISBURSEMENTS, FISCAL YEAR 2005, MONTANA[1]

Product	Sales Volume	Royalty Value ($)	Disbursed to State ($)
Coal (ton)	27,398,404	32,895,894	16,207,608
CBNG (mcf)	3,586,513	2,131,761	938,787
Condensate (bbl)	29,799	169,892	82,709
Drip or Scrubber Condensate (bbl)	868	4,143	496
Fuel Gas (mcf)	2,248	1,347	400
Gas Lost – Flared or Vented (mcf)	59,905	48,205	
Gas Plant Products (gal)	3,711,746	308,212	141,156
Oil (bbl)	4,255,590	22,080,910	8,281,428
Other Royalties		2,113,546	959,664
Processed (Residue) Gas (mcf)	438,035	245,717	71,863
Sulfur (long ton)	1,620	984	477
Unprocessed (wet) Gas (mcf)	26,302,336	15,417,717	6,307,602
Subtotal		**75,418,326**	**32,992,191**
Rents		3,809,836	1,653,314
Bonus		1,059,752	417,503
Other Revenues		970,906	499,298
Subtotal		**5,840,493**	**2,570,116**
Total		**81,258,819**	**35,562,307**

Source: U.S. Department of Interior, Minerals Management Service 2006.
[1]Does not include revenues collected from American Indian lands or offshore operations. Revenues and disbursements by county of origin are not available.

American tribes. This corresponds to $5.1 billion to the U.S. Treasury, $1.6 billion to special purpose funds, $843 million to states and $235 million to tribes. These disbursements were made to tribes that leased their land for minerals development.

Federal legislation provides that Montana receive 50 percent of the net receipts of all bonuses, rents and royalties collected on BLM-administered lands within Montana. As a result, the percentage of royalties disbursed in Montana is much greater than the national average. Of the $42.8 million in royalties collected on federal lands in Montana counties in 2000, nearly half, or $20.4 million, was disbursed to the state.

Statewide for FY 2005, the Minerals Management Service reported nearly 3,587,000 mcf of CBNG produced in Montana. This production generated $2.13 million in royalties, of which $939,000 was disbursed to the state (U.S. Department of Interior Minerals Management Service 2006).

Private Landowner Revenue

Some landowners in Montana own the mineral rights to their land and lease those rights for natural gas development and other uses. Landowners who do not own mineral rights may be subject to the development of natural gas or other energy or mineral resources on their land. Both of these categories of landowners receive income for use of their land, in the form of natural gas royalties or one-time compensation for land disturbance and use, respectively. This income is included in the total per capita incomes presented in Table 3-34.

Water Resource Values

Water plays an important role in the state and local economies of Montana. Water is a scarce resource in Montana—particularly in eastern Montana. Many of the state's surface water basins are over-appropriated and have been closed to future appropriations. In these locations, water users are turning more and more to groundwater to meet their water needs.

Most of the water used in the Planning Area is surface water (see Hydrology section of this chapter). Most of the surface water is from snowmelt and precipitation. Livestock watering and domestic water wells are the primary uses of groundwater in the area. Surface water and groundwater are also used for agricultural irrigation and surface water is used for recreation in some areas. Continued availability of adequate quantity and quality for these major uses is essential to maintaining the health of these sectors of the local and state economies.

The economic value of water resources for human uses varies greatly by location and by use and user. As an example, it has been estimated that the value of irrigation water to agricultural producers, based on the increase in production attributable to the use of the water for irrigation, is between $25 and $50 per acre-foot in eastern Montana (Schaefer 2001). Costs for domestic water would generally be more. The values are inherent components of the values of the various sectors of the economy, such as income from grazing and agriculture or costs of providing public water service. Changes in the supply or cost of water would contribute to changes in the costs and revenues for these activities.

Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations" (1994) requires the non-discriminatory treatment of minority populations and low-income populations for projects that occur on federal lands, require federal permits, use federal funds, or are otherwise under the jurisdiction of a federal agency. Disproportionately high or adverse health or environmental effects on such populations must be identified and addressed as appropriate.

Native Americans are environmental justice populations represented in the Planning Area. Information on the Northern Cheyenne and Crow tribes is provided in the *Demographics, Social Organization* and *Economics* subsections of this section. In addition, information on the Northern Cheyenne and Crow Indian Reservations is provided in the *Indian Trust Assets* and *Native American Concerns* sections of this chapter.

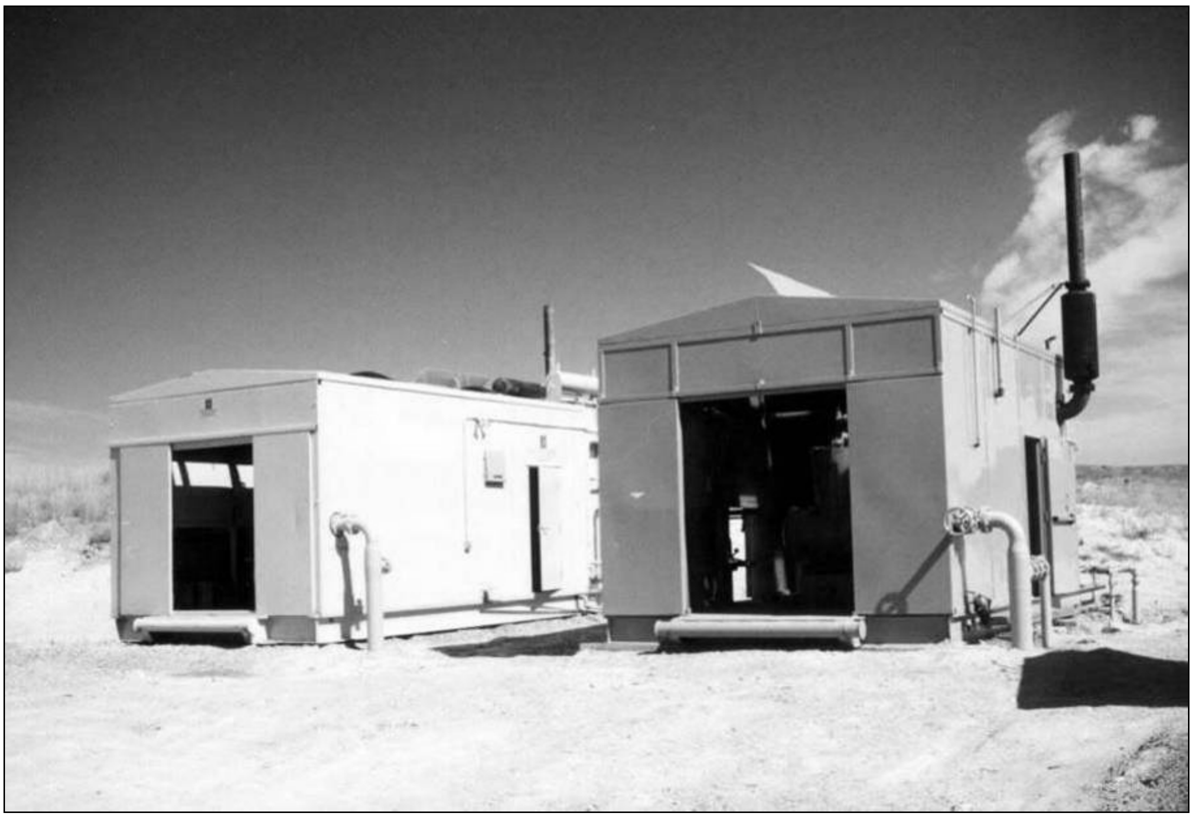
Low-Income and Minority Populations

This section describes locations of concentrations of minority populations and low-income populations at the county level, in accordance with the scope of this study. Potential sub-county concentrations of minority populations and low-income populations are also possible but could only be identified on a project-specific basis. The occurrences of minority populations and low-income populations are discussed in detail in the Demographics section of this report and are presented in Tables 3-26 and 3-27, respectively.

The Montana population is 90.6 percent white, similar to the 13-county Planning Area, which is 88.8 percent white. While 11 of the 13 Planning Area counties are between 92.8 percent and 99.1 percent white, two of the counties—Big Horn and Rosebud—include Indian reservations with substantial Native American populations. Big Horn County, where the population is 59.7 percent Native American, includes most of the Crow Reservation and part of the Northern Cheyenne Reservation. Rosebud County also includes part of the Northern Cheyenne Reservation and is 32.4 percent Native American. Bighorn and Rosebud counties are two of the counties with the most potential for CBNG activity.

The percentage of the Montana population living in poverty is 15.5 percent; the average in the 13-county Planning Area is 14.3 percent. The Planning Area contains 27,934 persons below the poverty level, or about 20.6 percent of the state’s total below the poverty level. Nine of the 13 study-area counties have poverty rates greater than the state average. The county with the highest rate is Big Horn, where more than one quarter of the population had an income below the poverty level in 1997.

An Amish community located along the Tongue River north of Ashland in Rosebud County could be considered a low-income population. This small community consists of 15 people (BLM 2003).



Two typical field compressors. These four-stage, 6.0 million cubic foot per day, reciprocal compressors operate at 380 horsepower and use natural gas as a fuel.

Soils

Montana, with its wide mix of geologic parent material, has a vast array of different soil types. Differences in climate, parent material, topography and erosional conditions result in soils with diverse physical and chemical properties. The distribution and occurrence of soils can be highly variable and is dependent on a number of factors including slope, geology, vegetation, climate and age. All areas covered by the Billings and Powder River RMPs have had soils mapped. Soil surveys in some areas are currently being updated. More detailed information is available from Soil Survey Geographic Databases (SSURGO) at http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/index.html. Interpretations and physical and chemical characteristics of soils, can be found in the Soils Appendix.

The five major soil forming factors are as follows (Brady 1990):

1. Climate—particularly temperature and precipitation.
2. Living Organisms—especially native vegetation, microbes, soil animals and human beings.
3. Nature of parent material.
4. Topography of the site.
5. Time that parent materials are subject to soil formation.

Soils in the RMP areas are derived mainly from sedimentary bedrock and alluvium. The soils generally range from loams to clays, but are principally loams to silty clay loams.

Soil salinity affects the suitability of a soil for crop production and the stability of the soil. The SAR is the measure of sodium relative to calcium and magnesium and affects the soil structure and infiltration rate of water. The Soils Technical Report presents a more detailed discussion pertaining to the salinity and SAR of the soils in the Billings RMP and Powder River RMP areas. A summary of this report is presented in the Soils Appendix.

Irrigated Soils

Virtually all of the irrigated lands are currently located in the river and stream valleys. Some dry farming occurs on the higher terraces above the valleys. Some of the land next to the rivers and major tributaries is irrigated for wheat, feed grains, alfalfa, grass hay, sugar beets and tame pasture (BLM 1992). However, most of the area is native range used for grazing livestock.

The principal irrigated crops grown in the study area and their estimated acreages are shown below:

PRINCIPAL CROPS IN STUDY AREA

Crop	Irrigated (acre)	Non-Irrigated (acre)
Wheat	17,200	535,100
Barley	27,800	95,700
Oats	5,000	15,400
Corn	37,600	0
Sugar Beets	26,200	0
Alfalfa	139,500	279,500
Grass Hay	49,500	126,500

Source: Montana Department of Agriculture, Agricultural Statistics (2000) for 1999 Crop Year.

Solid and Hazardous Wastes

The BLM's hazardous materials program priorities are to protect the public health and safety; protect natural and environmental resources; comply with applicable federal and state laws and regulations; and minimize future hazardous substance risks, costs and liabilities on public lands. BLM is responsible for all releases of hazardous materials on public lands and requires notification of all hazardous materials to be used or transported on public land.

Solid and hazardous wastes can be generated during oil and gas and CBNG activity. These wastes are under the jurisdiction of the MDEQ for Resource Conservation and Recovery Act (RCRA) wastes; the MBOGC for RCRA-exempt wastes such as drilling wastes; and the EPA on tribal lands. At the present time, wastes generated from the wellhead through the production stream to and through the gas plant are exempt from regulation as a hazardous waste under RCRA's exploration and production exemption, but are covered by mineral leasing regulations.

The exemption does not apply to natural gas as it leaves the gas plant for transportation to market. Releases must be reported in a timely manner to the National Response Center the same as any release covered under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Prior to a gas plant, releases are reported to the BLM via a Report of Undesirable Event (NTL-3A; 43 CFR 3162.5-1(c)). The BLM requires immediate reporting of all Class I events, which involve the release of more than 100 barrels of fluid/500 MCF of gas, or fatalities. The MDEQ's Waste and Underground Tank Management Bureau is responsible for administering both the Montana Solid Waste Management Act (75-10-201 *et seq.*, MCA) and the Montana Hazardous Waste Act (75-10-401 *et seq.*, MCA).

It has been established by CERCLA that the owner of the land is ultimately responsible for hazardous materials or substances placed or released on their lands. Under CERCLA, the term "hazardous substance" is typically any toxic, corrosive, ignitable, explosive, or chemically reactive substance, but does not include petroleum, crude oil, natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel, or mixtures of natural gas and synthetic gas. According to MCA 82-10-505: the oil and gas developer or operator is responsible for all damages to property, real or personal, resulting from the lack of ordinary care by the oil and gas developer or operator. The oil and gas developer or operator is responsible for damages to property, real or personal, caused by drilling operations and production. This places the liability of any cleanup that results from spills or unused non-exempt waste and the removal of such waste (paint, acid, or other chemicals) to the oil and gas developer and operator. The oil and gas industry transports hazardous materials on the highways, stores and uses the materials at the sites and produces some hazardous wastes, such as paint waste from the painting of facilities and unused acid or chemicals that were not used in well treatments. This presents a potential for spills, leaks and illegal disposal. Reserve pits may be required to be lined, which reduces but does not eliminate leaks. Produced water is the predominant fluid, but some hazardous substances also are released. The content of the releases or spills will be varied and unpredictable.

The transportation of hazardous materials is regulated by Montana's Department of Transportation (MDT) under CFR Parts 171-180. These regulations pertain to packing, container handling, labeling, vehicle placarding and other safety aspects. The transportation of all hazardous waste materials in Montana must comply with the Federal Motor Carrier Safety Regulations, part 390 through part 397.

The EPA requires manufacturers to report releases of more than 600 designated toxic chemicals into the environment. EPA compiles this data in an annual Toxics Release Inventory. Toxics Release Inventory facilities are required to report on releases of toxic chemicals into the air, water and land. In addition, they report on offsite, pollution prevention activities and chemical recycling. The Toxics Release Inventory also provides information about potentially hazardous chemicals and their use; however, the law does not cover toxic chemicals that reach the environment from non-industrial sources, such as dry cleaners or auto service stations.

In 1998, EPA added seven new industries to the Toxics Release Inventory: metal mining, coal mining, electrical utilities that combust coal or oil, RCRA Subtitle C hazardous waste treatment and disposal facilities, chemicals and allied products wholesale distributors, petroleum bulk plants and terminals and solvent recovery services. There are currently (as of the end of 2003, the period for which the most recent data are available) eight facilities in the RMP areas that report Toxics Release Inventory information to the EPA, with most of them being related to the energy and mining industries. The Solid and Hazardous Waste Appendix contains *the Toxics Release Inventory for Montana*.

Vegetation

The land classification system developed by the University of Montana for the Montana Gap Analysis (MT-GAP) is used for this discussion because it has a large amount of detailed information about vegetation and wildlife distribution. All classification descriptions are from the MT-GAP project and acreage estimates and calculations are based on their data results (Fisher et al. 1998).

The Planning Area includes six general land classes or vegetative communities: Agriculture/Urban Areas, Grassland, Shrubland, Forests, Riparian Areas and Barren Lands. (Non-riparian wetlands are also present but are widespread and generally in relatively small areal units compared to other land classes, so are not defined separately.) The six general land classification descriptions and their subdivisions will be explained in more detail below. All of these habitats are important to a wide variety of wildlife species.

Plant Communities

Grasslands

Grasslands are among the most biologically productive of all vegetative communities because of soil nutrient retention and fast biological recycling. They are also very valuable because the vegetation is nutritious and used by livestock and by a large constituent of wildlife (Williams and Diebel 1996; Estes et al. 1982). Grassland sites are dominated by herbaceous canopy cover at greater than 15 percent, shrub cover at less than 15 percent and forest cover at less than 10 percent (Fisher et al. 1998).

Grasslands cover an estimated 7.9 million acres of the 13 counties that make up the SEIS Planning Area. This is almost twice as much land as any other vegetation type in the Planning Area. Those grasslands with underlying subbituminous or bituminous coal deposits cover 1.5 million acres of the Powder River RMP area and 1 million acres of the Billings RMP area. For grassland types, see the Vegetation Appendix.

Shrublands

Shrublands are characterized by shrub covers greater than 15 percent and forest cover less than 10 percent (Fisher et al. 1998). This vegetation type is dominant on approximately 4.8 million acres of the Planning Area. Of this, 1.7 million acres are underlain by subbituminous or bituminous coal deposits. Important shrubs include several species of sagebrush (*Artemisia nova*, *A. tridentata* ssp. *tridentata*, *A. tridentata* ssp. *vaseyana*, *A. cana* and *A. tridentata* ssp. *wyomingensis*) and shadscale (*Atriplex confertifolia)* or fourwing saltbush (*Atriplex canescens*). Other important shrub species in this category are bitterbrush (*Purshia tridentata*), creeping juniper (*Juniperus horizontalis*), greasewood (*Sarcobatus* spp.), mountain mahogany (*Cercocarpus* spp.), rabbitbrush (*Chrysothamnus* spp.) and shadscale (*Atriplex canescens*). These shrublands are often associated with a complex of understory grasses such as bluebunch wheatgrass (*Agropyron spicatum*), blue grama (*Bouteloua gracilis*), Idaho fescue (*Festuca idahoensis*), needle and thread (*Stipa comata*) and western wheatgrass (*Agropyron smithii*).

Forests

Land is classified as forest if it has more than 10 percent tree cover. Montana has 19 categories of forests under this classification. Within the Planning Area, 2.8 million acres are classified as forest. Of that, almost 1.3 million acres are underlain by subbituminous or bituminous coal deposits. Two forest types account for the majority of the forested areas within the Planning Area: Ponderosa Pine Forests and Low-Density Xeric Forests. Ponderosa Pine sites are dominated by ponderosa pine (*Pinus ponderosa*) at 20 to 80 percent cover. They are associated with big sagebrush, ninebark, snowberry, bluebunch wheatgrass, blue grama and Idaho fescue. Low-density xeric forests have tree cover at 5 to 20 percent with a grass understory. Dominant tree species are Douglas fir, limber pine, ponderosa pine, Rocky Mountain juniper, or Utah juniper (Fisher et al. 1998).

Riparian Areas

These are sites that are associated with intermittent and perennial water sources or with woody draws. Riparian areas are classified as Conifer, Broadleaf, Mixed Broadleaf and Conifer, Graminoid and Forb, Shrub and Mixed (Fisher et al. 1998). All riparian types have high species richness, which reaffirms why riparian sites are considered to be some of the most biologically diverse habitats anywhere.

Other Wetlands

Wetlands not associated with streams or rivers (riparian) are found in many low areas across Montana. In general, these wetlands (palustrine) are dominated by either emergent marsh vegetation, such as cattails, sedges and/rushes, or by shrub vegetation, such as willows. Forested wetlands many also be present in some areas.

Barren Lands

These are sites with less than 10 percent forest cover, less than 10 percent shrub cover and less than 10 percent herbaceous cover (Fisher et al. 1998). The category name may imply that these areas have no biological value, but this would be misleading.

Noxious Weeds

Noxious weeds are generally non-native plants designated by federal, state, or local governments that can be directly or indirectly injurious to public health, agriculture, livestock, navigation, recreation, fish, wildlife, or property (Sheley et al. 1999; Montana Summit Steering Committee and Weed Management Task Force 2005). In disturbed areas, noxious weeds readily establish and may out-compete native plants. Once established, they can spread by aggressive vegetative growth and advantageous seed dispersal mechanisms. They are generally unpalatable, potentially toxic and highly competitive in native rangeland and riparian habitats.

An indicator of the extent of exotic or introduced species, including noxious weeds, in the Planning Area was derived from the Montana GAP Analysis. MT-GAP was described previously under plant communities. The altered herbaceous habitats cover type includes areas dominated by noxious weeds and old agricultural field areas previously planted for pasture with crested wheatgrass (*Agropyron cristatum*) and yellow sweet-clover (*Melilotus officinalis*). The altered herbaceous habitats cover type encompasses approximately 36,969 acres underlain by subbituminous or bituminous coal beds in the Planning Area. This estimate includes land altered by exotic or introduced species and it is larger than surveyed areas for state-listed noxious weeds. The list of state of Montana noxious weeds is provided in the Vegetation Appendix (Table VEG-7). Detailed noxious weed surveys have been conducted for only small portions of the Planning Area.

Since the spring of 2003, the state of Montana has increased the listed number of noxious weeds to 31 from the 26 reported in the original EIS. The noxious weeds are divided into three categories. Category 1 species are currently established and widespread in many counties. Category 2 weeds are recently introduced and are rapidly spreading. Category 3 weeds are either not detected in Montana, or are usually found in small localized infestations. The Invaders Database at the University of Montana (2004) is an electronic database of noxious weeds in Montana. In the state, there are 15 plants classified as Category 1 noxious weeds (Table VEG-7).

Noxious weeds surveys were last reported in the Planning Area in 2002. Many of these weed occurrences were recorded during an extensive survey of weed populations conducted in 2002 along the Yellowstone River in Yellowstone County within the Billings RMP area. Approximately 2,690 weed occurrences were reported, covering approximately 1,900 acres. In addition, 8 and 20 acres of noxious weeds were found in Carbon and Stillwater Counties, respectively, within the Billings RMP area. A few additional occurrences of noxious weeds, totaling 2 acres, have been reported in Treasure County within the Powder River RMP area.

See the Vegetation Appendix for a complete list of noxious weeds for Montana.

Species of Concern

Federally listed plant species have been designated as either threatened, endangered, or candidate species of concern under ESA. The MNHP (2005) did not report any federally listed plants currently present within the Planning Area.

State Species of Concern

In addition to species that are federally protected under the ESA, the state of Montana has designated additional species of concern within its jurisdictional boundaries. There are five rankings for State Species of Special Concern. This document focuses only on the highest ranking (S1). This ranking is defined as critically imperiled because of extreme rarity (five or fewer occurrences, or very few remaining individuals), or because some factor of its biology make it especially vulnerable to extinction.

Special status or sensitive plant species on BLM-administered lands are managed through guidelines in Section 6840 of the BLM Manual. Sensitive species are those thought to be rare or imperiled by proper study and have been documented on BLM-administered land. Seven criteria outlined in Section 6840 are used to determine whether a species is at risk. The sensitive species designation is used to provide conservation actions for species to preclude the need for listing and to improve the status of species to the point where special status recognition is no longer warranted (BLM 2005a).

The Montana NHP maintains the statewide rare plant database for the state of Montana. Table VEG-8 includes BLM, USFS and state species of concern identified by Montana NHP on September 23, 2005. State-listed species (with BLM and Forest Service rankings) that have potential distributions within the 13-county Planning Area are listed in the Vegetation Appendix (see Table VEG-8). The Vegetation Appendix also includes the type of habitat where they are likely to be found (Montana NRIS 2001). Table VEG-6 links wildlife species to habitat requirements.

The Montana NHP (2005) reported 45 BLM sensitive plant species of concern that occur in the Planning

Area. Thirteen USFS sensitive plant species also occur within the Planning Area (Table VEG-8). In addition, detailed surveys were conducted in selected areas in Rosebud (Barton and Crispin 2003), Big Horn (Carlson and Cooper 2003) and Powder River counties (Heidel et al. 2002). These studies identified several new occurrences of various BLM sensitive species in these areas.

The large geographic area of the Planning Area supports a variety of habitats that support special status species. Currently, there are 83 state-listed species of concern in the 13-county Planning Area (Table VEG-8). Most occurrences (42) have been documented in Carbon County. Conversely, only one special status species occurs in Golden Valley and in Musselshell counties.

Thirteen special-status species have been reported in Big Horn County, while nine occur in both Powder River and Rosebud counties. This disparity in species occurrences reflects the degree of diversity of habitats in the area, but also may result from less extensive field surveys conducted in some areas. Fifteen species of concern are restricted to alpine habitats, which would not be affected by CBNG development. Historic maps for most species of concern show much wider distributions than present distributions.

Visual Resource Management

Visual resources are visual features in the Montana landscape that include landform, water, vegetation, color, adjacent scenery, uniqueness or rarity, structures and other man-made features. The 13 counties in the Planning Area portray a variety of landscapes and habitats, all with different visual qualities. Current visual resource management is in accordance with the two RMPs. The four classes are as follows:

- Class I—preserve the existing character of the landscape
- Class II—retain the existing character of the landscape
- Class III—partially retain the existing character of the landscape
- Class IV—provide for management activities that require major modifications to the existing character of the landscape

Non-federal land is not under any visual resource management system although there are often visual quality concerns. Federally authorized projects, however, undergo a visual assessment to comply with aesthetic requirements. Typically, sensitive areas include residential areas, recreation sites, historical sites, significant landmarks or topographic features, or any areas where existing visual quality is valued.

Three CBNG well heads forming a field pod near Decker, Montana. Each well is drilled to a different depth and into a different layer of coal.

Wilderness Study Areas

Six wilderness study areas (WSA) are within the Planning Area:

- Carbon County
  - Burnt Timber Canyon WSA
  - Pryor Mountain WSA
  - Big Horn Tack-On WSA

- Golden Valley County
  - Twin Coulee WSA

- Rosebud County
  - Zook Creek WSA

- Powder River County
  - Buffalo Creek WSA

Monitoring reports for these WSAs list little or no activity with the exception of some minor vehicle tracks found in the Pryor Mountain WSA, Big Horn Tack-On WSA and Burnt Timber Canyon WSA.

Wildlife

The SEIS Planning Area covers a large portion of southeast and south central Montana and includes substantial geographic and topographic variation and a wide variety of plant communities and wildlife habitat types. This combination of factors results in diverse wildlife communities, with some species having widespread occurrence throughout the Planning Area and others being restricted to one or a few specialized habitats and locations.

The Vegetation section described the predominant native plant communities that provide habitat for wildlife in the Planning Area. These include a variety of grassland, shrubland, forest and riparian habitat types. Drier grasslands and shrublands are dominant with breaks, badlands, coulees, wooded draws, open conifer forests and riparian shrub and forest communities along perennial and intermittent drainages. Two other cover types present in the Planning Area include open water and a variety of agricultural land uses, both of which provide important habitat value to certain species during some seasons. Additionally, special habitat features such as cliffs, snags, springs, natural potholes, reservoirs, lakes and islands are present in the Planning Area.

Mammals

The variety of locations, topography and cover types in the Planning Area support many mammal species. The MT-GAP atlas of terrestrial vertebrates (MT-GAP 1998) shows the known distribution of vertebrates in Montana. It indicates the Planning Area supports 10 species of bats; 8 species of shrews; 34 other species of small mammals and lagomorphs; 17 omnivores or predators ranging in size from the least weasel (*Mustela nivalis*) to the black bear (*Ursus americanus*) and mountain lion (*Felis concolor*); and 5 to 7 big game species. Several of these species have suffered substantial habitat loss and population decline and are considered to be rare or are protected by federal statutes. These species are addressed in the Species of Concern (SOC) section.

Some of the more common predators include the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), badger (*Taxidea taxus*) and striped skunk (*Mephitis mephitis*). Local occurrence of these and other predators varies by habitat type.

Big game species common within parts or all of the Planning Area include elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), white-tailed deer (*O. virginianus*) and pronghorn (*Antilocapra americana*). The MT-GAP (1998) provides the following summary of habitat preferences for these species.

Elk habitat preference is described as including moist sites during the summer. Elk use open areas such as alpine pastures, marshy meadows, river flats and aspen parkland as well as coniferous forests, brushy clearcuts and forest edges. High-quality winter range is critical to long-term elk survival. The distribution of elk winter habitat in the planning area is shown on Map 3-12.

Mule deer are the most widely distributed big game species in Montana and occupy a wide range of habitat types during the year. Breaks, badlands and brushy draws are preferred in open prairie country. McCracken and Uresk (1984) reported that both hardwood and pine forests were important to mule deer in southeastern Montana, with hardwood forests preferred. The Billings RMP (BLM 1983) indicates that although mule deer occur throughout the Planning Area, they are more abundant in the open shrub-grassland habitats adjacent to timbered or broken terrain. Habitat such as riparian bottoms, agricultural areas and forests are used as well, either year long or seasonally. Winter ranges are typically at lower elevation than summer ranges and are often dominated by shrub species that provide crucial browse. The distribution of mule deer winter range in the Planning Area is shown in Map 3-13.

In the Powder River RMP area, mule deer use all habitat types, but generally prefer sagebrush, grassland and conifer (BLM 1984b). Broken terrain provides important cover in these habitats (Hamlin 1978). Browse is an important component in the mule deer annual diet. Observations by the Montana Department of Fish, Wildlife and Parks (Youmans et al. 1982), indicated 73 percent of the mule deer observed in winter concentration areas in southeastern Montana were in rough topography, especially in pine-dominated habitats. However, along the Powder and Little Missouri Rivers, however, riparian habitat accounted for 94 percent of the wintering mule deer concentrations, probably due to the lack of rough breaks. These habitats are crucial to herd survival in the Powder River RMP area. There appears to be little or no seasonal migration of mule deer in southeastern Montana (BLM 1984b). The Wildlife Surveys and Monitoring since the Statewide Document section provides information on the number of mule deer and other ungulates observed on the southern portion of the Northern Cheyenne Reservation and in the Planning Area.

White-tailed deer also occur throughout Montana but are more restricted by habitat preference than are mule deer. Preferred habitats include forest types, agricultural fields and prairie areas adjacent to cover. Mesic areas such as riparian areas and montane forests are preferred in the drier portions of central and eastern

Montana. McCracken and Uresk (1984) reported a strong preference for hardwood forests in southeastern Montana. During the winter, white-tailed deer using forested areas prefer dense canopy classes, moist habitat types, uncut areas and low snow depths. Suitable winter range is a key habitat factor for white-tailed deer and winter concentration areas occur almost exclusively in riparian-wetland habitats and in dense pine (Youmans and Swenson 1982). Although white-tailed deer move on and off winter range, as dictated by seasonal habitat requirements, the animals do not migrate long distances (Hamlin 1978). The distribution of white-tailed deer winter habitat in the PRB is shown on Map 3-14.

Pronghorn are relatively common throughout eastern and central Montana and occupy a variety of grassland and shrubland habitats on prairies, semi-desert areas and foothills. Summer habitat preferences are reported to include mixed shrub communities, perennial grasslands, silver sagebrush stands, annual forblands and croplands (Armstrup 1978; Wentland 1968). McCracken and Uresk (1984) reported a strong preference to sagebrush-grassland cover types in southeastern Montana. Sagebrush-grasslands with shrubs 12 to 24 inches tall are preferred in the winter when sagebrush composes a significant portion of the pronghorn diet (Bayless 1967). The distribution of pronghorn winter habitat in the PRB is shown on Map 3-15.

The range of moose (*Alces alces*) overlaps with coal-bearing lands in Carbon County. Moose habitat generally consists of a mosaic of second-growth forest, openings, swamps, lakes and wetlands. Water bodies are required for foraging and hardwood-conifer forests provide winter cover. Willow flats may provide yearlong habitat in some areas (Stone 1971) and closed canopy stands may be important in late winter (Mattson and Despain 1985).

The other two big game species that may occur in the Planning Area include the mountain goat (*Oreamnos americanus*) and Rocky Mountain Bighorn Sheep (*Ovis canadensis*). Mountain goats typically occupy alpine and subalpine habitats, steep grassy talus slopes, grassy ledges and cliffs, or alpine meadows. Both mountain goats and mountain sheep may overlap with coal-bearing lands in southwestern and southern Carbon County, respectively. The Pryor Mountain bighorn herd, which occurs south of Billings, is estimated at 125 to 150 individuals as of the 2005/2006 winter index count conducted by MFWP (Stewart, 2006). Grasses and forbs provide the major portion of their yearlong diet, which is supplemented with browse types such as curlleaf mountain mahogany and sagebrush (USFWS 1978). Little information is currently available on the migratory routes of this herd.

In eastern Montana, most mule deer and elk winter range is located on relatively large areas of land with a diversity of slopes, aspects and topographic features (MBOGC 1989). Winter range is often part of year-round habitat.

Prairie dog towns provide habitat for more than 163 vertebrate species, including several rare or endangered species such as the burrowing owl (*Athene cunicularia*), swift fox (*Vulpes velox*), mountain plover (*Charadrius montanus*) and black-footed ferret (*Mustela nigripes*), an endangered species (Reading et al. 1989, Koford 1958, Tyler 1968, Campbell and Clark 1981, Clark et al. 1982 and Agnew 1983). Most prairie dog towns in the Planning Area are composed of black-tailed prairie dogs (*Cynomys ludovicianus*); white-tailed prairie dogs (*C. leucurus*) are found only along the Clarks Fork of the Yellowstone River in Carbon County, which is at the northern limit of its range.

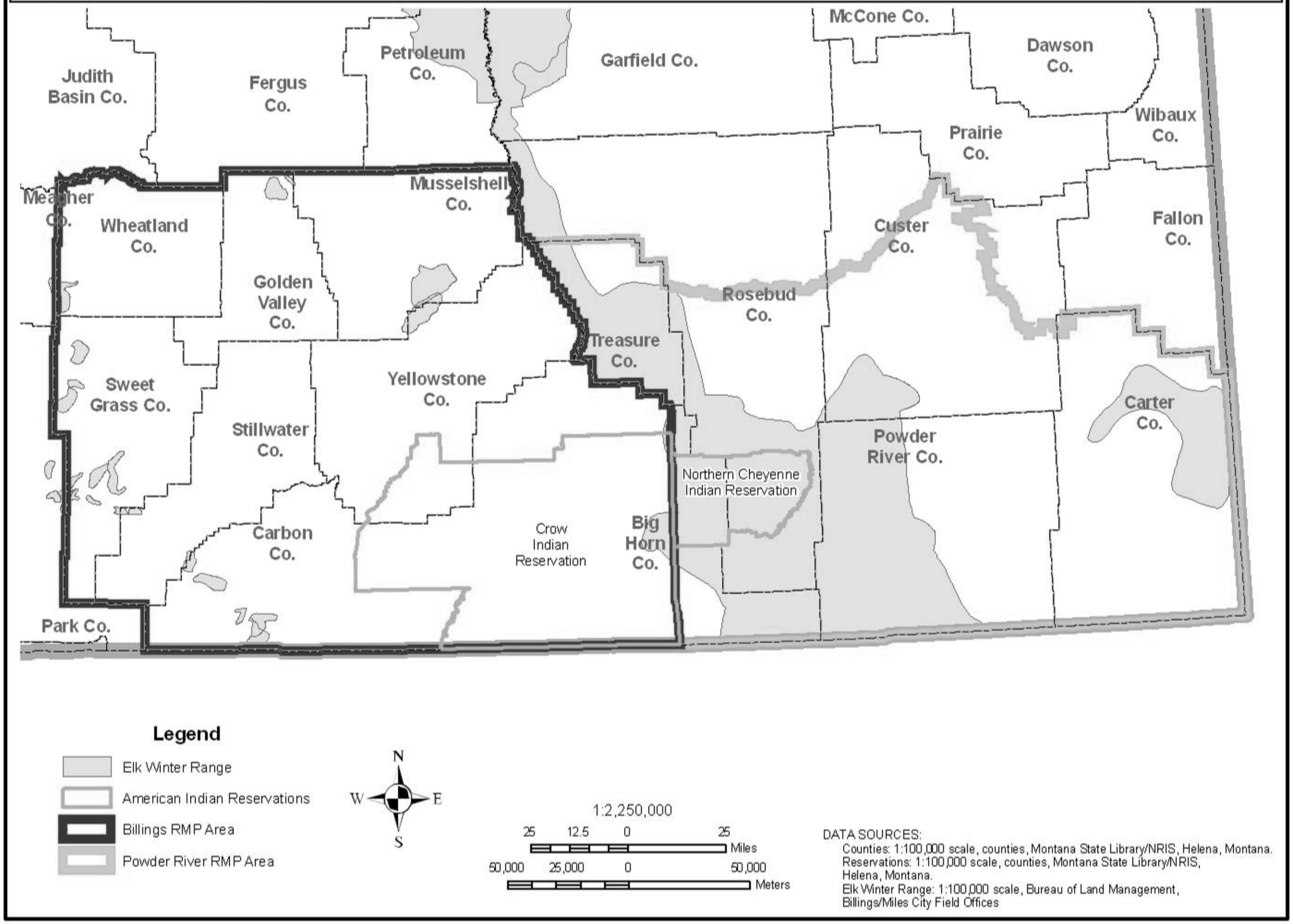
As noted above, at least 10 species of bats probably occur in the Planning Area. Additional species migrate through central and eastern Montana. Habitat varies by species and includes caves, large-diameter hollow trees, old buildings, abandoned mines, rock crevices and under the loose bark on large trees.

As noted above, at least 42 species of small mammals and lagomorphs occur in the Planning Area. MFWP has expressed particular concern about the Preble's shrew (*Sorex preblei*) and Merriam's shrew (*S. merriami*). Preble's shrew has a spotty distribution associated with dry sagebrush and sagebrush grasslands (Hoffman and Pattie 1968) and riparian shrubs (Allen et al. 1994, Ports and George 1990). Merriam's shrew is apparently somewhat more widely distributed in the Planning Area. It occupies the same general habitat types as the Preble's shrew plus grasslands and open ponderosa pine stands (MT-GAP 1998).

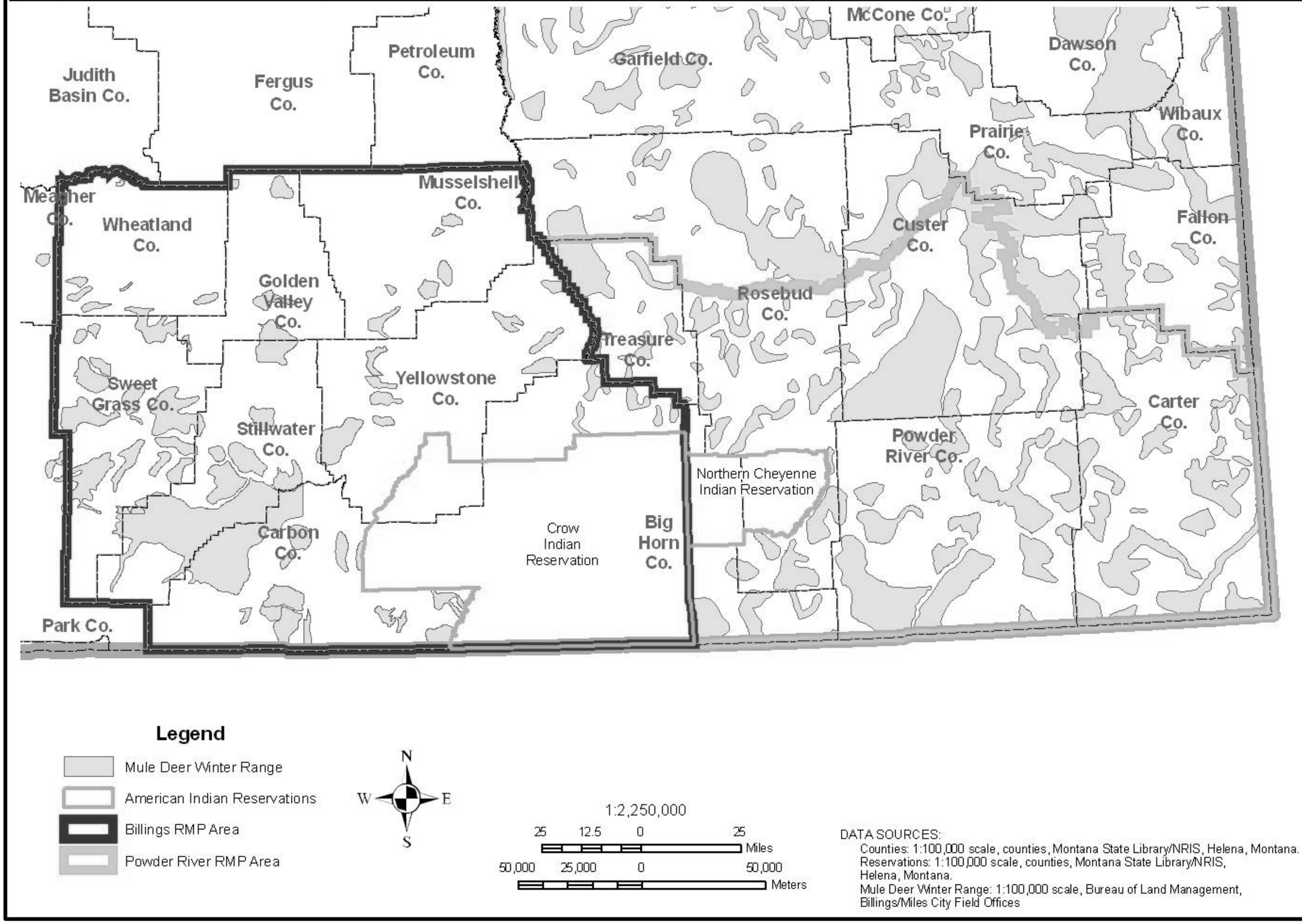
Birds

As noted for mammals, the variety of locations, topography and cover types in the Planning Area also support many bird species. The MT-GAP (1998) indicates that more than 250 species of birds occur in the Planning Area. Some are yearlong residents; a few migrate south into the Planning Area during the winter and most breed in the Planning Area and winter to the south. Approximate numbers of species include 32 waterfowl and related species; 33 shore and wading birds; 18 diurnal and 11 nocturnal raptors; 8 species of gallinaceous birds; 8 woodpeckers; and 137 songbirds, including many neotropical migrants. Species richness and breeding bird densities are highest in riparian woodlands and wetland habitats.

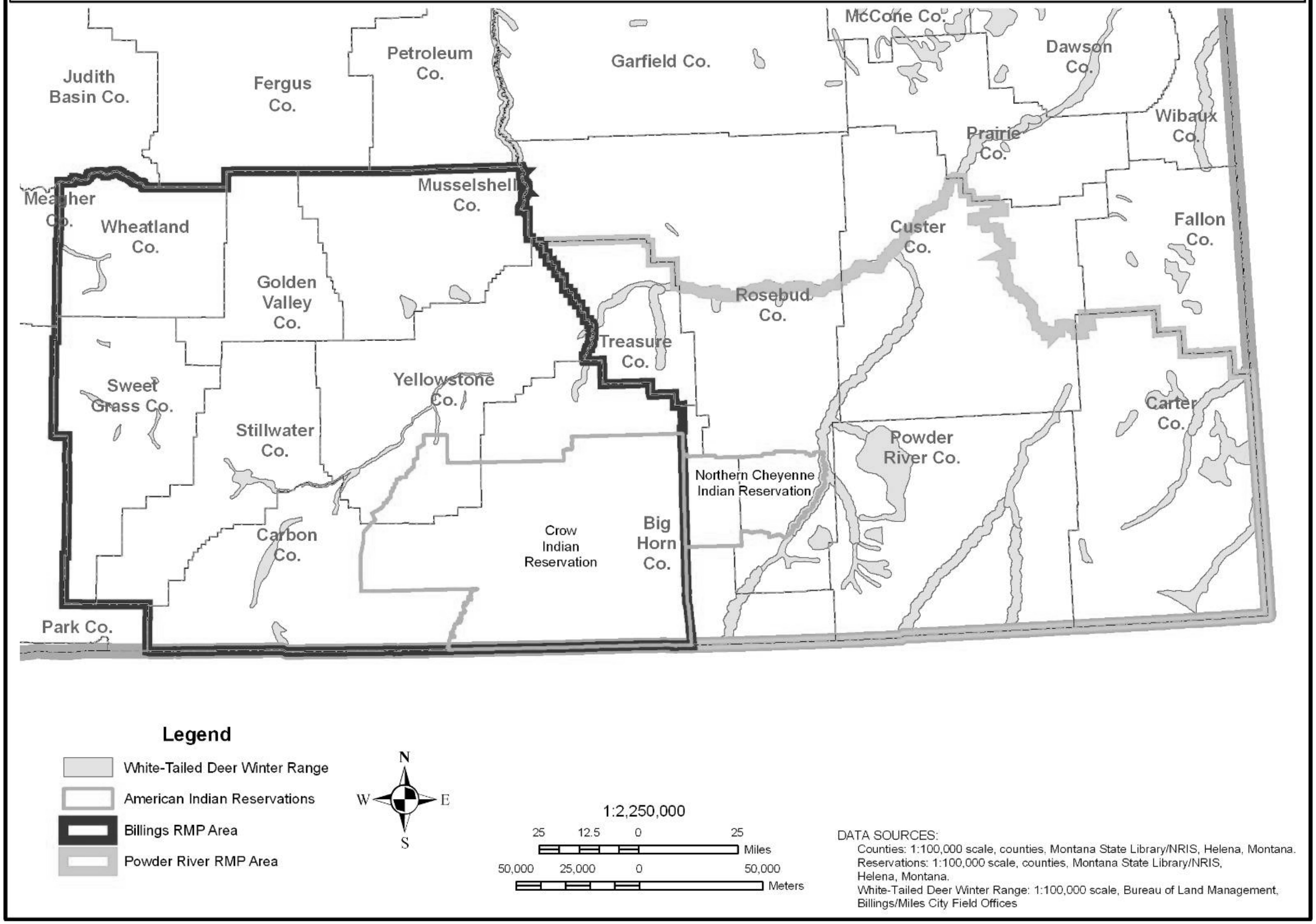
Map 3-12: Elk Winter Range in the CBNG Planning Area



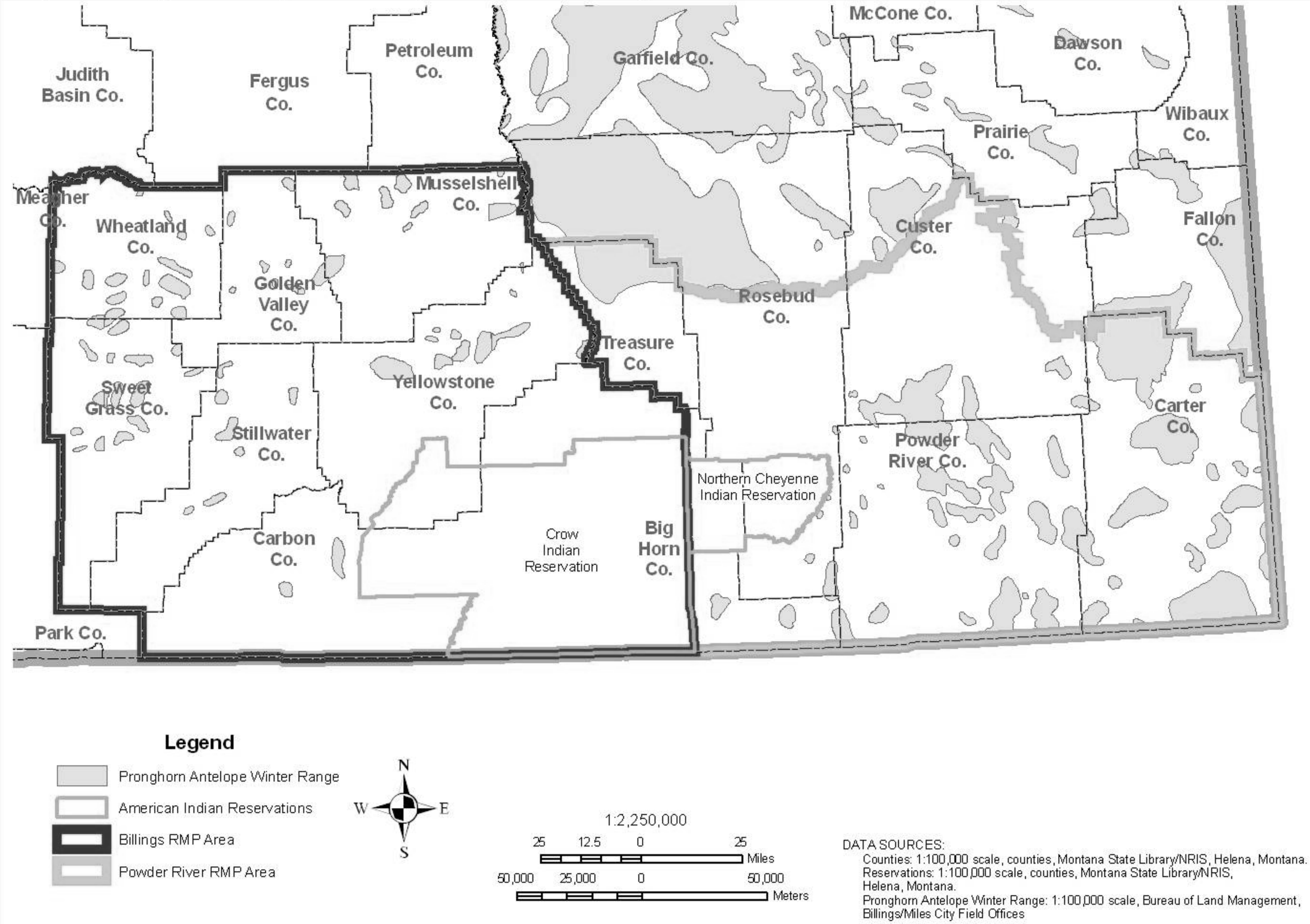
Map 3-13: Mule Deer Winter Range in the CBNG Planning Area



Map 3-14: White-Tailed Deer Winter Range in the CBNG Planning Area



Map 3-15: Pronghorn Antelope Winter Range in the CBNG Planning Area



Waterfowl

The Planning Area is within the Central Flyway, which has important migration corridors. Lands in the Planning Area also fall within the Prairie Pothole Joint Venture Management Zone established through the North American Waterfowl Management Plan. The Prairie Pothole Joint Venture is thought to contain the most important duck-breeding habitat in North America. Many spring runoff ponds in the Planning Area provide important habitat for nesting waterfowl. The major rivers and stock ponds provide important habitat for resident ducks and geese, as well as resting areas for migrants. A large variety of ducks, geese and shorebirds use riparian-wetland habitats within the Planning Area for both nesting and migration stopovers. Common species include the mallard (*Anas platyrhynchos*), pintail (*A. acuta*), gadwall (*A. strepera*), blue-winged teal (*A. discors*), common merganser (*Mergus merganser*), Canada goose (*Branta canadensis*), killdeer (*Charadrius vociferus*) and American avocet (*Recurvirostra americana*). The Yellowstone and Clarks Fork drainages are used heavily for nesting by Canada geese and some species of ducks. Nesting occurs mostly on established islands and brushy riparian-wetland areas, providing protection from predators.

Hansen (2001) identified several specific areas that are important to waterfowl and shorebirds. One critical habitat (for waterfowl and shorebird nesting and migration) is the Lake Mason National Wildlife Refuge (NWR), its entire watershed and some associated shallow lakes located in Musselshell County. Another is the Spidel Waterfowl Production Area, USFWS area for waterfowl and shorebirds located at the edge of one of the coal areas about 3 miles northeast of Broadview. A group of major waterfowl and shorebird areas located in Stillwater County between Molt and Rapelje includes Big Lake, Halfbreed NWR and Hailstone NWR.

The Yellowstone River through Yellowstone, Big Horn, Treasure, Rosebud and Custer counties is a major habitat for nesting, migrating and wintering waterfowl. Also, the Howrey Island ACEC is a large island in the Yellowstone River in Treasure County that provides valuable habitat for waterfowl and many other species.

Raptors

Many of the raptors occurring in the Planning Area have been identified by the state of Montana, the USFS, or BLM as sensitive species or species of special interest or concern (Flath 1991; Houtcooper et al. 1985). Those listed by the state include the ferruginous hawk (*Buteo regalis*), osprey (*Pandion haliaetus*), Cooper's hawk (*Accipiter cooperii*), northern goshawk (*Accipiter gentilis*), golden eagle (*Aquila chrysaetos*), merlin (*Falco columbarius*), prairie falcon (*Falco mexicanus*), burrowing owl, flammulated owl (*Otus flammeolus*), great gray owl (*Strix nebulosa*) and Boreal owl (*Aegolius funereus*). The bald eagle (*Haliaeetus leucocephalus*) is discussed in the *Species of Concern* section.

Raptor surveys conducted from 2002 to 2005 in proposed CBNG drilling and pipeline development areas in Big Horn and Powder River counties, red-tailed hawk nests were the most frequently detected raptor nest (see the Wildlife Surveys and Monitoring Since the Statewide Document section).

Burrowing owls are of particular interest because of the rapid decline in their numbers (MT-GAP 1998). They occur in a variety of open habitat types, nesting and roosting in burrows dug by mammals (AOU 1983). They appear to be totally dependent on these mammal burrows with prairie dog towns providing prime habitat (MT-GAP 1998). Raptor surveys conducted from 2002 to 2005 in proposed CBNG drilling and pipeline development areas in Big Horn and Powder River counties, active burrowing owl nesting areas were detected in three of seven surveys (see the Wildlife Surveys and Monitoring Since the Statewide Document section).

Ferruginous hawks occupy relatively undisturbed prairie and shrub steppe regions with scattered trees, rock outcrops and wooded stream bottoms (Evans 1982; Clark et al. 1989). MFWP notes there are a few pairs that apparently nest along tributaries in both the Powder River and Tongue River watersheds. Ferruginous hawks have declined throughout their range over the last 30 years. In seven raptor surveys conducted from 2002 to 2005 in proposed CBNG drilling and pipeline development areas in Big Horn and Powder River counties, one active ferruginous hawk nest was detected (see the Wildlife Surveys and Monitoring Since the Statewide Document section).

Merlins have also suffered substantial population declines. They occur in sparsely treed prairie, prairie parkland, along stream bottoms and in grassland habitats. MFWP notes merlins were present in the Powder River watershed, but little current information is available. No merlin nest sites were detected in the seven raptor surveys mentioned above.

Upland Game Birds

The following section from the Billings and Powder River RMPs describes habitat preferences and important natural history information for the prairie sharp-tailed grouse *(Tympanuchus phasianellus jamesi*) and sage-grouse (*Centrocercus urophasianus*) that applies to the entire Planning Area. Sharp-tails are widely distributed and are generally found in the grassland, shrub-grassland and woodland vegetation areas. Sharp-tail habitat includes hills, benchlands and other areas of rolling topography that have good stands of residual cover composed chiefly of grasses for roosting, feeding and nesting. Dancing grounds, or leks, are usually flat areas on elevated knolls or benches. The dancing or mating sites are nearly bare of vegetation, although brushy cover is located nearby for feeding and escape. The breeding and nesting period from March to June is the most critical period in the life cycle. Females nest and raise their broods in the grassy uplands, with most nests located within 4 miles of mating grounds.

Studies in southwestern North Dakota have shown more than 90 percent of the nest sites occurred in areas with residual vegetation over 6 inches high and 70 percent of brood locations were in vegetation over 9 inches high (Kohn 1976). Habitat preferences in this Planning Area are similar.

Sage-grouse are discussed under *Species of Concern* later in this Wildlife section.

Neotropical Migrants

A wide variety of neotropical migrants pass through or breed in the Planning Area. Habitat types expected to support the highest species richness and breeding densities include cottonwood and green ash riparian communities (Hopkins 1984) and emergent wetland communities. Several species of birds declining in numbers, including Baird's sparrow (*Ammodramus bairdii*), Sprague's pipit *(Anthus spragueii*), chestnut-collared longspur (*Calcarius lapponicus*) and McCown's longspur (*Calcarius mccownii*) are found in the Planning Area. A number of other bird species, including the Brewer's sparrow (*Spizella breweri*) and loggerhead shrike (*Lanius ludovicianus*), are also declining throughout their range (Hansen 2001) and found within the Planning Area.

Reptiles and Amphibians

The MT-GAP (1998) indicates that the Planning Area supports 9 species of amphibians and 14 species of reptiles. These include one salamander, four frogs, four toads, three turtles, two lizards and nine snakes. MFWP has expressed particular concern about nine of these species, including the northern leopard frog (*Rana pipiens*), boreal/western toad (*Bufo boreas*), Great Plains toad (*Bufo cognatus*), Plains spadefoot (*Spea bombifrons*), western hog-nose snake (*Heterdon nasicus*), milk snake (*Lampropeltis triangulum*), greater short-horned lizard (*Phrynosoma hernandesi*), snapping turtle (*Chelydra serpentine*) and spiny softshell turtle (*Trionyx spiniferus*).

Leopard frogs have declined substantially in western and to a somewhat lesser extent, central Montana (MT-GAP 1998). They are locally abundant in southeastern Montana (Reichel and Flath 1995). They are associated with permanent slow moving water bodies with considerable vegetation, but may also range into moist meadows and grassy woodlands and occasionally agricultural areas (Nussbaum et al. 1983). They are most often associated with riparian habitats and near permanent water. Tiger salamanders occur throughout the Planning Area wherever there is terrestrial substrate suitable for burrowing and a nearby body of water for breeding (MT-GAP 1998). All amphibians are particularly susceptible to effects from water quality degradation because larval stages are spent in water and they absorb water through their skin during all life stages.

The western hognose snake occurs in a variety of habitats throughout central and eastern Montana. They are especially associated with arid areas, prairie grasslands and shrublands and floodplains with gravely or sandy soils (Reichel and Flath 1995). Milk snakes occur in suitable habitats throughout south central and southeastern Montana. Preferred habitats include sandstone bluffs, rock outcrops, grasslands and open ponderosa pine and juniper stands (Hendricks and Reichel 1996). The spiny softshell is a riverine species that occurs primarily in the larger rivers of southeastern Montana. It is found in well-oxygenated, slower moving water with nearby mud flats and sandbars and occasionally in back water sloughs (MT-GAP 1998).

Species of Concern

This section discusses wildlife species of concern that occur in the Planning Area. These include species listed or proposed for protection under the ESA, species classified as sensitive by the BLM or Forest Service and species considered to be critically imperiled in the State of Montana. Table 3-39 and the following discussion present information about the species protected under ESA.

Birds

Bald Eagle

This species was removed from the list of threatened and endangered species in 2007. Bald eagles concentrate in and around areas of open water where waterfowl and fish are available. They prefer solitude, late-successional forests, shorelines adjacent to open water, a large prey base for successful brood rearing and large, mature trees for nesting and roosting.

Bald eagle recovery zones include the Powder and Missouri rivers. Bald eagles nest along the Yellowstone River in Rosebud and Custer counties and the Tongue River in Custer and Powder River counties. The Yellowstone River is used during spring and fall

TABLE 3-39

ENDANGERED, THREATENED AND PROPOSED ANIMAL SPECIES PRESENT IN THE SEIS PLANNING AREA

Common Name	Scientific Name	Habitat in Montana	Federal Status*
Birds			
interior least tern	*Sterna antillarum athalassos*	Sandbars and beaches in eastern Montana and along the Yellowstone and Missouri rivers	E
Mammals			
gray wolf	*Canis lupus*	Adapted to many habitats, need large ungulate prey base and freedom from human influence	E/10(j)
Canada lynx	*Felis lynx canadensis*	Montana spruce/fir forest in western Montana	T
black-footed ferret	*Mustela nigripes*	Prairie dog complexes in eastern Montana	E
grizzly bear	*Ursus arctos horribilis*	Alpine/subalpine coniferous forest in western Montana	T

*T = Threatened; E = Endangered; C = Candidate; PT = Proposed Threatened;
E/10(j) = Endangered/Experimental Nonessential Populations.

migration. Peak occurrence is November through April. The Missouri, Yellowstone, Musselshell, Tongue and Powder rivers provide habitat during migration as well as during the winter months. Bald eagles currently are expanding their nesting territories down the Yellowstone River (Flath 1991).

Bald eagle winter roost and nest surveys have been conducted in association with the POD areas (Dry Creek, Pond Creek, Deer Creek North, Coal Creek and Badger Hills). These surveys are conducted for the area covered by the POD as well as a 2-mile buffer. Additionally, winter roost and nest surveys have been conducted along the Tongue River corridor from the Wyoming state line to below the Tongue River Reservoir along the Tongue River corridor. Surveys are ongoing and have been conducted by Fidelity Exploration, Quaneco, Powder River Gas and BLM.

Three bald eagle winter habitat/roost surveys were completed within the Upper Tongue River in 2004. The survey route started at Birney, Montana, to approximately 5 miles south of the Montana/Wyoming border at the intersection of the Tongue River and Wyoming Highway 338. Survey results were as follows:

- January 14th —15 bald eagles (9 mature and 6 immature) were observed at 11 locations.
- February 2nd—17 bald eagles (9 mature and 8 immature) were observed at 9 locations.
- March 4th—50 bald eagles (24 mature/26 immature) were observed at 22 locations.

The increase in numbers of bald eagles in the March flight was due, in part, to this portion of the river containing relatively little ice cover. The Wildlife Surveys and Monitoring since the Statewide Document section provides additional information on recent bald eagle surveys.

Interior Least Tern

The historic distribution of the interior least tern is the major river systems of the plains states and midwestern U.S. The occurrence of breeding least terns is localized and is highly dependent on the presence of dry, exposed sandbars and favorable river flows that support a forage fish supply and isolate the sandbars from the riverbanks. Characteristic riverine nesting sites are dry, flat, sparsely vegetated sand and gravel bars within a wide, unobstructed, water-filled river channel. In the upper Missouri River Basin, it often nests with piping plovers. During spring and fall migrations, the least tern uses stockwater reservoirs (Flath 1991).

The least tern is known to nest in the Planning Area. Its habitat includes graveled islands in the lower Yellowstone River.

Peregrine Falcon

The peregrine falcon was delisted on August 25, 1999 and protection from take and commerce for the peregrine falcon is no longer provided under the ESA. However, peregrine falcons are still protected by the Migratory Bird Treaty Act (MBTA). The MBTA and its implementing regulations (50 CFR parts 20 and 21) prohibit take, possession, import, export, transport, selling, purchase, barter, or offering for sale, purchase, or barter any migratory bird, their eggs, parts and nests, except as authorized under a valid permit (50 CFR 21.11). With limited exceptions, take will not be permitted under MBTA until a management plan is developed in cooperation with state wildlife agencies, undergoes public review, is approved, finalized and published in the FR.

Peregrine falcons migrate through the Planning Area during spring and fall, especially along rivers and other water bodies that support waterfowl and shorebirds. Peregrines are believed to nest northeast of Great Falls, possibly within the Planning Area.

Mammals

Gray Wolf

This species was listed as endangered on March 11, 1967. On November 18, 1994, the USFWS announced experimental populations of this species would be reintroduced in central Idaho and southwestern Montana. Populations classified as experimental are exempt from full endangered status. Historically, the gray wolf ranged throughout Montana. It appears to have been common throughout the state, inhabiting both short and tall grass prairie as well as forested regions. It has no particular habitat preference, but requires areas with low human population, low road density and high prey density, which are ideally large, wild ungulates.

Most confirmed wolf sightings and pack accounts are for western Montana, along the Bitterroot divide and in the areas around Yellowstone National Park, where it has been reintroduced (Fisher et al. 1998).

The most recent Rocky Mountain Wolf Recovery Annual Report estimates the experimental wolf population in southern Montana to be 73 wolves (MFWP, 2008). The range of the Moccasin Lake, Phantom Lake, Red Lodge and Beartooth wolf packs occurs within, or partially within, the Planning Area (USFWS et al. 2005).

Canada Lynx

This species was listed as threatened on March 24, 2000. It is dependent on snowshoe hares and found in the same habitats, which include dense, mature old-growth lodgepole pine, Douglas fir, Engelmann spruce and subalpine fir forest. Distribution and primary potential habitats for Montana are in the western portion of the State in mature coniferous forests with a well-developed understory. Dens are primarily located in mature lodgepole pine and spruce-fir forests.

Black-footed Ferret

Black-footed ferrets depend almost exclusively on prairie dogs for food and shelter. They primarily prey on prairie dogs and use their burrows for shelter and dens. Ferret range is coincident with that of prairie dogs. There is no documentation of black-footed ferrets breeding outside of prairie dog colonies. There are specimen records of black-footed ferrets from ranges of three species of prairie dogs: the black-tailed prairie dog (*Cynomys ludovicianus*), white-tailed prairie dog (*Cynomys leucurus*) and Gunnison’s prairie dog (*Cynomys gunnisoni*).

Several releases of black-footed ferrets have taken place over the years on public land and the Fort Belknap Indian Reservation north of the Planning Area in Phillips County, Montana. Black-footed ferrets have been released on the Northern Cheyenne Reservation in January of 2008 and additional ferrets will be released the summer of 2008. This population is considered endangered (Hanebury 2008). In Montana, the goal is to reestablish two viable populations with a minimum of 50 breeding adults in each.

Grizzly Bear

This species was listed as threatened on March 11, 1967. On November 11, 2000, the USFWS listed some populations in Montana and Idaho as experimental in order to facilitate restoration to designated recovery areas. The grizzly bear was once found in a wide variety of habitats including open prairie, brushlands, riparian woodlands and semidesert scrub. Its distribution in Montana is now limited to the Northern Continental Divide Ecosystem and the Yellowstone Ecosystem with a few in the Cabinet-Yaak Ecosystem. Scattered individuals may occur in the mountainous areas of western Montana. It no longer exists in the wild in eastern Montana. Most populations require vast areas of suitable habitat to prosper. This species is common only in habitats where food is abundant and concentrated, including white-bark pine, berries and salmon or cutthroat runs and where conflicts with humans are minimal.

State Species of Special Concern

In addition to species that are federally protected under the ESA, the State of Montana has designated additional species of concern within its jurisdictional boundaries. There are five rankings for State Species of Special Concern. This document focuses only on the highest ranking (S1). This ranking is defined as critically imperiled because of extreme rarity (five or fewer occurrences, or very few remaining individuals), or because some factor of its biology makes it especially vulnerable to extinction.

State-listed species (with BLM and USFS rankings) that have potential distributions within the 13-county Planning Area of this SEIS or have undefined distributions in the state are listed in the Wildlife Appendix, *Wildlife Species of Concern* (see Table WIL-1 for Special Status Species of State of Montana, BLM and USFS). Species that are federally listed under the ESA have been omitted from these tables because they have been considered. Table WIL-1 also lists vertebrate species of concern for the state, BLM, or the USFS.

The Statewide Document included three other species proposed for listing or considered possible candidates for listing under ESA. These species include sage-grouse, mountain plover and black-tailed prairie dog and are discussed below.

Birds

Sage-grouse

Previously considered a possible candidate for listing under ESA, USFWS determined the sage-grouse is not warranted for listing, because the species is not likely to become endangered or threatened in the foreseeable future (USFWS 2005b). However, a recent ruling in Idaho (December 2007) remanded the decision not to list the sage grouse back to the USFWS for reconsideration. This species is a BLM and a Forest Service sensitive species.

Sage-grouse Distribution, Habitat Needs and Population Dynamics

Sage-grouse are native to the sagebrush steppe of western North America and their distribution closely follows that of sagebrush, primarily big sagebrush (Montana Sage-grouse Work Group 2005). The importance of mature sagebrush with a good understory of grasses and forbs is well documented. In eastern Montana, where close interspersion of wintering, nesting, breeding and brood-rearing habitat rarely require large seasonal movements, sage-grouse are essentially nonmigratory. Seasonal habitat components for sage-grouse are described in Table 3-40 and habitat distribution and use within the Planning Area are depicted in Map 3-16.

Sage-grouse densities for Wyoming and Montana are shown on Map 3-17. Densities were derived from male lek attendance and are meant to illustrate the importance of the PRB to sage-grouse (Draft Greater Sage Grouse Comprehensive Conservation Strategy). The map illustrates the importance of the PRB for connectivity for sage-grouse.

Sage-grouse males appear to form strutting grounds (leks) opportunistically at sites within or next to potential nesting habitat. Although the lek may be an approximate center of annual ranges for non-migratory populations (Eng and Schladweiler 1972, Wallestad and Pyrah 1974, Wallestad and Schladweiler 1975), this may not be the case for migratory populations (Connelly et al. 1988, Wakkinen et al. 1992). Average distances between nests and nearest leks vary from 0.66 to 3.75 miles, but the documented distances from leks with which females were associated to their nests have exceeded 12 miles (Autenrieth 1981, Wakkinen et al. 1992, Fischer 1994, Hanf et al. 1994, Lyon 2000). Nests are placed independent of lek location (Bradbury et al. 1989, Wakkinen et al. 1992). Nesting habitat is usually located under sagebrush with about 50 percent of the nests within 2 miles of leks (Wallestad and Pyrah 1974, Martin 1970).

Since the 1950s, counts of sage-grouse males on leks have been used to provide an index of relative size and trends of breeding populations of sage-grouse in Montana (Montana Sage-grouse Work Group 2005). Statewide, sage-grouse numbers increased from the mid-1960s through 1973 and fluctuated at about the same level until 1984. Sage-grouse declined rather sharply statewide from 1991 through 1996 and increased through 2000.

Results illustrated in Table 3-41 bear out the general trend of sage-grouse in the Planning Area. Results indicate average male high counts from 2002 to 2004 were lower than those from 1999 to 2001 (Table 3-41).

TABLE 3-40
CHARACTERISTICS OF SAGE-GROUSE SEASONAL HABITATS

Seasonal Habitat	Characteristics
Breeding	Strutting grounds (leks) where breeding actually occurs are key activity areas and most often consist of clearings surrounded by sagebrush cover.
Nesting	Sagebrush (with a combination of shrub [sage-grouse most frequently select nesting cover with a sagebrush canopy of 15 to 31 percent] and residual grass cover) provides for concealment of nests.
Brood-rearing	Relatively open (generally canopy cover from 1 to 25 percent) stands of sagebrush contain an abundance and diversity of succulent forbs. In late summer, sage-grouse often move to moist areas still supporting succulent vegetation, including alfalfa fields, roadside ditches and other moist sites.
Winter	Relatively tall and large expanses of dense sagebrush are present. The importance of shrub height increases with snow depth; thus, snow depth can limit the availability of wintering sites for sage-grouse.

Source: Montana Sage-grouse Work Group 2005.

TABLE 3-41

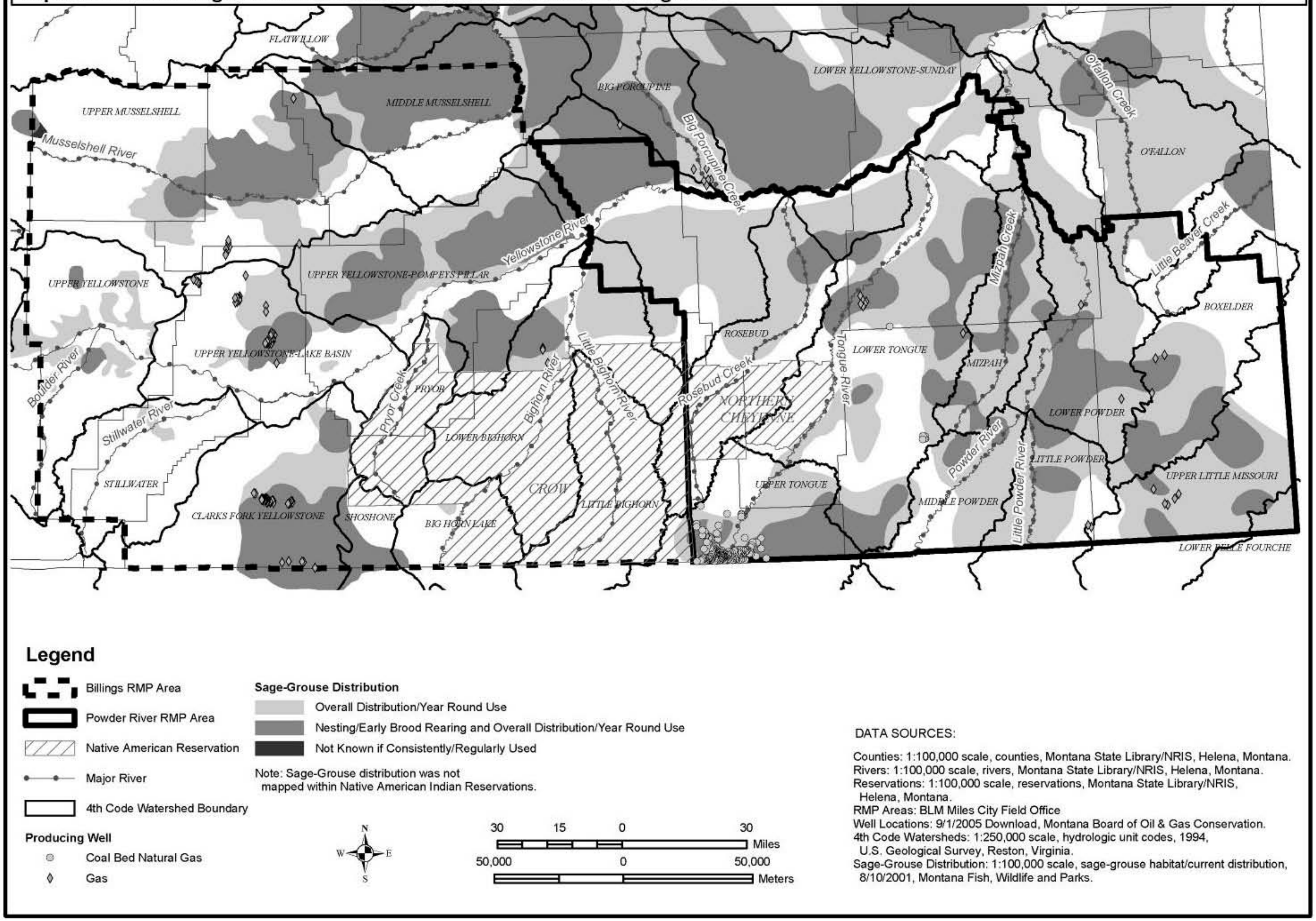
SAGE-GROUSE ACTIVE LEK AVERAGE MALE HIGH COUNTS IN THE PLANNING AREA, 1995 TO 2004

Year	Number of Active Leks Surveyed	Average Male High Count for Active Leks[1]
1995	4	10.3
1996	9	12.1
1997	4	21.0
1998	4	20.0
1999	39	21.4
2000	73	25.2
2001	67	22.2
2002	52	14.0
2003	73	10.3
2004	42	14.0

Source: Montana Department of Fish, Wildlife and Parks (2004).

[1] Values are based on those active leks where at least one male was observed during a given year.

Map 3-16: Greater Sage-Grouse Distribution within the CBNG Planning Area



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Sage-grouse Diet

Sagebrush provides 80 to 100 percent of sage-grouses' winter diet (Wallestad and Schladweiler 1975, Martin 1970, Eng and Schladweiler 1972). Forbs, especially dandelion and salsify and insects are an important dietary component for the juveniles and adults in the spring and summer and wet meadows and other riparian areas are heavily used in the summer as sagebrush areas dry out.

West Nile Virus

West Nile virus (WNV) is a disease transmitted to birds and other animals by the mosquito (*Culex tarsalis*). Mosquitoes can potentially breed in any standing water that lasts more than four days. However, *Culex tarsalis* depends at least somewhat on water bodies with emergent vegetation (BLM 2005b).

Since publication of the Statewide Document, research has indicated that WNV is affecting sage-grouse (Naugle et al. 2004, Walker et al. 2004). A report published by Naugle and others in 2004 indicated WNV reduced late summer 2003 female sage-grouse survival an average of 25 percent in four radio-marked populations in Montana, Wyoming and Canada (Naugle et al. 2004). In the following spring (2004), the researchers discovered breeding sage-grouse populations declined precipitously in an area of northeastern Wyoming with concentrated WNV mortalities the previous summer, whereas unaffected areas showed increased populations (Walker et al. 2004).

Despite regular spring and summer precipitation, researchers confirmed only two WNV mortalities in 2005. The low rates of WNV-related mortality and the low seroprevalence (less than 10 percent) suggests that WNV impacts may be limited by low rates of exposure to the virus rather than to high levels of resistance (B. Walker, e-mail communication, December 1, 2005).

Another study, (Zou, et. al, 2006) shows a 75 percent increase in larval habitats for mosquitoes from 1999 to 2004 as a result of coal bed natural gas water discharge ponds. In addition, 70 percent of all human cases of WNV in 2003 in Wyoming were from the PRB. In a similar, but unrelated, study near Roundup, Montana, researcher Jay Rotella at Montana State University documented that in 2005 three sage-grouse mortalities tested positive for the WNV (J. Sika, e-mail communication, September 16, 2005).

Montana Management Plan and Conservation Strategies for Sage-grouse

The Montana Sage-grouse Work Group, a cooperative membership of state, federal, tribal and private entities, recently prepared a conservation and management plan for sage-grouse in Montana (Montana Sage-grouse Work Group 2005). The plan establishes a process to achieve sage-grouse management objectives and provides a framework to guide local management efforts and coordinated management across jurisdictional boundaries. The overall goal of the plan is to "provide for the long-term conservation and enhancement of the sagebrush steppe/mixed-grass prairie complex within Montana in a manner that supports sage-grouse and a healthy diversity and abundance of wildlife species and human uses. Objectives include maintaining the distribution of sage-grouse populations within the mountain foothills mixed sagebrush and Wyoming big sagebrush-silver sagebrush ecotypes based on a consistently applied monitoring protocol" (p. *ii* of the Plan).

BLM is an active participant in the Montana Sage-grouse Work Group. The agency continues to collaborate with the work group and implement actions to conserve sage-grouse and other sagebrush-associated species. BLM is also an active participant in the southeastern Montana Local Working Group developing plan implementation strategies. BLM has provided funding for a statewide interagency sage-grouse coordinator.

Ongoing Sage-grouse Habitat and Oil and Gas Research

Naugle et.al. (2004) from the University of Montana and Gail Patricelli (2005) from the University of California-Davis are currently conducting studies on the effects of oil and gas development on sage-grouse, including nest success and brood survival. Patricelli's study focuses on the effects of noise from oil and gas development on sage-grouse. Naugle is investigating sage-grouse habitat use and developing sage-grouse habitat models to prioritize landscapes for sage-grouse conservation.

In 2006, Naugle, used satellite imagery to identify priority habitats for sage-grouse in the PRB. This information coupled with digital elevation models and ground verified, identified areas of high value sage-grouse habitat. This mapping used several components, including roughness, sagebrush coverage (height/abundance) and distance from conifers. Much of the recent research conducted by Naugle, et al.

focused on the impact of CBNG development on male sage-grouse attendance on strutting grounds.

Research conducted by Holloran in southwest Wyoming focused mainly on natural gas development in the Jonah Field and the Pinedale Anticline. The research clearly indicated male sage-grouse avoid strutting grounds close to active development. Avoidance was observed to a distance of approximately 6.2 kilometers from active development. Male sage-grouse avoided leks within 2 kilometers of development. Leks within areas of development showed a drop in the number of males, while leks on the edge of development showed increases in male attendance. This increase is possibly due to male displaced from leks within areas of development.

Sage-grouse hens near active development moved twice as far in search of undisturbed nesting habitat as did hens in areas with no development. Holloran also found nest success was lower, the closer hens nested to development.

BLM identified four crucial sage-grouse habitat areas within the study area (see Map 3-18), two of which extend into Wyoming. These areas are considered to be of crucial importance to maintaining viable populations of sage-grouse within the Montana portion of the PRB. The goal was to identify nonfragmented, core habitats in which existing sage-grouse populations could be maintained.

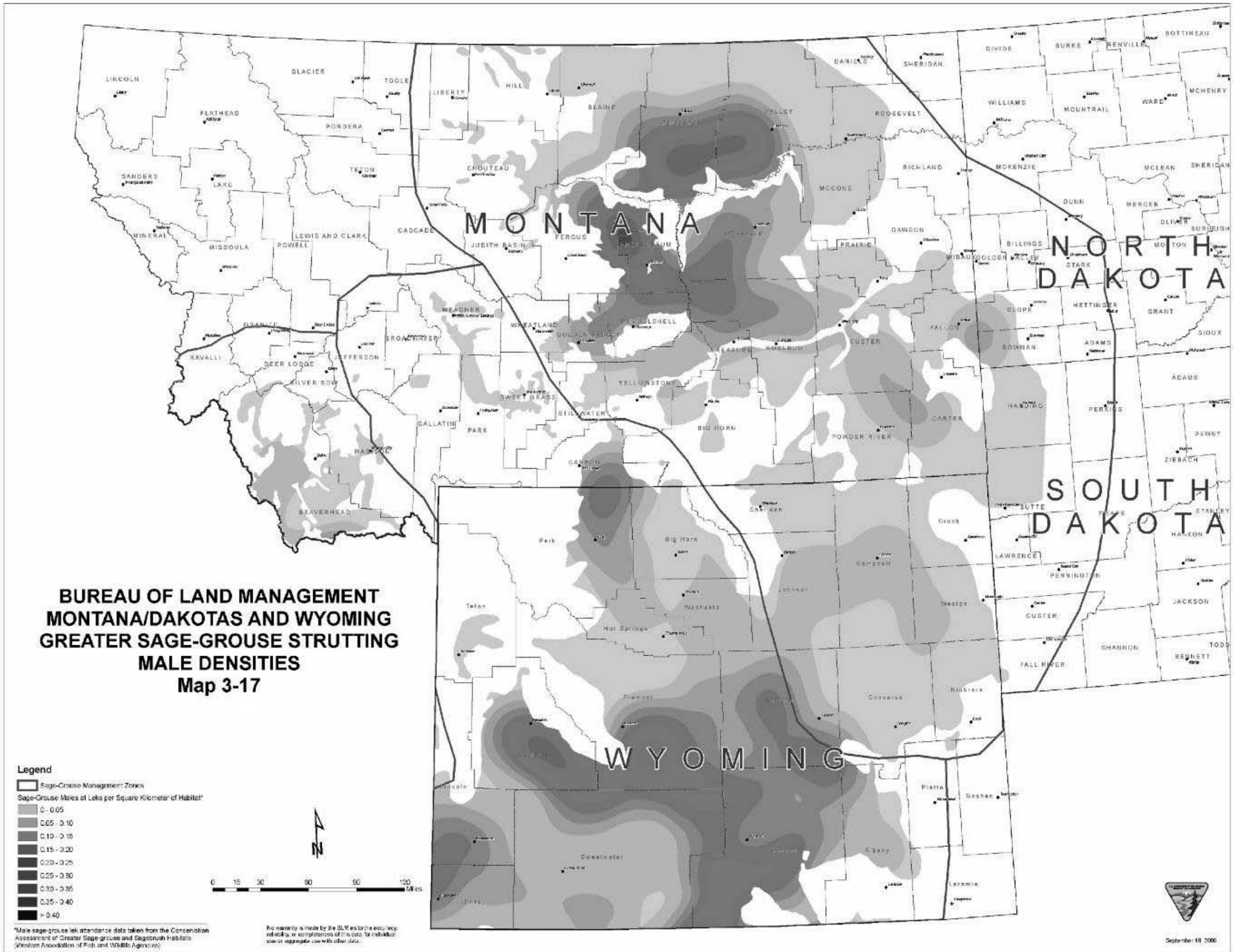
Maintaining core populations is important to conserve sage-grouse throughout this area. Genetic diversity is necessary for the sage-grouse to adapt to changes within its environment. Loss of genetic diversity will limit a population's ability to overcome stressors such as habitat change, disease and climate. Maintaining the ability of the sage-grouse to disperse (corridors) is the most efficient way to ensure genetic diversity. In addition, these small populations may be an important source of birds needed to repopulate those portions of the PRB, once energy development has been competed (personal communication, David Naugle).

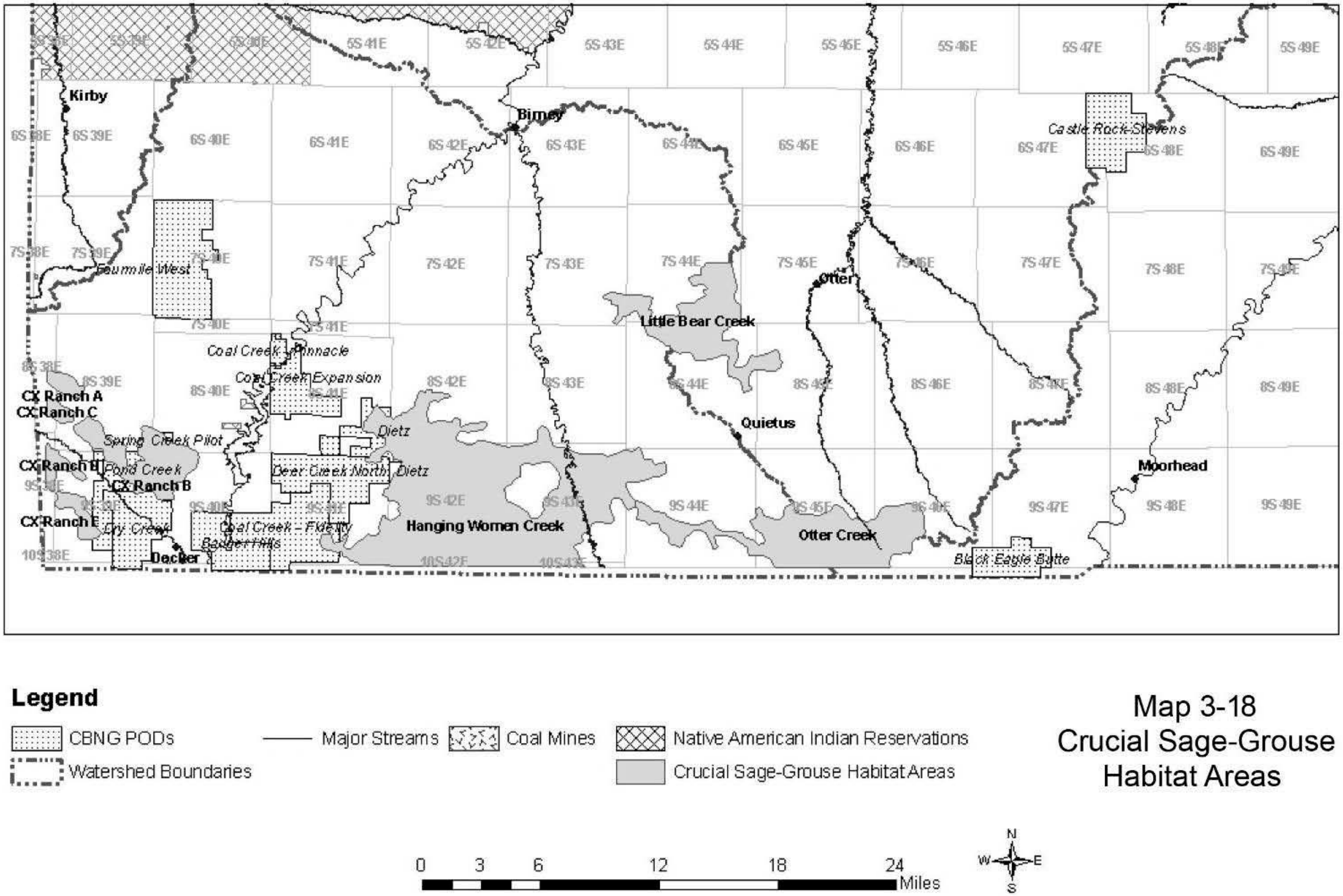
Holloran and Anderson from the University of Wyoming, recently conducted studies on the effects of natural gas development on sage-grouse. This recent research (Holloran and Anderson 2004, Holloran 2005) and ongoing studies specific to CBNG development in the Powder River Basin indicate local populations of sage-grouse will decline unless areas are maintained to provide suitable habitat for all critical life cycle periods (i.e., brood rearing, breeding and wintering).

Mountain Plover

When the Statewide Document was completed, the mountain plover had been proposed for listing as threatened. USFWS withdrew the proposed listing because new information indicated threats to the species included in the proposed listing were lower than earlier believed (USFWS 2003). This species is a BLM sensitive species.

The mountain plover was once widely distributed across short-grass prairies on the western Great Plains, occupying a range extending from Montana to New Mexico and Texas. Conversion of native prairies to agriculture has significantly reduced suitable breeding habitats for this species. It prefers relatively flat sites of short grass. Intensive grazing may be beneficial for mountain plovers and they also regularly occupy prairie dog towns. High arid plains and shortgrass prairie with blue grama-buffalo grass communities are the primary habitat. The mountain plover does not winter in Montana, but may breed within the Planning Area, particularly on black-tailed prairie dog towns. A breeding population is known to exist north of Ingomar, Montana, as well as central, north-central and southwest Montana and is considered transitory in other parts of the state, such as the Greater Yellowstone ecosystem. Blaine and Phillips Counties currently support the bulk of mountain plovers that nest in Montana. No mountain plovers were detected in surveys conducted from 2002 to 2005 in areas of proposed CBNG development in Big Horn, Powder River and Rosebud counties (see the Wildlife Surveys and Monitoring Since the Statewide Document section).


BUREAU OF LAND MANAGEMENT
MONTANA/DAKOTAS AND WYOMING
GREATER SAGE-GROUSE STRUTTING
MALE DENSITIES
Map 3-17
MONTANA
NORTH DAKOTA
SOUTH DAKOTA
WYOMING
Legend
Sage-Grouse Management Zones
Sage-Grouse Males at Leks per Square Kilometer of Habitat*
0 - 0.05
0.05 - 0.10
0.10 - 0.15
0.15 - 0.20
0.20 - 0.25
0.25 - 0.30
0.30 - 0.35
0.35 - 0.40
> 0.40
*Male sage-grouse lek attendance data taken from the Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats (Western Association of Fish and Wildlife Agencies)
0 15 30 60 90 120 Miles
N
No warranty is made by the BLM as to the accuracy, reliability, or completeness of this data for individual use or aggregate use with other data.



Map 3-18
Crucial Sage-Grouse
Habitat Areas

Mammals

Black-tailed Prairie Dog

This species was proposed for listing as threatened on March 25, 1999. On February 3, 2000, USFWS determined the black-tailed prairie dog warranted listing under ESA. USFWS did not propose to list the species at that time due to higher priority species awaiting listing. Since that time, USFWS removed the black-tailed prairie dog from the list of candidate species because it is not likely to become endangered or threatened within the foreseeable future (USFWS 2004). The black-tailed prairie dog is a BLM sensitive species.

The current distribution of black-tailed prairie dogs (*Cynomys ludivicianus*) includes suitable short grass prairie within all but the southwestern most portion of the Planning Area (MFWP 2005). Black-tailed prairie dogs were detected in each of six surveys conducted from 2002 to 2005 in areas of proposed CBNG development in Big Horn, Powder River and Rosebud counties (see Wildlife Surveys and Monitoring Since the Statewide Document section). Although the original abundance of prairie dogs in Montana is unknown, early accounts indicate they were abundant and widely distributed east of the Continental Divide in grasslands and sagebrush-grasslands. This species can colonize a variety of shrub-grassland and grassland habitats. Generally, the most frequently used habitats in Montana are dominated by western wheatgrass, blue grama and big sagebrush and are located in relatively level areas in wide valley bottoms, rolling prairies and the tops of broad ridges. Species with close associations to prairie dogs include black-footed ferrets, burrowing owls, mountain plovers and ferruginous hawks. These are all species of concern.

Wildlife Surveys and Monitoring Since the Statewide Document

Since publication of the Statewide Document, numerous wildlife-related surveys and inventories have been conducted, as described below. Due to adjacent overlapping survey areas, some raptor nests have been inventoried or monitored in more than one POD. Therefore, the total number of raptor nests is not additive in the following inventory or monitoring efforts.

1. **Raptor Nests Inventory and Monitoring in the CBNG Area, 2003 to 2005**

   BLM maintains a database of results from multiple raptor nest surveys conducted from 2003 through 2005. Information from this database identifies 67 nest sites surveyed and monitored from 2003 to 2005 in the CBNG area (Table 3-42).

2. **Ongoing Sage-grouse Studies**

   Male sage-grouse attendance on leks has been surveyed annually, primarily since 2001. Essentially all leks within and directly adjacent to areas of development have been surveyed by BLM MFWP, industry, interest groups and researchers. This information has been provided to and is stored by MFWP.

3. **Fidelity Exploration & Production Company, Montana 2002 and 2003 Drilling Area, Baseline Wildlife Inventory**

   Hayden-Wing Associates (2002) conducted baseline wildlife surveys (raptor nests, prairie dog towns and mountain plover) in 2002 on Fidelity Exploration & Production Company's proposed CBNG drilling areas located in Big Horn County, Montana. Forty-four raptor nest sites were located in the area (Table 3-43). Other survey results included the identification of 11 prairie dog colonies. No mountain plovers were observed.

4. **Fidelity Exploration & Production Company, Big Horn County Black-footed Ferret Surveys**

   Hayden-Wing (2003) conducted black-footed ferret surveys in an area proposed for pipeline installation in Big Horn County, Montana. No black-footed ferrets or their sign were observed.

TABLE 3-42

RAPTOR NESTS SURVEYED AND MONITORED IN THE CBNG AREA, 2003-2005

Species	Total Number of Nests	Active Nests
Red-tailed hawk	41	23
Cooper's hawk	1	1
Golden eagle	5	5
Bald eagle	1	1
Prairie falcon	1	0
Osprey	6	5
Great-horned owl	2	2
Barn owl	1	1
Burrowing owl	8	7
Unidentified raptor	1	0

Source: BLM database raptor nests inventory and monitoring in the CBNG area, 2003 to 2005

TABLE 3-43

RAPTOR NESTS LOCATED IN THE FIDELITY'S MONTANA 2002 AND 2003 DRILLING AREA IN BIG HORN COUNTY, MONTANA 2002

Species	Total Number of Nests	Active Nests (during the May surveys)
Red-tailed hawk	24	7
Golden eagle	6	2
Bald eagle	2	2
Prairie falcon	8	1
Osprey	2	2
Great-horned owl	2	2

Source: Hayden-Wing Associates baseline wildlife surveys (2002)

5. Fidelity Exploration & Production Company, Proposed Coal Creek POD, Big Horn County, Baseline Wildlife Inventory

Hayden-Wing Associates (2004a) conducted baseline wildlife surveys (raptor nests, prairie dog towns and mountain plover) during 2003 on Fidelity Exploration & Production Company's Coal Creek POD located in Big Horn County, Montana. Eleven raptor nest sites were located in the area (Table 3-44).

No bald eagle nests were located within the POD area or 1-mile buffer. One active bald eagle nest was located approximately 10.6 miles from the POD. Bald eagle winter surveys were also conducted in January and December 2003. Fifty-three bald eagles were observed during the January 30th survey. Nineteen bald eagles were observed during the December 2nd survey and ten bald eagles were observed during the December 12th survey, although none of these birds were located within the POD or the 1-mile buffer. During the December 19th survey, 14 bald eagles were located, with one inside the 1-mile buffer and the others outside the buffer. Other survey results include identification of one active double-crested cormorant rookery, one active great blue heron rookery and one black-tailed prairie dog colony. No mountain plovers were observed.

6. Fidelity Exploration & Production Company, Proposed Pond Creek POD and Dry Creek POD, Big Horn County, Black-footed Ferret Surveys

Hayden-Wing (2004b) conducted black-footed ferret surveys in areas proposed for road construction and well development (Pond Creek POD and Dry Creek POD) in Big Horn County, Montana. No black-footed ferrets or their sign were observed.

TABLE 3-44

RAPTOR NESTS LOCATED IN THE FIDELITY'S MONTANA PROPOSED COAL CREEK POD, BIG HORN COUNTY, MONTANA 2002

Species	Total Number of Nests	Active Nests (during the May surveys)
Red-tailed hawk	8	1
Bald eagle	1	1
American kestrel	1	1
Great-horned owl	1	1

Source: Hayden-Wing Associates baseline wildlife surveys (2003)

7. Fidelity Exploration & Production Company, Coalbed Natural Gas Development Areas in Big Horn County, Montana, Wildlife Surveys, 2004

Hayden-Wing Associates (2005) conducted baseline and monitoring surveys for wildlife (raptor nests, wintering bald eagles, sage-grouse, sharp-tailed grouse, prairie dog towns, mountain plover and black-footed ferret) during 2004 on Fidelity Exploration & Production Company's proposed CBNG drilling areas located in Big Horn County, Montana. Seventy raptor nest sites were located in the area (Table 3-45).

In addition, one bald eagle nest was located just outside the 1-mile buffer of the Coal Creek and Pond Creek PODs. Forty-three bald eagles were observed during the three winter surveys. Other survey results include the identification and monitoring of 20 sage-grouse leks, 10 of which were active; 26 sharp-tailed grouse leks, four of which were active; and 29 black-tailed prairie dog colonies. No mountain plovers or black-footed ferrets or their signs were observed.

8. Fidelity Exploration & Production Company, Coalbed Natural Gas Development Areas in Big Horn County, Montana, Wildlife Surveys, 2005

Hayden-Wing Associates (2006) conducted baseline and monitoring surveys for wildlife (raptor nests, wintering bald eagles, sage-grouse, sharp-tailed grouse, prairie dog towns, mountain plover and mule deer) during 2005 on Fidelity Exploration & Production Company's proposed CBNG drilling areas located in Big Horn County, Montana. Seventy-five raptor nest sites were located in the area (Table 3-46).

In addition, one bald eagle nest was located just outside the 1-mile buffer of the Coal Creek and Pond Creek PODs. Seventy-nine bald eagles were observed during the three winter surveys, 46 of which were on or within 1 mile of the PODs. Other survey results include the identification and monitoring of 26 sage-grouse leks, eight of which were active; 29 sharp-tailed grouse leks, six of which were active; and 33 black-tailed prairie dog colonies. No mountain plovers or their signs were observed. A total of 369 mule deer and 168 pronghorn were recorded on and around the Dry Creek POD area during the three winter surveys.

9. Mule Deer Survey on the Southern Portion of the Northern Cheyenne Reservation and Adjacent Public and Private Lands, 2004

Mackie (2004) surveyed mule deer on the southern portion of the Northern Cheyenne Reservation and adjacent public and private lands south of the reservation boundary from April 27 to 29, 2004. The surveys covered approximately 250 square miles. Two hundred forty-seven mule deer were observed, 35 (14 percent) of which were recorded on the Northern Cheyenne Reservation.

TABLE 3-45

RAPTOR NESTS LOCATED IN THE FIDELITY'S COALBED NATURAL GAS DEVELOPMENT AREAS IN BIG HORN COUNTY, MONTANA 2002

Species	Total Number of Nests	Active Nests (during the May surveys)
Red-tailed hawk	37	17
Golden eagle	8	3
Bald eagle	2	2
Prairie falcon	7	0
Osprey	1	0
American kestrel	1	0
Great-horned owl	6	3
Burrowing owl	6	5
Unidentified raptor	2	0

Source: Hayden-Wing Associates baseline and monitoring surveys for wildlife (2004)

TABLE 3-46

RAPTOR NESTS LOCATED IN THE FIDELITY'S COALBED NATURAL GAS DEVELOPMENT AREAS IN BIG HORN COUNTY, MONTANA 2005

Species	Total Number of Nests	Active Nests (during the May surveys)
Red-tailed hawk	33	19
Golden eagle	10	4
Bald eagle	2	2
Prairie falcon	7	1
Osprey	2	1
American kestrel	1	0
Great-horned owl	11	6
Burrowing owl	7	2
Unidentified raptor	2	0

Source: Hayden-Wing Associates baseline and monitoring surveys for wildlife (2005)

10. Raptor Inventory and Monitoring Report, Powder River County, BLM Miles City Field Office 2005

During 2005, raptor monitoring and inventory for the BLM MCFO were conducted in Powder River County. Ninety-seven raptor nests were located in the area (Table 3-47).

11. Raptor Survey and Inventory for Big Horn County, Montana, conducted for BLM Miles City Field Office, 2004

Greystone Environmental (2004a) completed a raptor survey and inventory covering 376,000 acres of suitable nesting habitat (cliffs, rims, buttes, cottonwood/riparian areas, green ash draws, etc.) within Big Horn County, Montana.

Aerial surveys were conducted on two days in May 2004 and ground surveys were conducted over four days in May 2004. Thirty-five raptor nests were located in the area (Table 3-48). In addition, one sharp-tailed grouse lek was documented.

TABLE 3-47

RAPTOR NESTS LOCATED DURING THE POWDER RIVER COUNTY SURVEYS, 2005*

Species	Total Number of Nests	Active Nests	Total Number of Young
Red-tailed hawk	25	24	40+
Golden eagle	14	7	10+
Ferruginous hawk	4	1	N/S
Prairie falcon	5	3	N/S
Great-horned owl	4	3	N/S
Unidentified raptor	45	7	12+

*Source: BLM raptor monitoring and inventory (Greystone Environmental Consultants 2005)

N/S = not specified in report.

TABLE 3-48

RAPTOR NEST FOUND DURING THE BIG HORN COUNTY SURVEYS, 2004

Species	Total Number of Nests	Active Nests	Total Number of Young
Red-tailed hawk	21	10	?
Golden eagle	3	3	6
Bald eagle	1	1	3
Osprey	4	4	?
Great-horned owl	3	3	?
Barn owl	1	1	?
Burrowing owl	1	1	?
Unidentified raptor	1	0	0

Source: Greystone Environmental raptor survey and inventory (May 2004a)

12. Mountain Plover Habitat Evaluation and Survey and Black-tailed Prairie Dog Survey - Big Horn, Powder River and Rosebud Counties, Montana, 2004

Greystone Environmental (2004b) completed a mountain plover habitat evaluation and survey, as well as black-tailed prairie dog surveys, in Big Horn, Powder River and Rosebud Counties. Aerial surveys for black-tailed prairie dogs were conducted over two consecutive days in February 2004 and ground surveys for prairie dogs were conducted over five consecutive days in May 2004. Aerial surveys documented 100 black-tailed prairie dog colonies previously documented by BLM from 2001 to 2003. Four of the colonies previously documented by BLM were not present and 59 new colonies were located. Of the colonies located through aerial surveys, all but eight were active. The ground surveys documented 28 active prairie dog colonies and 5 inactive colonies.

Mountain plover habitat surveys were conducted in May 2004 and surveys for mountain plovers were conducted over five consecutive days during the same month. No mountain plovers were observed and habitat surveyed indicated there was little potential mountain plover habitat in the area.

13. 2005 Bald Eagle Winter Observations in the CBNG area

Hayden-Wing and Associates documented the following wintering bald eagle observations in the CBNG area over four days of surveys in January and February 2005:

- 24 bald eagle observations on January 6
- 15 bald eagle observations on January 25
- 36 bald eagle observations on February 22
- 4 bald eagle observations on February 23

14. 2005 Mule Deer Observations in the CBNG area.

Hayden-Wing and Associates documented the following wintering mule deer observations in the area of Fidelity's CBNG holdings in Bighorn County, Montana over three days of surveys in January and February 2005:

- 95 mule deer on January 6
- 119 mule deer on January 25
- 160 mule deer on February 22

Additional observations included 95 pronghorn on January 6, 57 pronghorn on January 25 and 16 pronghorn on February 22.

15. Coalbed Natural Gas Program Wildlife Monitoring and Protection Plan, 2003 Annual Report

The 2003 annual report for the Coalbed Natural Gas Program Wildlife Monitoring and Protection Plan (Rau 2004) provided information on the following surveys not discussed in previous text:

Breeding Birds

One hundred four bird species were observed in June to August 2002 surveys on the Forks Unit of the Padlock Ranch. Thirty-seven bird species were observed in a June 2001 study in the Decker area. Forty-nine bird species were observed in a different study in the Decker Montana area during the 2002 field season.

Sage-grouse

- BLM completed comprehensive sage-grouse lek surveys in 2003. All known sage-grouse lek locations between the Crow Indian Reservation and the Powder River were aerially searched by helicopter. Forty-two known lek locations were surveyed, with 13 active leks, found with 109 sage-grouse counted.
- BLM completed winter surveys focusing on sagebrush habitats within core CBNG development areas in 2002/03. Approximately 41,000 acres of potential sage-grouse winter habitats were surveyed and eight winter flocks totaling 173 individual birds were observed.

16. Coalbed Natural Gas Program Wildlife Monitoring and Protection Plan, 2004 Annual Report

The 2004 Annual Report for the Coalbed Natural Gas Program Wildlife Monitoring and Protection Plan (BLM 2004a) provided information on the following surveys not discussed in previous text

Bald Eagles

- The Tongue River was surveyed for bald eagle nest occupancy and new territory establishment in spring 2004. Three active nests were located between the Wyoming state line and Birney, Montana. Two of these nests are within current or proposed CBNG project areas. One new territory was identified. However, the nest associated with this territory was apparently abandoned later in the spring.
- BLM conducted three wintering bald eagle surveys between January 14 and March 4, 2004. Preliminary results include sightings of 15, 17 and 50 eagles, respectively, in the three surveys.

Sage-grouse

- A comprehensive landscape-level sage-grouse lek survey was not conducted in 2004. However, all leks within current and near-future CBNG development areas were intensively surveyed. Seven leks were observed in these areas.

Black-footed Ferret

- Project proponents were required to complete black-footed ferret surveys on nine prairie dog colonies totaling 550 acres within CBNG development areas. No ferrets or sign were observed.

17. Coalbed Natural Gas Program Wildlife Monitoring and Protection Plan, 2005 Annual Report, Draft

The Draft 2005 Annual Report for the Coalbed Natural Gas Program Wildlife Monitoring and Protection Plan (BLM 2005b) provided information on the following surveys not discussed in previous text.

Mule Deer

- A second spring mule deer survey was conducted over two days in April 2005 on the southern portion of the Northern Cheyenne Reservation and adjacent public lands. Two hundred twenty-one mule deer were observed. Twenty white-tailed deer and forty-six pronghorn were also observed. Most (mule deer and pronghorn were observed on private and public lands south of the reservation boundary.

Sage-grouse

- Surveys conducted by BLM and contractors for CBNG development companies within the

CBNG development area recorded12 sage-grouse leks, 11 of which were active.

- Winter surveys could not be conducted due to inadequate snow cover.

18. Maximum Number of Males/Lek, CBNG Monitoring, Montana, 2000 to 2005

The Draft 2005 Annual Report for the Coalbed Natural Gas Program Wildlife Monitoring and Protection Plan (BLM 2005b) lists the maximum number of males/leks for 28 sites in the CBNG monitoring area. Each lek site was monitored at least once between 2000 and 2005. For the six leks within POD/mine boundaries, two of the sites were inactive and the maximum number of males for the other four sites ranged from 5 to 55. For the seven leks outside, but within 2 miles of POD/mine boundaries, three of the leks were inactive and the maximum number of males for the other four leks ranged from 8 to 14. For the 15 leks located more than 2 miles from the POD/mine boundaries, 5 were inactive and the maximum number of males for the other 10 sites ranged from 7 to 29.

Aquatic Resources

Aquatic habitat in the CBNG Planning Area that supports, or could potentially support, fisheries and other aquatic resources briefly described in the following paragraph includes rivers, streams, lakes and stock ponds. Extensive information on aquatic habitat and fisheries resources in the Billings and Powder River RMP areas is contained in the Montana NRIS on the Internet at http://nris.state.mt.us/wis/mris1.html (Montana State Library NRIS 2005).

Tables WIL-2 through WIL-4 in the Wildlife Appendix summarize representative Planning Area information from the Montana State Library NRIS (2005) Internet data base. Table WIL-2 summarizes aquatic resources characteristics of major drainages and representative tributaries within the boundaries of each RMP area. These characteristics include drainage length, aesthetics, fisheries management, fisheries resource value, number of fish species present and whether a dewatering problem has been identified. The relative abundances of fish species present in major drainages and representative tributaries are summarized in Table WIL-3 (Billings RMP area) and WIL-4 (Powder River RMP area). The scientific names of fish species discussed in the following text are given in Tables WIL-3 and WIL-4.

While additional fish sampling has occurred in the Planning Area and throughout the state, long-term trends are difficult to identify because scant data exist for baseline biological and ecological conditions. The Statewide Document identified the number of fish species found in the various streams and stream reaches within the Planning Area (Table WIL-2). While additional sampling can identify new or previously unrecorded species in a stream, this is not necessarily an indication of a long-term change or evidence that a species no longer occurs in that stream. Species do not necessarily occupy a stream or stream reach throughout the year, so sample timing can have a substantial influence on sampling results. The particular sampling methods can also influence the results, as each method varies in effectiveness based on environmental conditions and species present.

Only when sampling is conducted in the same reach, at the same time of year and with similar methods can some relative inference be obtained regarding long-term changes. Annual variation can, however, confound even these results. Therefore, while the number of species identified in the various Planning Area streams may have changed since the Statewide Document (see WIL-2), the numbers tend to increase rather than decrease. Such increases result from the identification of previously unrecorded species, while there typically is no definitive information regarding the loss of a species.

Numerous other aquatic resources besides fish are present in Planning Area water bodies. These resources often are important in the diet of various species of fish, or they comprise part of the food web that fish ultimately depend on in their diet. Examples of other aquatic resources include benthic macroinvertebrates and microinvertebrates, zooplankton, phytoplankton, periphyton (attached algae), snails, clams and worms. Numerous taxa of aquatic insects whose distribution and abundance vary with geographic location, habitat type and habitat condition occur in Planning Area drainages. Immature and adult forms of Plecoptera (stoneflies), Ephemeroptera (mayflies), Trichoptera (caddisflies) and Diptera (true flies) are particularly important in the diets of juvenile and adult trout, whitefish and other native fish species.

Fish and other aquatic species listed, proposed, or are candidates for listing as federally endangered or threatened species, or have otherwise been designated as federal or state sensitive species or species of concern, are discussed under Special Status Species in this Aquatic Resources section.

Billings RMP Area

Major rivers and streams in the Billings RMP area are the Yellowstone River and its tributaries in the southern two-thirds of the area and the Musselshell River and its tributaries in the northern one-third of the area. Both of these rivers eventually drain to the Missouri River outside of the RMP area. Major tributaries to the Yellowstone River are the Boulder, Stillwater, Clarks Fork of the Yellowstone and Bighorn rivers. Careless Creek is a major tributary to the Musselshell River. Each of the referenced drainages is characterized by a dendritic pattern of tributaries, with flows ranging from perennial to ephemeral (MBOGC 1989). Examples of other water bodies that provide important habitat for aquatic resources in this resource management plan are Bighorn Lake, Cooney Reservoir, Big Lake, Lebo Lake, numerous mountain lakes at higher elevations and miscellaneous water bodies such as storage reservoirs and stock ponds.

The Billings RMP area drainages listed in Table WIL-2 have been characterized as ranging from “national renown” in the more upstream reaches to “stream and area fair” in some of the downstream reaches (Montana NRIS 2001). Designated fisheries management in these drainages is for trout, except in the Yellowstone River east of Billings (managed for warm/cool water and non-trout species) and in the downstream section of the Clarks Fork of the Yellowstone (managed for non-trout species) (see Table WIL-2). The fisheries resource value in these drainages is outstanding, high, or substantial, except in the Little Bighorn River (moderate value) and Careless Creek (moderate or limited value in some reaches). The greatest numbers of fish species are generally found in the more downstream reaches of larger drainages, with comparatively fewer species present in the more upstream, or upstream reaches of, tributaries. Numbers of fish species present vary from 32 in the Musselshell River, 28 in the Yellowstone River east of Billings, 20 in the Yellowstone River west of Billings, 9 in the Boulder and Stillwater rivers and 8 in the Little Bighorn River (see Table WIL-2).

Table WIL-3 provides detail about the relative abundance of fish species collected from each of the Billings RMP area drainages listed in Table WIL-2. Many of the same fish species are abundant or common in many of these drainages, although there is a pattern, proceeding downstream, of increased species diversity and the replacement of predominantly cold-water species by cool and warm water species. Examples of abundant or commonly occurring game fish in the Yellowstone River west of Billings are rainbow trout, brown trout, mountain whitefish and burbot (ling); abundant or common non-game fish species in this reach of the Yellowstone River include, among others, goldeye, longnose sucker, white sucker, mountain sucker, shorthead redhorse and mottled sculpin (see Table WIL-3).

The same species of trout and whitefish, as well as Yellowstone cutthroat trout and brook trout, also are abundant or common in the Boulder and Stillwater rivers. By comparison, these same species of salmonids are either uncommon in occurrence or absent from the mainstem Yellowstone River east of Billings. Instead, game fish typically associated with cool or warm water regimes—such as channel catfish, northern pike, smallmouth and largemouth bass, yellow perch, sauger and walleye—first appear in river collections or are more abundant than farther upstream (see Table WIL-3).

Fish species present in the Clarks Fork of the Yellowstone and in the Bighorn River generally represent a subset of fish species present in nearby reaches of the Yellowstone River. There are more fish species present in the downstream sections of the Clarks Fork (19 species) and the Bighorn (30 species) than in their upstream sections (12 species in the Clarks Fork and 17 species in the Bighorn) (see Table WIL-2). Rainbow trout, brown trout and mountain whitefish are present in both sections of the Clarks Fork and Bighorn rivers, but these game species are more abundant in the upstream than downstream sections (see Table WIL-3). Yellowstone cutthroat trout also are present in the Clarks Fork and Arctic grayling are present in the upstream section of the Clarks Fork. Other game species present in these two drainages include channel catfish, burbot and sauger in the downstream section of the Clarks Fork and channel catfish, northern pike, burbot, smallmouth bass, sauger and walleye in both sections of the Bighorn River. The Little Bighorn River, which is tributary to the downstream section of the Bighorn River, supports five commonly occurring game fish species, including rainbow trout, brown trout, mountain whitefish, channel catfish and smallmouth bass (see Table WIL-3).

A variety of 32 fish species are present in the Musselshell River within the Billings RMP area (Table WIL-2). More than half of these species have been rated as abundant or common in occurrence in various fisheries studies conducted on this drainage (see Table WIL-3) (Montana NRIS 2001). Examples of game species present in the Musselshell, which is managed as a trout fishery within the RMP area, include brown trout, mountain whitefish, channel catfish, black bullhead, northern pike, smallmouth bass, sauger and walleye. Examples of dominant non-game species present in the Musselshell are goldeye, common carp, sand shiner, flathead chub, longnose dace, longnose sucker, white sucker, mountain sucker, shorthead redhorse and mottled sculpin. The 10 species of fish present in Careless Creek, a tributary to the Musselshell, are dominated by non-game fish, such as lake chub, fathead chub, longnose dace and white sucker. The only game fish reported from Careless Creek is brook trout, which is common in occurrence (see Table WIL-3).

Some of the storage reservoirs and stockponds in the Billings RMP area and in other Planning Area reservoirs and stockponds, have been stocked with various game fish species. Examples include northern pike, largemouth bass, yellow perch, walleye, bluegill, crappie and rainbow trout (MBOGC 1989, BLM 1995). Rainbow trout must be restocked regularly because they will not reproduce in ponds, but other species such as bass, perch, bluegill and crappie may establish self-sustaining populations in ponds.

Water quality in perennial rivers and streams within the Billings RMP area is generally good. Water quality in the Yellowstone River has been rated as good for wildlife uses, while water quality in the Musselshell River has been rated as satisfactory for wildlife uses (BLM 1995). The BLM (1995) also reported that the area's semi-arid climate is not conducive to maintaining fish habitat and populations in most intermittent streams. However, Regele and Stark (2000), citing the Montana Fish, Wildlife and Parks (MFWP), stated that perennial as well as intermittent prairie streams in southeastern Montana are important in the life histories of native fish species and often provide spawning and rearing habitat for mainstem fish species.

Powder River RMP Area

Major rivers and streams that comprise important aquatic habitat in the Powder River RMP area are the Yellowstone River and its tributaries in the western two-thirds of the area and the Little Missouri River and its tributaries in the eastern one-third of the area. All of these rivers eventually drain to the Missouri River outside of the RMP area. Major tributaries to the Yellowstone River are the Tongue (and Tongue River Reservoir), Little Powder and Powder rivers and Rosebud, Pumpkin, Otter, Armells, Hanging Woman and Mizpah creeks. Box Elder Creek is a tributary to the Little Missouri River. The referenced drainages are characterized by a dendritic pattern of perennial and ephemeral tributaries (MBOGC 1989). Examples of other water bodies that provide habitat for aquatic resources in this RMP area are lakes, storage reservoirs and stock ponds.

The Powder River RMP area drainages listed in Table WIL-2 have been characterized as typically ranging from "clean stream and natural setting" to "stream and area fair," although the Powder River varies from "natural and pristine beauty" in the upstream section to "low" in the downstream section (Montana NRIS 2001). Fisheries management in these drainages is primarily for non-trout species, warm/cool water species, or has not been designated. One exception is in the upstream section of the Tongue River, including the 10-mile reach immediately downstream of the Tongue River Dam, where designated fisheries management is for trout.

Relatively cool water released from the Tongue River Dam allows rainbow and brown trout to occupy the upper 10 miles of the reach immediately downstream of the Tongue River Dam. However, high water temperatures, flow fluctuations, predation and habitat conditions limit natural reproduction of these two species throughout much of the rest of the lower Tongue River (BLM 2004b). As a result, these trout populations exist and are maintained with a stocking program by MFWP. The rainbow trout stocking program likely contributes little to natural production, because the natural spring spawning timing has been shifted from the spring to the fall for the hatchery stock. Lack of success for brown trout spawning is due to (1) brown trout migrate downstream during cooler temperatures to feed and then get caught in natural warm stream temperatures and end up perishing below the 10 mile reach that can support trout and (2) there is a limited amount of deep pool habitat for fish to hold over in during low flows. In addition to these two trout species, the reach downstream of the Tongue River Dam supports recreational fisheries for smallmouth bass, sauger, walleye and channel catfish (BLM 2005c, d).

Nineteen fish species recently have been documented in the Tongue River Reservoir and fourteen species occur upstream of the reservoir (BLM 2005c). The primary species occurring in these areas include black crappie, white crappie, walleye, smallmouth bass, sauger, northern pike and channel catfish. In addition, sauger is the only sensitive species in these areas of the Tongue River (BLM 2005c).

The fisheries resource value in most of the Powder River RMP drainages is high, substantial, or moderate, except in some reaches of Pumpkin and Mizpah creeks that have limited fisheries resource value. The greatest numbers of fish species are generally found in the downstream reaches of larger drainages, with fewer species typically present in the more upstream reaches or in smaller tributaries. Numbers of fish species present vary from 40 in the Yellowstone River and 33 in the downstream section of the Tongue River to 13 in the Little Powder River and 18 in the Little Missouri River (see Table WIL-2).

Table WIL-4 provides detail on the relative abundance of fish species collected from many of the Powder River RMP area drainages listed in Table WIL-2. The number of fish species in this reach of the Yellowstone River (40 species) is considerably greater than in the Yellowstone River reach within the Billings RMP area, either east of Billings (28 species) or west of Billings (20 species). The most abundant game fish in the Yellowstone River in the Powder River RMP area are shovelnose sturgeon, paddlefish, channel catfish, burbot, sauger and walleye. Lesser numbers of a wide variety of other game species also are present, such as northern pike, smallmouth and largemouth bass, white and black crappie and rainbow and brown trout. Examples of some of the more abundant non-game species in the Yellowstone River are goldeye, common carp, emerald shiner, flathead chub, river carpsucker, white sucker, shorthead redhorse and stonecat. The federally listed endangered pallid sturgeon occurs rarely in the Yellowstone River within this RMP area (see Table WIL-4).

Species present in tributaries to the Yellowstone River within the Powder River RMP area generally overlap with those species present in the mainstem Yellowstone. However, species composition in the tributaries is less diverse overall, particularly in the smaller drainages and in the upstream sections of drainages (see Table WIL-4). Some of the fish species dominant in the Yellowstone River are also prominent in sections of the Tongue and Powder Rivers include shovelnose sturgeon, channel catfish, sauger, goldeye, common carp, flathead chub, white sucker and shorthead redhorse (Montana NRIS 2002). However, recent sampling found no common carp, shovelnose sturgeon, sauger, shorthead redhorse, or white sucker at any of the four lower Powder River sampling sites in Montana and no goldeye, shovelnose sturgeon, or sauger were found at any of the five lower Tongue River sites (USGS 2005a). While this suggests a decrease in diversity in these reaches, these fish are migratory species that typically occur in the tributary areas only for relatively short periods of time (i.e., spawning periods). Therefore, the inconsistent sampling results are likely due to sampling bias related to the timing of the sampling, as well as the sampling methods used. The size and turbidity of these rivers also contribute to the variable effectiveness of different sampling methods.

Other species present in the Tongue and Powder rivers include northern pike, walleye, several species each of bullheads, sunfishes and crappies in the Tongue River; burbot, green sunfish and walleye in the Powder River; and rainbow and brown trout, which are uncommon in occurrence, in the upstream sections of the Tongue and Powder rivers (see Table WIL-4). Smallmouth bass, a popular cool water game fish, have been captured at various locations throughout the Tongue River and are reported to be abundant in Tongue River Reservoir (Montana State Library NRIS 2002).

Considerably fewer game species are present in the smaller Powder River RMP area tributaries. For example, the only game species reported as common in occurrence are channel catfish, northern pike, burbot and sauger in Rosebud Creek, which drains directly to the Yellowstone; channel catfish in Pumpkin Creek, which is a tributary to the downstream section of the Tongue River; and channel catfish in the Little Powder River, which is tributary to the downstream section of the Powder River (Montana State Library NRIS 2001) (see Table WIL-4). The Little Missouri River, which empties into the Missouri River, contains 18 fish species, including three game species (channel catfish, black bullhead and sauger) (see Table WIL-4).

Since the Statewide Document was completed, additional sampling has occurred within the Powder River RMP area. These results provide more detailed information regarding specific fish species within the Planning Area, as well as areas directly or indirectly affected by CBNG development facilities.

Confluence Consulting (2004) reported only two sturgeon chub at one Wyoming sampling location in the Powder River, while sampling in the early 1990s revealed sturgeon chub at considerably more Wyoming locations. Monthly sampling at 10 Powder River locations in Wyoming, between June and October 2004, resulted in no sturgeon chub collected (Zafft 2005a). However, sturgeon chub were collected at three of four Powder River sites in Montana (USGS 2005b).

Jaeger (2004) also reports the sauger distribution to be limited to the Yellowstone River, downstream of Rosebud Creek, but rare or absent in major tributaries such as Big Horn and Tongue Rivers and a small population is present in the Powder River. Sampling in 2004 and 2005 found no sauger in the Montana or Wyoming portions of the Tongue or Powder Rivers (Zafft 2005a, USGS 2005a). FWP (2005c) also reported that historically, the lower Tongue River facilitated a considerable sauger migration for spawning, but few migration movements have been evident in recent years.

Recent sampling within streams affected by CBNG development has also provided some specific information regarding changes in species composition and biodiversity possibly resulting from such activities. However, the complexity and uncertainties associated with determining biological effects are confounded by numerous factors. These factors include geologic, hydrologic and land use variations throughout the Planning Area. The effects of these factors, as well as their interactions, result in substantial variation in the biological, physical and chemical influences that might occur from CBNG development. Such variations affect the ability to sample the different aquatic habitats effectively and consistently, resulting in substantial uncertainty regarding species composition and distribution (Zafft 2005b). Other confounding factors are drought conditions that have occurred in the region for about the last six years. As a result, there are limited data to assess baseline population conditions accurately or to allow an assessment of potential CBNG effects.

Fish sampling in a number of Tongue River tributaries suggests fish in Squirrel Creek have a substantial potential to be affected by CBNG development, primarily from impoundments located within intermittent and ephemeral draws that flow into the creek (BLM 2005d). The stream has not, however, been assessed to the extent needed to identify the specific cause(s) of habitat changes between sampling sites located upstream and downstream of CBNG development facilities. Despite these uncertainties, the data suggest an increase in dissolved solids and a marked decline in biological integrity ratings between the upper and lower reaches of Squirrel Creek. Conductivity increased by approximately a factor of four, while aquatic invertebrate taxa richness and fish numbers substantially decreased between the upstream and downstream sampling locations in 2002 (BLM 2005d). Preliminary results from sampling in 2004 suggest similar differences between these same sampling locations. While these changes could be the result of natural conditions, dissolved solids were substantially higher in the lower river site compared to 1970.

Sampson (2005) and MFWP (2006) reported the results of fish sampling in 2003, 2004 and 2006 at a number of sites where CBNG extraction was occurring in MFWP Region 7. Sampling occurred once in 2003 and twice (spring and summer) in 2004 and 2005. In addition, four of these sites had historical data compiled by Elser (1980). The recent sampling results indicate a decrease in species at two of these four historically sampled sites (Sampson 2005, MFWP 2006). One site in Pumpkin Creek showed a decrease from 10 to 4 species, with only white suckers occurring both historically and recently. There are currently no CBNG discharges to Pumpkin Creek. In contrast, fathead minnow was the only species captured in all three recently sampled years, but not historically. Confluence Consulting (2003) reported fathead minnow was among the most saline tolerant species in the Tongue River Basin.

Another site showing a substantial decrease in species over time was Sarpy Creek. This site showed a decrease from five species historically to one species (fathead minnow) in 2003 and 2005 (MFWP 2006). There are currently no CBNG discharges to Sarpy Creek. Two other sites (Hanging Woman and Rosebud creeks) showed a similar number of species, both historically and recently. Overall, fathead minnow were captured at most locations and in most years. Fathead minnow were found in 7 of 8 sites in 2003 and in 8 of 10 sites in 2004 and 2005. No other species were captured at more than four sampling sites in any of the three years. In addition, fathead minnow comprised 38 percent of all fish caught in 2004 and more than 72 percent in 2005.

Confluence Consulting (2004) found the Wyoming reach of the Powder River to have a high level of biological, chemical and physical integrity. It also maintained a mostly native assemblage of fish. These fish included flathead chub and sturgeon chub, which Confluence Consulting reported to be declining throughout their historic range.

Confluence Consulting (2004) reported 15 species of fish were captured in the Wyoming portion of the Powder River in 2002 and 2003, with flathead chub, plains minnow and sand shiner the most abundant species at most sampling locations. They also found abundant channel catfish at one location, suggesting some areas are important rearing areas for this species. While sampling in 2004 indicated flathead chub and sand shiner at all 10 Powder River sampling sites (6 in Wyoming and 4 in Montana), no plains minnow were captured (Zafft 2005a, USGS 2005a). Other frequently observed fish in the four Montana reach sites were channel catfish (four sites), plains killifish (three sites), river carpsucker (three sites) and longnose dace (two sites) (USGS 2005a).

Skaar et al. (2005) reported the presence and absence of native fish at six sites in the Powder River Basin, relative to where they would be expected to occur based on historic distributions and habitat conditions. They found sand shiner, white sucker and flathead chub at all the sites where they were expected to occur (and at least five of the six sites). However, lake chub, sauger and goldeye were found at fewer than 50 percent of the expected locations. Results from the Tongue River Basin were similar, although fathead minnow and mountain sucker were also absent from more than half of the areas where they were expected. This apparent widespread decline in the distribution of some native fish species suggests that a number of environmental factors may be affecting the presence of native fish in southeastern Montana.

While some data suggest that CBNG development might be affecting aquatic resources, a number of other factors also likely contribute to these apparent resource changes. These factors include coal mining, livestock grazing, agriculture/irrigation, dams/reservoirs, residential development and existing transportation systems (BLM 2004b, 2005d). No data are available, however, to quantify the effects of any of these factors on aquatic resources in the Planning Area. Drought conditions over the past several years also likely affected aquatic resources in the Planning Area.

Regarding other aquatic resources Confluence Consulting (2004) reports that the Powder River in Wyoming supports several rare macroinvertebrate species, which have been extirpated in other areas due to river modifications throughout the northern Great Plains. It also observed a marked decline in species diversity between samples obtained in the 1970s and 2002.

Aquatic invertebrate sampling was conducted at two sites on the Tongue River in 2003, near the state line and at Brandenburg Bridge. These data indicate ephemeroptera (mayfly) was the most abundant invertebrate species (62 percent and 49 percent at the two sites). Other abundant species included Diptera (12 percent) and Coleptera (11 percent) at the state line site and Tricoptera (27 percent at Brandenburg Bridge (BLM 2005c).

The Aquatic Biota Monitoring Plan (November 9, 2006) has been developed by an aquatic task group for Montana and Wyoming. Members include representatives from BLM, MFWP, Wyoming Game and Fish, EPA, MDEQ, WYDEQ, MSU, USFWS and Montana Natural Heritage. The Aquatic Biota Monitoring Plan was developed in 2005 and has been implemented for aquatic species from 2005 to present. The plan addresses fish, macro-invertebrates, peryphyton, water quality, habitat, amphibians and reptiles. Monitoring results are not available at this time. However, preliminary research indicates the following.

Recent experiments have shown that increased concentrations of a salt compound (sodium bicarbonate) typically occurring in CBNG-produced water may be more toxic to some fish than previously estimated (Skarr et al, 2005). These data indicate significant mortality of newly hatched fathead minnow at concentrations greater than 400 mg/L. In contrast, similar experiments with white suckers indicated improved hatching and early survival at concentrations as high as 1,400 mg/L compared to control groups. Fifty percent mortality of white suckers occurred, however, at a concentration between 4,049 and 6,678 mg/L (Skarr et al. 2005). By comparison, CBNG wells in the Tongue and Powder River basins may average concentration of about 1,000 to 1,500 mg/L (Skarr 2006).

The Aquatic Biota Monitoring Plan will use a weight-of-evidence approach to determine effects on aquatic species. Triggers that would indicate a need for change in management would include the following: (1) fish kill, (2) losing or gaining species of fish, (3) gaining invasive species, (4) decrease in spawning runs, (5) acute and chronic toxicity of ions, (6) instream habitat loss, (7) avoidance of certain habitat types due to CBNG discharge, (8) large increases or decreases in temperature and (9) decrease in the score of 15 to 20 points for the index of Biological Integrity for fish assemblages (Bramblett et al. 2005). Information on aquatics monitoring is found in the Monitoring Appendix, Table MON-1.

Water quality conditions and concerns in perennial, intermittent and ephemeral drainages in the Powder River RMP area are generally similar to those described for drainages in the Billings RMP area. Water quality in the Yellowstone and Powder rivers has been rated as good for wildlife uses (MBOGC 1989).

Elser et al. (1980) reported the results of extensive fisheries investigations conducted on numerous large and small drainages in southeastern Montana. The authors found that the lower Yellowstone River in this part of the state supports a diverse, productive fishery that is dependent on adequate flows and good water quality.

Elser et al. (1980) reported that in the Tongue River, fish populations range from a cold water-mixed population immediately downstream of the Tongue River Dam to an assemblage of slow-water species downstream near the river's mouth. They added that migrant fish species from the Yellowstone River depend on high spring flows to allow good passage into the Tongue River. Elser et al. (1980) noted that fish populations in the Powder River are limited in diversity and abundance because of water quality and water quantity conditions. Fish populations are probably limited for similar reasons in the Little Missouri River, which Elser et al. (1980) described as having highly erratic flows, fair to poor water quality, very hard water and moderate to high turbidities.

Special Status Species

Many federally listed threatened, endangered, or candidate species of special concern exist in the Planning Area and are given special consideration under Section 7(c) of the ESA of 1973. As required by the ESA, the USFWS has provided a list of endangered, threatened and proposed species that may be present in the Planning Area. This section reviews the habitat requirements of the one special status aquatic species identified by the USFWS (Table 3-49), as well as the likelihood of them being found in the 13 counties that may be potentially affected by this project.

While USFWS found that Yellowstone cutthroat trout did not warrant listing under ESA in 2001, a recent court ruling resulted in another status review to determine whether to propose listing the species as threatened or endangered (USFWS 2005a). This review process was completed in February 2006 with a determination that Yellowstone cutthroat trout did not warrant listing under ESA.

In addition to the federal special status species, seven other fish species expected to occur in the Planning Area are listed as sensitive species by BLM (Table 3-49). Sturgeon chub were, however, the only sensitive species captured in recent sampling in the Tongue and Powder River Basins (USGS 2005a, Zafft 2005a).

Montana Arctic Grayling

This species is a candidate for listing under the ESA. On October 2, 1991, a petition requested that the "fluvial Arctic grayling" be listed as an endangered species throughout its historic range in the lower 48 states. The petitioners stated the decline of the fluvial Arctic grayling was a result of many factors, including habitat degradation as a result of the effects of domestic livestock grazing and stream diversions for irrigation, competition with nonnative trout species and past overharvesting by anglers.

TABLE 3-49
SPECIAL STATUS AQUATIC SPECIES PRESENT IN THE CBNG PLANNING AREA

Common Name	Scientific Name	Habitat in Montana	Federal Status*
Montana Arctic grayling	*Thymallus arcticus*	Fluvial populations in the cold-water, mountain reaches of the Upper Missouri River	S
Pallid sturgeon	*Scaphirhynchus albus*	Bottom dwelling fish of the Missouri and Yellowstone rivers	E
Blue sucker	*Cycleptus elongatus*	Large rivers like the Missouri and Yellowstone, but spawn in tributaries	S
Northern redbelly X Finescale dace	*Phoxinus eos x P. neogaeus*	Boggy lakes, creeks and ponds, often with cool, dark-colored water	S
Paddlefish	*Polyodon spathula*	Calm open water of large rivers, such as the Missouri and Yellowstone Rivers	S
Pearl dace	*Semotilus/Margariscus margarita*	Cool or cold water lakes, bog ponds, creeks and springs	S
Sauger	*Sitzostedion canadense*	Large turbid rivers and shallow turbid lakes	S
Sturgeon chub	*Macrhybopsis gelida*	Turbid rivers with moderate currents and depths and sand or rock substrates	S
Yellowstone cutthroat trout	*Oncorhynchus clarki bouvieri*	Relatively clear, cold streams, rivers and lakes	S

*E = Federal Endangered; C = Federal Candidate; S = BLM Sensitive.

Additionally, the petition stated that much of the annual recruitment is lost in irrigation ditches. Historically, this species was widely, but irregularly, distributed and locally abundant above Great Falls in the upper Missouri River drainage in Montana (USFWS 1994c).

In 2007, USFWS determined the following: "currently available genetic information indicates fluvial Arctic grayling of the upper Missouri River drainage do not differ markedly in their genetic characteristic from adfluvial (lake or reservoir dwelling) Arctic grayling native to the Missouri River system. The fluvial Arctic grayling, therefore, is not considered biologically or ecologically significant based on genetics... Because the Service is unable to conclude at this time that the fluvial Arctic grayling populations of the upper Missouri River is significant, it does not qualify as a distinct population segment and is not a listable entity under the Act."

Pallid Sturgeon

This species was listed as endangered on September 6, 1990 (55 FR 36641). They evolved in large rivers with high turbidity and a natural hydrograph consisting of spring flooding and other natural highwater events. Historically in Montana, they occupied reaches of the Missouri River from Fort Benton downstream and in the Yellowstone River from about Forsyth (RM 183) to the Missouri River (USFWS 1993, Montana NRIS 2005). There are three priority recovery management areas in Montana, two on reaches of the Missouri and one on the Yellowstone River.

Blue Sucker

USFWS listed the blue sucker as a Category 2 species in 1994 and it was listed as a species of concern by the state of Montana in 1996. This species may be susceptible to population declines in Montana due to its slow maturity, relatively low recruitment rate, migratory life history and reliance on high flows in tributary streams for spawning. The blue sucker is found in the Missouri and Yellowstone Rivers, although blue suckers have also been found in many of the major tributary streams during their April to June spawning season. They prefer main channel swift water habitats. Where extensive riverine habitat losses and population isolation have occurred due to impoundments, however, major population declines and population fragmentation have resulted. In

Montana, the blue sucker is present in most places with available habitat. They are an indicator species for ecosystem health because of their habitat-specific requirements.

Northern Redbelly x Finescale Dace

The northern redbelly x finescale dace hybrid is designated as a species of special concern in Montana, primarily due to its limited distribution. This unique species consists only of female fish, as the hybrid female breeds with redbelly dace males, but the genetic material of the redbelly dace is not passed on to the progeny. Thus, the progeny are clones of the female. Northern redbelly and finescale dace prefer quiet water habitat in beaver ponds, bogs and clear streams, although finescale dace are also found in larger lakes and reservoirs. The northern redbelly x finescale dace hybrid has a relatively limited distribution in the Planning Area, primarily in the Yellowstone River drainage

Paddlefish

The paddlefish is a mostly cartilaginous fish with smooth skin and is closely related to the sturgeon. Males mature at about age 9 or 10, while females mature at age 16 or 17. Montana is home to one of few remaining self-sustaining populations. These long-lived game fish have low reproductive rates, making them susceptible to the effects of habitat loss and recreational harvest. Because of its biological vulnerability, it was listed as a sensitive species in Montana in 1979. Paddlefish are more commonly found seasonally in the Upper Missouri River during the spawning season (May to July). In or near the CBNG Planning Area, they are found in the lower Missouri and Yellowstone Rivers. Paddlefish spawn during high water periods in late spring (May to June).

Pearl Dace

Pearl dace likely have a relatively limited distribution in the CBNG Planning Area. They have been found primarily in small, cold tributaries north of the Missouri River, with limited observations in the lower Yellowstone River. They are designated as a species of special concern in Montana, primarily because of their limited distribution. Pearl dace mature in two years and they spawn during the spring in clear water from 1 to 2 feet deep, over gravel and sandy substrate.

Sauger

The sauger is a game fish added to the Montana species of special concern list in June 2000 because of the recent widespread declines in populations throughout Montana. This designation recognizes sauger as vulnerable to relatively minor disturbances to its habitat and deserving of careful monitoring as to its status. A severe decline in sauger numbers was first noticed in 1989 and populations have remained low. Sauger fingerlings depend on normal summer flows for maintaining adequate nursery habitat in side channels and backwater areas. A combination of drought years, flow control from the upstream dams and lack of woody cover in the rivers have contributed to poor conditions for the survival of young sauger (Jaeger 2004). Adult sauger inhabit sand and gravel runs or sandy and muddy pools and backwater areas in small to large river systems. The sauger distribution within the Planning Area is limited primarily to the larger rivers and streams.

Sturgeon Chub

The sturgeon chub is indigenous to the Missouri-Mississippi River Basins from Montana to Louisiana. The sturgeon chub is classified as a species of special concern in Montana because of its limited numbers and/or habitat, although recent data show this species has a wide distribution in the Missouri, Yellowstone and Powder Rivers in Montana.

The biology of the sturgeon chub is not well known. It apparently spawns from June through July in waters from about 64 to 75 degrees (°F) (18 to 25° C). Chub are most closely associated with sites having moderate currents and depths and sand or rock substrates and they appear to be highly adapted to life in turbid waters. The major threat to the sturgeon chub is thought to be habitat alteration by dam and irrigation operations, as well as development. Low stream flows probably have eliminated some peripheral sturgeon chub populations, but dewatering poses little threat to the core populations of chubs in the Missouri and Yellowstone Rivers.

This species has persisted in the Powder, Yellowstone and Missouri Rivers during the recent years of drought in Montana, as well as in a few isolated tributaries. Recent sampling in the Tongue and Powder River Basins revealed the presence of sturgeon chub at only three sites in the lower Powder River (USGS 2005).

Yellowstone Cutthroat Trout

The Yellowstone cutthroat trout is one of two cutthroat trout subspecies in Montana and, as the name implies, is native to the Yellowstone River drainage of southwest and south-central Montana. Originally its range was as far downstream as the Tongue River, but today pure, unhybridized populations are limited to some headwaters streams and Yellowstone National Park.

The complex life-history behavior of many Yellowstone cutthroat trout populations requires movement among diverse habitats. Hence, disruptions in habitat quality or availability may reduce their diversity or lead to extinction of isolated populations.

Hybridization with non-native fish species is, however, considered the greatest threat to the persistence of Yellowstone cutthroat trout. The influence of other non-native organisms also threatens the persistence of Yellowstone cutthroat trout. Yellowstone cutthroat trout are susceptible to infection by *Myxobolus cerebralis*, a European protozoan and the causative agent of whirling disease (AFS 2005).

Other factors affecting Yellowstone cutthroat trout include irrigation, dam and culvert barriers, poor reservoir habitat, river channelization and rip rap, grazing, mining, logging and road building. Unfortunately, most remaining populations in Montana are isolated and are at risk of extinction from natural and human-caused events (AFS 2005).