3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

The Affected Environment for the proposed Red Rim project discusses environmental, social, and economic factors currently existing within the Red Rim Project Area (Project Area). The Project Area includes the Red Rim Plan of Development (POD), and the pipeline corridor, which extends northeast from the proposed well locations toward Rawlins. The material presented here has been guided by management issues identified by the RFO, by public scoping, and by interdisciplinary field analysis of the area.

The critical elements, as listed in BLM's NEPA Handbook H-1790-1 (BLM 1988b), and other resource elements of the human environment have been considered. The elements of the human environment, including critical elements, their status in the Project Area, and their potential to be affected by the proposed project, are listed in **Table 3-1**. Those items listed as "none present" would not be affected by the project or the No Action alternative and are not addressed further in this document.

TABLE 3-1 ELEMENTS OF THE HUMAN ENVIRONMENT, RED RIM PROJECT ATLANTIC RIM INTERIM DRILLING PROGRAM CARBON COUNTY, WYOMING – 2003

Element	Project Area Status	Addressed in Text
Geology/Minerals/Paleontology	Potentially affected	Yes
Climate and Air Quality	Potentially affected	Yes
Soils	Potentially affected	Yes
Water Resources (including surface and groundwater quality)	Potentially affected	Yes
Vegetation, Wetlands, and Noxious Weeds (including riparian zones, invasive species, threatened, and endangered, and special status species)	Potentially affected	Yes
Range Resources and Other Land Uses	Potentially affected	Yes
Wildlife/Fisheries (including threatened and endangered species, and special status species)	Potentially affected	Yes
Recreation	Potentially affected	Yes
Visual Resources	Potentially affected	Yes
Cultural Resources	Potentially affected	Yes
Socioeconomics	Potentially affected	Yes
Environmental Justice	Potentially affected	Yes
Transportation	Potentially affected	Yes
Health and Safety	Potentially affected	Yes
Noise	Potentially affected	Yes
Areas of Critical Environmental Concern	None present	No
Prime or Unique Farmlands	None present	No
Floodplains	None present	No
Native American Religious Concerns	Potentially affected	Yes
Hazardous or Solid Wastes	Potentially affected	Yes
Wild and Scenic Rivers	None present	No
Wilderness	None present	No

3.2 GEOLOGY, MINERALS, AND PALEONTOLOGY

3.2.1. Physiography, Topography, and Landforms

The Project Area occupies the southeastern portion of the Greater Green River Basin, a large intermontane structural and topographic basin that is part of the Wyoming Basin Physiographic Province. The Project Area is located in an area of northwest/southeast trending ridges that have been greatly dissected by several small drainages of Hadsell Draw. Landforms consist of ridges, finger ridges, knolls, hills, and gentle to moderate slopes. Elevations range from 6,200 feet to 7,630 feet (Hatcher 2003). Carbon County Road 605 (Twentymile Road) connects the Project Area with Rawlins, which is located 8 miles to the northeast.

3.2.2. Geology

The Greater Green River Basin began developing about 70 million years ago and filled with sediments eroded from surrounding highlands and mountains during the late Cretaceous and early Tertiary. The Project Area lies within the southeastern part of the Great Divide Basin, a sub-basin of the Greater Green River Basin, and is near the Continental Divide, which forms the eastern limit of the Greater Green River Basin. The Continental Divide splits around the Great Divide Basin, and isolates it as a closed, interior drainage basin. Therefore, any water entering the basin is contained within it.

Sub-basins within the Greater Green River Basin are separated by uplifts caused by the deformation of basement rock, which consists of a complex of Precambrian metamorphics and intrusives. At the surface, structural features define the margins of the basin. These structural features include the Wind River Range and the Green Mountains to the north, the Rawlins Uplift to the east, and the Rock Springs Uplift to the west. The Washakie Basin is south of the Great Divide Basin, and is separated from it by the Wamsutter Arch. The east-west trending Cherokee Ridge along the border between Wyoming and Colorado forms the southern limit of the Washakie Basin and separates the southeastern portion of the Greater Green River Basin of Wyoming from the Sand Wash Basin of Colorado. (GHEP 2003)

Late Cretaceous rocks exposed at the surface and underlying the Project Area consist of a complex sequence of sedimentary units, including sandstone, shale, coal, and carbonaceous shale. The Upper Cretaceous Lance Formation, which consists of interbedded gray sandstone and mudstone, carbonaceous shale and coal of alluvial origin (GHEP 2003), is exposed at the surface in the Project Area. The Lance Formation is underlain by the nonresistant Lewis Shale of late Cretaceous age.

The Lewis Shale is exposed at the surface along Hogback Ridge, just south of the Project Area (Colorado School of Mines 1999). This formation consists of a thick sequence of shale, siltstone, and sandstone that accumulated in deltaic, interdeltaic, and marginal marine environments within a shallow epicontinental sea that extended northward from the Gulf of Mexico to the Arctic Ocean in the Maestrichthian (Winn et al. 1985a, 1985b, 1985c). These

sediments were derived from thrust belts to the west. The Lewis Shale is underlain by 12,000 feet of sedimentary rock, which in turn lies on basement rock.

The Cretaceous seaway retreated eastward, and the marine deposits of the Lewis Shale were replaced progressively upward by beach, estuarine, and continental deposits that spread westward in response to the Sevier and Laramide orogenies. The Laramide orogeny resulted locally in the uplift of the Sierra Madre Mountains and the subsidence of the Great Divide Basin. The basin was subsequently filled with Paleocene deposits of the Fort Union Formation, and later, with Eocene deposits of the Wasatch Formation.

In places atop modern terraces and buttes, these consolidated sedimentary rocks are overlain by a thin veneer of much younger, unconsolidated sediments of Quaternary age. These sediments include alluvium, colluvium, stream terrace gravels, and wind-blown sands that are late Pleistocene to Holocene in age.

Underlying the Lewis Shale at depth in the Project Area is the Mesaverde Group, which contains massive beach and shelf sandstones with abundant carbonaceous shale and coal. Resistant sandstone beds of the Mesaverde Group form the Atlantic Rim escarpment located immediately east of the Project Area.

The Mesaverde Group includes the Almond Formation, the Pine Ridge Sandstone, and the Allen Ridge Formation, which contain numerous thin coal seams (GHEP 2003, Roehler 1990). The coal beds within these formations are targeted as exhibiting the greatest potential for natural gas production in the Atlantic Rim area. The lateral continuity of the coal seams is variable (Hamilton 1993). Geophysical logs from test wells within the Atlantic Rim EIS study area indicate that the coal beds are somewhat discontinuous laterally; however, data to correlate the coal seams are limited.

3.2.3. Mineral and Energy Resources

The three primary mineral commodities that occur in Carbon County are coal, natural gas, and oil (Hoffman and Nunley 2000). Mineral development in the Project Area has been limited to natural gas and oil. Additional mineral resources near the Project Area include coal, uranium, construction aggregate, and geothermal resources.

The Great Divide Basin has been explored and developed for oil and gas resources for many years. Production has been proven in a number of formations; however, Cretaceous-age formations have been the most productive. The coal beds of the Mesaverde Group, underlying the Lewis Shale, are the objective for the proposed exploratory gas wells. Existing and authorized gas wells and facilities in the Project Area are listed in Table 2-1. One abandoned well, the Mesa Federal 1, is located within the Project Area. This conventional oil well was plugged and abandoned in 1975.

Coal reserves in the Greater Green River Basin have been estimated at nearly 1,300 trillion tons (Scott et al. 1995). Coal occurs primarily in the Allen Ridge, Pine Ridge, and Almond Formations within the upper part of the Mesaverde Group. The coal is sub-bituminous to

high-volatile C bituminous in rank (Tyler et al. 1995). Significant quantities of natural gas also are associated with coal seams in other formations of the Mesaverde Group and the Fort Union Formation. Scott (et al. 1994) estimated total reserves of natural gas in the Greater Green River Basin at 300 trillion cubic feet. Two nearby gas fields have been explored for coal bed natural gas (CBNG) resources: the Dixon Field (T12N R90W), and the Cow Creek Field (T16N R92W); both target coal seams in the Mesaverde Group.

3.2.4. Geologic Hazards

Potential geologic hazards include landslides, subsidence, and known or suspected active faults. No known active faults with evidence of Quaternary movement or earthquake epicenters occur within the Project Area (GHEP 2003). Landslide potential is greatest in areas where steep slopes occur, particularly where rock layers dip parallel to the slope, or where erosional undercutting may occur. Landslides occur east of the Project Area in steeper regions of the Sierra Madre Mountains, but none have been mapped in the Project Area (Case et al. 1991). Slope gradients in the Project Area are gentle to moderate. Unstable soils in steep areas may be susceptible to slumping, sliding, and creeping.

An earthquake that measured 4.3 on the Richter scale occurred on April 4, 1999, southwest of the Project Area, with its epicenter near Baldy Butte in T17N R92W (41.45°N, 107.74°W). No other earthquake epicenters have been recorded in or immediately adjacent to the Project Area in the past 100 years.

No subsidence hazards or features with potential for subsidence are known to exist within the Project Area.

3.2.5. Paleontology

Paleontological resources include the remains or traces of any prehistoric organism that have been preserved in the earth's crust by natural processes (BLM Information Bulletin WY-93-371). Within sedimentary deposits in the Project Area, paleontological resources serve as a record of the history of animal and plant life in Wyoming during the Late Cretaceous Period. The Lewis Shale represents this period and is known to yield scientifically significant vertebrate fossils in several areas of Wyoming. However, no specific localities have been reported within the Project Area.

Fossils of scientific interest may occur within or in association with energy minerals such as coal, oil shale, lignite, bitumen, asphalt, and tar sands. They may also occur with industrial minerals such as phosphate, limestone, diatomaceous earth, and coquina. Fossils of scientific interest include those of interest to professional paleontologists and educators, or any vertebrate fossil. If other types of fossils are discovered in the Project Area, the BLM state director and field managers, in consultation with BLM staff paleontologists or other source of expertise, may consider them of scientific interest.

Fossils known from the Lewis Shale represent a large and varied marine invertebrate fauna, including many genera of bivalves, baculites, scaphites, and ammonites and isurid shark teeth (Breithaupt 1985; Gill et al. 1970). Significant fossils are known from the Lewis Shale from some areas of Wyoming. Still, the potential for discovery of scientifically significant fossils in the Project Area is considered moderate to low when compared with other Late Cretaceous age formations in Wyoming.

3.3 CLIMATE AND AIR QUALITY

3.3.1. Climate

The Project Area is located in a semiarid, upland climate regime of the Northern Great Plains that is typified by dry, windy conditions with limited rainfall, and long, cold winters. The nearest meteorological measurements were collected at Rawlins, Wyoming (1951 to present), 14 miles northeast of the Project Area, at an elevation of 6,736 feet (WRCC 2003).

The average annual precipitation at Rawlins is 9.21 inches, ranging from 4.90 inches (1954) to 12.63 inches (1998). An average of 51.9 inches of snow falls during the year (the annual high was 89.7 inches in 1980), with January and March being the snowiest months. In the Project Area, average annual precipitation is about 13 inches, as recorded near U.S. Geological Survey (USGS) gaging station 09216527. Approximately half the annual precipitation occurs during the growing season, from April through June.

Temperatures are generally cooler, frost-free periods are shorter, and both precipitation and snowfall are greater at higher elevations. The region is typically cool, with average daily temperatures ranging between 5 ºF (low) and 33 ºF (high) in mid-winter and between 48 ºF (low) and 86 ºF (high) in mid-summer. Extreme temperatures have ranged from –50 ºF to 100 ºF (both occurring in 1984). The frost-free period (at 32 ºF) generally occurs from mid-May to mid-September.

Mean annual evaporation ranges from 38 inches (lake) to 55 inches (pan) and potential annual evapotranspiration is 18 inches (U.S. Department of Commerce 1979). Compared with the average annual precipitation of 13 inches, this mean annual evaporation yields an average annual deficit of 6 inches. These characteristics of the Project Area combine to produce a predominantly dry climate where evaporation exceeds precipitation.

The Project Area is subject to strong and gusty winds, reflecting channeling and mountain valley flows caused by the complex terrain. During the winter, strong winds are often accompanied by snow, producing blizzard conditions and drifting snow. The closest comprehensive wind measurements are collected at the airport in Rawlins, Wyoming, about 14 miles northeast of the Project Area. However, hourly wind measurements for December 1994 through November 1995 were collected near Baggs, Wyoming, during the Mount Zirkel Wilderness Area Visibility Study. Based on the data collected at Baggs, winds originate from the south to southwest nearly 37 percent of the time, and the annual mean wind speed is nearly 10 mph.

3.3.2. Air Quality

The National Ambient Air Quality Standards (NAAQS) and the Wyoming Ambient Air Quality Standards (WAAQS) set the upper limits for concentrations of specific air pollutants. Incremental increases in the ambient concentration of criteria pollutants are regulated under the Prevention of Significant Deterioration (PSD) program. The program is designed to limit the incremental increase in concentrations of specific air pollutants above a legally defined baseline level, depending on the classification of a location. The Project Area and adjacent areas are identified as PSD Class II where incremental increases are not as restrictive compared with the incremental increases allowed in PSD Class I areas.

Emissions are limited within the Project Area, with only a few industrial facilities and residential sources in the relatively small communities and isolated ranches. In addition, the good atmospheric dispersion conditions in the Project Area are expected to result in low concentrations of criteria air pollutants. Although criteria air pollutants have not been monitored in the Project Area, background values measured in the region are well below the NAAQS, WAAQS and the Colorado Ambient Air Quality Standards (CAAQS). Standards have been established for six criteria air pollutants, including carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 10 microns in effective diameter (PM_{10}), sulfur dioxide (SO_2), and lead (Pb).

The Wyoming Department of Environmental Quality, Air Quality Division (WDEQ AQD 1997) and Colorado Department of Public Health and Environment, Air Pollution Control Division (CDPHE APCD 1996) provided data on the background concentration of air pollutants, with the exception of lead. Inferred background concentrations of air pollutants, applicable WAAQS and NAAQS, and Class I and II increments (measured in micrograms per cubic meter, or $\mu g/m^3$) are provided in **Table 3-2**. Values included in **Table 3-2** reflect the most recently available air quality monitoring data collected near the Project Area. An estimate of background concentrations is needed to combine with modeled, project-related impacts to air quality and to compare the total predicted impacts with applicable air quality standards. It is important that the background concentration of each pollutant, model predictions, and air quality standards are all based on the same averaging times.

TABLE 3-2 AIR POLLUTANT BACKGROUND CONCENTRATIONS, STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS, AND PSD INCREMENTS (µg/m^3)

Pollutant/Averaging Time	Measured Background Concentration	State and National Ambient Air Quality Standards	Incremental Increase Above Legal Baseline PSD Class I	Incremental Increase Above Legal Baseline PSD Class II
Carbon Monoxide (CO)				
1-hour	2,299 [a]	40,000	n/a	n/a
8-hour	1,148 [a]	10,000	n/a	n/a
Nitrogen Dioxide (NO_2)				
Annual	10 [b]	100	2.5	25
Ozone (O_3)				
1-hour	117 [c]	235	n/a	n/a
Particulate Matter (PM_{10})				
24-hour	20 [c]	150	8	30
Annual	12 [c]	50	4	17
Sulfur Dioxide (SO_2)				
3-hour (National)	29 [d]	1,300	25	512
24-hour (National)	18 [d]	365	5	91
24-hour (Wyoming)	18 [d]	260	n/a	n/a
Annual (National)	5 [d]	80	2	20
Annual (Wyoming)	5 [d]	60	n/a	n/a

Notes:

- Data for measured background concentration of ozone are the top tenth percentile maximum 1-hour value during July; other short-term background concentrations are second-maximum values measured.
- n/a - not applicable
- Wyoming Ambient Standards from: Wyoming Air Quality Standards and Regulations, Chapter 2 – Ambient Standards
- National Ambient Standards from: Title 40 Code of Federal Regulations (CFR) Part 50
- PSD Increments from: 40 CFR Parts 51 and 52 Prevention of Significant Deterioration for Particulate Matter, EPA Final Rule. Federal Register Vol. 58, No. 105, Thursday, June 3, 1993.
- Background Air Quality Data Sources:

a Data collected at Rifle and Mack, Colorado, in conjunction with proposed oil shale development during early 1980s (CDPHE-APCD 1996).

b To supplement monitored NO_2 data, a separate NO_2 modeling analysis was performed, including many oxides of nitrogen (NO_x) emission sources (BLM 1996).

c Data collected at UCG Project, 9 miles west of Rawlins, Wyoming, June 1994 – November 1994 (WDEQ-AQD 1997).

d Data collected at Craig Power Plant site and at Colorado oil shale areas (CDPHE-APCD 1996).

uA/m^3 = micrograms per cubic meter.

Concern has been expressed in recent years regarding the potential impacts of oil, gas, and other activities on air quality and Air Quality Related Values (AQRV) in the Class I and sensitive Class II airsheds in the region. The closest federally mandated Class I areas located potentially downwind (northeast or southeast) of the Project Area are the Mount Zirkel Wilderness, 60 miles southeast, and the Rawah Wilderness, 92 miles southeast, in northern

Colorado. The USFS manages both of these areas. **Table 3-3** shows Distant Class I and Class II wilderness areas or monuments located within 100 miles of the Project Area.

TABLE 3-3 CLASS I AND II WILDERNESS AREAS AND NATIONAL MONUMENT WITHIN 100 MILES OF THE PROJECT AREA

Area	State	Federal classification	Distance[a] (miles)	Managed by
Huston Park	Wyoming	II	42	USFS
Encampment River	Wyoming	II	50	USFS
Mount Zirkel	Colorado	I	60	USFS
Savage Run	Wyoming	II[b]	62	USFS
Platte River	Wyoming and Colorado	II	65	USFS
Rawah	Colorado	I	92	USFS

Notes:
a Distances are south and east of the Project Area.
b The State of Wyoming manages the Savage Run Wilderness as a Class I air quality area.
USFS = U.S. Forest Service.

Continuous data for the visibility-related optical background were collected at the Class I Bridger Wilderness Area in Wyoming and the Class I Rocky Mountain National Park (just south of the Class I Rawah Wilderness Area) in Colorado, as part of the Interagency Monitoring of Protected Visual Environments (IMPROVE) program. Visibility in the Central Rocky Mountains is very good (averaging more than 70 miles Standard Visual Range), with impacts from fine particles accounting for nearly half of the average degradation (Sisler 1996). In addition, impacts from background atmospheric deposition (acid rain) were monitored at the National Acid Deposition Program/National Trends Network sampling station near Pinedale, Wyoming. In addition, site-specific background data on lake chemistry (pH, acid neutralizing capacity, elemental concentrations, and other factors) have been collected by the USGS Water Quality Division in several high mountain lakes in the nearby wilderness area.

The frequency and strength of the winds greatly affect dispersion and transport of air pollutants. Because of the strong winds in the Project Area, the potential for atmospheric dispersion is relatively high. It is possible that nighttime cooling, which stabilizes air, could inhibit mixing and transport of air pollutants. Dispersion will be the greatest to the north and along the ridge and mountaintops.

The WDEQ AQD is the primary regulatory agency responsible for evaluating potential impacts when detailed development plans are finalized. These plans for natural gas development are subject to applicable air quality laws, regulations, standards, control measures, and management practices. Therefore, the State of Wyoming has responsibility, with U.S. Environmental Protection Agency (EPA) consultation, for reviewing and permitting proposed emission sources before the Companies begin operations in the Project Area. The WDEQ AQD pre-construction air quality permitting would be based on site-specific, detailed engineering values that would be included in the Companies' permit application.

3.4 SOILS

The description of the soils resource forms the basis by which to assess the intensity, duration and magnitude of soil impacts associated with the construction of access roads, well pads, and facilities and to develop effective mitigation measures to prevent, reduce or eliminate impacts to the soils resource. Productivity of soils can be affected by removal of vegetative cover, invasion by undesirable weed species, soil compaction and an increased potential for wind and water erosion. Wind and water erosion potential is, in part, dependent on grain size distribution. For example, clayey soils are sensitive to reduction in permeability through the reduction in the amount and distribution of pore spaces. Reduced permeability can increase runoff of precipitation, thereby increasing concentrated overland flow. Reduction in the amount and distribution of porosity can also exacerbate potential for upward migration of soluble salts. In addition, clay in lower horizons of a soil retards permeability and may cause salt to build up in the soil, reducing productivity. In addition to these physical limitations of the soils, in many areas chemical limitations exist primarily in terms of sodium.

The soils in the Project Area have been formally mapped and described at different levels of detail. Munn and Arneson (1999) described the soils within the Project Area using a broad perspective of soils within a large area, at an Order IV or V level of detail. Texas Resource Consultants (1981) and Wells et al. (1981) describe the dominant soils in the Project Area at an Order III level of detail. As the survey order number decreases, the level of survey detail or specificity increases. For example, the components of an Order IV map unit are typically phases above the series level, whereas the components of an Order III map unit are typically phases at or below the series level. The Order III soil surveys of the Project Area complement the survey conducted by Munn and Arneson. The results of these surveys are described in this section.

Munn and Arneson (1999) describe the soils within the Project Area at an Order IV or V level of intensity. Order IV soil surveys typically include a map scaled at 1:63,360 to 1:250,000 that contains soil map units of approximately 40 to 623 acres. Based on this survey, the Project Area is located within Soil Zone 9, which is characterized as intermontane basin, frigid, and ustic. There are two soil types in the Project Area: Ustic Haplargids (in a small area south of Rawlins) and Ustic Torrifluvents. Ustic Haplargids and Ustic Torrifluvents are fine-loamy, sandy or sandy-skeletal soils that occur on alluvium and slopes. Torrifluvents occur on active floodplains. Haplargids occur on more stable terrain along the Hogback Ridge. Most have ustic moisture regimes and frigid temperature regimes. Climates are usually dry and cold where these soil types occur. According to established range site descriptions for the associated soil series descriptions, 10 to 14 inches of rainfall fall during the year, with an average air temperature of 35 to –40 ºF. The climax plant community is characterized by species with high tolerance to salt that are capable of withstanding drought.

More detailed soils information is also available for the Project Area. An Order III soil survey was prepared by Texas Resource Consultants (1981) and Wells et al. (1981) for the BLM, in cooperation with the Natural Resources Conservation Service (then Soil Conservation Service). Order III soil surveys typically include a map scaled at 1:20,000 to 1:63,360

that contains soil map units approximately of 4 to 40 acres in size that delineate soil associations and complexes. The soil associations and complexes that are mapped represent various soil series. To augment existing soils data, Greystone Environmental Consultants (Greystone) conducted a field reconnaissance on September 19, 2003, to verify the distribution and properties of soils in the Project Area.

Characteristics of the soil map units delineated within the Project Area according to the Order III survey, are presented in **Table 3-4**. Soils in the Project Area formed in residuum and alluvium derived from Cretaceous and Tertiary shales, siltstones and sandstones. An ustic moisture regime with a frigid temperature regime prevails. Soils typically are dry for more than 90 days, but less than 180 days within a year. The mean annual soil temperature is between 0°C to 8°C (32°F to 47°F).

Textures in surface soil are typically fine sandy loam to loam. The textures in the B-horizon (if present) are sandy clay loams. The textures in the C-horizon and regolith are typically fine sandy loam to clay loam. These soils are classified as well drained. In general, permeability is moderate. Runoff potentials are slow to rapid.

The water and wind erosion hazard classification for disturbed soils is generally moderate to severe. The soil erodibility factor (Revised Universal Soil Loss Equation - K-factor) for these soils varies from 0.32 to 0.43 and the tolerable soil loss is between 1 and 2 tons/acre/year. The soil erodibility factor is a measure of the susceptibility of a soil to erosion based on empirically derived relationships between soil texture, organic matter, structure and permeability. It ranges from 0.1 to 0.64 where higher values denote a higher susceptibility to erosion. The wind erodibility grouping is 4L. Wind erodibility groupings are explained in **Table 3-4**.

Soil salinity is generally low and ranges from 2-4 mmhos/cm. The soil horizon pH may range above 8.5 in all or parts of each map unit. Typically, this condition indicates sodic soils.

The average annual aboveground biomass productivity (based on range site classifications) of these soils ranges from 200 to 1,200 lbs/acre (dry weight).

TABLE 3-4 RED RIM SOIL CHARACTERISTICS

Map Unit #	Map Unit Name	Series (% of map unit)	Taxonomic Classification	Landscape Position	Slope	Soil Parent Material	Horizon	Depth	Texture	Shrink/Swell	Depth to Bedrock	Erosion Factor		Wind Erodability Group[1]	Runoff	Drainage Class	Permeability	Erosion Hazard	
								(inches)			(inches)	K	T (tons/ acre/yr)					Water	Blowing
202	Rentsac - Shinbara Complex	Rentsac - 40%	Loamy-skeletal, mixed (calcareous), frigid, Lithic, Ustic Torriorthents	Gentle sloping to moderately steep uplands on residuum	6%-30%	Hard sandstone	A	0-3	loam, fine sandy loam, sandy loam	NA	18	NA	NA	NA	Medium - Rapid	Well Drained	Moderately Rapid	Moderate	NA
							C	3-15	loam, sandy loam	NA		NA		NA					
		Shinbara - 40%	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents		6%-30%	Shale and siltstone	A	0-2	loam	Low	8	0.32	1	4L	Medium - Rapid	Well Drained	Moderate	Moderate - Severe	Moderate
							C	2-9	channery loam	Low		0.32							
213	Seaverson - Blazon Complex	Seaverson - 40%	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents	Undulating to rolling, dissected uplands on residuum	3%-15%	Shale	A	0-3	clay loam	Moderate		0.43	2	4L	Medium - Rapid	Well Drained	Moderately Slow	Moderate - Severe	Moderate
							C	3-16	clay loam	Low	10-20	0.43							
		Blazon - 30%	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents		3%-15%	Shale, siltstone, or loamstone	A	0-15	loam	Low	10-20	0.32	1	4L	Medium - Rapid	Well Drained	Moderate	Moderate - Severe	Moderate
		Shinbara - 10%	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents																
		Abston, Rallod, Delphill, Diamondville, and Rock outcrop - 20%																	
235	Blazon - Shinbara Complex	Blazon - 45%	Loamy, mixed (calcareous), frigid, shallow Ustic Torriorthents	Ridgecrests, sideslopes, and footslopes on residdum. Slopes irregular with	6%-20%	Shale	A	0-10	loam	Low	10-20	0.32	1	4L	Rapid	Well Drained	Moderate	Severe	Moderate
		Shinbara - 30%	Loamy, mixed (calcareous),		6%-40%	Shale	A	0-2	loam	Low	2-10	0.32	1	4L	Rapid	Well Drained	Moderate	Severe	Moderate

TABLE 3-4 RED RIM SOIL CHARACTERISTICS

Map Unit #	Map Unit Name	Series (% of map unit)	Taxonomic Classification	Landscape Position	Slope	Soil Parent Material	Horizon	Depth	Texture	Shrink/Swell	Depth to Bedrock	Erosion Factor		Wind Erodability Group[1]	Runoff	Drainage Class	Permeability	Erosion Hazard	
			frigid, shallow Ustic Torri-orthents	some highly dissected areas			C	2-9	channery loam	Low		0.32							
		Rock Outcrop, Seaverson, Cushool and Diamondville - 25%																	
258	Rock River - Satanka Associa-tion	Rock River - 45%	Fine-loamy, mixed Borollic Haplargids	Level to sloping allu-vial fans and adjacent uplands	0%-12%	NA	A	0-3	sandy loam	NA	>60	NA	NA	NA	Medium	Well Drained	Moderate	Moderate	Moderate
							B	3-37	sandy clay loam			NA							
		Satanka - 35%	NA		0%-12%	NA	C	37-60	sandy loam	NA	NA	NA	NA	NA	Medium	Well Drained	Moderate	Moderate	Moderate
							NA	NA	NA			NA							
		Blazon, Black-hall, and Rock Outcrop - 20%																	
1301	Sand-branch - Tresano Loams	Sandbranch - 60%	Fine-loamy, mixed, frigid Typic Natrar-gids	Gentle to steep upland ridges on residuum	0%-8%	Sandstone and shale	A	0-1	fine sandy loam	NA	>60	NA	NA	NA	Medium	Well Drained	Moderate Slow	Moderate	Moderate
							B	1-12	sandy clay loam	NA		NA							
							C	12-60	silt loam	NA		NA							
		Tresano - 25%	Fine-loamy, mixed, frigid Typic Haplar-gids		0%-8%	Sandstone and shale	A	0-7	fine sandy loam	NA	>60	NA	NA	NA	Slow	Well Drained	Moderate	Slight	Moderate
							B	7-27	sandy clay loam	NA		NA							
							C	27-60	fine sandy loam	NA		NA							
		Westvaco and Sagecreek and soils similar to Tresano, but with less clay in the subsoil - 15%																	
1		no data available																	
230		no data available																	

TABLE 3-4 RED RIM SOIL CHARACTERISTICS

Map Unit #	Map Unit Name	Series (% of map unit)	Taxonomic Classification	Landscape Position	Slope	Soil Parent Material	Horizon	Depth	Texture	Shrink/Swell	Depth to Bedrock	Erosion Factor	Wind Erodability Group[1]	Runoff	Drainage Class	Permeability	Erosion Hazard
401		no data available															
1405		no data available															

NA - data Not Available
*Source - Soil Inventory of the Overland Area, Wyoming, Volume 1 - Soil and Land Use Technologies, Inc.

1 **Wind erodibility** groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most suspectible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are as follows:

1	Coarse sands, sands, fine sands, and very fine sands.
2	Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, ash material, and sapric soil material.
3	Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams.
4L	Calcareous loams, silt loams, clay loams, and silty clay loams.
4	Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay.
5	Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material.
6	Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay.
7	Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material.
8	Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

1
** Source - Soil Inventory of the Overland Area, Wyoming, Volume 1 - Soil and Land Use Technologies, Inc.*

3.5 WATER RESOURCES

3.5.1. Groundwater

Groundwater resources include deep and shallow, confined and unconfined aquifers. Site-specific groundwater data for the Project Area and vicinity are limited, however. Existing information comes primarily from WOGCC oil and gas well records, water well records from the Wyoming State Engineers Office (WSEO), and the USGS (Weigel 1987). Regional aquifer systems pertinent to the Project Area are discussed by Heath (1984), Freethey (1987), and Driver et al. (1984). Basin-wide evaluations of hydrogeology specific to the Project Area have been investigated by Collentine et al. (1981). The most relevant hydrogeologic study specific to the Project Area is by Welder and McGreevy (1966). The Project Area is located in the Colorado Plateau and Wyoming Basin groundwater regions described by Heath (1984); the Upper Colorado River Basin groundwater region described by Freethey (1987); and the Great Divide and Washakie Basins described by Collentine et al. (1981) and Welder and McGreevy (1966).

3.5.1.1. Location and Quantity

Groundwater in the Great Divide and Washakie Basins is generally found in artesian aquifers, although it is also present in unconfined alluvial valleys and in isolated, saturated outcrops (Welder and McGreevy, 1966). **Table 3-5** summarizes the water-bearing characteristics of the geologic formations present in the Project Area and vicinity. Of the geologic units listed in Table 3-4, Welder and McGreevy (1966) suggest that the units capable of producing the largest quantity of water include the following: Quaternary alluvium; Tertiary deposits in the Browns Park, Wasatch, and Fort Union Formations; Cretaceous formations, including the Mesaverde Group, Frontier and Cloverly Formations; the Sundance-Nugget Sandstone of Jurassic age; and the Tensleep and Madison Formations of Paleozoic age.

Quaternary aquifers in the Great Divide and Washakie Basins are made up of alluvial deposits along major floodplains and isolated windblown and lake sediments elsewhere. Ephemeral and intermittent drainages often contain groundwater in the associated unconsolidated valley fills. Flow of groundwater within the sandy Quaternary aquifers is typically downward, toward permeable underlying formations (Collentine et al. 1981).

Tertiary aquifers in and near the Project Area occur in the Browns Park Formation along the Little Snake River floodplain and adjacent to the Sierra Madre Uplift, the Fort Union Formation near the Muddy Creek floodplain to the west, and isolated outcrops of the Wasatch Formation to the southwest. Groundwater generally flows west-southwest from the higher elevations along the Sierra Madre Uplift toward the low-lying centers of the Great Divide and Washakie Basins and the major streams (Collentine et al. 1981).

TABLE 3-5 WATER-BEARING CHARACTERISTICS OF GEOLOGIC FORMATIONS IN THE GREAT DIVIDE AND WASHAKIE BASINS[A]

Era	Period	Geologic Unit	Thickness (feet)	Hydrologic Properties		
				Well Yield (gpm)	Transmissivity (gpd/ft)	Permeability (gpd/ft[b])
Cenozoic	Quaternary		0-70	<30	168-560	21-62
	Tertiary	Browns Park Formation	0-1,200	3-30	100-10,000	NM
		Wasatch Formation	0-4,000+	30-50	150-10,000	0.04-18.2
		Fort Union Formation	0-2,700+	3-300	<2,500	<1
Mesozoic	Upper Cretaceous	Lance Formation	0-4,500+	<25	<20	0.007-8.2
		Fox Hill Sandstone	0-400	NM	10-20	0.9
		Lewis Shale	0-2,700+	2-252	0.03-50	0.002-0.9
		Almond Formation[c]	0-600	NM	2,000-8,000	100-800
		Mesaverde Group (incl. Almond Formation)	300-2,800	<100	<3,000	NM
		Baxter Shale (incl. Steele Shale and Niobrara Formation)	2,000-5,000+	Major regional aquitard between Mesaverde and Frontier aquifers. Hydrologic data unavailable.		
		Frontier Formation	190-1,900+	1-100+	<100-6,500	NM
	Lower Cretaceous	Mowry Shale	150-525	Regional aquitard. Hydrologic data unavailable.		
		Thermopolis Shale (incl. Muddy Sandstone)	20-235	Considered a leaking confining unit. Hydrologic data unavailable.		
		Cloverly Formation	45-240	25-120	340-1,700	1-177
	Upper Jurassic	Morrison Formation	170-450+	Confining unit between Cloverly and Sundance-Nugget aquifers. Hydrologic data unavailable.		
		Sundance Formation	130-450+	27-35	12-3,500	NM
	Lower Jurassic-Upper Triassic	Nugget Sandstone	0-650+	35-200	<2,166	NM
	Triassic	Chugwater Formation	900-1,500+	Confining unit between Sundance-Nugget and Paleozoic aquifers. Hydrologic data unavailable.		
Mesozoic-Paleozoic	Lower Triassic Permian	Phosphoria Formation (incl. Goose Egg Formation)	170-460	Probable poor water-bearing capabilities because of low permeability. Hydrologic data unavailable.		
Paleozoic	Permian-Pennsylvanian	Tensleep Formation	0-840+	24-400	1-374	NM
	Lower and Middle Pennsylvanian	Amsden Formation	2-260+	Probably poor water-bearing capabilities because of predominance of fine-grained sediments.		
	Mississippian	Madison Limestone	5-325+	<400	Variable	NM
	Cambrian	Indef. Rocks	0-800+	4-250	NM	NM
Precambrian	N/A	Igneous and metamorphic rocks	Unknown	10-20	<1,000	Generally high in upper 200 ft of unit

Notes:
a Adapted from Table V-1 in Collentine et al. (1981). Formations that are not encountered in the Atlantic Rim Project Area have been omitted.
b From well completion records on file with WSEO.
c From Atlantic Rim gas well test data.
gpm = gallons per minute.
gpd/ft = gallons per day per foot.

Cretaceous aquifers in and near the Project Area occur in three major geologic formations. From youngest to oldest, they are the Almond Formation of the Mesaverde Group, the Frontier Formation, and the Cloverly Formation. The Mesaverde Group is exposed along the eastern slopes of the Project Area, although a mantle of Tertiary deposits unconformably

overlies large areas of Late Cretaceous strata. No outcrops of the Frontier or Cloverly Formations are present within the Project Area.
The Cretaceous aquifers are composed of interbedded sandstone, shale, and coal and have demonstrated considerable yields in existing wells (Collentine et al. 1981). Recharge to these water-bearing strata is principally from infiltration of precipitation and movement of groundwater from the overlying Tertiary sediments at their outcrops and subcrops along the elevated eastern margin of the Washakie Basin. The direction of regional groundwater flow is toward the west in response to the structural dip and surface topography.

Separated from the Cretaceous aquifers by the impermeable Morrison Formation is the Sundance-Nugget Aquifer of the Jurassic Age. The Sundance-Nugget aquifer is composed of permeable sandstone with minor quantities of shale, siltstone, and limestone (Collentine et al. 1981). The flow characteristics of the Sundance-Nugget aquifer are not well defined.

The remaining two major aquifers occur in Paleozoic Era rocks. The Tensleep Formation from the Pennsylvania Age consists of fine- to medium-grained sandstone between confining layers of the Chugwater Formation (Triassic) and the Amsden Formation (Pennsylvanian) (Collentine et al. 1981). The Madison aquifer is composed of limestone and dolomite bordered on the top by the fine-grained Amsden sediments and on the bottom by Cambrian rocks. Wells completed in both of these Paleozoic aquifers have demonstrated yields up to 400 gallons per minute (gpm). Groundwater flow is to the south-southeast in the Project Area.

Recharge to the aquifers is generally by precipitation and surface water seepage percolating through permeable overlying materials (Welder and McGreevy 1966). Driver et al. (1984) suggest that the Browns Park Formation would be the best candidate for large-scale groundwater development.

3.5.1.2. Quality

Groundwater quality is related to the depth of the aquifers, flow between aquifers, and the rock type. Groundwater quality is variable in the Project Area. Total dissolved solids (TDS), an indicator of salinity, is generally less than 2,000 mg/L (slightly saline to saline) in the Pro-ject Area, with local concentrations of less than 500 mg/L (considered fresh and meeting EPA National Secondary Drinking Water Regulations).

As the proposed wells of the Project Area occur in aquifers in the Mesaverde Group, a detailed analysis of groundwater from this unit has been included. **Table 3-6** lists the major cation and anion composition of groundwater from the Mesaverde Group in the area of the project. Sodium and bicarbonate dominate as the major ionic species. Collentine et al. (1981) offer three possible explanations for this dominance: (1) exchange of dissolved calcium for sodium; (2) sulfate reduction, resulting in generation of bicarbonate; and (3) intermixing of sodium-rich, saline water from low-permeability zones within the Mesaverde or adjacent aquifers.

TABLE 3-6 MAJOR ION COMPOSITION OF MESAVERDE GROUNDWATER

Cation	Concentration (mg/L)	Anion	Concentration (MG/L)
Sodium	513	Bicarbonate[a]	1,284
Calcium	7	Carbonate[b]	9
Magnesium	3	Chloride	56
Potassium[b]	5	Sulfate	11

Notes:
[a] Bicarbonate was not measured; value shown was calculated from ion balance.
[b] Concentrations of potassium and carbonate were not measured in well samples; values represent composite of USGS data for Mesaverde wells in the vicinity of the project (USGS 1980).
mg/L = milligrams per liter.

Table 3-7 presents a comparison of the quality of groundwater from the Mesaverde Group with WDEQ standards for groundwater suitability. The composite results of samples from three gas wells analyzed indicate water that is generally suitable for livestock use, but is unsuitable for domestic supply or irrigation without treatment or dilution. Parameters measured at concentrations that exceed Wyoming drinking water standards include iron, manganese, and TDS. Calculated values for SAR (47.3) and residual sodium carbonate (41 milliequivalents per liter [meq/L]) exceed the agriculture suitability limits of 8 for SAR and 1.25 for residual sodium carbonate. Unless the water were mixed with an existing water source of lower sodium and bicarbonate and lower total salinity, irrigation with this water would reduce infiltration in the affected soil and potentially decrease crop production.

Confining beds slow the vertical movement of water, and hence, movement of potential contaminants between aquifers. Although there is some downward movement of water from the surface units, most of the groundwater movement, if any, is upward from the deeper aquifers to the shallower aquifers. Concerns have been raised for several gas field projects in southwest Wyoming over degradation of groundwater quality caused when confining layers are pierced and allow vertical and horizontal migration and mixing of water of variable qualities. Data that would suggest this degradation is a current problem in the Project Area are not available. Improperly completed injection wells could be a source of contamination, however.

There are no permitted water wells within 1 mile of the Project Area, based on information obtained from the WSEO (Appendix B).

TABLE 3-7 GROUNDWATER QUALITY FOR MESAVERDE WELLS IN VICINITY OF PROJECT AREA

Parameter	Concentration[a]	Unit	Groundwater Suitability Standards[b]		
			Domestic	Agriculture	Livestock
Aluminum	0.045	mg/L	---	5	5
Ammonia	0.9	mg/L	0.5	---	---
Arsenic	0.0006	mg/L	0.05	0.1	0.2
Barium	0.36	mg/L	1	---	---
Beryllium	<0.002	mg/L	---	0.1	---
Boron	0.25	mg/L	0.75	0.75	5
Cadmium	<0.0002	mg/L	0.01	0.01	0.05
Chloride	56	mg/L	250	100	2000
Chromium	0.002	mg/L	0.05	0.1	0.05
Cobalt	NM	mg/L	---	0.05	1
Copper	0.03	mg/L	1	0.2	0.5
Cyanide	<5	mg/L	0.2	---	---
Fluoride	1.0	mg/L	1.4 - 2.4	---	---
Hydrogen Sulfide	NM	mg/L	0.05	---	---
Iron	3.06	mg/L	0.3	5	---
Lead	0.004	mg/L	0.05	5	0.1
Lithium	NM	mg/L	---	2.5	---
Manganese	0.102	mg/L	0.05	0.2	---
Mercury	<0.0004	mg/L	0.002	---	0.00005
Nickel	0.041	mg/L	---	0.2	---
Nitrate	<0.03	mg/L	10	---	---
Nitrite	<0.03	mg/L	1	---	10
Oil & Grease[c]	<1	mg/L	Virtually Free	10	10
Phenol	65	mg/L	0.001	---	---
Selenium	<0.005	mg/L	0.01	0.02	0.05
Silver	<0.003	mg/L	0.05	---	---
Sulfate	11	mg/L	250	200	3000
TDS	1,322	mg/L	500	2000	5000
Uranium	NM	mg/L	5	5	5
Vanadium	NM	mg/L	---	0.1	0.1
Zinc	0.3	mg/L	5	2	25
pH	8.2	s.u.	6.5 - 9.0	4.5 - 9.0	6.5 - 8.5
SAR	47.3	<none>	---	8	---
RSC[d]	41	meq/L	---	1.25	---
Radium 226 + Radium 228	0.9	pCi/L	5	5	5
Strontium 90	NM	pCi/L	8	8	8
Gross alpha	NM	pCi/L	15	15	15

a Concentrations ammonia, fluoride, and nitrate/nitrite from 11 Mesaverde groundwater wells (USGS 1980); remaining concentrations from three Mesaverde gas wells in Atlantic Rim Project Area.
b From WDEQ Water Quality Rules and Regulations, Chapter VIII.
c Reported as total petroleum hydrocarbons.
d Residual sodium carbonate calculated from measured calcium and magnesium concentrations and calculated bicarbonate concentration.

Notes:
meq/L = Milliequivalents per liter
mg/L = Milligrams per liter
NM = not measured
pCi/L = Picocuries per liter
s.u. = Standard units
TDS = Total dissolved solids

3.5.2. Surface Water

The Project Area is located within the Great Divide Closed Basin, Hydrologic Unit Code (HUC) 14040200. Surface waters near the Project Area include the intermittent to perennial

Separation Creek, ephemeral tributaries including Hadsell Draw, and several unnamed ephemeral channels and constructed ponds. Surface drainages carry water most of the year to the confluence of Hadsell Draw with Separation Creek, which then flows into Separation Lake, a topographically closed lake located north of I-80. The proposed pipeline corridor is within the Upper North Platte Basin (HUC 10180002). The two basins are separated by the Continental Divide.

3.5.2.1. Quantity

Statistics on flow have been compiled for the USGS gaging station (09216527) located on Separation Creek. There are no stream gaging stations in the Project Area since all drainages are ephemeral. These statistics provide a perspective of perennial streamflow in the vicinity of the Project Area. This information is summarized in **Table 3-8**.

TABLE 3-8 HISTORICAL STREAMFLOW AT SELECTED USGS GAGING STATIONS

Station Name	Station Number	Drainage Area (mi^2)	Period of Record	Mean Annual Flow (cfs)	Mean Annual Flow (ac-ft/yr)	Maximum Peak Flow (cfs)	Annual Runoff (ac-ft/yr)
Separation Creek near Riner, WY	09216527	53.3	10/1/75 – 9/30/81	2.1	1,520	141 (4/20/1980)	1,300

Source: USGS 2003.
mi^2 = square mile.
cfs = cubic feet per second.
ac-ft/yr = acre-feet per year

Annual peak flows for all streams in the Project Area and vicinity generally occur in late May through early June in response to snowmelt. Baseflows are reached in the fall and continue through March, until low-elevation snowmelt initiates the rising limb of the hydrograph. Hadsell Draw, Abundance Tributary, and Bountiful Tributary are intermittent to ephemeral drainages in the Project Area that flow mostly in response to precipitation and snowmelt. These streams are supplemented by discharge from bedrock but do not maintain a quantifiable baseflow.

Peak flows for Hadsell Draw, Abundance Tributary, and Bountiful Tributary were calculated using regression equations developed by H.W. Lowham (1988). These equations provide an analysis tool for estimating mean annual flow and peak flow where gaging data are not available. Calculated values for the 2-year, 5-year, 10-year, 25-year, 50-year, and 100-year 24-hour storm events, as well as mean annual flow for Hadsell Draw, Abundance Tributary, and Bountiful Tributary, were tabulated and are summarized in **Table 3-9**.

TABLE 3-9 ANALYSIS OF PEAK FLOW

Drainage	Recurrence Interval (years)	Peak Discharge (cfs)
Hadsell Draw	2	176
Mean Annual Flow = 0.81 cfs	5	461
= 585.39 ac-ft/yr	10	726
	25	1,192
	50	1,742
	100	2,273
Abundance Tributary to Hadsell	2	67
Mean Annual Flow = 0.14 cfs	5	173
= 98.32 ac-ft/yr	10	275
	25	448
	50	660
	100	859
Bountiful Tributary to Hadsell Draw	2	31
Mean Annual Flow = 0.04 cfs	5	84
= 30.18 ac-ft/yr	10	139
	25	232
	50	354
	100	464

cfs = cubic feet per second.
ac-ft/yr = acre feet per year.

3.5.2.2. Reservoirs

There are two existing reservoirs in the Project Area; however, neither of these reservoirs has been permitted by the WSEO. The Abundance Reservoir, located in the NENE quarter-quarter of Section 16 in T20N R89W, is less than 5 acre-feet in capacity and is in poor structural condition. Mean annual discharge from this reservoir to Hadsell Draw was estimated at about 55 acre-feet; however, this estimate did not consider releases from upstream reservoirs located outside the Project Area. The Espy Reservoir, located in the NESE quarter-quarter of Section 3 in T20N R89W, is 5 to 10 acre-feet in capacity and is in poor structural condition. Mean annual discharge from this reservoir could not be estimated, as there is no outlet structure or spillway.

3.5.2.3. Quality

Average data on water quality collected at the USGS monitoring station on Separation Creek are shown in **Table 3-10**. The data suggest that surface water in the Project Area is of neutral to slightly alkaline pH and contains moderate quantities of TDS.

TABLE 3-10 SURFACE WATER QUALITY IN THE VICINITY OF THE PROJECT AREA[a]

Station Name	Separation Creek near Riner, WY
Station Number	09216527
Period of Record	1975-1981
Number of Samples[b]	39
pH, standard units	8.20
Total Dissolved Solids (TDS)[c]	774
Total Suspended Solids (TSS)	363
Turbidity (JTUs)[d]	131
Hardness as $CaCO_3$	467
Dissolved Oxygen	9.01
Sodium	80.4
Calcium	74.4
Magnesium	68.6
Potassium	5.5
Bicarbonate	276
Carbonate	0.2
Sulfate	385
Chloride	13
Nitrate	0.14
Sodium Adsorption Ratio (SAR), unitless	1.6

Source: USGS 2003

a Values are representative of means.

b Total number of grab samples analyzed; not every parameter was analyzed in every sample.

c All units are milligrams per liter (mg/L) except as noted.

d Jackson Turbidity Units.

WDEQ classifies Wyoming streams according to quality and degree of protection. WDEQ identifies all surface waters within the Great Divide Closed Basin as Class 4 waters, which support agricultural uses and wildlife watering (WDEQ 2000).

3.5.2.4. Waters of the United States

Surface waters in the Great Divide Closed Basin drain toward the inner areas of the basin, with no connection to external drainages or to navigable waterways leaving the state. Therefore, surface water features in the Project Area do not qualify as waters of the United States. Surface water features in the Upper North Platte watershed, where the proposed pipeline corridor for the project is located, qualify as waters of the U.S. These areas are regulated by the EPA and U.S. Army Corps of Engineers (COE). Any activity that would involve excavation or discharge of dredge or fill material in a manner that affects waters of the U.S. is subject to regulation by the COE pursuant to Section 404 of the Clean Water Act (CWA). Activities that modify the morphology of stream channels are also subject to regulation by the WSEO.

3.5.2.5. Water Use

The total surface water withdrawals for the Great Divide Closed Basin that encompasses the Project Area equaled 103.2 million gallons per day (MGD) in 1995 (USGS 1995). Consump-

tion of surface water is predominantly associated with irrigation, which represents about 99 percent of surface water withdrawals in the basin (102.7 MGD) (USGS 1995).

3.5.2.6. Water Rights

Surface water rights in the Project Area on file with WSEO are summarized in Appendix D. All of the water rights identified support irrigation use, with some additional stock watering. The water right does not necessarily mean that all of the water is available every year for the intended use, but instead reflects legal claims on the water.

3.6 VEGETATION, WETLANDS AND NOXIOUS WEEDS

3.6.1. Vegetation and Cover Types

Vegetation within the Project Area represents the semi-arid Wyoming Great Divide Basin floristic region, where precipitation and parent material for soils are the primary variables that control composition, cover, and annual production of the plant species. The Project Area is located in the sagebrush steppe plant community that is typical of the high intermountain desert of south-central Wyoming. The primary vegetation cover types, as identified by the Wyoming Gap Analysis Program, are Wyoming big sagebrush, desert shrub, and shrub-dominated riparian.

A biological survey of the Project Area was conducted in 2000 and 2001 by Hayden Wing Associates (HWA 2003). To enhance the general vegetation information provided above, a field reconnaissance of the Project Area was conducted on September 18, 2003, as part of this analysis. Existing vegetation within the proposed disturbance areas was observed and recorded.

Wyoming big sagebrush cover type typically consists of a mixture of greasewood, Wyoming big sagebrush, rabbitbrush, and saltbush. These tall shrubs provide excellent cover for many species of wildlife and protection from adverse weather and detection by predators. Understory grasses and forbs include western wheatgrass, little bluegrass, Indian ricegrass, bottlebrush squirreltail, needle and thread, phlox, buckwheat, penstemon, and prickly-pear cactus.

Common species in shrub-dominated riparian areas include sagebrush, greasewood, and willow, as well as the grass and forbs that are common to Wyoming big sagebrush community type. The principal riparian habitat within the Project Area consists of a narrow band of vegetation along Hadsell Draw and its tributaries. Key species in riparian areas include spikesedge, redtop, tufted hairgrass, Kentucky bluegrass, and saltgrass.

The vegetation community type in the proposed disturbed area is generally sagebrush/grassland. Typically, two integrading varieties of sagebrush occur in the Project Area and tend to occupy distinct habitats. Wyoming sagebrush typically is found in the more xeric uplands, while big sagebrush is found in the more mesic narrow valley bottoms. Wyoming sagebrush is distinguished from big sagebrush by its shorter growth form and spherical canopy. In some locations along parallel ridges, the shrub canopy is absent and a grass

grass canopy predominates. The dominant grass is prairie junegrass with species of wheatgrass and wild rye, and Indian ricegrass occuring less frequently.

Within the sagebrush/grassland community type, rubber rabbitbrush, broom snakeweed, gray horsebrush, and Gardner's saltbush are common. In a few small locations the density of rubber rabbitbrush and Gardner's saltbush equals or exceed that of sagebrush. Black greasewood is generally uncommon but is often a dominant component of the shrub canopy in valley terraces and toe-slopes where shale and saline soils are prevalent. Antelope bitterbrush occurs rarely to infrequently. Common herbaceous forbs included species of buckwheat flower and lupine, and to a lesser degree, species of phlox.

3.6.2. Threatened and Endangered Species

Three federally listed plant species, blowout penstemon (*Penstemon haydenii*), Ute ladies' tresses orchid (*Spiranthes diluvialis*), and Western prairie fringed orchid (*Platanthera praeclara)*, have the potential to occur within the Atlantic Rim EIS study area; however, none have the potential to occur within the Project Area for the Red Rim POD.

3.6.3. Species of Concern

Seven species of plants of special concern may occur within or near the Project Area (HWA 2003). Four of the species (Laramie columbine, Weber's scarlet-gilia, persistent sepal yellowcress, and Laramie false sagebrush) are unlikely to occur in or near the Project Area because their preferred habitat types are not present. Two special-concern species (Nelson's milkvetch and Cedar Rim thistle) have low to moderate potential to occur in or near the Project Area. Gibben's beardtongue has a high probability of occurrence in the eastern portion of the Project Area. The occurrence and distribution of any of these species will require specific consideration in planning the proposed project. **Appendix E** provides information on the names and sensitivity status, notes on their overall range and distribution within Wyoming, probability of occurrence in the Project Area, and descriptions of habitat types where these special concern plants are found.

3.6.4. Wetlands

No special aquatic sites or wetlands have been identified in or near the Project Area, including the lateral sales pipeline route; therefore, these resources were not analyzed further.

3.6.5. Noxious Weeds and Invasive Species

The Project Area is vulnerable to invasion of noxious weeds species such as Canada thistle, spotted and Russian knapweed, and whitetop, and invasive species such as black greasewood, musk thistle, black henbane, halogeton, and cheatgrass. Based on field reconnaissance conducted on September 18, 2003, noxious weeds and invasive species are a relatively minor component of the vegetation community within the Project Area.

One noxious weed species on the Wyoming Designated Noxious Weed List, spotted or Russian knapweed (*Centaurea maculosa or repens*), was observed rarely to infrequently in the vicinity of proposed production facilities in the southwest quarter of Section 16 and the northwest quarter of Section 29, in T20N R89W. Other noxious weed species that where not apparent during the site reconnaissance may exist within the Project Area.

Halogeton, an invasive species, was observed on the recently completed drill pad for the AR Fee 2089 NW 21 well.

3.7 RANGE RESOURCES AND OTHER LAND USES

3.7.1. Range Resources

The Project Area is within the Sixteen Mile Allotment (#10616). The allotment includes 81,509 acres, of which 37,513 acres are public land, 42,716 acres are private land, and the remaining 1,280 acres are state land. The allotment is permitted for 7,257 Animal Unit Months (AUMs), which includes 4,325 AUMs for cattle, 2,674 AUMs for sheep, and 258 AUMs for horses. The average stocking rate is 11 acres per AUM. The season of use extends from March 1 to November 10. The Sixteen Mile Allotment will be included in a watershed assessment that will evaluate rangeland health.

3.7.2. Other Land Uses

The Project Area contains an estimated 1,840 acres of federal surface ownership lands in Sections 16, 20, and 28, T20N R89W. These public lands are open for public use and are administered by the RFO in accordance with the Great Divide RMP. Within the Project Area, privately owned lands are located in Sections 6, 21, and 9, T20N R89W. Public lands within and adjacent to the Project Area are interspersed with private lands in a checkerboard pattern. There are no State of Wyoming lands within the Project Area.

Other land uses within and adjacent to the Project Area include wildlife habitat; oil and gas exploration, development, and transmission; and dispersed outdoor recreation (primarily hunting in the fall).

3.8 WILDLIFE AND FISHERIES

3.8.1. Wildlife

The Project Area includes sagebrush steppe and greasewood wildlife habitats. Many common species of birds, mammals, amphibians, and reptiles may be found within the Project Area. The proposed development is not expected to significantly affect the common species found in the Project Area; therefore, they are not discussed further in this analysis. Species considered for threatened or endangered status, big game species, raptors, and greater sage-grouse are considered in this analysis. The area of analysis for wildlife concerns consists of

the Project Area plus a 2-mile buffer for greater sage-grouse leks and a 1-mile buffer for raptor nests. Wildlife surveys discussed and summarized were conducted as part of larger-scale surveys performed in preparing the Atlantic Rim EIS (HWA 2003); the following discussion focuses only on the Project Area for the Red Rim POD.

Information on the occurrence of big game species, raptors, and greater sage-grouse near the Project Area was obtained from several sources. Locations of greater sage-grouse leks, seasonal big game range designations, and raptor nest locations were obtained from the Wyoming Game and Fish Department's (WGFD) Wildlife Observation System (WOS). WGFD annual reports on big game herd units were used for statistics on the population of the herd units. The existing information on wildlife for the Project Area was supplemented through survey data collected by in 2000 and 2001 (HWA 2003). Data were collected through a series of aerial and ground surveys to: (1) determine the occurrence, location, size, and burrow density of white-tailed prairie dog colonies; (2) determine the location and activity status of raptor nests; (3) search for previously undocumented greater sage-grouse leks and determine the activity status of all leks in the area; and (4) locate winter greater sage-grouse concentration areas

3.8.1.1. Big Game

Three big game species — pronghorn antelope, mule deer , and elk — occur within the Project Area during all or parts of the year. Winter ranges are used by substantial numbers of animals only during the winter (December through April). Winter/year-long ranges are occupied throughout the year, but during winter these ranges are used by additional animals that migrate from other seasonal ranges. Crucial big game range (crucial winter or year-long range) describes any seasonal range or habitat component that has been documented as a determining factor in the ability of a population to maintain itself at a specified level over the long term. Crucial winter ranges are typically used eight out of 10 winters.

3.8.1.1.1. Pronghorn Antelope

The Project Area is within the 1,394-square-mile Baggs Herd Unit. The Project Area contains seasonal ranges for pronghorn designated as winter, spring/summer/fall, and crucial winter/year-long. Crucial winter/year-long range exists in the extreme northwestern corner of Sections 16 and 20 (less than 11 acres). Pronghorn likely migrate across the southern portion of the Project Area onto the crucial winter/year-long range (HWA 2003). Pronghorn congregate on the crucial winter range during years with higher snowfall across the winter range, resulting in heavy browse use and only light use of the transition area in the fall and spring. The pronghorn are not forced to spend as much time on the crucial winter range in years with low amounts of snow. Use of important shrub species is then more evenly distributed across this transition area, with lighter consumption of the plants in the crucial winter range. The 2001 post-hunt season population estimate of 6,800 animals is 9 percent higher than the 1996-2000 estimated population average of 6,240 (HWA 2003). The population objective was increased 25 percent in 1994, from 7,200 to 9,000 animals. The current population estimate is 24 percent below the WGFD management objective. The Baggs antelope herd had experienced low fawn production, resulting in slow growth, but production has improved during recent years and the population appears to be rebounding (HWA 2003).

The Project Area is located within Hunt Area 55, where the hunter success rate in 2001 was 77.8 percent.

3.8.1.1.2. Mule Deer

The Project Area is within the Baggs Herd Unit. The Baggs Herd Unit is large (3,440 square miles) and contains habitats that range from subalpine and montane coniferous forests to desert shrub. The Project Area is within the portion of the unit designated as winter/year-long mule deer range. No migration routes for mule deer pass through the Project Area. The 2001 post-hunt population estimate for the Baggs Herd Unit was 18,000 animals. This estimate is slightly below the WGFD's management objective of 18,700 animals (HWA 2003). The Project Area is within Hunt Area 84; of the three hunt areas within the Baggs Herd Unit, only 3 percent of hunters used this area.

3.8.1.1.3. Elk

The Project Area is located within the Sierra Madre Herd Unit (2,425 square miles). Most elk in the herd unit use spring/summer/fall ranges in the Sierra Madre Mountains, although some groups use habitats on Atlantic Rim and around McCarty Canyon. During winter, the elk migrate to winter range habitats at lower elevation on the western side of the Sierra Madre Mountains and into the Atlantic Rim/Sand Hills areas. Some animals may migrate as far west as the Powder Rim (about 40 miles west of Baggs; Porter 1999). However, no major migration routes for elk pass through the Project Area (HWA 2003). The majority of the pod is classified as elk non-use and the remaining southern portion of the pod is classified as elk winter range. The 2001 post-hunt season population estimate for the Sierra Madre Herd Unit of 5,500 animals is 31 percent above the WGFD management objective of 4,200. The Project Area is located within Hunt Area 108, where the hunter success rate for 2001 was 67.7 percent.

3.8.1.2. Upland Game Birds

3.8.1.2.1. Greater Sage-Grouse

The Project Area is located within the extensive sagebrush/grassland habitat of south-central Wyoming, where greater sage-grouse are common. Strutting grounds (leks), nesting, brood-rearing, and wintering habitats are all important components required by greater sage-grouse. This habitat can occur as contiguous or in a patchy, disconnected pattern (HWA 2003). Preferred nesting habitat is usually located within 2 miles of leks (HWA 2003; HWA et al. 1986). The greater sage-grouse is listed as a BLM sensitive species and receives special consideration because its population is declining over much of its range.

The Project Area is within the Sierra Madre upland game management unit area (Area 25). According to the Annual Report of Upland Game and Furbearer Harvest for 2001, 761 greater sage-grouse were harvested in Area 25, providing 724 hunter recreation days (HWA 2003). The Sierra Madre Upland Game Management Area accounted for about 6 percent (761 birds out of 12,742) of the statewide harvest of greater sage-grouse in 2001.

The Project Area is covered by habitats dominated by sagebrush. Because greater sage-grouse use sagebrush habitats all year, the area provides excellent year-round range. Aerial surveys were conducted during the winter of 2001 to identify and define greater sage-grouse winter concentration areas. The Atlantic Rim EIS study area, including the Project Area, was surveyed on February 17 to 18, 2001. Snow cover during the winter of 2000 and 2001 was much deeper than normal. Deep snow cover forced greater sage-grouse to seek out habitat with tall sagebrush. During the spring and summer of 2001, each location where greater sage-grouse were observed during the winter aerial survey was visited on the ground, and habitat used by the greater sage-grouse was mapped. Habitat patches located from the air were refined by walking the perimeter and recording Universal Transverse Mercator (UTM) coordinates with a handheld global positioning system (GPS). Sagebrush in the greater sage-grouse winter use areas was usually located in long linear patches in drainage bottoms and was between 2 and 4 feet tall. These habitat areas are referred to as crucial or severe winter relief habitat (HWA 2003). This single season survey in the winter of 2000/2001 found no crucial greater sage-grouse winter habitat was located in the Project Area (HWA 2003).

Aerial surveys were also conducted by HWA biologists in late March and early April 2001 to check the status of known sage-grouse leks and document new leks. Two active greater sage-grouse leks were documented south of the Project Area (**Figure 3-1**). Additionally, one active lek was located south of the delivery pipeline and access road (**Figure 3-1**). A 2-mile buffer around these three leks includes approximately 1,539 acres of the Project Area. Neither lek is within ¼ mile of the pod, however. The proposed Red Rim Lateral Pipeline would intersect 4.4 miles of potential nesting habitats within 2-mile buffers of these two known lek sites.

In addition the greater sage-grouse surveys in 2001, the Wyoming Game and Fish Department maintains an on-going database of lek locations and activity. The two leks identified by HWA were the Scotty's Peak and Ram Canyon leks. Wyoming Game and Fish records identify several other leks in the area, including one on private land inside the pod boundary and two just outside the pod boundary on the north end. In all 6 pods have two mile seasonal restriction areas within the pod boundary. No portion of the project area is outside of the two mile timing stipulation.

Leks are monitored annually for greater sage-grouse use in the spring. Not every lek is visited every year, and absence of strutting birds in a single year does not result in its classification as a historic lek. "Historic" leks do not receive protection however "inactive" leks do. This lek is classified as "undetermined. "Undetermined" leks are those leks that have not been documented as being active in the last ten years, but do not have sufficient documentation to be designated as historical. The lek found inside the pod boundary on private land is Hogback lek. As shown on Table 3-11 the last record of greater sage-grouse activity is 1978. It is located next to an existing road and within less than ¼ mile of an existing well site on private land. This lek is classified as "inactive" under the Wyoming BLM definitions for greater sage-grouse leks.

Table 3-11
Wyoming Game & Fish Recorded Leks and Location

Lek Name	Legal Location				Last Year	
	TXXN	RXXW	Section	Location	Active	Surveyed
Red Rim Basin	20	89	17	SE NE	1990	2001
Red Rim	20	89	19	C E2	2001	2001
Hogback	20	89	29	SE	1978	2003
Scottys Peak	20	89	34	SW N	2001	2001
Ram Canyon	19	89	4	S2 N	2001	2003
Midnight Valley	19	89	5	SW NE	2003	2003

3.8.1.3. Raptors

Several species of raptors occur or potentially occur within the Project Area. They include the golden eagle, northern harrier, sharp-shinned hawk, Cooper's hawk, northern goshawk, red-tailed hawk, Swainson's hawk, rough-legged hawk, ferruginous hawk, American kestrel, merlin, prairie falcon, peregrine falcon, short-eared owl, long-eared owl, great-horned owl, and burrowing owl.

Helicopter surveys in and around the Project Area were conducted during late May 2001 to locate raptor nests (HWA 2003). One inactive raptor nest is located within the Project Area. Observations during the helicopter survey within the 1-mile buffer of the Project Area included an active golden eagle nest, 0.6 miles west of the Project Area; two inactive ferruginous hawk nests; one inactive red-tailed hawk nest; and an inactive nest of an unknown raptor. One inactive ferruginous hawk nest and two inactive golden eagle nests are located within 0.5 miles of the proposed pipeline route in Sections 7 and 13 of T20N R88W (**Figure 3-1**). Approximately 5 miles of the proposed pipeline route were not included in the May 2001 survey, as the area is located outside the area flown for the Atlantic Rim EIS study area. The Companies will consult with the BLM RFO to identify any additional raptor surveys that are needed before construction of the pipeline begins.

3.8.2. SPECIAL STATUS SPECIES – Wildlife and Fish

U.S. Fish and Wildlife Service (FWS) surveys for federally listed threatened, endangered, candidate, and species of concern discussed and summarized here were conducted as part of larger-scale surveys performed in preparing the Atlantic Rim EIS in 2000 and 2001 (HWA 2003). The area of interest for threatened, endangered, candidate and species of concern includes the Project Area and a 1-mile buffer for raptor nests. In addition, the Red Rim pipeline corridor, which extends northeast from the well locations toward Rawlins, is also considered. Locations for threatened and endangered species were obtained from the WGFD WOS.

Figure 3-1 Wildlife and Sensitive Species

Data were collected through a series of aerial and ground surveys to: (1) determine occurrence of threatened, endangered, proposed, or candidate species for listing in the Project Area; and (2) determine the occurrence, location, and size of mountain plover habitat and conduct a preliminary presence/absence survey for the species.

3.8.2.1. Threatened and Endangered Species – Wildlife and Fish

3.8.2.1.1. Wildlife Species

Black-footed Ferret and Associated White-tailed Prairie Dog Colonies

In Wyoming, large colonies of white-tailed prairie dog (*Cynomys leucurus*) provide habitat for black-footed ferrets. Aerial surveys for prairie dog colonies were conducted over the Project Area in late March and early April 2001. One prairie dog colony of approximately 3 acres occurs in the Project Area (**Figure 3-1**). The colony is part of a larger prairie dog complex that stretches north, south, and west of the Project Area. During a July 2001 survey, four colonies in this complex were found to exceed 200 acres in size and to exhibit burrow densities of eight burrows per acre. Therefore, these colonies are considered potentially suitable habitat for black-footed ferrets (HWA 2003). A nocturnal survey for black-footed ferrets was conducted in August 2001 over the entire prairie dog town, and no ferrets or their sign were found (HWA 2001). The black-footed ferret is not likely to occur within the Project Area.

Canada Lynx

Records of lynx in Wyoming indicate that most lynx or lynx sign between 1973 and 1986 were in lodgepole pine (18 percent) and spruce-fir (41 percent) communities. There is a lack of high-elevation lodgepole pine/spruce-fir habitat types preferred by this species within the Project Area, the area does not support a population of snowshoe hares (preferred prey), there are no recorded lynx sightings near the Project Area (HWA 2003), and the closest potentially suitable habitats are located more than 10 miles away in the Sierra Madre Mountains (HWA 2001). The nearest records of lynx to the Project Area were from the Medicine Bow River in 1856. Therefore, it is unlikely that Canada lynx occur within or near the Project Area.

Bald Eagle

Primary wintering areas for the bald eagle are typically associated with concentrations of food sources along major rivers that remain unfrozen where fish and waterfowl are available, and near winter ranges for ungulates that provide carrion (HWA 2003). Wintering bald eagles are also known to roost in forests with large, open conifers and snags protected from winds by ridges, often near concentrations of domestic sheep and big game (HWA 2003). Incidental sightings of bald eagles have been recorded near the Project Area (HWA 2003). Most observations were documented between November and March, indicating that the area is commonly hunted by bald eagles during the winter. However, the occurrence of communal winter roosts in or near the Project Area has not been documented. Inspection of BLM and WGFD records on raptor nests and the results of aerial and ground surveys for raptor

nests conducted suggest that bald eagle nests do not occur within 2 miles of the Project Area. The closest known nest occurs more than 21 miles southwest of the Project Area. This nest has been active each of the last 5 years.

3.8.2.1.2. Fish Species

No federally listed fish species have the potential to occur within the Project Area.

3.8.3. Species of Concern - Wildlife and Fish

3.8.3.1. Wildlife Species

Twenty-five species of special concern wildlife occur or potentially occur in the Project Area. They include seven mammal species, 16 bird species, and three amphibian species (HWA 2003). These species and their sensitivity status and rank are listed in **Appendix E**.

3.8.3.1.1. Mammals

Seven sensitive mammal species may be found in the Project Area. These species include the dwarf shrew, Wyoming pocket gopher, white-tailed prairie dog, swift fox, fringed myotis, long-eared myotis, and Townsend's big-eared bat. Only one of these species, the white-tailed prairie dog, is known to occur within the Project Area; one small town (3.04 acres) exists in the northwestern quarter of Section 16. The dwarf shrew, Wyoming pocket gopher, and swift fox are likely to occur in the Project Area. The remaining species (fringed myotis, long-eared myotis, and Townsend's big-eared bat) have a slight potential to occur on the Project Area.

3.8.3.1.2. Birds

Sixteen sensitive bird species may be found in the Project Area. These species include Baird's sparrow, sage sparrow, Brewer's sparrow, long-billed curlew, sage thrasher, western burrowing owl, yellow-billed cuckoo, loggerhead shrike, Columbian sharp-tailed grouse, greater sage-grouse, white-faced ibis, trumpeter swan, peregrine falcon, ferruginous hawk, northern goshawk, and mountain plover. The western subspecies of yellow-billed cuckoo is considered an FWS candidate for listing as endangered. Eight of these species are known to be present in the Project Area and include sage sparrow, Brewer's sparrow, sage thrasher, western burrowing owl, loggerhead shrike, greater sage-grouse(see Section 1.2.3), ferruginous hawk, and northern goshawk (not likely to nest in the Project Area, however). Five species (Baird's sparrow, long-billed curlew, yellow-billed cuckoo, white-faced ibis, and trumpeter swan) are unlikely to occur. The Columbian sharp-tailed grouse and peregrine falcon have a slight potential to occur in the Project Area.

Mountain Plover

The mountain plover nests over much of Wyoming, but preferred habitat is limited throughout its range (HWA 2003). This ground-nesting species is typically found in areas of short (less than 4 inches) vegetation on slopes of less than 5 percent. Any short grass, short shrub,

or cushion plant community could be considered plover nesting habitat (HWA 2003); however, mountain plovers prefer shortgrass prairie with open, level or slightly rolling areas dominated by blue grama and buffalograss (HWA 2003). Loss of wintering and breeding habitats and declines in the prey base from pesticide use are thought to be factors that contribute to the decline of mountain plovers on the North American Continent (HWA 2003).

The Project Area was surveyed for mountain plover habitat in May 2001 (HWA 2003). Five habitat patches, totaling 699.9 acres, of potential mountain plover habitat were located within the boundary of the Project Area (Figure 3-1). Potential plover habitats defined during 2001 were again surveyed for plovers in April 2002 and 2003. No plovers were sighted during any of the three years' surveys of the Atlantic Rim EIS study area. One opportunistic sighting of a mountain plover was recorded approximately 2 miles east of the Project Area on June 20, 2001. Potential effects to mountain plover habitat will be determined during the APD phase of development.

3.8.3.1.3. Amphibians

Three sensitive amphibian species may be found in the Project Area. These species include the boreal toad, Great Basin spadefoot toad, and northern leopard frog. The Great Basin spadefoot toad has a slight potential to occur, and the boreal toad and northern leopard frog are unlikely to occur in the Project Area.

3.8.3.2. Fish Species

Fish species, the roundtail chub, bluehead sucker, flannelmouth sucker, and Colorado River cutthroat trout, are classified as candidate species and are included on the BLM (2002) Sensitive Species List. These species are not listed as endangered or threatened by the FWS, but have been identified for possible listing in the future. The four BLM sensitive fish species do not occur in the Great Divide Basin or the Platte River system (BLM 2002); therefore, no BLM sensitive fish would occur in or downstream of the Project Area.

3.9 RECREATION

Hunting, camping, and off-road vehicle (ORV) use are the most popular recreational activities in or near the Project Area, although no developed recreational sites, facilities, or special recreational management areas exist within or adjacent to the Project Area. An OHV/motocross recreation area is proposed for Hogback Lake in Section 34, T21N R88W, about 5 miles to the northeast. The majority of recreation use is associated with the fall hunting seasons, specifically during September and October for the greater sage-grouse. Pronghorn hunting also occurs in September, and other hunting use occurs during the mule deer season in mid- to late October. Rabbits and some predators are hunted during the fall and winter. Outside the hunting seasons, the area attracts small numbers of visitors who engage

in rock collecting, camping and hiking, observing wildlife, outdoor photography, and picnicking. Although data on recreational visitation are not available, overall use levels are generally low (BLM 2000). Low visitation to the Project Area is a result of the small number of local residents, the long drives from major population centers, lack of publicized natural attractions, and road conditions or land ownership patterns that limit access by vehicles into many areas.

The Continental Divide National Scenic Trail is located along State Highway 71 through Rawlins. The proposed delivery pipeline route ends near this portion of the trail corridor. This portion of the trail along the highway provides a link between designated segments of the trail, which are entirely on public land. Land ownership near Rawlins, including the Project Area, is a checkerboard of public and private land. No other developed recreational sites, facilities, or special recreational management areas exist within or adjacent to the Project Area.

3.10 VISUAL RESOURCES

The Project Area is typical of the more rugged sections of Wyoming Red Desert region: lands in the Project Area are moderately undulating. Numerous small drainages dissect the landscape, providing topographic diversity. The visual resource management (VRM) class of the Project Area is Class III, which includes areas where changes in the basic elements (form, line, color, or texture) caused by management activities may be evident in the characteristic landscape. The objective of this class is to provide for management activities that may modify the existing character of the landscape. However, changes should remain subordinate to the visual strength of the existing character.

Larger views that encompass several viewsheds are available from high points. The expansive panorama dominated by the horizon between sky and land is a significant aspect of all distant views. The predominant vegetation types, typical of cold desert steppe, are alkali and low sagebrush, mixed desert scrub, and grasses and forbs, with scattered patches of big sage/rabbit brush on flatter north- and east-facing slopes, along drainage ways, and in large depressions. Small, established stands of juniper also grow within the Project Area. The combination of plant communities creates a subtle mosaic of textures and colors. Predominant vegetation colors in early spring are green and gray green, changing to gray/green and buff/ochre as grasses and forbs cure in the summer and fall. Reddish brown and buff colors of the badland formations add contrast and dominate in areas of steep topography.

Evidence of cultural modification in the Project Area includes unimproved roads and some oil and gas production facilities. Motorists traveling I-80 and WY 71 would not have visual access to the Project Area because of the viewing distance (5 to 8 miles) and intervening elevated topography. However, facilities and activities located on ridgelines or buttes are visible over longer viewing distances. The quality of the visual resource is an important part of the recreational experience for many of these users. Other nonrecreational users of the area, including grazing permit holders and employees working in the oil and gas industry, would also be affected by changes to the visual landscape.

The pipeline corridor is within the foreground views of motorists on State Highway 71and is within an existing pipeline corridor. The visual resource management class of the Project Area is Class III. Class III includes areas where changes in the basic elements (form, line, color, or texture) caused by a management activity may be evident in the characteristic landscape. The objective of this class is to provide for management activities that may require modification of the existing character of the landscape. However, changes should remain subordinate to the visual strength of the existing character.

3.11 CULTURAL RESOURCES

3.11.1. Culture History

The earliest known period of culture history in southwestern Wyoming is that of Paleoindian beginning about 12,000 years before present (B.P.), which has come to signify hunting and gathering adaptations of late Pleistocene and early Holocene age. The hunting and butchering of megafaunal animals such as mammoths and bison characterize this period. At these sites large, lanceolate projectile points are often found in association with the skeletal remains of the now extinct megafauna.

Following the Paleoindian period is the Archaic. The Archaic period dates from about 8,500 to 2,000 years B.P. During this time, groups adopted a more varied hunting and gathering subsistence pattern. In southwestern Wyoming, recent investigations reveal a subsistence system with an emphasis on plant processing and small game. The Early Archaic period is also marked by a change in projectile point technology from lanceolate types to side-notched dart points. The Archaic period in Washakie Basin is divided into the Early and the Late periods. The Early period is subdivided into the Great Divide and Opal phases. The Middle Archaic period is represented in other areas of the southwest Wyoming and is known as the McKean complex. The subsistence economy remained much as it had been during the Early Archaic period with both hunting and gathering activities in evidence. By 3,000 years before present, new cultural manifestations replaced the McKean complex. The first of these is Pelican Lake, known for its corner-notched projectile points. In the Wyoming Basin, Elko series points are also relatively common during this time. In the Waskakie Basin, the chronology goes from the Early Archaic to a Late Archaic. The Late Archaic is subdivided into the Pine Spring and Deadman Wash phases. The subsistence economy remained much as it had been during the Early Archaic period.

The Late Prehistoric period 2,000 B.P. is subdivided into the Uinta and the Firehole phases in the Washakie Basin and is marked by the introduction of bow and arrow and pottery. Small side- and corner-notched projectile points including the Desert side-notched and Rose Springs types appear at this time. With the exception of the bow and arrow and ceramics, there was little change in the material culture or in life ways over the preceding Archaic periods. The Protohistoric period is marked by the introduction of the horse and European trade goods. The horse and gun allowed some tribes to concentrate intensely on bison hunting. The influx of European technology also changed patterns of trade and migration among groups. In some instances, the social and economic organization shifted from small family bands to larger, more permanent groups of several families.

Southwestern Wyoming in the Historic period has predominantly been used for cattle and sheep ranching. Fur trapping and trading was not an important occurrence in the Project Area due to lack of perennial streams. Settlement has been limited due to scarce water sources and rugged terrain. There are historic trails and transportation routes such as the Overland Trail, Cherokee Trail, Outlaw Trail, Rawlins to Baggs Stage Road, and Baggs to Wamsutter Road that are important corridors that occur in and near the Project Area. The Rawlins to Baggs Stage Road (48CR3648) is within the Project Area. This stage road was a route used for freight, mail, and passengers between Rawlins and Baggs, Wyoming. The route was first used in 1881 and was known as the Rawlins to White River, the Rawlins, and the Snake River Road (GHEP 2003). The route was later labeled the Baggs to Rawlins Road (1916). The road is depicted on Holt's Map of Wyoming (1883). Stage stations were established along the route with service to ranching communities in the Little Snake River Valley. There is a strong association between the road and the history of the Ute White River Agency and the Ute Massacre.

The Rawlins to Baggs Stage Road and the Baggs to Wamsutter Road (48CR5739) follow the same route for about 10 miles north of Baggs; generally the same route as Wyoming Highway 789. At this point, they diverge with the Rawlins to Baggs Stage Road trending north and east toward Rawlins, crossing Muddy and Dry Cow Creeks. This route has been maintained as a transportation corridor with blading and widening of the route in the 1960s as needed to meet changing needs of vehicles used. Portions of the original route have been abandoned with the construction of Twentymile Road.

The accepted cultural chronology of the Washakie Basin is based on a model for the Wyoming Basin by Metcalf (1987) and revised by Thompson and Pastor (1995). The Wyoming Basin prehistoric and historic chronology is documented in **Tables 3-12** and **3-13**.

TABLE 3-12 PREHISTORIC CHRONOLOGY OF THE WYOMING BASIN

Period	Phase	Age (B.P.)
Paleoindian		12,000 – 8,500
Early Archaic	Great Divide	8,500 – 6,500
	Opal	6,500 – 4,300
Late Archaic	Pine Spring	4,300 – 2,800
	Deadman Wash	2,800–2,000/1,800
Late Prehistoric	Uinta	2,000/1,800 – 650
	Firehole	650 – 300/250
Protohistoric		300/250 – 150

Source: Metcalf (1987), as modified by Thompson and Pastor (1995)
B.P. = Before present

TABLE 3-13 HISTORIC CHRONOLOGY OF THE WASHAKIE BASIN

Phase	Age A.D.
Pre-Territorial	1842 – 1868
Territorial	1868 – 1890
Expansion	1890 – 1920
Depression	1920 – 1939
Modern	1939 – Present

Source: Massey 1989

3.11.2. Cultural Environment

The Red Rim Project Area is located on Hogback Ridge with local topography dominated by northeast-southwest trending ridges. These ridges have been cut by Sixteenmile Draw, Hadsell Draw, and small intermittent drainages. Landforms consist of ridges, finger ridges, knolls, and hills. Stabilized, intermittent sand dunes occur in hilly upland areas. Eolian sands from western sources add an additional component to localized soils. In southwest Wyoming, sand deposits (dunes, shadows, and sheets) are recognized as highly likely to contain cultural material.

Prehistoric use of the Washakie Basin reflects a hunter-gatherer lifestyle. Research into the subsistence and settlement patterns during the Archaic period indicates summer occupations in the mountains, winter occupations in the foothills, and spring and fall movements that made use of all available zones (Creasman and Thompson 1997). Subsistence patterns in the Archaic and the Late Prehistoric periods are similar in that they are based on seasonal movement throughout the basins and foothills in response to the availability of floral and faunal resources (Creasman and Thompson 1988). The topographic setting is conducive to prehistoric occupation. A high potential for prehistoric sites occurs near reliable water such as Sixteenmile Draw and Hadsell Draw. As distance increases from these water sources, site density drops.

Historical use of the Washakie Basin area was affected by the formidable topographic relief. Steep canyons, hogback ridges, and escarpments make the area more difficult for settlement. The area was primarily used for cattle and sheep ranching. Limited ranching is identified by the presence of historic debris scatters and the historical record. A portion of the Rawlins to Baggs Stage Road is in the southern boundary of the Project Area. Stage stops, road ranches, and historic trash can be found along historic transportation corridors such as the Rawlins to Baggs Stage Road.

3.11.3. Summary of Cultural Resources

Previous fieldwork was identified during the Class I file searches requested from the Wyoming Cultural Records Office for the surveys (Hatcher 2003). A limited amount of field work has occurred near the Project Area, resulting in the documentation of only a few cultural resources through survey, examination of ethnographic records, and research of historic records. No sites have been extensively tested or excavated in the Project Area. However,

several sites have been excavated in the surrounding area, contributing data about the prehistory and history of the area.

3.11.3.1. Previous Surveys

One previous survey has been conducted in the Project Area. The Class III linear survey resulted in the recording of two sites and no isolated finds. One other site has been previously recorded in the Project Area but it is not associated with a project. Only the linear survey covered any portion of the Project Area.

The previously recorded sites include two prehistoric and one historic resource. Site 48CR928 and Site 48CR3648 were re-located and re-recorded. These two sites are discussed below in the section on Recent Cultural Resource Investigations. The third site is 48CR7618, a prehistoric lithic scatter. This site is recommended as not eligible for the NRHP and is outside the current Project Area boundaries, although it is within ¼ mile of the boundary.

3.11.3.2. Potential Site Types

Based on the results of the files searches, the expected cultural resources for this area include prehistoric and historic resources. The prehistoric and historic site types that could be expected are:

- ü Prehistoric open camps that contain evidence of a broad range of activities, including subsistence-related activities. Cultural remains include features, lithic debris, chipped stone tools, and depending on the temporal period of use, evidence of milling and vegetable processing, including ground stone and pottery.

- ü Prehistoric lithic scatters consist of lithic debris such as debitage or chipped stone tools.

- ü Prehistoric or historic cairns that are low piles of local stone. Historic cairns are often constructed by sheepherders.

- ü Historic artifact scatters that are collections of historic debris often left by sheepherders and consist of artifacts such as glass, ceramic, and cans. Small artifact scatters may also be found along historic transporation routes such as the Rawlins to Baggs Stage Road.

Other site types that could occur but that have not been recorded in the Project Area include:

- ü Prehistoric quarries that are areas where lithic raw material was obtained and initially processed.

- ü Human burials, rock art (both pictographs and petroglyphs), and rock alignment could occur and may be identified as sensitive or sacred to Native Americans. Few of these types of sites have been located in southwestern Wyoming.

- ü Historic sheepherder's camps that would consist of features and historic debris.

Historic ranch complexes that are complex sites with historic debris and features and structures such as corrals, barns, dugouts, foundations, or standing elevation walls.

3.11.3.3. Cultural Resource Inventory for the Project

The Project Area was intensively surveyed in 2003 (Hatcher 2003). This investigation resulted in the recording of seven new sites, re-recording two previously recorded sites, and recording of seven new isolated finds. There are three prehistoric sites, six historic sites, and seven prehistoric isolated artifacts. Three prehistoric sites are recommended eligible to the NRHP and one historic site is eligible to the NRHP.

Site 48CR928 is a prehistoric site that was previously recorded and updated with the current investigation. The site consists of lithic debitage and features. The site has the potential for buried in situ cultural deposits and could contribute information regarding the prehistory of the area. The site is recommended eligible to the NRHP.

Site 48CR3648 is the Rawlins to Baggs Stage Road and consists of intact two-track ruts, swales and vegetative changes which can be followed with a reasonable degree of certainty. This segment is recommended as a contributing element to this eligible resource.

Site 48CR7927 is a prehistoric lithic scatter consisting of lithic debitage. The site is recommended as not eligible to the NRHP.

Site 48CR7928 is a historic stock watering structure and scatter of historic artifacts. The structure and artifacts are not unique or associated with events or persons important in the history of the area. The site is recommended as not eligible to the NRHP.
Site 48CR7929 is a prehistoric open camp with three features, one chipped stone tool, a scatter of possible groundstone, fire altered rock, and lithic debitage. This site has potential of buried in situ cultural deposits. The site is recommended as eligible to the NRHP.

Site 48CR7930 is a large cairn constructed of hundreds of tabular sandstone slabs. This cairn is located on a section line and is likely historic. The site is recommended as not eligible to the NRHP.

Site 48CR7931 is a prehistoric open camp consisting of lithic debitage, one core, and fire altered rock. The site has potential for buried in situ cultural deposits and is recommended as eligible to the NRHP.

Site 48CR7932 is a cairn constructed of tabular sandstone slabs. The cairn is next to the Section marker and is likely historic. The site is recommended as not eligible to the NRHP.

Site 48CR7933 is a historic artifact scatter consisting of scatter milled lumber, wooden wheel, tin cup, metal shovel, wooden hame, metal lid, oven, and glass jar. The site is recommended as not eligible to the NRHP.

3.11.4. Conclusion

The recent cultural inventory of the Red Rim Project Area identified three previously recorded sites, three newly recorded prehistoric sites, four newly recorded historic sites, and seven isolated finds. One site is within ¼ mile of but outside the Project Area. There are three eligible prehistoric sites and one eligible historic site. The eligible historic site is the Rawlins to Baggs Stage Road and the segment recorded in the Project Area is recommended as a contributing element to this eligible resource.

In southwest Wyoming, sand deposits (dunes, shadows, and sheets) are recognized as highly likely to contain cultural material. Certain topographic settings have greater archaeological sensitivity including eolian deposits (sand dunes, sand shadows, and sand sheets), and to a limited degree, colluvial deposits along lower slopes of ridges. The Project Area includes these deposits. The eligible prehistoric sites contain these deposits and have the potential for buried in situ cultural remains. Proximity to reliable water sources such as Sixteenmile Draw and Hadsell Draw is an important factor in predicting the occurrence of prehistoric resources and usually results in a high potential for prehistoric sites. If the proposed action is modified, an additional cultural resources inventory for the new area of proposed disturbance would be required.

3.12 SOCIOECONOMICS

The geographic area of analysis for potential socioeconomic effects is Carbon County, Wyoming, and the nearest communities of Baggs, Dixon, and Rawlins. The availability of temporary housing is also described for the communities of Craig in Moffat County, Colorado, and Wamsutter in Sweetwater County, Wyoming, the closest and most likely sources of the available workforce. Socioeconomic conditions in Carbon County that were characterized for the assessment include economic and population conditions, temporary housing re-sources, law enforcement and emergency management services, certain local and state government revenues, and local attitudes and opinions.

3.12.1. Economic Conditions

The economy of Carbon County is based on natural resources. Basic economic sectors that bring revenues into the county include oil and gas production and processing, coal mining, electric power generation, agriculture (primarily ranching and logging), some manufacturing, and transportation (primarily the Union Pacific railroad). Those portions of the retail and service sectors that serve travelers and tourism and recreation visitors are also basic.

Employment and earnings are two common measures of economic activity. The mining sector, which includes oil and gas employment, would be the primary sector affected by exploration or development of CBNG resources.

Employment, like the overall economy, has followed a boom and bust cycle. In 2000, employment in Carbon County totaled 12,392 full- and part-time jobs, which was about 25 percent higher than the 1990 level (WDAI 2000a, 2003) and about 9 percent lower than the1980 level of 13,560 jobs. Employment in the mining sector, which includes jobs in the oil and gas industry, decreased 76 percent from 1990 to 2000, from 934 to 223 jobs. The 2000 level was 94 percent lower than the 1980 level of 3,563 jobs mining jobs (UW 1997). The losses in the mining sector and the volatility in total employment are attributed to the shutdown of the Rosebud and Seminoe # 2 mines (BLM 1999a) and more recently the RAG Shoshone mine near Hanna (Rawlins Daily Times 2000). Other reductions in the mine workforce and the delay in opening an anticipated mine have further affected employment in the mining sector throughout the county; however, increased natural gas drilling has resulted in growth in employment in the oil and gas industry in recent years (Schnal 2000).

In Carbon County, 10-year unemployment rates ranged from a low of 4 percent (2000) to a high of 6.1 percent (1993). In 2000, the total labor force in Carbon County was 8,357, which included 337 unemployed persons, resulting in an unemployment rate of 4 percent (Wyoming Department of Employment 2003).

Carbon County earnings increased from $202 million to $211 million between 1990 and 1998, a 5 percent increase. However, when adjusted for inflation, earnings in Carbon County decreased by 21 percent from their 1990 level during the 8-year period.

3.12.1.1. Oil and Gas Activities

Production of natural gas in Carbon County increased from 76 million cubic feet (MCF) in 1995 to about 97 MCF during 2000. In addition, production of oil in Carbon County in 2000 was within 1.6 percent of the 1995 level of 1.3 million barrels. During 2000, there were 1,032 producing oil and gas wells in Carbon County (WOGCC 1995-2000).

One indicator of future production, approved Applications for Permits to Drill, increased steadily in Carbon County in recent years, from 50 in 1995 to 162 in 2000 to 225 to date in 2003. Increased drilling may result in increased production in the county if drilling efforts are successful and commodity prices rise or stabilize at economic levels.

3.12.1.2. Economic Activities

Other economic activities occurring in and near the Project Area include oil and gas exploration (Vosika Neuman 2000), cattle grazing (Warren 2000), and outdoor recreation such as hunting (pronghorn antelope, mule deer, elk and upland birds), hiking, off-road vehicle use, camping, and sightseeing. Many commercial hunting outfitters hold permits for the hunt areas where the Project Area is located, although the Project Area makes up only a small portion of these hunt areas (Clair 2000).

3.12.1.3. Population

The growth and decline in the population of Carbon County parallel the employment boom and bust cycle outlined at the beginning of this section. For example, the 2000 population of Carbon County (15,639) was 29 percent lower than its 1980 level of 21,896 (WDAI 2001). Between 1990 and 2000, the City of Rawlins, the largest community in Carbon County, lost an estimated 842 persons to end the period at 8,538, although the city is growing because a new state prison opened. The Town of Baggs gained 76 residents or 28 percent of its 1990 population. Likewise, the Town of Dixon, several miles east of Baggs, gained 12 persons to end the period with an estimated population of 79.

3.12.2. Temporary Housing Resources

Natural gas development typically involves relatively short-duration tasks carried out primarily by contractors. The nature of these activities results in demand for temporary housing resources such as motel rooms and mobile home and recreational vehicle (RV) spaces in the Project Area and vicinity.

The most convenient access to the Project Area would be from communities located along I-80 in Carbon and Sweetwater Counties. Rawlins is the county seat of Carbon County and the community nearest to the Red Rim Project Area. Temporary housing includes 20 hotels and four RV parks. Hotels and RV parks routinely accommodate oil and gas industry workers as well as tourists, travelers, and hunters. Longer-term rental housing in the Rawlins area consists of 10 apartment complexes and numerous rental houses. According to the 2000 Census, 17.3 percent, or 667 housing units, of the total 3,860 housing units were rental vacancies.

Temporary housing resources are available in the Town of Wamsutter, located 28 miles west of the Project Area on I-80, including several mobile home parks and three motels (Carnes 2000; Carbon County Chamber of Commerce 2003). The town is the center of a 200-well per year British Petroleum (BP) drilling and field development program. Wamsutter officials recently stated that no housing was available in the town to accommodate workers and their families associated with the current drilling and field development (Rock Springs Rocket Miner 2001).

3.12.3. Local Government and State Government Revenues

The fiscal condition of local and state governments most likely to be affected by interim drilling includes county, school, and special district ad valorem property tax revenues; state, county, and municipal sales and use tax revenues; state severance taxes; and federal and state mineral royalty distributions. Some county, municipal, and special district service expenditures may also be minimally affected.

3.12.3.1. Ad Valorem Property Tax

The assessed valuation in Carbon County for fiscal year (FY) 2001 totaled about $554 million, which yielded total property tax revenues of $34.9 million. Mineral production is assessed at 100 percent of value. The countrywide mill levy in 2001 was 12.76. Assessed valuation in FY 2001 from 2000 natural gas production totaled $363 million, or about 66 percent of total assessed valuation. Assessed valuation from oil production totaled $31.1 million, or about 6 percent of total valuation (WTA 2001).

3.12.3.2. Sales and Use Tax

FY 2000 sales and use tax collections in Carbon County totaled about $21 million. These collections include a 4 percent statewide sales and use tax, a 1 percent general purpose local-option sales and use tax, and a 1 percent specific-purpose local option sales and use tax, which expired in the summer of 2001 (WDAI 2000b).

3.12.3.3. Severance Taxes

In Wyoming, severance taxes are levied against certain minerals produced in the state, including a 6 percent severance tax on natural gas. In FY 2000, distributions from the severance tax totaled $275 million (WDAI 2000c). Of the total, 44 percent was attributable to severance taxes on natural gas.

3.12.3.4. Federal Mineral Royalties

The federal government collects a 12.5 percent royalty on oil and natural gas extracted from federal lands. After certain costs are deducted, half of those royalties are returned to the state where production occurred. In Wyoming, the state's share is distributed to a variety of accounts, including the university, school foundation fund, highway fund, Legislative Royalty Impact Account, and cities, towns, and counties. During FY 2000, $309 million in federal mineral royalty funds were distributed to entities in Wyoming (WDAI 2000d).

3.12.3.5. State Mineral Royalties

The State of Wyoming collects a 16.7 percent royalty on the fair market value of gas produced from state leases, less production, and transportation costs. During FY 2000, income from state leasing was $35 million (PRCBMIC 2001).

3.12.4. Attitudes and Opinions

A 1996 survey conducted in conjunction with preparation of the Carbon County Land Use Plan provides some insight into the attitudes and opinions of residents regarding land use, oil and gas development, natural resource conservation, and use and other topics. Slightly more than 300 residents completed the survey, yielding an estimated statistical reliability of about

95 percent (Pederson Planning Consultants 1998). Water resource conservation and concern for government regulation of land use were the most frequently listed important land use issues. This issue was followed closely by the availability of water to support future land uses; the economic viability of ranching, timber, and oil and gas industries; and the need to conserve wildlife habitat.

Approximately 55 percent of countywide survey respondents (based on a weighted average; some respondents indicated more than one response) indicated that conservation of land, water, and wildlife resources was more important than increased oil and gas production, while 36.9 percent indicated that increased oil and gas production was more important. However, 54 percent of the respondents from Baggs indicated that increased oil and gas production was more important than conservation of land, water, and wildlife resources, while 36 percent indicated that resource conservation was more important. The land use plan attributes this difference to the greater economic dependence in Baggs on future employment in the oil and gas industry.

Concerning management of federal lands, the largest number of respondents (69.5 percent) indicated that more federal lands within the county should be designated for conserving fish and wildlife habitat and surface water and groundwater resources. In addition, 60.8 percent of respondents indicated that more land should be designated for public recreation, 48.8 percent indicated that more land should be leased for oil and gas industry exploration and production, 48.7 percent indicated that more land should be leased for commercial mining, and 44.5 percent indicated that more land should be made available to local timber companies for commercial timber harvest.

3.12.5. Environmental Justice

Executive Order (EO) 12898, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations," was published in the *Federal Register* (59 FR 7629) on February 11, 1994. EO 12898 requires federal agencies to identify and address disproportionately high and adverse effects on human health or the environment of their programs, policies, and activities on minority and low-income populations (defined as living below the poverty level). The EO makes clear that its provisions apply fully to American Indian populations and Indian tribes, and specifically to effects on tribal lands, treaty rights, trust responsibilities, and the health and environment of Indian communities.

Communities within Carbon County and entities or individuals with interests in the area may have concerns about the presence of natural gas development within the Project Area. Communities potentially affected by the presence or absence of the proposed development have been identified in the previous sections. Environmental justice concerns are usually directly associated with impacts on the natural and physical environment, but these impacts are likely to be interrelated with social and economic impacts as well. Environmental justice concerns focus on promoting the protection of human health and the environment, encouraging public participation, and disseminating relevant information to educate potentially affected communities.

Native American access to cultural and religious sites may fall under the umbrella of environmental justice concerns if the sites are on tribal lands or access to a specific location has been granted by treaty right. With regard to environmental justice issues affecting Native American tribes or groups, the Project Area contains no tribal lands or Indian communities, and no treaty rights or Indian trust resources are known to exist for this area.

3.13 TRANSPORTATION

The regional transportation system that serves the Project Area includes an established network of interstate and state highways and county roads. Improved and unimproved BLM roads serve local traffic on federal land.

Federal and state highways that provide access to the Project Area include U.S. Interstate Highway 80 (I-80) Wyoming State Highway (WY) 789, WY 71, and WY 70. The Wyoming Department of Transportation (WYDOT) measures annual average daily traffic (AADT) and collects accident statistics on federal and state highways. AADT and accident statistics for highways providing access to the Project Area are shown in **Table 3-14**.

WYDOT assigns levels of service to highways in the state system. Levels of service (A through F) are assigned based on qualitative measures (speed, travel time, freedom to maneuver, traffic interruptions, and comfort and convenience) that characterize operational conditions within traffic streams and the perceptions of those conditions by motorists. "A" represents the best travel conditions, and "F" represents the worst. Levels of service for highways that provide access to the Project Area are shown in **Table 3-14**.

The Project Area would be accessed from Carbon County Road (CCR) 605 (Twentymile Road), which connects with I-80 at the west side of Rawlins. Limited access is also available from unimproved BLM roads that connect with State Highway 71. CCR 605 is a one-lane road that is graded and partially graveled. It is located adjacent to most of the pipeline corridor and intersects the southeastern portion of the Project Area. The road currently provides access to hunting on public lands, grazing operations on public and private lands, and other oil and gas operations in the area.

TABLE 3-14 HIGHWAY ACCESS, ANNUAL AVERAGE DAILY TRAFFIC, AND ACCIDENT STATISTICS

Highway	2000 AADT	Projected 2012 AADT	Level of Service/Annual Average Accidents 1996 -2000
I-80 from Rawlins west to Creston Junction	10,900	15,000	A/123.4
I-80 from Rock Springs east to Creston Junction	10,900	15,000	A/246.6
WY 789 from Creston Junction south to Baggs	760	800	B/18.8
WY 70 from Savery west to Baggs	530	550	B/14.8
WY 71 I-80 south	160	160	B/3.2

Sources: GHEP 2003

3.14 HEALTH AND SAFETY

Existing health and safety concerns in and adjacent to the Project Area include occupational hazards associated with natural gas exploration and operations; risks associated with vehicular travel on improved and unimproved county and BLM roads; firearms accidents associated with hunting or casual use of firearms; and low-probability events such as landslides, flash floods, and range fires.

3.14.1. Occupational Hazards

Two types of workers would be employed by the project: oil and gas workers who in 1998 had an annual accident rate of 4.0 per 100 workers, and special trade contractors, who had a non-fatal accident rate of 8.9 per 100 workers (U.S. Department of Labor, Bureau of Labor Statistics 1998). These rates compare with an overall private industry average for all occupations of 6.2 per 100 workers.

There has been recent concern among drillers that worker safety standards and training used for conventional oil and gas may not be appropriate for the CBNG industry (Rock Springs Rocket Miner 2001). During 2000, five workers died and six others were seriously injured in CBNG-related accidents in Campbell County, Wyoming. The Wyoming Occupational Safety and Health Administration (OSHA), Worker's Safety Division, is working with company officials to consider changes in worker safety standards and revised training requirements.

3.14.2. Pipeline Hazards

Accident rates for gas transmission pipelines are historically low. Nationwide, injuries associated with gas transmission pipelines averaged 12 per year from 1990 through 2001, fatalities averaged one per year, and incidents such as ruptures averaged 79 per year (U.S. Department of Transportation 2002).

3.14.3. Other Risks and Hazards

Hazards would exist from sanitation and materials used during oil and gas development. Federal regulations establish standards for safety procedures during drilling, including blowout prevention equipment to control abnormally high pressures if encountered during drilling operations, and procedures to be employed for the control and removal of wastes, spill prevention, fire prevention, and suppression. The existing risks associated with wildfire in the Project Area have not been characterized or quantified for either natural or human-caused ignitions. The handling, storage, transportation, and disposal of hazardous materials, if any are used, also are regulated. A spill prevention control and countermeasures plan is required.

The types of materials used in the development of CBNG are materials that are often found in a garage at a residence, including ammonia, gasoline, diesel fuel, motor oil, greases and lubricants, solvents to clean equipment, antifreeze-type heat transfer fluids (glycols), paint, sand, fertilizers, and herbicides (weed killers). Additional materials that are typically used are solutions that are used to regulate acidity and alkalinity, such as those that could be used for spa maintenance, including sodium hydroxide, and acids. Surfactants (soap-like materials), inert gases that are not toxic, flammable, or explosive, and welding or cutting materials also are used.

3.15 NOISE

The Project Area is located in a sparsely populated rural setting with modest sound disturbances. The principal source of sound within the Project Area is the wind. Vehicle traffic on I-80 and WY 71; jet aircraft overflights at high altitudes; localized vehicular traffic on county and BLM roads and two-tracks in the Project Area; nearby drilling; a compressor station, and generation also cause sound disturbances within the Project Area. The EPA has established an average 24-hour noise level of 55 A-weighted decibel (dBA) as the maximum level that does not adversely affect public health and welfare. The State of Wyoming has not established regulations for quantitative noise levels. Definitive data have not been established concerning noise levels that may affect animals.