3.0 Affected Environment

This chapter describes the affected environment for the Application Area, including conditions and trends of the human and natural environment that potentially could be impacted by the alternatives described in Chapter 2.0. The CEQ regulations discuss "human environment" in 40 CFR 1508.14: the term broadly relates to biological, physical, social, and economic elements of the environment. The description of the affected environment is defined and limited by the identified issues brought forward by the public and the BLM. As appropriate, ranges and trends for individual resources have been provided in the following resource sections, taking into account change factors such as development and climate change. Within the description of resources, the term "Application Area" refers to the area, encompassing 229,077 acres, specified in the applicant's Wind Site Testing and Monitoring Application and Application Areas for ROWs of ancillary facilities filed with the BLM (shown in **Figure 1-2**).

The CEQ regulations require the BLM to obtain information when preparing NEPA documents if it is "relevant to reasonably foreseeable significant adverse impacts," if it is "essential to a reasoned choice among alternatives," and if "the overall cost of obtaining it is not exorbitant" (40 CFR 1502.22). The majority of the data that are used to characterize the affected environment were collected from the RFO of the BLM, USEPA, USFWS, U.S. Geologic Survey (USGS), National Resources Conservation Service (NRCS), WGFD, Wyoming Department of Environmental Quality (WDEQ), and other county and local agencies. The data include published and unpublished reports, maps, and data in digital format. In addition, field surveys for wildlife, special status species, soils, vegetation verification, recreation, and visual resources were conducted by AECOM and subcontractors specifically for this project.

3.1 Air and Atmospheric Values

3.1.1 Air Quality

The federal CAA amendments of the 1990s require all states to control air pollution emission sources so that National Ambient Air Quality Standards (NAAQS) are met and maintained. Air quality within the Application Area has the potential to be affected by such activities as emissions from the construction of facilities, access roads, and maintenance and management of installed equipment. This section describes the existing air quality resource of the region and the applicable air regulations that would apply to the proposed project.

Air quality in a given location is defined by pollutant concentrations in the atmosphere and is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). One measure of a pollutant is its concentration in comparison to a national and/or state ambient air quality standard. The NAAQS are established by the USEPA and are outlined in 40 CFR 50. These standards represent the maximum allowable atmospheric concentrations that may occur without jeopardizing public health and welfare, and include a reasonable margin of safety to protect the more sensitive individuals in the population. The NAAQS represent maximum acceptable concentrations that generally may not be exceeded more than once per year, except the annual standards, which may never be exceeded. An area that does not meet the NAAQS is designated as a nonattainment area on a pollutant-by-pollutant basis. The State of Wyoming has adopted the NAAQS as state air quality standards and has additional Ambient Air Quality Standards for other pollutants that are more applicable to oil and gas projects; these standards are not included in this document as they would not pertain to this project. The Application Area is considered to be in attainment; that is, the air quality is within the NAAQS.

Pollutants emitted during construction and operation of a wind energy project include particulates (fugitive dust), as well as nitrogen dioxide (NO_2), carbon monoxide (CO), and sulfur dioxide (SO_2) from roadways, batch plants, construction activities and engines powering construction equipment and other mobile sources. Fugitive volatile organic compounds (VOCs) emissions are relatively small compared to other potential pollutants. These same pollutants, as well as others, are emitted by industrial facilities in the region including refineries, natural gas pipelines, compressor stations, mines, and sawmill operations. Fugitive VOCs also are emitted by exploration and production of oil and natural gas in the region. The pollutants of interest for the proposed project are listed in **Table 3.1-1**.

Table 3.1-1 National and State Ambient Air Quality Standards

		Wyoming Standards	National Standards	
Pollutant	**Averaging Time**	**Concentration**	**Primary**	**Secondary**
Ozone	8-hour[1]	0.08 ppm	0.08 ppm	0.075 ppm
CO	1-hour	35 ppm	35 ppm	35 ppm
	8-hour	9 ppm	9 ppm	9 ppm
SO_2	1-hour[2]	None	196 $\mu g/m^3$	None
	3-hour	1,300 $\mu g/m^3$	None	1,300 $\mu g/m^3$
	24-hour	365 $\mu g/m^3$	365 $\mu g/m^3$	None
	Annual Average	80 $\mu g/m^3$	80 $\mu g/m^3$	None
NO_2	Annual Average	100 $\mu g/m^3$	100 $\mu g/m^3$	100 $\mu g/m^3$
	1-hour[3]	None	188 $\mu g/m^3$	None
PM_{10}	24-hour[4]	150 $\mu g/m^3$	150 $\mu g/m^3$	150 $\mu g/m^3$

Table 3.1-1 National and State Ambient Air Quality Standards

		Wyoming Standards	National Standards	
Pollutant	**Averaging Time**	**Concentration**	**Primary**	**Secondary**
PM_{10}	Annual Average	50 μg/m^3	None	None
$PM_{2.5}$	24-hour	35 μg/m^3	35 μg/m^3	35 μg/m^3
$PM_{2.5}$	Annual Average	15 μg/m^3	15 μg/m^3	15 μg/m^3

[1] 3-year average of the fourth highest (98 percentile) daily 8-hour maximum.

[2] 3-year average of the 99th percentile of the highest daily 1-hour maximum.

[3] 3-year average of the 98th percentile of the highest daily 1-hour maximum.

[4] 3-year average of the 98th percentile of the highest daily average concentration.

Other state-only standards are not cited.

3.1.1.1 NAAQS

The criteria for potential air quality impacts include NAAQS requirements for CO, particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), SO_2, and NO_2/nitrogen oxides (NO_X). Applicable federal and state standards are presented in **Table 3.1-1**.

Other industrial, commercial, or government facilities in the general area also may be sources of air pollutants. For the latest year available (2002) on the USEPA Airdata website, the larger industrial sources of emissions of criteria pollutants in Carbon County are provided in **Tables 3.1-2** through **3.1-6**. The numerous small sources in the county are not included in these tables (the totals in the table do not add to 100 percent).

VOCs are not in themselves considered a criteria air pollutant. VOCs are largely responsible for the formation of ground level ozone; therefore, VOCs are reported in emissions inventories.

3.1.1.2 Air Quality Measurements

NO_2

Several ambient air quality stations are operated in Wyoming by the State of Wyoming or other operators; however, there are few data collection sites that measure ambient air quality in the vicinity of the Application Area in Carbon County. The highest measured 1-hour value of NO_2 in Carbon County at a site near the Atlantic Rim was 13 parts per billion (ppb) in 2007 and 14 ppb in 2008. The annual average at Atlantic Rim was 2 ppb in 2008. These annual and 1-hour values are well below the allowable annual average NAAQS of 53 ppb (USEPA 2009b).

An ambient air quality site near the town of Wamsutter in Sweetwater County is used to track meteorology and air quality downwind of an area of extensive natural gas development. The Wamsutter Station includes gaseous (NO_X, SO_2, and ozone), continuous particulate ($PM_{10,}$ tapered element oscillating microbalance, and meteorological monitoring. This station began operations on March 13, 2006. The Wamsutter site is generally upwind of the Application Area and provides a conservative representation of regional air quality. The highest annual average NO_2 measurements at Wamsutter were 7 ppb in both 2006 and 2007 (WDEQ 2008).

Table 3.1-2 Sources of NO_2

NO_2 Sources	2002 Emissions (tons per year [tpy])	Portion of Total Emissions in Carbon County (percent [%])
Sinclair Oil Corporation - Sinclair Refinery	1,207	49.52
Colorado Interstate Gas (CIG) Rawlins Compressor	794	32.56
Williams Field Services - Echo Springs	193	7.91
CIG Muddy Gap Comp	113	4.63

Table 3.1-3 Sources of SO_2

SO_2 Sources	2002 Emissions (tpy)	Portion of Total Emissions in Carbon County (percent [%])
Sinclair Oil Corporation - Sinclair Refinery	3,256	99.97
Louisiana Pacific Saratoga Mill	0.89	0.03
44 Lumber and Timber	0.15	<0.01

Table 3.1-4 Sources of PM_{10}

PM_{10} Source	2002 Emissions (tpy)	Portion of Total Emissions in Carbon County (percent [%])
Arch of Wyoming Medicine Bow Mine	130	37.27
Sinclair Oil Corp - Sinclair Refinery	104	29.85
Arch of Wyoming Seminoe - II Mine	45.7	13.13
Louisiana Pacific Saratoga Mill	44.7	12.85

Table 3.1-5 Sources of $PM_{2.5}$

$PM_{2.5}$ Sources	2002 Emissions (tpy)	Portion of Total Emissions in Carbon County (percent [%])
Sinclair Oil Corporation - Sinclair Refinery	71.4	39.65
Arch of Wyoming Medicine Bow Mine	45.3	25.16
Louisiana Pacific Saratoga Mill	39	21.66
Arch Of Wyoming Seminoe Mine	16.0	8.86

PM_{10}

Two exceedences of PM_{10} occurred at the Wamsutter monitor in 2007. The first occurred on March 27, 2007, with a concentration of 227 µg/m^3 and the second occurred on April 18, 2007, with a

concentration of 199 µg/m^3. During the spring of 2007, a pipeline was being constructed less than 1 mile south of the Wamsutter station. On both days, strong winds occurred, blowing dust from the pipeline construction site northeast to the Wamsutter station (WDEQ 2008).

Table 3.1-6 Sources of VOC

VOC Sources	2002 Emissions (tpy)	Portion of Total Emissions in Carbon County (percent [%])
Sinclair Oil Corporation - Sinclair Refinery	1,762	80.94
Williams Field Services - Echo Springs	133	6.11
Sinclair Oil Corp - Bairoil Station	82.6	3.79
Louisiana Pacific Saratoga Mill	63.6	2.92
CIG Rawlins Compressor	57.8	2.66

SO_2

WDEQ, Air Quality Division, has not reported any exceedences of the 3-hour, 24-hour, or annual SO_2 standards at the two monitoring sites near the Application Area (Murphy Ridge, near the Wyoming/Utah border, and Wamsutter). One year of data were collected at the sites in 2007. The measured values for Wamsutter are 0.010, 0.002, and 0.001 ppm for the 3-hour, 24-hour, and annual averages respectively (WDEQ 2008).

$PM_{2.5}$

There are six state-run monitoring sites that collect $PM_{2.5}$ data along with the four monitors in the Powder River Basin $PM_{2.5}$ network. None of the monitors are in the vicinity of the Application Area, and none of the monitors indicate concerns within the state of Wyoming with meeting the annual or 24-hour $PM_{2.5}$ NAAQS (WDEQ 2008).

3.1.2 Visibility

Visibility impairment in the form of regional haze obscures the clarity, color, texture, and form of what can be seen. Regional haze regulations were developed to maintain visibility on the least impaired days, and improve visibility on the most impaired days in mandatory federal Class I areas across the U.S. These mandatory Class I areas are defined as certain national wilderness areas (greater than 5,000 acres), national memorial parks (greater than 5,000 acres), and national parks (greater than 6,000 acres) that were in existence as of August 1977; they are afforded the highest level of protection (USEPA 2004). Ambient air criteria that apply within Class I areas are more stringent than those that apply to other areas (i.e., Class II areas). In addition to more stringent ambient air increments, Class I areas also are protected by the regulation of air quality related values (AQRVs) which include visibility, within their borders. Federal land managers are responsible for the management of Class I areas.

Mandatory Class I areas within 300 km of the project include Rocky Mountain National Park, Rawah Wilderness Area, Mount Zirkel Wilderness Area, Flat Tops Wilderness Area, and Eagles Nest Wilderness Area, all in Colorado, as well as Bridger and Fitzpatrick Wilderness areas in Wyoming.

Interagency Monitoring of Protected Visual Environments (IMPROVE) has measured visibility in national parks and wilderness areas in the United States since the 1980s. Visibility can be expressed in terms of deciviews (dv), a measure for describing perceived changes in visibility. One dv is defined as a change in visibility that is just perceptible to an average person, representing an estimate of 10 percent change in light extinction.

Monitored aerosol concentrations are used to reconstruct visibility conditions for each day monitored, ranked from clearest to haziest. Conditions are reported in three categories:

- 20 percent clearest – mean visibility for the 20 percent of days with the best visibility;
- Average – the annual mean visibility; and
- 20 percent haziest – mean visibility for the 20 percent of days with the poorest visibility.

In Rocky Mountain National Park, visibility on the 20 percent clearest days varies from 4 to 6 dv (visual range of about 150 to 173 miles). Average visibility varies from 8 to 10 dv (about 112 to 126 miles). Visibility for the 20 percent haziest days varies from 12 to 14 dv (about 71 to 88 miles). Trend analysis of Rocky Mountain National Park visibility data reveals no significant worsening of visibility from 1995 through 2004. Also, for comparison, **Figure 3.1-1** provides the reconstructed fine mass data (data values) for Rocky Mountain National Park from 2007 through mid-2009. Similar to the visibility data, no upward trend is evident in these data. Fine particulate matter consists of particles with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$). Fine particles are responsible for most atmospheric particle-induced extinction.

Visibility data for an IMPROVE visibility monitoring station near Centennial, Wyoming (Brooklyn Lake) indicates that the visibility on the 20 percent clearest days is 3.2 dv (visual range 178 miles). Average visibility (normal day) is 7.3 dv or 117 miles visual range. On the 20 percent haziest days, the visibility is 11 dv, or roughly 81 miles visual range.

These data indicate that visibility near Centennial is in the range of visibility measured over the last 10 years at Rocky Mountain National Park. Visibility data from the long-term study (Wyoming 2003) suggest that visibility is comparable to other sites around Wyoming.

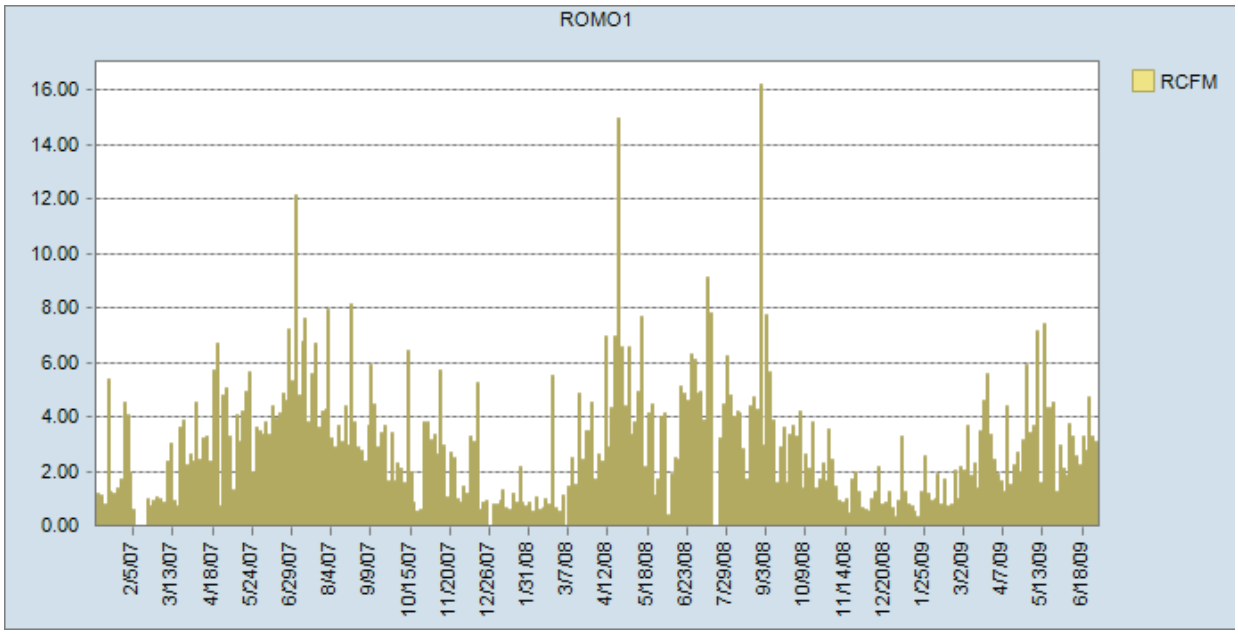
The BLM will use VISCREEN default screening criteria to assess the impacts at Class I area: (i.e., Delta E of 2.00 and Contrast of 0.05). Impacts that are below these screening level thresholds will be assumed to be very minor.

3.1.3 Climate and Meteorology

The climate of the Application Area is classified as desert and semiarid steppe (BLM 2009; Trewartha and Horn 1980) with cold winters and hot summers. Annual precipitation (rainfall and snowfall) in the region ranges from 8 to 10 inches. A climate summary for Rawlins is presented in **Table 3.1-7**.

Steppe climate is characterized by a large seasonal range in temperature (cold winters and warm summers) and by precipitation levels that are low but still sufficient for the growth of short sparse grass. The dryness of the mid-latitude steppe climate of southeast Wyoming is due to the area's distance from the Pacific Ocean, the main source of precipitation for storms in the western portion of the RFO. This aridity is intensified by the Sierra Nevada, Pacific Coast, and Rocky Mountain Ranges, which intercept the flow of humid coastal air. In addition, annual rainfall amounts can vary greatly from year to year.

Three important meteorological factors influence the dispersion of pollutants in the atmosphere: mixing height, wind (speed and direction), and stability. Mixing height is the height above ground within which rising warm air from the surface will mix by convection and turbulence. Local atmospheric conditions, terrain configuration, and source location determine dilution of pollutants in this mixed layer. Mixing heights vary diurnally, with the passage of weather systems, and with season. Temperature inversions, where air temperatures near the ground are colder than the temperatures above, are common in the basins and other lower elevations of the region. Inversions commonly occur in winter when snow accumulation on the ground combines with short daylight hours. In summer, inversions dissipate rapidly when early morning sunlight warms the air near the ground surface. Inversions can hinder air pollutant dispersion by preventing emissions from mixing with the ambient air in the vertical direction. On average, mean morning mixing heights in the area are approximately 1,000 feet; mean afternoon mixing heights



Source: http://views.cira.colostate.edu/web/DataWizard/.

Figure 3.1-1 Trend Analysis of Rocky Mountain National Park Reconstructed Fine Mass Data

Table 3.1-7 Rawlins, Wyoming, Period of Record Monthly Climate Summary

Period of Record: 3/ 6/1951 to 5/31/2008													
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Annual**
Average Max. Temperature (degrees Fahrenheit [°F])	30.8	33.8	41.3	52.6	63.9	75.4	83.8	81.1	70.5	57.0	40.7	32.0	55.2
Average Min. Temperature (°F)	12.6	14.7	20.4	27.6	36.3	44.6	51.5	50.0	40.8	31.2	20.4	14.0	30.3
Average Total Precipitation (inches)	0.45	0.50	0.69	1.01	1.30	0.90	0.76	0.76	0.84	0.81	0.55	0.46	9.03
Average Total Snowfall (inches)	7.9	7.5	7.8	7.1	1.6	0.2	0.0	0.0	1.2	3.4	7.7	7.5	51.9
Average Snow Depth (inches)	2	2	1	0	0	0	0	0	0	0	1	1	1

Source: Western Regional Climate Center 2009.

are more than 7,800 feet (Holzworth 1972). Mean morning mixing heights tend to be lowest in fall and highest in spring.

Morning atmospheric stability conditions tend to be stable because of the cooling of the layers of air nearest the ground. Afternoon conditions, especially during the warmer months, tend to be neutral to unstable because of the rapid heating of the surface under clear skies. During the winter, periods of stable afternoon conditions may persist for several days in the absence of synoptic (continental scale) storm systems to generate higher winds with more turbulence and mixing. A high frequency of inversions at lower elevations during the winter can be attributed to the nighttime cooling and sinking air flowing from higher elevations to the low lying areas in the basins. Although winter inversions are generally quite shallow, they tend to be more stable because of reduced surface heating.

The latitude of the Application Area is within the belt of prevailing westerly winds that circle the globe around the earth's northern hemisphere. However, the Application Area is located in complex terrain where the local winds are affected by topographic features.

Because of the typically dry atmosphere, bright sunny days and clear nights frequently occur. This in turn allows rapid heating of the ground surface during daylight hours and rapid cooling at night. Since heated air rises, and cooled air sinks, winds tend to blow uphill during the daytime and down slope at night. This upslope and down slope cycle generally occurs in all the geographical features, including mountain range slopes and river courses. The complexity of terrain features cause complex movements in the cyclic air patterns, with thin layers of moving air embedded within the larger scale motions. The lower level, thermally driven winds also are embedded within larger scale upper wind systems (synoptic winds). Synoptic winds in the region are predominantly west to east, are characterized by daily weather variations that enhance or diminish the boundary layer winds and are significantly channeled by regional and local topography.

Weather stations in the vicinity of the Application Area include stations located in Rawlins in Carbon County, and Wamsutter in Sweetwater County. Rawlins is located at an elevation of 6,736 feet and is north of the Application Area. Meteorological data available from the Rawlins weather station from 1951 through May 2008, as well as on-site data from the CCSM sites, form the basis of the climate and weather characterization below.

Air pollutant dispersion in the Application Area also is dependent on wind direction and speed. Although wind direction is highly influenced by the local terrain, on-site measurements indicate that the wind direction tends to be southwesterly (i.e., blowing from the southwest to northeast [PCW 2008a]) (**Figure 3.1-2**).

Wyoming is quite windy, and during the winter there are frequent periods when the wind reaches 30 to 40 mph with gusts to 50 or 60. Prevailing directions in the different localities vary from west-south-west through west to northwest. In many localities winds are so strong and constant from those directions that trees show a definite deformation towards the east or southeast (National Oceanic and Atmospheric Administration [NOAA] 1985).

Wind speeds within the CCSM sites are greater than those generally recorded for nearby Rawlins. Average wind speeds in the Chokecherry site are approximately 21 mph (9.5 m/sec) and winds are predominantly from the southwest (PCW 2008a).

Average wind speeds in the Sierra Madre site are approximately 22 mph (9.9 m/sec) and also are predominantly from the southwest. **Figure 1-3** shows the average monthly wind speeds recorded for the CCSM sites (PCW 2008a).

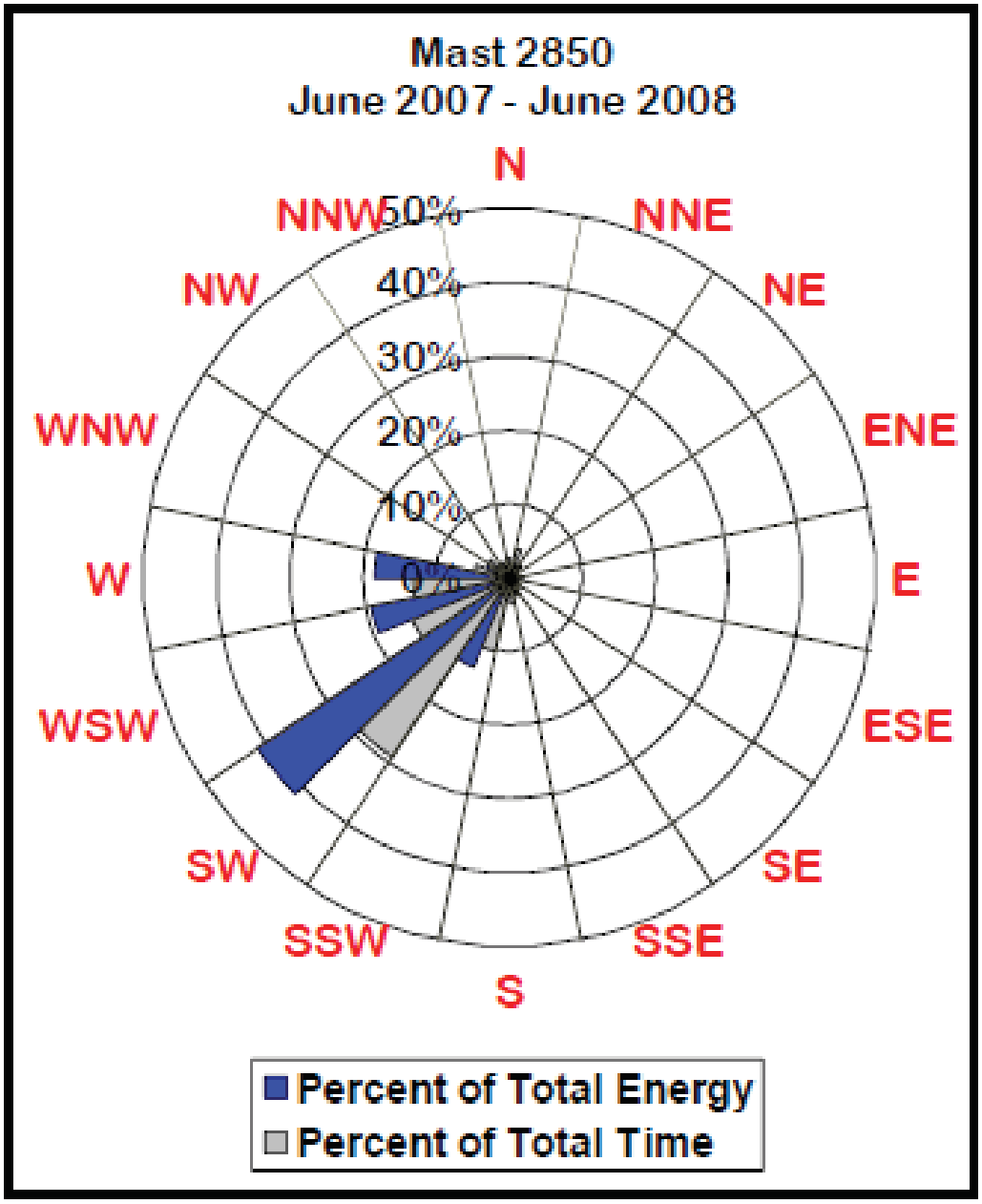


Figure 3.1-2 Windrose for the Application Area

3.1.4 Climate Change

Ongoing scientific research has identified the potential impacts of anthropogenic (man-made) greenhouse gas (GHG) emissions and changes in biological carbon sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space.

GHGs include CO_2 and other pollutants, the emissions of which are based on CO_2-equivalents (CO_2e) due to each compound's effect on trapping infrared radiation. CO_2e is the concentration of CO_2 that would cause the same level of radiative forcing as a given type and concentration of GHG. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused CO_2(e) concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The Intergovernmental Panel on Climate Change (IPCC) recently concluded that warming of the climate system is unequivocal and most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic GHG concentrations (IPCC 2007).

Global mean surface temperatures have increased nearly 1.8°F from 1890 to 2006. Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24°N) have exhibited temperature increases of nearly 2.1°F since 1900, with nearly a 1.8°F increase since 1970. Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

In 2001, the IPCC projected that by the year 2100, global average surface temperatures could increase by 2.5 to 10.4°F above 1990 levels. The National Academy of Sciences (NAS [2010]) has confirmed these projections, but also has indicated there are uncertainties regarding how climate change may affect different regions. Computer model predictions indicate that increases in temperature will not be equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures are more likely than increases in daily maximum temperatures. Although large-scale spatial shifts in precipitation distribution may occur, these changes are more uncertain and difficult to predict.

As with any field of scientific study, there are uncertainties associated with the science of climate change; however, this does not imply that scientists do not have confidence in many aspects of climate change science. Some aspects of the science are known with virtual certainty because they are based on well-known physical laws and documents trends (USEPA 2010).

Several activities contribute to the phenomena of climate change, including emissions of GHGs (especially CO_2 and methane) from fossil fuel development; large wildfires; activities using combustion engines; changes to the natural carbon cycle; and changes to radiative forces and reflectivity (albedo). It is important to note that GHGs will have a sustained climatic impact over different temporal scales. For example, recent emissions of CO_2 may influence climate for 100 years. It may be difficult to discern whether climate change is already affecting global resources, as well as the Application Area. In most cases there is little information about potential or projected effects of global climate change on resources. It is important to note that projected changes are likely to occur over several decades to a century. Therefore, many of the projected changes associated with climate change may not be measurably discernible within the reasonably foreseeable future. Existing climate prediction models are global in nature; therefore, they are not at the appropriate scale to estimate potential impacts of climate change on a regional scale that represents the vicinity of the project.

3.2 Cultural Resources and Native American Concerns

3.2.1 Cultural Resources

Cultural resources are finite locations of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional, cultural, or religious importance to specified social and/or cultural groups. Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and utilizing for public benefit.

3.2.1.1 Regulatory Framework

Federal historic preservation legislation provides a legal environment for documentation, evaluation, and protection of archaeological and historic sites that may be affected by federal undertakings, or by private undertakings operating under federal license or on publicly managed lands. NEPA states that federal agencies shall take into consideration impacts to the natural environment with respect to an array of disciplines, and that alternatives must be considered. The courts have made it clear that archaeological and historic sites (i.e., cultural resources) are regarded as part of the natural environment. The NHPA of 1966, as amended, established the Advisory Council on Historic Preservation (ACHP) and the National Register of Historic Places (NRHP). The NHPA mandates that federal agencies consider the effects of an undertaking on cultural resources that are listed or eligible for inclusion in the NRHP. Section 106 of the NHPA establishes a four-step review process by which cultural resources are given consideration during the conduct of federal undertakings. Cultural resources that are listed or eligible for inclusion in the NRHP are referred to as “historic properties.”

The BLM RFO currently is preparing a PA for the CCSM Wind Energy Project. The PA defines general and specific measures that would be undertaken by the BLM, Wyoming SHPO, and PCW to ensure that the BLM’s objectives and responsibilities regarding the protection of historic properties under the NHPA would be fulfilled. Specifically, the PA outlines the steps to be taken to: 1) identify prehistoric and historic sites; 2) evaluate them for eligibility for inclusion in the NRHP; 3) identify potential adverse effects; 4) develop measures to avoid, reduce, or mitigate adverse effects; and 5) address inadvertent discoveries. Additionally, the PA assigns roles and responsibilities for implementation of the PA, which ensures that all interested parties are given an opportunity to comment on the effects of an undertaking to historic properties and any mitigation for such effects. Additional information on BLM procedures for protecting historic properties is provided in **Appendix E**.

Prehistoric Narrative

The Application Area lies along a rough boundary zone between a plains-grasslands adaptation type and an interior basin adaptation type. The plains-grasslands adaptation type is epitomized by bison hunters of the prairies in the Northwestern Plains of eastern Wyoming and southern Montana. The interior basin adaptation type is typified by hunter-gatherers of the basins of southwestern Wyoming, who relied less on bison hunting and more on resources such as antelope, rabbits, and roots and seeds. One culture-historical classification scheme is used in the grasslands of the Northwestern Plains (Frison 1991), while another scheme has been developed for southwestern Wyoming (Metcalf 1987; Thompson and Pastor 1995). In a prehistoric context written for the 2008 Rawlins RMP, McNees et al. (2010) have drawn from both schemes, in the process updating the sequences in light of recent data. Four major periods, defined by the Northwestern Plains scheme, provide the overall structure to the prehistoric sequence; in chronological order these periods are Paleoindian, Archaic, Late Prehistoric, and Protohistoric. The Archaic and Late Prehistoric periods are further divided internally into phases defined for the southwestern Wyoming sequence. Information in the following paragraphs is drawn from the four sources cited above.

The Paleoindian period (12,000 to 7500 B.P. [years before present]) is the earliest well-documented era of human occupation in Wyoming and is represented by groups that occupied North America at the end of the last glaciation. Paleoindians in the plains-grassland areas subsisted primarily on large game such as mammoths and bison (of which some species are now extinct) with only rare evidence of smaller game or plant food use. In the basin areas more balanced hunter-gatherer subsistence practices were followed, featuring exploitation of large as well as smaller mammals. Finer divisions within the Paleoindian period, termed complexes, are based largely on distinctions in projectile point styles. Prominent in the Paleoindian period are the early Clovis and Folsom complexes, characterized by fluted point styles, and numerous later manifestations such as Hell Gap, Cody, Lusk, and James Allen that feature a variety of unfluted and sometimes stemmed styles.

The temporal transition from the Paleoindian to the Archaic period (7500 to 1500 B.P.) is indistinct and may have begun by 8500 B.P. or earlier in southwestern Wyoming. The Archaic period is divided into an early stage (7500-3500 B.P.) and a late stage (3500-1800 B.P.), each of which is further partitioned into phases. Projectile points of the Early Archaic period tend to be large, corner- and side-notched forms similar to those found in the Great Plains. Climatic warming and drying in western North America ultimately led to the Altithermal episode, which was characterized by significantly elevated temperatures, reduced effective moisture, and a general desiccation of the landscape for a period of 2000 to 3000 years. Early Archaic groups responded by switching to an emphasis on smaller game animals and plant resources. Compared to the preceding Paleoindian period and subsequent periods, bison hunting appears to have formed a relatively minor portion of the subsistence base. Hunting activities emphasized small game such as rabbits and medium-size game like antelope and deer.

The Early Archaic is divided into the Great Divide phase (7500 to 6000 B.P.) and Opal phase (6000 to 3500 B.P.). The Great Divide phase is defined more by its lack of Paleoindian and later Archaic artifacts than any intrinsic characteristics. The projectile points of this phase consist of a variety of side-notched, stemmed, and lanceolate (leaf-shaped) varieties. Evidence of jackrabbits, cottontails, and ground squirrels is common at Great Divide phase sites. The lengthy Opal phase is marked by the appearance in the archaeological record of simple habitation structures such as basin houses and an increase in the occurrence of slab-lined hearths and storage pits. Stone tools include large corner-notched, side-notched, stemmed, and lanceolate projectile points and large side-notched knives. Seeds are more common than in the preceding Great divide phase, as are ground stone implements. The remains of small game animals are common at Opal phase sites.

The transition to the Late Archaic is marked by a shift to the exploitation of larger game animals, particularly bison, as climatic conditions became somewhat cooler and wetter and grazing conditions improved. Projectile point styles during this period include a greater percentage of large corner-notched dart points, often called Elko or Pelican Lake. The Late Archaic is divided into the Pine Springs phase (3500 to 2800 B.P.) and Deadman Wash phase (2800 to 1800 B.P.). During the Pine Springs phase larger mammals like deer, elk, antelope, mountain sheep, and bison were exploited in greater quantities with a corresponding decline in the use of smaller game. The Deadman Wash phase corresponds with maximum neoglacial conditions, during which time the climate was relatively wet. Large game animals became increasingly important during the Deadman Wash phase, and plant remains are increasingly common at sites, suggesting the beginnings of an emphasis on seed processing that characterizes the following Late Prehistoric period. The projectile points are triangular corner-notched types that resemble Pelican Lake points common to areas further east.

The transition from the Archaic to the Late Prehistoric period (1800 to 250 B.P.) is marked by the development of pottery and the introduction of the bow and arrow. The Late Prehistoric period is divided into the Uinta and Firehole phases. The Uinta phase covers the span from 1800 B.P. to 650 B.P. and is represented by large numbers of sites occupying a broad range of ecological zones. Projectile point size is reduced significantly due to the shift to archery, with a predominance of Rose Spring points. The ceramics found at these sites are generally crude and include both locally-manufactured and imported wares. Basin houses are a common trait, as are abundant hearths. The Firehole phase (650 to 250 B.P.)

is of short duration and ends with the introduction of European trade goods and traders into the region. This phase also demonstrates a continuation of the increased exploitation of plant foods seen in the Deadman Wash phase and the use of crude structures. Desert side-notched, Cottonwood triangular, and tri-notched points are predominant during the Firehole phase; the tri-notched forms are thought to indicate the presence of Shoshoneans.

The Protohistoric period dates from approximately 250 B.P. (1700 A.D.) until the full development of the fur trade in the 1840s. The easiest way to differentiate the Protohistoric period from the preceding Firehole phase is through the presence or absence in the archaeological record of European trade goods. One of the most important changes in this period was the acquisition of the horse in the early eighteenth century. The horse greatly increased the mobility and range of the Shoshonean groups whose aboriginal territory encompasses the Application Area. Other tribal groups such as the Crow and Ute occasionally would venture into Shoshone territory to hunt or raid. Artifact assemblages from this period are often quite diverse with a mix of stone and metal projectile points, knives, copper trade goods, and glass beads.

Historic Narrative

The early exploration of southern Wyoming was undertaken informally by fur traders and trappers, particularly after the mid-1820s (Zier et al. 1983; Mueller and Zier 2006). Scientific mapping and description of the area began in the early 1840s with the expeditions of John C. Fremont. In 1841 the first emigrants crossed Wyoming, creating the Oregon Trail. The use of the trail increased through the 1840s and 1850s, declined during the Civil War and dropped dramatically with the completion of the transcontinental railroad in the late 1860s (Zier et al. 1983). The Overland Trail route, which acted as a more southerly transcontinental route than the Oregon Trail, was explored by Fremont in the early 1840s and the Stansbury expedition in 1849 (Goetzmann 1959). This route tied into the main Oregon Trail system at Fort Bridger in southwestern Wyoming, first traversing southern Wyoming by passing north of the Medicine Bow and Sierra Madre Mountains and then crossing the Red Desert. The Overland Trail was used mainly for freight and mail hauling. This route witnessed significant emigrant activity in the mid-1860s due to hostile Indian activity along the Oregon Trail.

The Pacific Railway Acts of 1862 and 1864 authorized land grants to encourage the construction of the transcontinental railroad. In southern Wyoming, the UPRR generally followed the route of the Overland Trail. Track crews entered the state east of Cheyenne in late 1867, and construction passed through the southwestern corner of the state in 1869. The UPRR rapidly rendered the Oregon and Overland Trails obsolete. By 1901, the original UPRR grade was abandoned, the tracks and ties were removed, and the railroad was realigned and rebuilt. Much of the original grade has been impacted by pipelines, roads, and other developments over time (as well as by the Lincoln Highway and the modern UPRR).

Coal mining began in southwestern Wyoming in 1867 and the first mines were operated by the UPRR. Railroad construction and coal mining brought a diverse selection of ethnic groups to the area, including people of Celtic, Mediterranean, Chinese and Slavic origins. The logging industry also owes its origins to the UPRR as so-called “tie hacks” were deployed to the timbered portions of the state to produce millions of railroad ties, many of which were floated down rivers such as the North Platte and Green to the railroad crossing points. Tie hacks began working in the region in the 1860s and endured into the 1930s. Timber harvesting began shortly after the turn of the twentieth century with the establishment of the Medicine Bow National Forest and continues to the present day (McNees et al. 2010).

Gold mining and exploration in the Medicine Bow Mountains of Albany and Carbon counties occurred from 1868 through the late 1920s. However, over time only the few mines in the Centennial District actually produced any gold, which was a fraction of the gold produced from the South Pass Mining District. Exploration continued for gold, silver, and copper, with the copper discoveries in the Grand Encampment area of the Sierra Madre Mountains proving to be the largest. By 1908, the price of

copper dropped significantly and by the time the Saratoga-Encampment Railroad was completed, the local copper industry had collapsed and the companies were in bankruptcy (Lowe 2005).

Wyoming's oil industry rose to prominence in the early decades of the twentieth century. Prior to 1906, oil recovery efforts were limited to surface oil seeps and springs. After 1906, and the acceptance and proliferation of scientific theories of petroleum geology, drilling efforts were aimed at geologic structures (e.g., anticlines) likely to contain oil (Metz 1986). Prior to 1912, the development of Wyoming's oil and gas deposits also was hampered by the lack of transportation facilities. Problems with marketing were a reality partly due to the small percentage of production in Wyoming compared to the total national output at the time. However, by the beginning of the second decade of the twentieth century, well-capitalized national oil companies successfully applied new recovery methods, invested in promising new fields, and built refineries and pipelines in Wyoming. Historic oil fields in Carbon County include Bailey Dome, Bell Springs, Big Medicine Bow, and Hatfield.

The livestock industry is considered to have originated in the 1840s to 1860 during the heyday of the Oregon Trail when tens of thousands of cattle, sheep, and horses were herded across the area (Zier et al. 1983). With completion of the transcontinental railroad, the stock ranching industry boomed due to access to the large markets on the East and West coasts. Cattle ranching was well established in the 1860s and the sheep industry by the 1870s. The first permanent ranches in southwestern Wyoming formed in the early 1870s, with many of these becoming large by the 1880s. After the devastating blizzard of 1886, the sheep industry made significant gains, and by 1900 there were 3.3 million head of sheep in Wyoming (Wentworth 1948). The biggest jump in the number of sheep in Wyoming started in 1897 when the market value of sheep increased. By 1901, the price of sheep had doubled, and in 1910, the number of sheep reached an all-time high of 7 million. Today, evidence of both cattle and sheep ranching in the area can be found through homesteads, ranches, sheepherder camps, and sheepherder cairns (sometimes used to demarcate grazing boundaries).

After the invention of the internal combustion engine, oil processing for gasoline skyrocketed. By 1900, hydrocarbon production was on the rise specifically to fuel gas and diesel engines. Automobile roads mark a progressive improvement of earlier wagon roads, often straightening and altering their paths for the different requirements of the vehicles. The coast-to-coast Lincoln Highway was proposed in 1912-1913. In 1913, the route of the Lincoln Highway in Wyoming followed the basic course of the Overland Trail and later the UPRR grade. Between 1919 and 1924, Wyoming completed its portion of the Lincoln Highway which re-aligned the 1913 route in many places. The Lincoln Highway entered Wyoming east of Pine Bluffs and followed county roads through Egbert and Hillsdale to Archer where it rejoined U.S. Route 30. It followed U.S. Route 30 (now largely I-80) through Cheyenne, Laramie, Medicine Bow, and Rawlins to Granger Junction. From there, it followed former U.S. Route 30 South and U.S. Route 530 (now I-80) to the Utah state line.

The highway system that had been growing since the 1920s and was expanded after each World War, essentially replaced the need for many of the alternate rural routes. The post-World War II spread of transportation and automobiles also diminished the need for railroad networks. Well-developed transportation networks and an expanding mineral energy market helped the growth of larger population centers like Casper and Rock Springs, and often helped urbanize the surrounding areas. Today, cattle ranches, coal fire plants, and oil and gas developments are found in the vicinity of the Application Area. An upgraded and modernized railroad and the highway still carry transportation along a main east-west corridor, now I-80.

3.2.1.2 Methods and Information Sources

A Class I files search was conducted through the Wyoming Cultural Resources Office to identify previously conducted cultural resources investigations and previously recorded cultural resources within the files search study area. The files search study area encompassed the proposed action with a 4-mile buffer. A total of 344 previous inventories have been conducted within the files search study area

(SWCA Environmental Consultants [SWCA] 2010). As a result of these inventories, 1,211 archaeological sites were recorded. Of the 344 previous inventories, 128 have occurred within the Application Area minus the sage grouse core areas where no disturbance is proposed. These 128 inventories include 111 Class III intensive field inventories, 4 Class II sample surveys, 3 historic overview surveys, 5 monitoring projects, 1 site testing project, 1 mitigation project, and 3 other projects.

A total of 467 cultural sites have been documented as a result of the 128 inventories. The 467 sites include 286 prehistoric sites, 83 historic sites, 93 multicomponent sites consisting of both prehistoric and historic components, and 5 sites of unknown cultural affiliation. Of the 467 sites, 2 are listed on the NRHP, 67 are eligible for inclusion in the NRHP, 197 are not eligible for inclusion in the NRHP, and 201 currently are unevaluated. The NRHP-eligible sites include the historic Overland Trail. Within the files search study area are segments of the Overland Trail that contribute to the trail's overall eligibility to the NRHP, as well as non-contributing segments.

Several prehistoric and historic sites are located outside of proposed disturbance areas, but are considered in the analysis because of their location within the viewshed of the proposed project. Of greatest concern are visual effects to sites in which site setting contributes to their eligibility to the NRHP. These include, but are not limited to, historic districts, historic trails and roads, and properties of traditional religious and cultural importance to Native Americans.

Based on the Class I files search, one site occurs every 436 acres or one site every 0.7 square mile (mile^2) within the files search study area. It should be noted that these site densities are based solely on inventoried areas and are provided here as an estimate of site densities that can be expected within the files search study area. To date, approximately 2 percent of the files search study area has been inventoried to Class III standards.

Prehistoric Sites

The 286 previously recorded prehistoric sites consist of 145 open camps/occupation sites, 89 lithic scatters, 30 stone feature sites, 1 lithic quarry, 3 rockshelters, 12 stone feature and habitation sites, 2 stone circle and lithic scatter sites, 1 house pit, 1 kill site, 1 milling/processing site, and 1 stone circle/burial site (**Table 3.2-1**).

The previously recorded prehistoric sites represent a wide range of human activities. Many of the sites are surface manifestations of hunter-gatherer campsites representing repeated, inseparable occupations over hundreds or thousands of years. Other sites are buried and contain intact, vertically separated cultural components. Based on the Class I files search, the most common site types are short-term open camps/occupation sites with limited activity areas. At these locations, stone tools were made or repaired, plant resources were processed, or animals killed or butchered. Most short-term camps/occupation sites contain flaked stone tools and debitage (waste flakes and debris), but little evidence of subsistence strategies.

Cultural material identified at the previously recorded prehistoric sites falls into two broad categories: artifacts and features. Artifactual sites consist of lithic scatters (flaked stone debitage and/or tools only), and camps (exhibiting combinations of artifact classes, such as flaked stone and ground stone). Features identified at the sites include cairns, hearths (sometimes manifested as fire-cracked rock concentrations or charcoal stains), stone circles, miscellaneous stone alignments, and unique structures, such as hunting blinds. Artifacts commonly occur in association with features. Although most of the prehistoric sites remain undated, projectile points recovered from selected sites suggest that the area was utilized during the four major periods of human occupations that have been identified for the region. In general, NRHP-eligible prehistoric sites are eligible under Criterion D based on their potential to yield information important in understanding the regional prehistory.

Table 3.2-1 Previously Recorded Prehistoric Sites by Descriptive Site Type

Descriptive Site Type	No. of Sites
Open Camps/Occupation	145
Lithic Scatters	89
Stone Features	30
Lithic Quarry	1
Rockshelters	3
Stone Features/Habitation	12
Lithic Scatter with Stone Circles	2
Housepit	1
Kill Site	1
Milling/Processing	1
Stone Circle/Burial	1
Site Total	**286**

Source: SWCA 2010.

Historic Sites

The 83 previously recorded historic sites consist of 18 debris scatters, 14 rock cairns, 5 bridges, 2 railroads, 1 building, 1 canal, 1 cemetery/grave, 13 roads, 3 trails, 1 transmission line, 1 homestead, 1 inscription, 5 mines, 5 stock herding camps, and 12 other sites (**Table 3.2-2**). Of these, most consist of localities that exhibit only artifacts, localities that exhibit only features, and localities with artifacts in combination with features. Sites without features include metal can scatters, glass scatters, and most commonly, debris scatters comprised of a combination of two or more material types such as metal cans, glass, and leather. Many debris scatters most likely represent dumping episodes, while others may be the remains of stockmen's camps. A wide range of feature types were previously recorded at historic sites, including living structures and structural remnants, cairns, ditches/canals, hearths, bridges, and an inscription. Artifactual evidence suggests that the majority of historic sites date from the latter part of the nineteenth century through the mid-twentieth century.

Multi-component Sites

Of the 93 previously recorded multi-component sites, 24 are prehistoric occupation/historic debris scatters, 48 lithic scatters/debris scatters, 2 lithic scatters/rock cairn sites, 2 lithic scatters/homesteads, 6 occupation/stock herding camps, 2 occupation and stone circle/debris scatters, 2 rock cairn sites, 1 rock cairn/debris scatter, 1 occupation/historic site, 1 occupation/rock cairn site, 1 lithic scatter/historic site, 1 lithic scatter/inscription, and 2 lithic scatters/stock herding camps (**Table 3.2-3**). The five unknown sites consist of cairn/cache/rock piles.

Class III Inventories

Site-specific Class III inventories of all proposed disturbance areas associated with the proposed project would be conducted once these areas have been identified. The site-specific inventories would be completed prior to project construction and with enough lead time to allow for evaluation of sites located during the inventories, assessment of impacts, and mitigation, if necessary. Based on the files search data, prehistoric sites most likely would be found on elevated ridge tops overlooking creeks; historic sites most likely would be found at lower elevations in flatter areas and near permanent water sources. Results of the inventories would be documented in a technical report, which would include a cultural background of the area, the results of the files searches and field surveys, descriptions of each site, a

Table 3.2-2 Previously Recorded Historic Sites by Descriptive Site Type

Descriptive Site Type	No. of Sites
Debris scatter	18
Cairn(s)	14
Bridges	5
Railroads	2
Building	1
Canal	1
Cemetery/Grave	1
Roads	13
Trails	3
Transmission Line	1
Homestead	1
Inscription	1
Mines	5
Stock Herding Camps	5
Miscellaneous	12
Site Total	**83**

Source: SWCA 2010.

Table 3.2-3 Previously Recorded Multicomponent Sites by Descriptive Site Type

Descriptive Site Type	No. of Sites
Prehistoric Occupation/Historic Debris Scatter	24
Prehistoric Lithic Scatters/Historic Debris Scatters	48
Prehistoric Lithic Scatters/Historic Rock Cairns	2
Prehistoric Lithic Scatters/Historic Homesteads	2
Prehistoric Occupation/Historic Stock Herding Camps	6
Prehistoric Occupation/Historic Stone Circle/Debris Scatters	2
Prehistoric Rock Cairns/Historic Rock Cairns	2
Prehistoric Rock Cairn/Historic Debris Scatter	1
Prehistoric Occupation/Historic Site	1
Prehistoric Occupation/Historic Rock Cairn	1
Prehistoric Lithic Scatter/Historic Site	1

Table 3.2-3 Previously Recorded Multicomponent Sites by Descriptive Site Type

Descriptive Site Type	No. of Sites
Prehistoric Lithic Scatter/Historic Inscription	1
Prehistoric Lithic Scatter/Historic Stock Herding Camps	2
Site Total	**93**

Source: SWCA 2010.

historic context to evaluate each site for NRHP eligibility, and management recommendations. The report would be submitted to the BLM and Wyoming SHPO for review and concurrence.

3.2.2 Native American Concerns

3.2.2.1 Regulatory Framework

Federal law and agency guidance require the BLM to consult with Native American tribes concerning the identification of cultural values, religious beliefs, and traditional practices of Native American people that may be affected by actions on public lands. This consultation includes the identification of places (i.e., physical locations) of traditional cultural importance to Native American tribes. Places that may be of traditional cultural importance to Native American people include, but are not limited to, locations associated with the traditional beliefs concerning tribal origins, cultural history, or the nature of the world; locations where religious practitioners go, either in the past or the present, to perform ceremonial activities based on traditional cultural rules or practice; ancestral habitation sites; trails; burial sites; and places from which plants, animals, minerals, and waters possessing healing powers or used for other subsistence purposes, may be taken. Some of these locations may be considered sacred to particular Native American individuals or tribes.

In 1992, the NHPA was amended to explicitly allow that “properties of traditional religious and cultural importance to an Indian tribe or Native Hawaiian organization may be determined to be eligible for inclusion in the NRHP.” If a resource has been identified as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property. Properties of traditional religious and cultural importance to Native Americans, including traditional cultural properties, must meet one or more of the National Register criteria (i.e., must be historically significant) in order to be determined eligible for inclusion in the NRHP. In addition to NRHP eligibility, some places of traditional cultural and religious importance also must be evaluated to determine if they should be considered under other federal laws, regulations, directives, or policies. These include, but are not limited to, the NAGPRA of 1990, AIRFA of 1978, ARPA of 1979, and EO 13007 of 1996, Indian Sacred Sites.

NAGPRA established a means for Native Americans, including Indian tribes, to request the return of human remains and other sensitive cultural items held by federal agencies or federally assisted museums or institutions. NAGPRA also contains provisions regarding the intentional excavation and removal of, inadvertent discovery of, and illegal trafficking in Native American human remains and sensitive cultural items located on public lands.

AIRFA established a federal policy of protecting and preserving the inherent right of individual Native Americans to believe, express, and exercise their traditional religions including, but not limited to, access to sites, use and possession of sacred objects, and the freedom to worship through ceremonials and traditional rites.

ARPA requires notification of the appropriate Indian tribe before approving a cultural resource use permit for the excavation (testing and data recovery) of archaeological resources, if the responsible public land manager determines that a location having cultural or religious importance to the tribe may be harmed or destroyed.

EO 13007 defines a sacred site as any specific, discrete, narrowly delineated location on public land that is identified by an Indian tribe, or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion, provided that the tribe or appropriately authoritative representative has informed the federal agency of the existence of such a site.

EO 13007 requires federal agencies to the extent permitted by law, and not clearly inconsistent with essential agency functions, to accommodate access to and ceremonial use of Indian sacred sites, to avoid adversely affecting the physical integrity of such sites wherever possible, and, where appropriate, to maintain the confidentiality of sacred sites.

3.2.2.2 Native American Consultation

In compliance with the NHPA, as amended, the BLM initiated government-to-government consultation for the CCSM Wind Energy Project EIS on July 23, 2009, by sending letters to the following federally recognized tribes: Northern Cheyenne, Eastern Shoshone, Northern Arapaho, Fort Peck Assiniboine and Sioux, and Northern Ute tribes. The letters were sent to inform the various tribes of the proposed undertaking and invite the tribes to participate in the EIS planning process. Additionally, the letter included a request for historical information on the use and significance of the Application Area such as places of traditional, religious, and cultural importance to the tribes. Included with the letters was a map of the Application Area and a self-addressed stamped postcard for the tribes to indicate their level of interest and return to the BLM.

As part of the government-to-government consultation efforts, the BLM held meetings at the Rawlins Field Office, coordinated conference calls, and organized field visits to the project area and to selected sites within the project area during the summer and fall of 2009 and 2011. Additional consultation and communication with the tribes has been via letters, emails, and telephone calls. The BLM also has been consulting with the tribes on development of the PA. Government-to-government consultation for the proposed project currently is ongoing and will continue up to and including project construction.

A Class II sample inventory was conducted in the Application Area. The objective of the inventory was to identify sensitive sites (i.e., places of cultural, traditional, or religious importance) outside of Class III inventory areas that could be affected by the proposed project. The BLM requested the Class II inventory to help facilitate Native American consultation as the NEPA process moves forward. As a result of the inventory, 45 sensitive sites were recorded. These 45 sites include stone cairns, some with lithic scatters or associated artifacts, and stone alignments. The BLM, in consultation with interested tribes, will evaluate the cultural, traditional, and religious values of the sites. If any of the sites would be affected by the proposed project, mitigation would be developed by the BLM and interested tribes, and incorporated into the PA currently being developed by the BLM.

3.3 Geology, Geologic Hazards, and Mineral Resources

3.3.1 Geology

3.3.1.1 Physiography and Topography

The Application Area is located in the Wyoming Basin Physiographic province (Fenneman 1928). The Wyoming Basin is 40,000 miles^2 (Howard and Williams 1972) and consists of a number of sub-basins found between the Southern and Northern Rocky Mountain Provinces (**Figure 3.3-1**). The Application Area is in the Kindt Basin, a small sub-basin southeast of Rawlins, Wyoming. Other sub-basins in the Application Area vicinity include the Great Divide Basin, Washakie Basin, Hanna Basin, Carbon Basin, Shirley Basin, and the Laramie Basin. The Washakie and Great Divide sub-basins are sometimes considered part of the Greater Green River Basin that occupies most of southwestern Wyoming, but the sub-basins are structurally and topographically distinct from the Green River Basin located west of Rock Springs (Love 1961). Also within the Wyoming Basins are small mountain ranges and uplifts such as the Green, Ferris, Seminoe, and Shirley Mountains that trend east to west 30 to 40 miles north of the Application Area. Elevations across the Wyoming Basin generally range from 6,000 to 7,000 feet above mean sea level (amsl) in the basins to more than 8,000 feet elevation in the mountain ranges. Topography in the basin areas is typified by rolling plains dissected by badlands.

Elevations in the Kindt Basin range from 7,000 to over 8,000 feet amsl. In the Chokecherry site, the land surface gradually slopes up to the south punctuated by hogbacks and structures formed by large folds in the underlying Cretaceous rocks. The Sierra Madre site is largely located on a cuesta named Miller Hill, which is a ridge formed by gently tilted sedimentary rocks. The cuesta has a gentle slope to the south and southwest and steep slopes along a prominent escarpment to the north and northeast. The cuesta is formed from a layer of Miocene-age Tertiary rocks that mantle the foothills of the Sierra Madre. To the north and west of Miller Hill is a major topographic feature called the Atlantic Rim, a hogback ridge composed of upper Cretaceous sandstones essentially marking the eastern edge of the Washakie Basin. The Continental Divide crosses the Application Area and follows the edge of the Miller Hill escarpment.

3.3.1.2 Stratigraphy

Bedrock Geology

The geologic units that outcrop in the Application Area range in age from upper Cretaceous to Recent and are listed in **Table 3.3-1**. **Figure 3.3-2** is a generalized bedrock geologic map of the Application Area. **Table 3.3-1** lists and describes the bedrock and surficial deposits that are exposed within the Application Area. **Table 3.3-1** lists the geologic units that would be found in the region composed of the Kindt, Hanna, Carbon, Shirley, and the Laramie Basins and adjacent uplifts. Rocks that do not outcrop in the Application Area are in the subsurface and range in age from Precambrian to Permian. The Jurassic and lower Cretaceous rocks that outcrop in the Application Area (Morrison, Sundance, and Cloverly Formations) were deposited in primarily fluvial continental environments. The upper Cretaceous rocks were deposited under conditions ranging from marine, marginal marine, delataic, and fluvial. The lower part of the Tertiary unit that outcrops on Miller Hill was probably derived from detrital material shed from the uplift of the Sierra Madre (Vine and Prichard 1959). The remainder of the unit was probably deposited in freshwater fluvial environments with material derived from volcanic eruptions. The resistant conglomerate unit is primarily responsible for the escarpment along the north and northeast rim of Miller Hill. The age and correlation of the Tertiary deposits is uncertain with various workers either calling it Pliocene-age North Park Formation or Miocene-age Brown's Park Formation (Vine and Prichard 1959). With similarities of lithology to both formations and no diagnostic fossils, Love and Christiansen (1985) assigned a general "Tertiary Miocene" designation to the Tertiary rocks on Miller Hill.

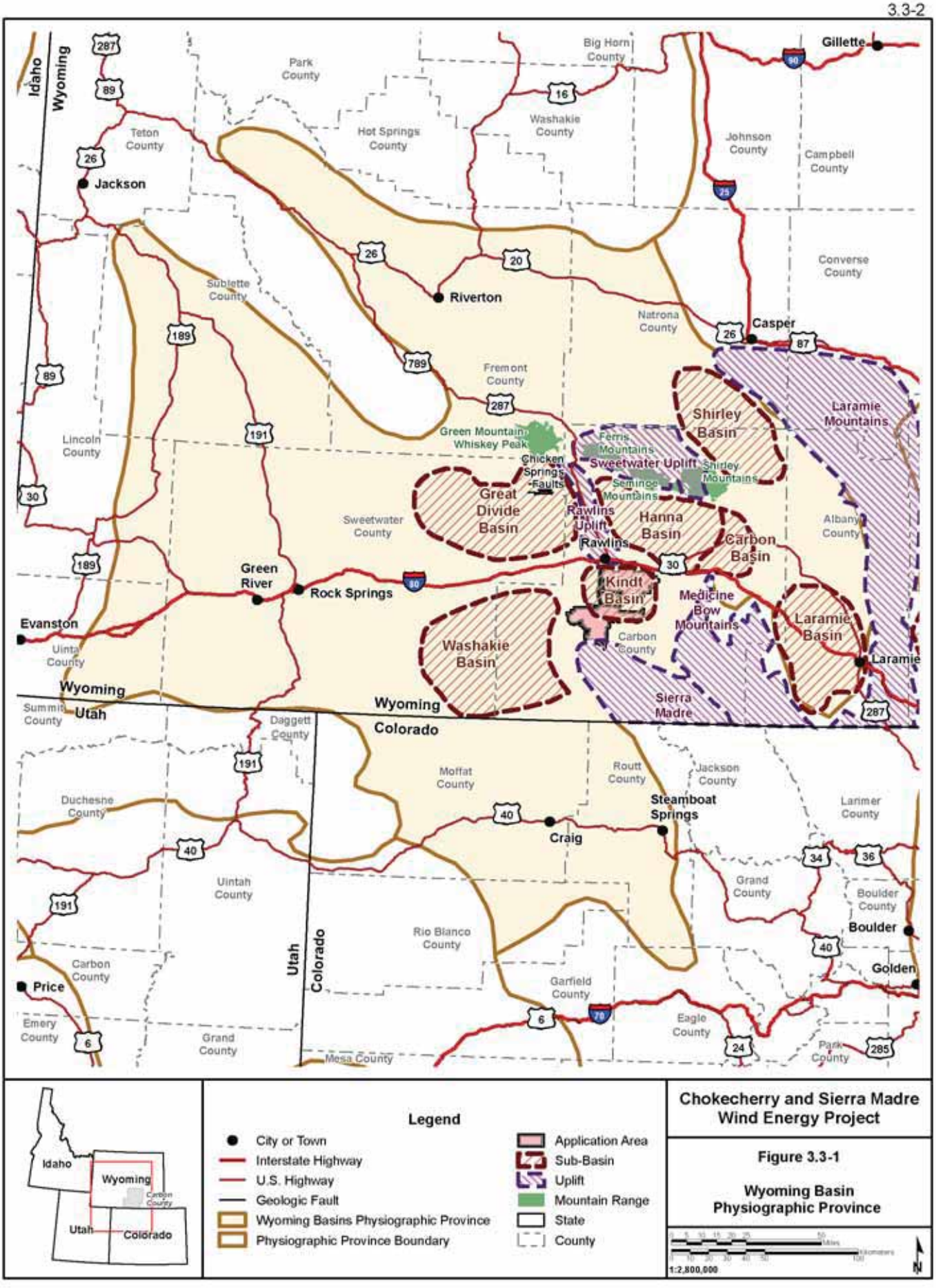

Idaho
Wyoming
Utah
Colorado
Gillette
Big Horn County
Park County
Washakie County
Hot Springs County
Johnson County
Campbell County
Converse County
Teton County
Jackson
Riverton
Sublette County
Natrona County
Casper
Fremont County
Shirley Basin
Laramie Mountains
Green Mountain
Whiskey Peak
Ferris Mountains
Sweetwater Uplift
Shirley Mountains
Seminoe Mountains
Chicken Springs Faults
Great Divide Basin
Rawlins Uplift
Hanna Basin
Carbon Basin
Albany County
Lincoln County
Sweetwater County
Rawlins
Kindt Basin
Medicine Bow Mountains
Laramie Basin
Laramie
Green River
Rock Springs
Evanston
Uinta County
Washakie Basin
Carbon County
Sierra Madre
Summit County
Daggett County
Moffat County
Routt County
Jackson County
Steamboat Springs
Larimer County
Craig
Ducheshe County
Uintah County
Grand County
Boulder County
Boulder
Golden
Rio Blanco County
Garfield County
Eagle County
Price
Carbon County
Emery County
Grand County
Mesa County
Park County
Legend
City or Town
Interstate Highway
U.S. Highway
Geologic Fault
Wyoming Basins Physiographic Province
Physiographic Province Boundary
Application Area
Sub-Basin
Uplift
Mountain Range
State
County
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.3-1
Wyoming Basin Physiographic Province
1:2,800,000
N

Table 3.3-1 Summary of Geologic Units in the Application Area

Geologic Formation (Fm)/Deposit (Map Symbol)	Period	Description
Alluvium (Qal), slopewash; terrace and bench deposits, playa (Qp), landslide (Qls).	Quaternary – Recent	Unconsolidated gravel, sand, silt, and clay. Thickness is variable.
Undefined Tertiary Rocks (Tm)	Tertiary – Miocene/ Pliocene	Conglomeratic sandstone in lower 100 feet, grading upward to sandstone, tuff, tuffaceous sandstone, and limestone. Thickness: 800 feet.
Lewis Shale (Kle)	Upper Cretaceous	Dark marine shale with thin sandstones and siltstones and occasional bentonite layers. Thickness: 2,100 feet.
Mesaverde Group (Kmv)	Upper Cretaceous	Sandstone, carbonaceous shale, and coal. Thickness: 2,600 feet.
Steele Shale (Ks)	Upper Cretaceous	Dark gray, silty, marine shale with thin beds of sandstone and siltstone. Thickness: 3,600 feet.
Niobrara (Kn)	Upper Cretaceous	Gray to black shale with calcareous lenses. Thickness: 1,200 feet.
Frontier Formation (Kf)	Upper Cretaceous	Frontier: Thin beds of sandstone and shale. Mowry: Dark gray to black siliceous and bentonitic shale. Thickness: 700 feet.
Frontier Formation/Mowry Shale/Thermopolis Shale undivided (Kft)	Upper/Lower Cretaceous	Frontier: Thin beds of sandstone and shale. Mowry/Thermopolis Shales: Dark gray to black siliceous and bentonitic shales. Thickness: 1,150 feet.
Cloverly Formation	Lower Cretaceous	Medium to coarse-grained quartz sandstone with occasional carbonaceous shale partings. Prominent cliff former. Thickness: 130 feet.
Morrison and Sundance Formations undivided	Jurassic	Morrison: Interbedded varicolored clays and siltstones, thin sandstones, and nodular limestone. Sundance: course to fine-grained sandstone. Thickness: 250 feet.
Chugwater Formation	Triassic	Interbedded red sandstone, siltstone, and shale.

Sources: Love and Christiansen 1985; Hallberg and Case 2006a,b; Hallberg et al. 1998; Perman 1990; Slattery 2007; Vine and Prichard 1959; Watson 1980; Wilson et al. 2001.

Surficial Geology

The surficial geological materials consist of alluvium, slopewash, terrace and bench deposits, playa, and landslides. Recent alluvial deposits are generally found in the modern stream valleys. Slopewash is widespread and is often mixed with other surficial deposits and bedrock. Terrace and bench deposits are adjacent to major drainages and are remnants of deposits that have been eroded in the latest stage of down cutting. Landslide deposits are common on the steep north slope of Miller Hill. Landslides are described in more detail in Section 3.3.3.

3.3.1.3 Structure

The Application Area is located in a small structural sub-basin called the Kindt Basin (**Figure 3.3-3**) (Dyman and Condon 2007). The origin of the designation of this small basin is obscure, but is shown on a map and discussed in a publication on the coal resources of eastern Carbon County (Veatch 1907). The basin is about 15 miles by 15 miles and is located southeast of Rawlins, Wyoming. The deepest portion of the basin is immediately south of I-80 and the Precambrian basement slopes up to the south and southeast. The Kindt Basin is bounded by the Sierra Madre uplift to the south, the Washakie Basin to the west, the Rawlins uplift on the north, the Hanna Basin on the northeast, and to the east the northern extension of the Medicine Bow Mountains uplift. The series of basins formed by the Laramie, Shirley, Hanna, and Kindt Basins is a structurally complex area formed in Paleocene time during the Laramide Orogeny (mountain building) responsible for the present-day Rocky Mountains in Colorado, Utah, and Wyoming.

There are a couple of geologic structures of note in the Application Area. One is the Grenville Dome (Otteman and Snoke 2005), an anticline in the north part of the Chokecherry site south of I-80 and the Town of Sinclair, Wyoming. The anticline is an extension of the Rawlins uplift and the core of the structure at the surface is composed of Mowry Shale and the ridges around the core are composed of Frontier Formation sandstones. The other structure is a prominent west to east trending hogback 2 to 3 miles south of I-80 in the northeast portion of the Chokecherry site (Mears et al. 1986). The hogback is composed of steeply south-dipping sandstone beds of the Mesaverde Group and essentially marks the surface expression of the north boundary of the Kindt Basin. In the Miller Hill area, the Miller Hill anticline trends from Miller Hill northeastward (Vine and Prichard 1959). The structure occurs in the rocks that underlie the Tertiary unit that caps Miller Hill and is the same structure on which the Hatfield oil and gas field was developed (**Table 3.3-2**).

3.3.2 Mineral Resources

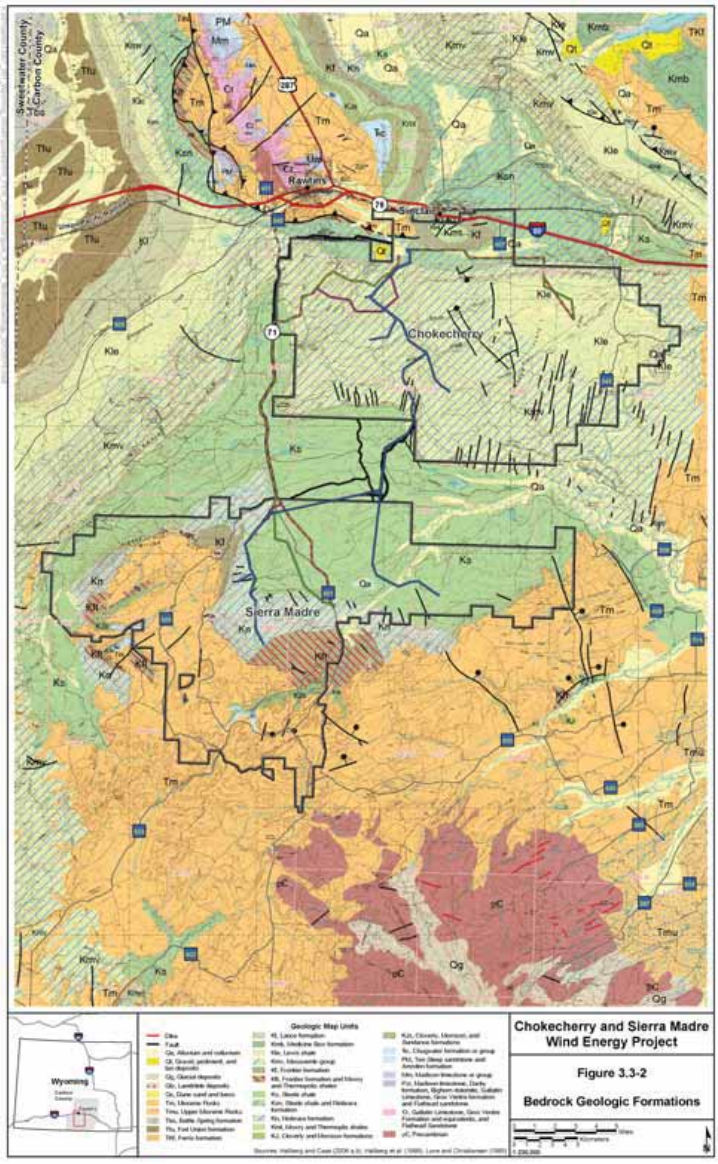
3.3.2.1 Leasable Minerals

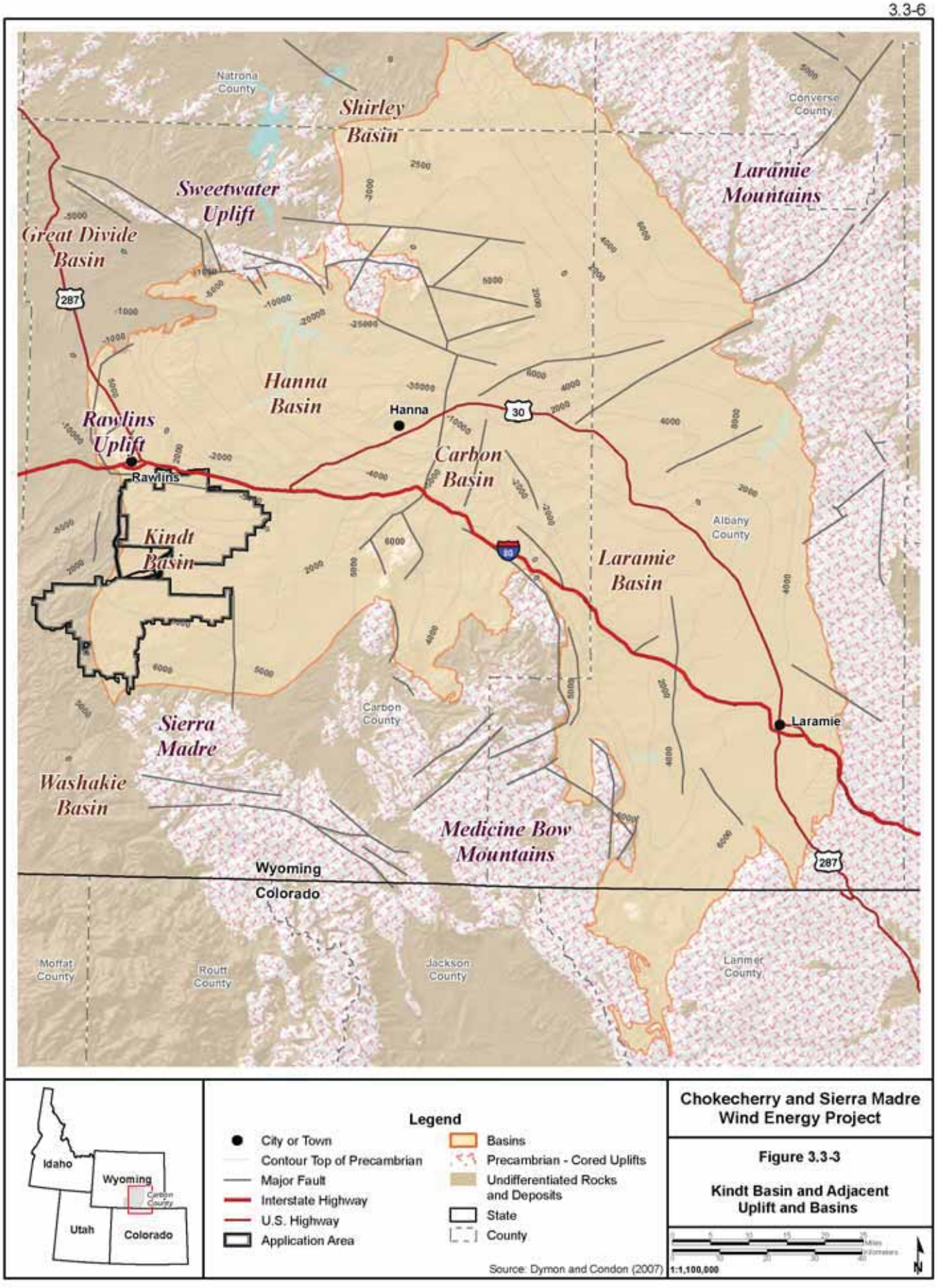
Leasable minerals are those minerals that are leased to individuals for exploration and development. The leasable minerals have been sub-divided into two classes, fluids and solid. Fluid minerals include oil and gas, geothermal resources and associated by-products, and oil shale, native asphalt, oil impregnated sands and any other material in which oil is recoverable only by special treatment after the deposit is mined or quarried. Solid leasable minerals are specific minerals such as coal and phosphates. These minerals are associated with the following laws; Mineral Leasing Act of 1920, as amended and supplemented, Mineral Leasing Act for Acquired Lands of 1947, as amended, and the Geothermal Steam Act of 1970, as amended (American Geological Institute [AGI] 1997). Leasable minerals are acquired by applying to the federal government for a lease to explore and develop the minerals.

Oil and Gas

The primary leasable mineral resources in the Application Area are oil and natural gas. Production was established in the area in 1915 with the discovery of natural gas at Hatfield Dome in T19N, R88W. **Table 3.3-2** lists the oil and gas fields in the vicinity of the Application Area. Only Hugus Field with one active oil well is located directly in the Application Area.

The U.S. Geological Survey (USGS) assessed the potential for undiscovered oil and gas resources in the Hanna, Laramie, and Shirley basins hydrocarbon resources assessment province (Dyman and Condon 2007). The Kindt Basin was included in the assessment province, but no resource potential probabilities were provided for the sub-basin. However, the entire assessment area has a probable mean of technically recoverable undiscovered resource of 132 million barrels of oil and 317 billion cubic feet of gas, and 13.5 million barrels of natural gas liquids (conventional and unconventional resources).


Sweetwater County
Carbon County
Rawlins
Sinclair
Chokecherry
Sierra Madre
Wyoming
Geologic Map Units
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.3-2
Bedrock Geologic Formations



Chokecherry and Sierra Madre Wind Energy Project

Figure 3.3-3

Kindt Basin and Adjacent Uplift and Basins

Table 3.3-2 Oil and Gas Fields in the Application Area

Name	Location	Discovery Year	Formation	Cumulative Production[1]		Status
				Oil (barrels)	Gas (thousand cubic feet)	
Espy	19N-89W	1964	Kn, Kf, Thaynes Limestone (Triassic)	1,065,335	178,119	Producing
Hatfield	19N-20N-88W	1915	Dakota, Nugget, Thaynes, Phosphoria	1,483,953	6,294,109	Producing
Hugus	19N-87W	1976	Ks, Kn	29,036	738	Producing
Rim	19N-88W	No data – indicated as Known Geologic Structure on BLM Oil and Gas Plat, there is no production information in Wyoming Oil and Gas Conservation Commission database.				
Sugar Creek	19N-90W	1968	Kf, Muddy, Thaynes	4,858	889,398	Abandoned

[1] As of January 2011.

Sources: Bauer 1992; BLM 2007b; Wyoming Oil and Gas Conservation Commission 2011; Wyoming State Geological Survey 2002.

Since the Kindt Basin contains the hydrocarbon source and reservoir rocks common to the entire assessment province, there is potential for undiscovered hydrocarbon resources in the Application Area. A number of oil and gas tests drilled in the vicinity of Miller Hill indicated that the total sedimentary rock section is thinning rapidly toward to the south diminishing the potential for hydrocarbon traps (Vine and Prichard 1959). The Kindt Basin was assigned a low potential for hydrocarbon development (Wyoming Reservoir Management Group 2004).

Coal

The Kindt Basin Coalfield is an eastward extension of the Green River Coal Region (Averitt 1972; Veatch 1907). The Kindt Basin coal field is immediately south of the UPRR and southeast of Rawlins, Wyoming. The field is composed of coal-bearing Mesaverde Group outcrops and the limit of the Mesaverde outcrop essentially defines the coal field (Berryhill et al. 1950) (**Figure 3.3-2**). To the west, the Mesaverde outcrops on the Atlantic Rim are part of the Little Snake River Coalfield.

In the Kindt Basin Coalfield, the Mesaverde Group is up to 3,600 feet thick and is generally comprised of alternating beds of sandstone and shale. Coal seams are present in the upper part of the Mesaverde at irregularly spaced intervals. The coalbeds are lenticular and variable in thickness ranging from 2 to 6 feet thick. On the north side of the Kindt Basin field the coalbeds dip at 45 degrees to 75 degrees southward; on the south side the dip is about 11degrees northward (Berryhill et al. 1950). The coal is of high volatile "C" bituminous rank. An analysis, on an as-received basis, from the Dillon mine indicated 11,010 British thermal units/pound heat value, 0.5 percent sulfur, and 8.4 percent ash. There is a low potential for development of the coal seams in the Kindt Basin because the seams are thin with limited lateral extent (ENSR and BAH 2003). Based on this, the 2008 Rawlins RMP did not identify the Kindt Basin as an area with coal development potential over the Plan's 20-year planning horizon.

Historic coal mining has been conducted in the area and there were mines in T19N R85W, Sections 19, 26, 28, and 35; and T19N R86W, Sections 13 and 14 (Veatch 1907). These mines are not located within the Application Area.

Other Leasable Minerals

No other leasable minerals have been identified in the Kindt Basin (ENSR and BAH 2003). Geothermal resources have been identified in the Saratoga Valley where hot springs are present near Saratoga, Wyoming (Breckenridge and Hinckley 1978). No geothermal potential has been identified in the Application Area and development of geothermal resources in the Kindt Basin is probably unlikely.

3.3.2.2 Saleable Minerals

Saleable minerals are common mineral materials that include sand, gravel, roadbed, ballast, and common clay and are sold by contract with the federal government. These have been identified as all other minerals that were not designated as leasable or locatable. These minerals are regulated under the Mineral Material Act of July 23, 1947, as amended, and the Surface Use and Occupancy Act of July 23, 1955 (AGI 1997).

Sand and Gravel

Sand and gravel deposits may be present in alluvial, alluvial fan, terrace, and bench deposits located in the Application Area. Sand and gravel resources may be present in alluvium associated with the North Platte River which is located to the east of the Application Area, but no quantitative estimate of sand and gravel resources is available (ENSR and BAH 2003). Two “free-use permits” as designated by the BLM were located in T18N, R88W, Section 10. Free-use pits permits are generally issued to federal or state agencies. However, the pits have been reclaimed and there are no existing free-use permits in the Application Area.

Crushed Stone

There are two quarries, one located north and the other west, of Rawlins with a combined capacity of 500,000 tpy. The quarries' mine limestone or sandstone which are crushed to various sizes for use as road base, in concrete, or winter road sanding by the Wyoming Department of Transportation (WYDOT).

3.3.2.3 Locatable Minerals

Locatable minerals include precious and base metallic ores and nonmetallic minerals such as bentonite, gypsum, chemical grade limestone and chemical grade silica sand. Uncommon varieties of sand, gravel, building stone, pumice, rock and cinders are also managed as locatable minerals. Locatable minerals are acquired under the General Mining Law of 1872, as amended and Surface Use and Occupancy Act of July 23, 1955 (AGI 1997).

The only identified locatable mineral deposits in the vicinity of the Application Area are uranium prospects located in the Miller Hill area and at Ketchum Buttes, approximately 6 miles south of the Sierra Madre site (ENSR and BAH 2003). The Miller Hill prospects are primarily located in T16 and 17N and R87 and 88 W. Vine and Prichard (1959) described exploration of the uranium potential of the area. The mineral uranophane is the primary uranium mineral and was found concentrated mainly in the freshwater limestones in the Tertiary Miocene unit. Mineralization was thought to have occurred due to the reaction of silica- and uranium-rich solutions with the limestone beds. The investigation included trench excavation and grab sampling, but the results yielded concentrations of uranium that for the most part were not economical for commercial extraction.

The Ketchum Butte uranium prospects, while not within the Application Area, are located nearby in T15N, R88W, Section 18 (USGS 2008a). The prospects are formally known as the Cloudy Group Claims and have been described as roll-front deposits in sandstones of the Brown’s Park Formation (ENSR and

BAH 2003). Another claim group in the Ketchum Buttes area has been recently explored for potential and may have as much as 1.5 million pounds of uranium oxide potentially leachable through in-situ methods of extraction (Market Wire 2006).

3.3.3 Geologic Hazards

Geologic hazards are "natural geologic events that can endanger human lives and threaten human property" (National Atlas 2008a). Although there are a variety of geological hazards, the ones that will be considered here are seismic hazards, landslides, sinkholes, and swelling clay.

3.3.3.1 Seismic Hazards

There are three major phenomena associated with seismic hazards: Seismicity, faults, and ground motion. The following paragraphs describe the potential for seismic hazard occurrence in the Application Area.

Seismicity

Seismicity concerns the intensity, frequency, and location of earthquakes in a given area. Carbon County and vicinity has historically little earthquake activity (Case et al. 2002). Twenty-five earthquakes of magnitude 2.0 or higher have been recorded in Carbon County. A Mercalli Scale Intensity IV earthquake was felt southwest of Rawlins in 1896. From 1973 to November 2008, 32 earthquakes have been recorded within a 60-mile radius of the Application Area, the strongest being a 4.3 magnitude earthquake about 15.0 miles west (USGS 2008b).

Faults

Faults are dislocations whereby blocks of earth material on opposite sides of the faults have moved in relation to one another (USGS 2008c). Rapid slippage of blocks of earth past each other can cause energy to be released, resulting in an earthquake. An active fault is one where movement has occurred in the last 10,000 years and a potentially active fault is one where movement has possibly occurred during Quaternary time or the last 1.6 million years (USGS 2008c,d). The closest potentially active faults are the Chicken Spring faults located about 30 miles northwest of the Application Area in northeast Sweetwater County (Machette 1999a). The Chicken Springs faults are a group of faults that trend both north-south and east-west, are 2 to 12 miles in length. In one location a fault exhibits displacement of a Holocene stream channel. The displacement of the stream channel is evidence for movement within the last 15,000 years. There is another nearby fault system named the South Granite Mountains fault system, located about 30 to 35 miles north of the proposed site in northern Carbon County and northeastern Sweetwater County along the Crooks, Green, Ferris, and Seminoe mountains (Machette 1999b). The fault system is about 100 miles long. Faults in the South Granite Mountains fault system are considered to be potentially active to active. There are no documented active faults in the Application Area.

Ground Motion

Ground motion hazards result when the energy from an earthquake is propagated through the ground. The USGS ground motion hazard mapping indicates that potential ground motion hazard in the Application Area is low. The hazard map used estimates of peak ground acceleration expressed as a percentage of the acceleration of gravity with a 10 percent probability of exceedence in 50 years (USGS 2008e). Peak acceleration from a probable maximum earthquake event for the area is estimated to be less than 5 percent of gravity.

3.3.3.2 Landslides

Landslide is a term used for various processes involving the movement of earth material down slopes (USGS 2004). Landslides can occur in a number of different ways in different geological settings. Large masses of earth become unstable and begin to move downhill by gravity. The instability can be caused

by a combination of factors including steep slopes, periods of high precipitation, undermining of support by natural processes (stream erosion), or unintentional undercutting or undermining the strength of unstable materials in the construction of roads and structures.

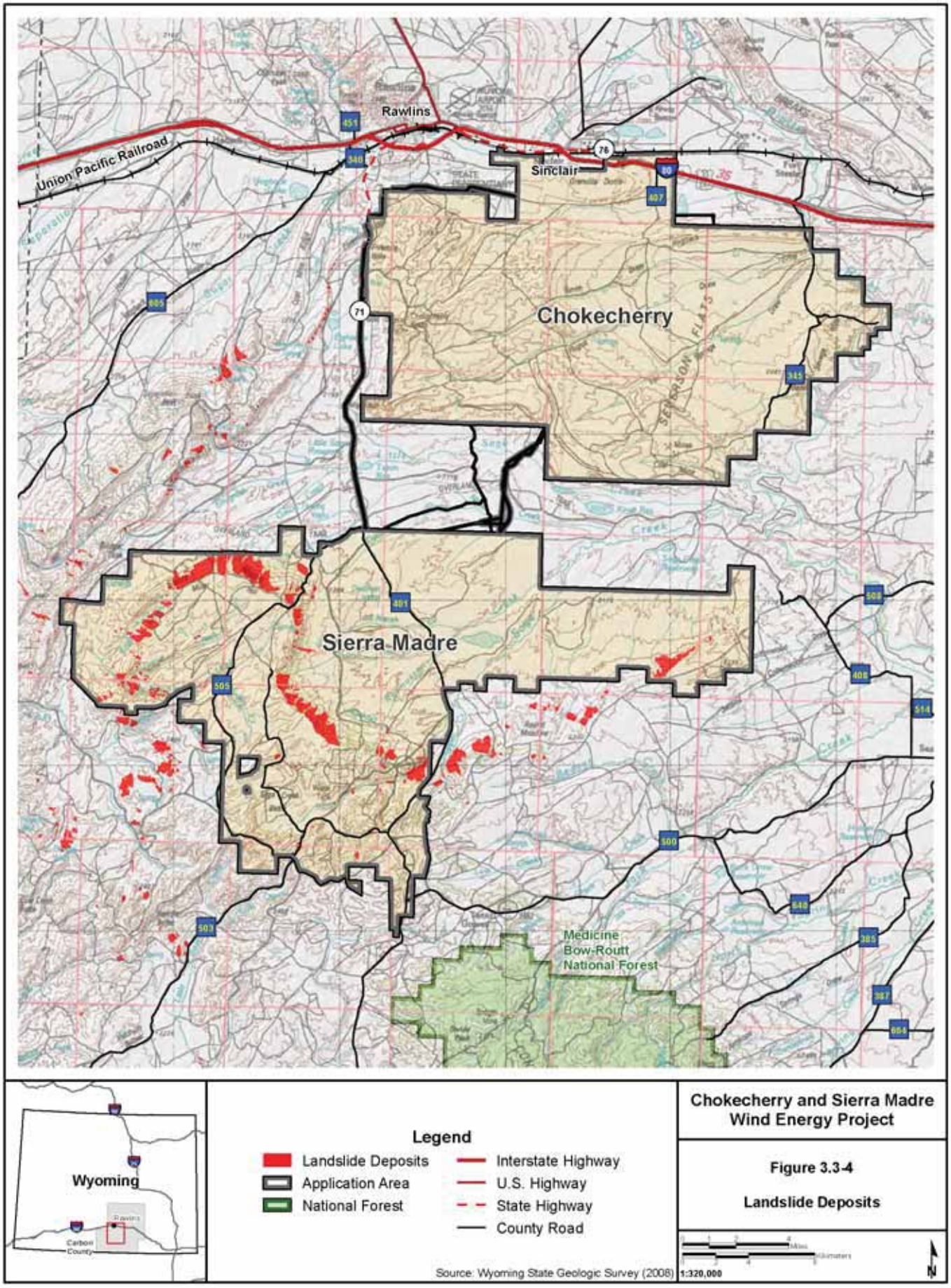
Landslide deposits have been mapped along the steep north-facing slope of Miller Hill (Wyoming State Geological Survey 2008) (**Figure 3.3-4**). The landslides generally consist of multiple block slides or debris flows of rock or earth. The landslides have most likely occurred as a result of mass-wasting occurring along the steep face of Miller Hill.

3.3.3.3 Subsidence

Subsidence is a decrease of surface elevation of the ground and may be caused by a variety of phenomena including, but not limited to, solution of subsurface strata, compaction, removal of groundwater, and earthquake ground motion. The surface expression from subsidence can range from localized precipitous collapses (sinkholes) to broad regional lowering of the earth's surface. No subsidence has been identified in the Application Area (National Atlas 2008b).

3.3.3.4 Swelling Clay

The bentonite layers in the Lewis Shale, Frontier Formation, and other upper Cretaceous units may present hazards associated with swelling clays (Olive et al. 1989; Wyoming State Geological Survey undated). These formations are considered to have “high swelling potential”. Bentonite has the property whereby when wet, it expands significantly in volume. When bentonite layers are exposed to successive cycles of wetting and drying, they swell and shrink, the soil fluctuates in volume and strength. Structures built on soil with high shrink-swell potential can be damaged as soils expand and shrink.


Rawlins
Sinclair
Union Pacific Railroad
Chokecherry
Sierra Madre
Medicine Bow-Routt National Forest
Wyoming
Carbon County
Legend
Landslide Deposits
Application Area
National Forest
Interstate Highway
U.S. Highway
State Highway
County Road
Source: Wyoming State Geologic Survey (2008)
1:320,000
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.3-4
Landslide Deposits

3.4 Land Use

3.4.1 Land Ownership and Use

3.4.1.1 Land Ownership

The Application Area comprises a total of 229,077 acres; 109,086 acres in the Chokecherry site, 118,552 acres in the Sierra Madre site, and 1,439 acres within corridors between the Chokecherry and Sierra Madre sites. Most of the Application Area is in the checkerboard landownership pattern common along Union Pacific railroad routes across the west. Little consolidation of the checkerboard has taken place, so that the majority of the checkerboard remains intact. As a consequence, current landownership is a mix of private, public land, and to a lesser extent, state-owned lands and City of Rawlins lands as shown in **Figure 3.4-1**. Landowners in the Application Area include the BLM, the State of Wyoming, and private landowners. **Table 3.4-1** shows land ownership in the Chokecherry and Sierra Madre sites within the Application Area.

Table 3.4-1 Surface Land Ownership within the Application Area

Area	Surface Landowner	Acres	Percent (%) of Application Area
Chokecherry	BLM	49,872	21.8
	State of Wyoming	1,937	0.8
	Total Private	57,276	25.0
	TOTCO	54,088	23.6
	Other Private Owners	3,188	1.4
Subtotal		**109,086**	**47.6**
Sierra Madre	BLM	59,856	26.1
	State of Wyoming	7,633	3.3
	Wyoming Game and Fish	744	0.3
	City of Rawlins	2,350	1.0
	Total Private	47,977	20.9
	TOTCO	47,481	20.7
	Other Private Owners	488	0.2
Subtotal		**118,560**	**51.8**
Off-site	BLM	540	0.2
	State of Wyoming	85	0.0
	Total Private	814	0.4
	TOTCO	560	0.2
	Other Private Owners	254	0.1
Subtotal		**1,439**	**0.6**
Total Application Area		**229,077**	**100.0**

Source: Carbon County 2012 and BLM 2012c.

Private land in the Application Area includes sections within the checkerboard land ownership pattern as well as in-holdings south of T18N. Each section within the checkerboard is 1 mile square, while private inholdings south of T18N range in size from small parcels to relatively large consolidated blocks. Private landowners other than TOTCO that own more than 640 acres include the Union Pacific/Anadarko, which owns land in sections located along the north boundary of the Chokecherry Site and along SH 71 in sections adjacent to the west boundary of the Chokecherry site; and the Rawlins Stone Company which owns 713 acres. Most of the private land not owned by TOTCO is in the Sage Creek Basin and east of Miller Hill in the Sierra Madre site, and along the Platte River within the Chokecherry site as shown in **Figure 3.4-1**. Sections that contain private lands not owned by TOTCO, as well as land owned by the City of Rawlins, are listed in **Table 3.4-2**.

Table 3.4-2 Major Non-TOTCO Private Landowners within the Application Area

Surface Landowner	Acres	Location of Property
Union Pacific/Anadarko	2,591	T21N R87W, Sections 20, 28, 29, 31, 33, 35; T20N R87W, Sections 3,4,5; T20N R88W, Sections 1, 11, 13, 23, 25, 35; and T19N R88W, Sections 1, 11, 13, 23
Rawlins Stone Company	713	T20N, R87W, Sections 4, 5; and T21N, R87W, Section 33
Multiple Other Private Owners (less than 640 acres)	628	T21N R87W, Sections 25, 26, 31; T21N R86W, Section 25; T21N R84W, Sections 31, 33; T20N R88W, Sections 1, 23; T20N R85W, Sections 1, 2; T20N R84W, Section 33; T19N R88W, Sections 11, 23, 35; T19N R85W, Sections 21, 22, 33, 34; T18N R89W, Section 4; T18N R88W, Section 9; T18N R87W, Section 34; T18N R85W, Section 3,4; T18N R84W, Section 13; T17N R88W, Sections 5, 24, 25; T17N R87W, Sections 19, 29, 30; and T16N R88W, Sections 22, 44
Total Non-TOTCO Private Landowner Acres	**3,931**	

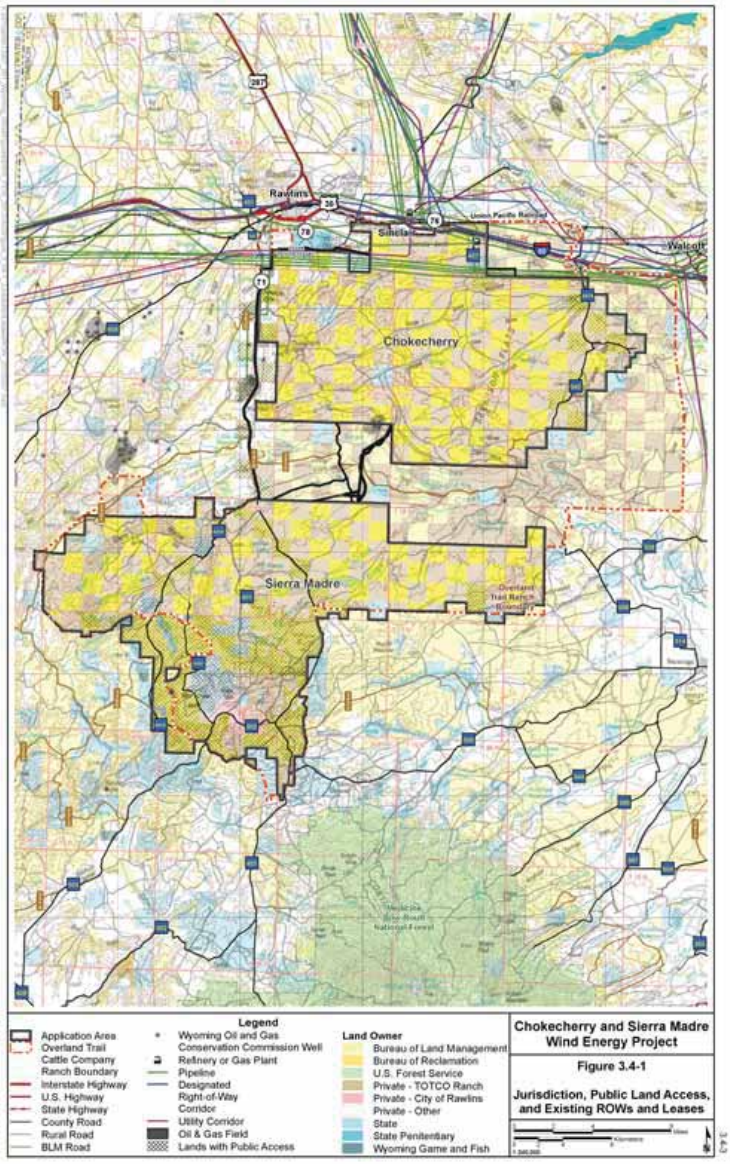
Source: Carbon County 2012 and BLM 2012c.

Note: Total acres may be slightly different than total acres in other tables due to rounding errors.

The checkerboard ownership pattern that characterizes the Application Area poses challenges for public access and land tenure. Transportation access within the Application Area is currently provided by Carbon County roads, BLM roads, and many undesignated roads and two-tracks on BLM, state, and private lands, as described in Section 3.10. Access to private sections owned by TOTCO within the checkerboard requires TOTCO's consent. The BLM does not have jurisdiction over development on private or state lands and would provide reasonable access to private in-holdings. Access and land tenure are generally managed through easements and ROWs, which are addressed below in Section 3.4.3.

3.4.1.2 Land Use

Livestock grazing is the primary land use of public land in the Application Area, as addressed in Section 3.6. Utilities and other facilities within authorized leases and ROW grants on public lands occur throughout the Application Area, as described in Section 3.4.3. Dispersed recreation occurs on public


287
Rawlins
35
80
Sinclair
Walcott
Chokecherry
Sierra Madre
Overland Trail Ranch
Medicine Bow-Routt National Forest
Legend
Application Area
Overland Trail
Cattle Company Ranch Boundary
Interstate Highway
U.S. Highway
State Highway
County Road
Rural Road
BLM Road
Wyoming Oil and Gas Conservation Commission Well
Refinery or Gas Plant
Pipeline
Designated Right-of-Way Corridor
Utility Corridor
Oil & Gas Field
Lands with Public Access
Land Owner
Bureau of Land Management
Bureau of Reclamation
U.S. Forest Service
Private - TOTCO Ranch
Private - City of Rawlins
Private - Other
State
State Penitentiary
Wyoming Game and Fish
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.4-1
Jurisdiction, Public Land Access, and Existing ROWs and Leases
N

land outside of the checkerboard, primarily in the Sierra Madre site. Recreation uses are addressed in greater detail in Section 3.7. The City of Rawlins owns land in the Sage Creek Basin portion of the Sierra Madre site that contains a collection of springs that are the primary water source for the city (City of Rawlins 2009a).

Livestock grazing is also the primary land use of private land owned by TOTCO in the Application Area. Other private land uses include residences within the Sierra Madre site and near the Platte River in the Chokecherry site, and a rock quarry in the Chokecherry site. Existing development on private land within the Application Area include TOTCO maintenance buildings and approximately 20 buildings that include second/vacation homes and associated out buildings in the southern portion of the Sierra Madre site. There are no year-round residences within the Application Area. The Wyoming State Penitentiary is located just outside of the Application Area, approximately 2 miles north of the Chokecherry boundary and 2 miles south of Rawlins on South Higley Road.

3.4.2 Land Ownership Adjustment and Consolidations

The 2008 Rawlins RMP identifies public lands for consideration of disposal under the disposal criteria of the FLPMA as identified in the 2008 Rawlins RMP. Lands considered for disposal through the FLPMA sale must meet one or more of the criteria outlined in Section 203(a) of the FLPMA. Disposal criteria characterize lands for potential disposal as lands that are difficult or uneconomical to manage; lands acquired for a specific purpose but no longer required for that or another federal purpose; or lands that will serve important public objectives, including but not limited to expansion of communities and economic development, that outweigh other public objectives and values. Land being considered for disposal within the Application Area includes T21N, R87W, Sections 32 and 34, and part of Section 35. These sections are located at the north boundary of the Application Area, in the checkerboard land ownership area just south of Rawlins.

Land is consolidated through fee or easement acquisition, exchange, condemnation, and donation processes. Land consolidation can resolve access and resource management challenges of checkerboard ownership lands; however, according to the 2008 Rawlins RMP there are currently no active efforts to consolidate land within the RFO, including the Application Area. Land consolidations are not further addressed in the Land Use analysis.

3.4.3 Withdrawals/Classifications

Withdrawals and classifications are typically placed on land or minerals to protect resource values or existing facilities, although they can selectively prohibit some management actions that would otherwise protect additional resource values. Current withdrawals in the Application Area include the Teton Reservoir Recreation Site.

3.4.4 ROWs and Leases

Land tenure involves the rights of individuals or other entities to secure access to public land and associated land resources. In general, public access and land tenure are managed through ROWs or easements. The checkerboard ownership pattern that characterizes the Application Area poses challenges for ROW management for linear ROWs such as roads and utilities that would need to cross private lands to access public lands. As stated in the 2003 Management Situation Analysis (BLM 2003b), management actions pertaining to transportation, utility and other access to public lands include the consideration that access across private lands will be pursued as needed through a variety of methods, including, but not limited to, purchase of ROWs or easements, land exchange, reciprocal ROWs, and other statutory authorities.

A review of the National Integrated Land System Geocommunicator (BLM 2011a) identifies currently active leases and nearly 100 authorized and pending ROW grants in the Application Area for facilities that include electric transmission lines, county roads, BLM roads, state highways, water plants, oil and gas pipelines, fiber optic lines, telephone and telegraph lines, and wind test facilities. The majority of oil

and gas leases are non-producing; however, there is a lease with one oil-producing well in SESW T19N R87W, Section 12. The City of Rawlins Sage Creek Water Transmission Pipeline ROW carries water from Rawlins Reservoir and the Sage Creek Spring Area in the Sierra Madre project area to the city (City of Rawlins 1986). The pending ROW grant for wind development facilities occupies most public land within the Application Area.

Access to public land, such as for dispersed recreation, occurs through Carbon County roads and BLM roads, the Continental Divide National Scenic Trail (CDNST), the North Platte River, and across public lands. Access to public land is limited in some parts of the Application Area due to the lack of access ROWs or easements on private lands, particularly in the Chokecherry site and the northern portion of Sierra Madre site. The southern portion of the Sierra Madre site has more open access to public lands for recreation. To legally use public lands for recreation, there must be public access to them via a public ROW or easement. Easements along the North Platte River allow anglers and waterfowl hunters to access enclosed public lands by legally crossing deeded lands within 50 feet of the river on foot. Similarly, recreationists access enclosed public lands or public tract easements reached by navigable waters from adjacent private lands with permission of the private landowner. There are some public land parcels within the Application Area that have no public access. To recreate on these public lands, a person must have permission from the owner of the adjacent private land, even if there is only a small distance of private land between a public road and public lands. Public land sections (BLM and State) accessible to the public are shown in **Figure 3.4-1**.

3.4.5 Transportation and Utility ROW Corridors

The 2008 Rawlins RMP identifies two designated ROW Corridors for transportation and utilities that cross through the Application Area: the I-80 Corridor and the Rock Springs to Dave Johnson Corridor. These ROW Corridors are shown on Map 2-2 (Designated ROW Corridors) of the Approved 2008 Rawlins RMP. The I-80 Corridor is used for buried utilities only. The Rock Springs to Dave Johnson Corridor is used for overhead utilities only. There are no other designated or major transportation and utility ROWs that cross through the Application Area. Existing major transportation and utility ROWs provide the greatest opportunities for the location of new utility and transportation systems.

A designated Section 368 energy corridor crosses through public lands in the Application Area in T21N R87W, Sections 32 and 34 and part of Section 35. These sections are located at the north boundary of the Application Area, in the checkerboard land ownership area just south of Rawlins, and also have been identified as potential disposal lands. The corridor was designated in accordance with Section 368 of the Energy Policy Act of 2005 (P.L.109-58) as part of a comprehensive, coordinated network of preferred locations for future energy transport projects that could be developed to satisfy the demand for energy (BLM 2008i).

3.4.6 Wind Energy Exclusion and Avoidance Areas

Areas with important resource values should be excluded, avoided, or mitigated in planning for new wind energy facilities (BLM IM No. 2009-043) (BLM2008d). Exclusion and Avoidance Areas for Linear Utility/Transportation Systems/Communication Sites and Wind Energy are shown on Maps 2-33a and 2-33b of the Approved 2008 Rawlins RMP. The following exclusion and/or avoidance resources occur in the Application Area:

- CDNST(avoidance area for linear utilities, exclusion area for wind energy);
- Upper Muddy Creek Watershed/Grizzly WHMA (avoidance area);
- North Platte River Special Recreation Management Area (SRMA) (avoidance area);
- Historic Trails Management Area (avoidance area);
- Existing and new recreation sites such as the Teton Reservoir Recreation Site (avoidance area); and

- VRM Class II areas such as along the North Platte River (avoidance area).

The 2008 Rawlins RMP further states that if it becomes necessary for facilities to be placed within avoidance areas, effects will be intensively managed (BLM 2008).

3.4.7 BLM Special Management Areas

Applicable BLM management is discussed in Section 4.4. As shown in **Figure 3.4-2**, the 2008 Rawlins RMP identifies the following special designations and management areas in the Application Area:

- Upper Muddy Creek Watershed/Grizzly WHMA; and
- Overland Trail Historic Trail Management Area.

There also are two SRMAs in the Application Area, which are described in Section 3.7:

- CDNST SRMA; and
- North Platte River SRMA.

3.4.7.1 Wildlife Habitat Management Areas

The Application Area contains portions of two separately designated WHMAs: the Red Rim-Grizzly WHMA and the Upper Muddy Creek Watershed/Grizzly WHMA. The Red Rim-Grizzly WHMA was jointly designated in 1994 by the BLM and the Wyoming Game and Fish Department (WGFD) and is managed in accordance with a cooperative agreement between the BLM, WGFD, and the local Conservation Districts to maintain and enhance wildlife habitat conditions in conjunction with livestock grazing (BLM and Wyoming Game and Fish Commission [WGFC] 2010; BLM and WGFD 1994). The boundaries of this WHMA were determined by the existing grazing allotments it encompasses. The Red Rim-Grizzly WHMA consists of two distinct areas, the Red Rim area and the Grizzly area. The Sierra Madre portion of the Application Area includes a portion of the Grizzly area.

The Upper Muddy Creek Watershed/Grizzly WHMA was designated in the 2008 Rawlins RMP. The boundary of this WHMA is the Upper Muddy Creek Watershed within the BLM Rawlins Field Office Resource Area. The goals for this WHMA, as defined in the 2008 Rawlins RMP, are to promote management of habitat for the Colorado River fish species unique to the Muddy Creek watershed and crucial winter habitat for elk and mule deer, as well as to seek cooperation of land owners of adjacent property in the management of the wildlife habitat (BLM 2008b). Additionally, this area is designated in the 2008 Rawlins RMP as a wind energy avoidance area (BLM 2008a, 2008 Rawlins RMP ROD Table 205 and map 2-33a) and has been closed to new oil, gas, and coal leasing. The Upper Muddy Creek Watershed/Grizzly WHMA overlaps a large portion of the Grizzly area of the Red Rim-Grizzly WHMA.

Information on the wildlife resources within each WHMA is provided in Section 3.14 and Section 3.15.

3.4.7.2 Historic Overland Trail Management Area

The historic Overland Trail route passes between the CCSM sites; the Historic Trail Management Area is defined as 0.25 mile on either side of the Overland Trail. Approximately 3 miles of the Overland Trail cross the northern portion of the Sierra Madre site. The Overland Trail is considered to be eligible for listing on the NRHP, as described in Section 3.2.

3.4.7.3 Other Areas of Special Designation

There are no ACECs, Wilderness Areas, Wilderness Study Areas (WSAs) or designated Wild and Scenic Rivers in the Application Area. Special designations are shown in **Figure 3.4-2**. Other areas with

special designations nearest to the Application Area are Jep Canyon WHMA (1 mile west of the Sierra Madre area), Sand Hills/JO Ranch ACEC (3.5 miles west), and the Stratton Sagebrush Steppe RA (1 mile east of the Sierra Madre area).

The CDNST is located within and near the Application Area and is an avoidance area for Linear Utility/Transportation Systems/Communication Sites and an exclusion area for wind energy. Between I-80 and the Medicine Bow-Routt National Forest, the CDNST is located within 5 miles from the Application Area boundary. Two segments of the CDNST are within the Application Area. The first segment is approximately 1.5 miles west of Miller Hill and the second segment follows the south boundary of the Sierra Madre project area for approximately 6 miles with a small portion (3 miles) inside the Application Area. As described in the 2009 CDNST Comprehensive Plan, the nature and purpose of the CDNST is to provide for high-quality scenic, primitive hiking and horseback riding opportunities; and to conserve natural, historic, and cultural resources along the CDNST corridor. The CDNST in the RFO is managed as a Special Recreation Management Area, which is a 0.25-mile wide corridor centered on the trail, to provide specific trail-related recreational activities and opportunities. The CDNST SRMA is further described in Section 3.7.2.1.

3.4.7.4 Eligible Wild and Scenic Rivers

As part of the 2008 Rawlins RMP revision process, the BLM conducted a review of waterways in the RFO planning area for potential eligibility as Wild and Scenic Rivers (WSRs). Out of 402 waterways reviewed, 9 met the eligibility requirements for WSR designation. One of the 9, Littlefield Creek, crosses a corner of the Sierra Madre project site. The outstandingly remarkable values on public lands identified for Littlefield Creek that qualified it for eligibility were fisheries and ecological values (BLM 2002c). This segment, though an eligible WSR, was not recommended as suitable for inclusion in the WSR System in the 2008 Rawlins RMP.

3.4.8 Lands with Wilderness Characteristics

Section 201 of the FLPMA requires the BLM to maintain, on a continuing basis, an inventory of public lands. The BLM may conduct the inventory of lands, including lands with wilderness characteristics (LWCs), using available information (e.g., existing maps, photos, records related to range projects, monitoring data) and field verification. The inventory for wilderness characteristics is based on criteria defined in Section 2(c) of the Wilderness Act and incorporated in Section 603 of the FLPMA for sufficient size, naturalness, outstanding opportunities for either solitude or primitive and unconfined recreation, and supplemental values (ecological, geological, or other features of scientific, educational, scenic, or historical values).

The LWC analysis only addresses inventory units that intersect the Application Area (**Table 3.4-3**). Since project-related disturbance would only occur in the conceptual area of development within the Application Area, inventory units that would not be directly disturbed by the project also were eliminated from further evaluation. Therefore, inventory units that did not meet the size criterion of 5,000 acres or any of the size exceptions, the naturalness criteria, or that did not intersect the conceptual area of development were not evaluated for wilderness characteristics.

The BLM reviewed the existing initial wilderness inventory conducted in 1979 to determine whether the project would directly affect any LWCs in the Application Area. Through this process, the BLM determined that there are six inventory units that intersect the Application Area, three of which are intersected by the conceptual area of development (**Figure 3.4-3** and **Table 3.4-3**). The analysis and field inventory conducted in 2011 found that these six inventory units do not have wilderness characteristics in accordance with Section 201 of the FLPMA and BLM Washington Office Instruction Memorandum (IM) 2011-154 (BLM 2011b). As discussed in Section 3.1, Volume 1, in 2012 the BLM further conducted an analysis of LWC inventory units throughout the RFO and found that no units over 5,000 acres contained wilderness character. The inventory forms are on record at the RFO.

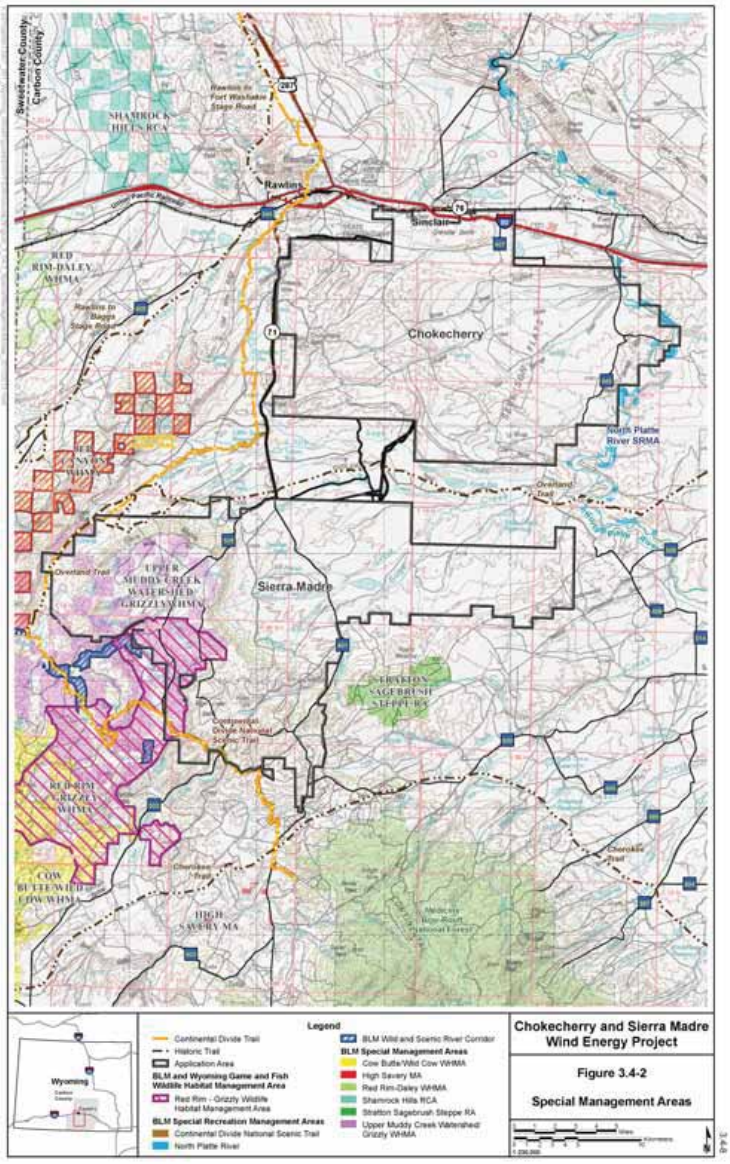
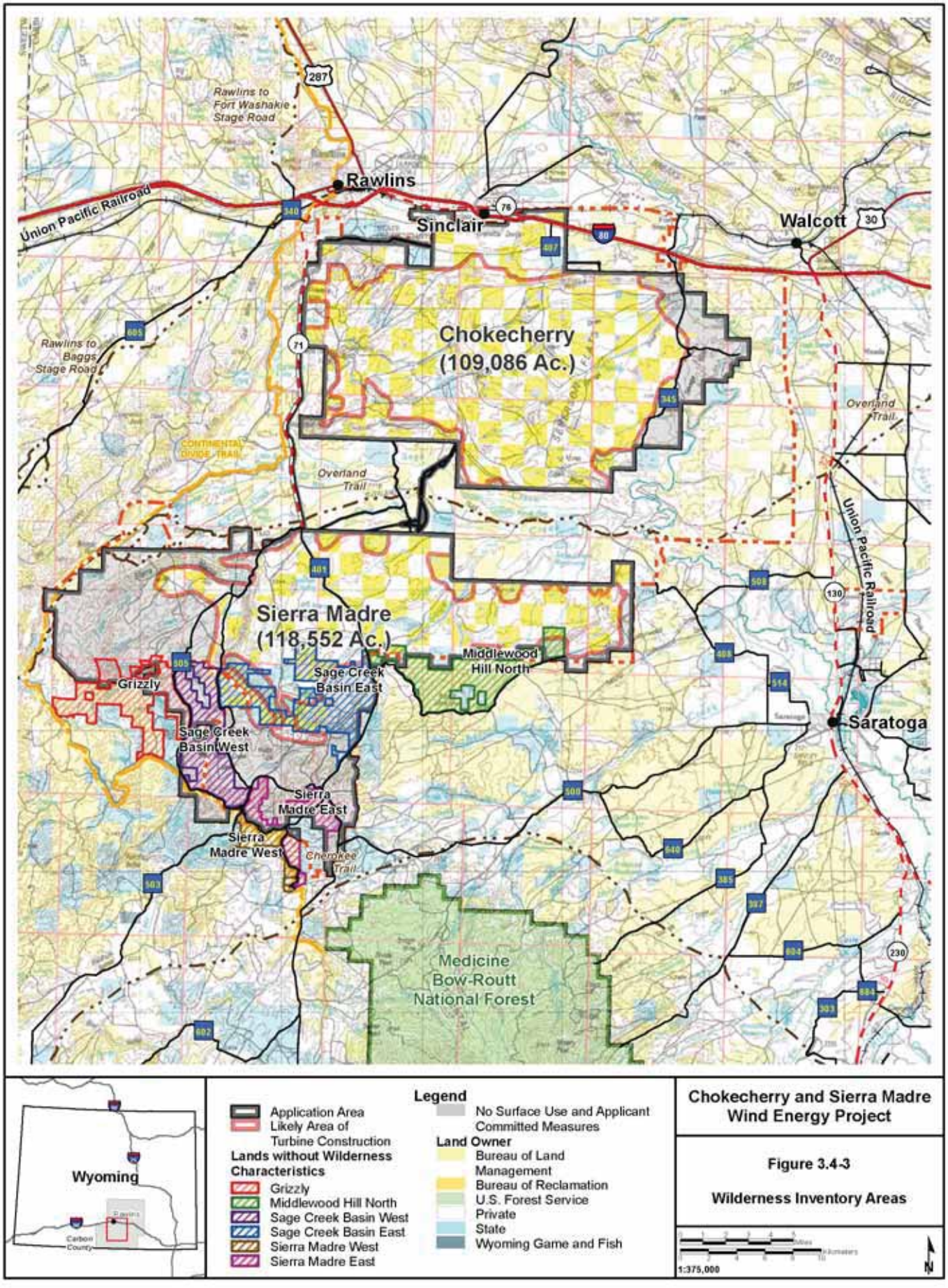

Sweetwater County
Carbon County
SHAMROCK HILLS RCA
Rawlins to Fort Washakie Stage Road
Rawlins
Union Pacific Railroad
Sinclair
RED RIM-DALEY WHMA
Rawlins to Baggs Stage Road
Chokecherry
North Platte River SRMA
Overland Trail
UPPER MUDDY CREEK WATERSHED GRIZZLY WHMA
Sierra Madre
STRATTON SAGEBRUSH STEPPE RCA
Continental Divide National Scenic Trail
RED RIM GRIZZLY WHMA
Cherokee Trail
COW BUTTE WILD COW WHMA
HIGH SAVERY MA
Medicine Bow-Routt National Forest
Wyoming
Legend
Continental Divide Trail
Historic Trail
Application Area
BLM and Wyoming Game and Fish Wildlife Habitat Management Area
Red Rim - Grizzly Wildlife Habitat Management Area
BLM Special Recreation Management Areas
Continental Divide National Scenic Trail
North Platte River
BLM Wild and Scenic River Corridor
BLM Special Management Areas
Cow Butte/Wild Cow WHMA
High Savery MA
Red Rim-Daley WHMA
Shamrock Hills RCA
Stratton Sagebrush Steppe RA
Upper Muddy Creek Watershed/Grizzly WHMA
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.4-2
Special Management Areas
Miles
Kilometers
1:200,000

Table 3.4-3 2011 Inventory Units Crossed by the Application Area

Unit ID	Unit Name	In the Conceptual Development Area	Size (acres)	Sufficient Size	Naturalness	Solitude	Primitive and Unconfined Recreation	Supplemental Values	Lands with Wilderness Characteristics
WYO-030-17N89W10-11	Grizzly	No	7,737	Yes	No	No	No	No	No
WYO-030-17N87W7-11	Sage Creek Basin West	Yes	6,717	Yes	No	No	No	No	No
WYO-030-17N88W20-11	Sage Creek Basin East	Yes	10,719	Yes	No	No	No	No	No
WYO-030-16N88W2-11	Sierra Madre East	No	4,193	No	NA[1]	NA[1]	NA[1]	NA[1]	No
WYO-030-16N88W9-11	Sierra Madre West	No	1,743	No	NA[1]	NA[1]	NA[1]	NA[1]	No
WYO-030-17N866W6-11	Middlewood Hill North	Yes	8,373	Yes	No	No	No	No	No

[1] Inventory unit eliminated due to size.


Rawlins to Fort Washakie Stage Road
Rawlins
Union Pacific Railroad
Sinclair
Walcott
Rawlins to Baggs Stage Road
Chokecherry (109,086 Ac.)
Overland Trail
CONTINENTAL DIVIDE TRAIL
Overland Trail
Union Pacific Railroad
Sierra Madre (118,552 Ac.)
Middlewood Hill North
Grizzly
Sage Creek Basin East
Sage Creek Basin West
Saratoga
Sierra Madre East
Sierra Madre West
Cherokee Trail
Medicine Bow-Routt National Forest
Wyoming
Carbon County
Legend
Application Area
Likely Area of Turbine Construction
Lands without Wilderness Characteristics
Grizzly
Middlewood Hill North
Sage Creek Basin West
Sage Creek Basin East
Sierra Madre West
Sierra Madre East
No Surface Use and Applicant Committed Measures
Land Owner
Bureau of Land Management
Bureau of Reclamation
U.S. Forest Service
Private
State
Wyoming Game and Fish
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.4-3
Wilderness Inventory Areas
1:375,000
N

3.4.9 State and Local Planning and Zoning

State of Wyoming House Bill No. HB0072 addresses the regulation of wind energy facilities by counties in Wyoming. The bill allows for counties to adopt requirements for regulating and permitting wind farms. Permits must be in compliance with all land use and zoning regulations adopted by the affected county.

Land use on private lands in the Application Area is guided by the goals, objectives, and strategies of the Carbon County Comprehensive Land Use Plan, and controlled through zoning districts. The Future Land Use Map included in the Carbon County Comprehensive Land Use Plan identifies the desired future land uses of private land within the Application Area as Smaller Lot Rural, Agricultural Rural Living, and Rural Agricultural Areas. Most of the private lands within the Chokecherry site are categorized with the future land use designation of Agricultural Rural Living, which is intended to accommodate a moderate density, rural land use pattern. Industrial uses should be carefully sited to avoid conflicts with other land uses.

The land use plan also includes a wind energy overlay to identify where wind energy uses predominate in future land use planning. The overlay acknowledges the BLM wind energy ROW applications within the Application Area and that non-energy developments should be designed to minimize conflicts with energy developments.

The County will utilize the Future Land Use Map and the associated goals will be used to evaluate land use proposals and adopt an updated zoning map. The current zoning map shows private lands in the Application Area zoned as Ranching, Agriculture, and Mining (RAM) (Carbon County 2010). In the RAM zoning district, commercial wind farms are a Conditionally Permitted Use which are subject to the planning approval pursuant to Chapter V of the Carbon County Zoning Resolution of 2003 (Carbon County 2010).

3.5 Paleontological Resources

Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (P.L. 59-209; 16 USC 431 et seq.; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on publicly administered lands. Federal protection for scientifically important paleontological resources would apply to construction or other related project impacts that would occur on publicly owned or managed lands. Another federal law regulating paleontological resources is the Archaeological and Paleontological Salvage Act (23 USC 305). The act provides for funding for mitigation of paleontological resources discovered during Federal Aid highway projects, provided that "excavated objects and information are to be used for public purposes without private gain to any individual or organization". In addition to the foregoing, the National Registry of Natural Landmarks provides protection to paleontological resources.

The BLM manages paleontological resources (fossils) on public lands under the following statutes and regulations (BLM 2010b):

- FLPMA of 1976 (P.L. 94-579);
- NEPA of 1969 (P.L. 91-190);
- Various sections of the BLM's regulations found in Title 43 CFR that address the collection of invertebrate fossils and, by administrative extension, fossil plants; and
- A recently enacted statute, the Paleontological Resources Preservation Act, was passed in March 2009. The law authorizes the BLM and USFS to manage and provide protection to fossil resources using "scientific principles and expertise" (BLM 2010b).

In addition to the statutes and regulations listed above, fossils on public lands are managed through the use of internal BLM guidance and manuals. Included among these are the BLM Manual 8270 and the BLM Handbook H-8270-1 (BLM 2010b). Various internal instructional memoranda have been issued to provide guidance to the BLM in implementing management and protection to fossil resources.

3.5.1 Potential Fossil Yield Classification

Recently, the BLM adopted the PFYC system to identify and classify fossil resources on public lands (BLM 2007c). Paleontological resources are closely tied to the geologic units (i.e., formations, members, or beds) that contain them. The probability for finding paleontological resources can be broadly predicted from the geologic units present at or near the surface. Therefore, geologic mapping can be used for assessing the potential for the occurrence of paleontological resources.

The PFYC system is a way of classifying geologic units based on the relative abundance of vertebrate fossils or scientifically significant fossils (plants and invertebrates) and their sensitivity to adverse impacts. A higher class number indicates higher potential. The PFYC is not intended to be applied to specific paleontological localities or small areas within units. Although significant localities may occasionally occur in a geologic unit, a few widely scattered important fossils or localities do not necessarily indicate a higher class; instead, the relative abundance of significant localities is intended to be the major determinant for the class assignment.

The PFYC system is meant to provide baseline guidance for predicting, assessing, and mitigating paleontological resources. The classification should be considered at an intermediate point in the analysis, and should be used to assist in determining the need for further mitigation assessment or actions. The BLM intends for the PFYC system to be used as a guideline as opposed to rigorous definitions. Descriptions of the potential fossil yield classes and land management guidance are in **Table 3.5-1** (BLM 2007c).

Table 3.5-1 Potential Fossil Yield Classification with Management Guidance

Class	Description	Basis	Comments
1	Igneous and metamorphic (tuffs are excluded from this category) geologic units or units representing heavily disturbed preservation environments that are not likely to contain recognizable fossil remains.	Fossils of any kind known not to occur except in the rarest of circumstances. Igneous or metamorphic origin. Landslides and glacial deposits.	The land manager's concern for paleontological resources on Class 1 acres is negligible. Ground disturbing activities will not require mitigation except in rare circumstances.
2	Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant invertebrate fossils.	Vertebrate fossils known to occur very rarely or not at all. Age greater than Devonian. Age younger than 10,000 B.P. Deep marine origin. Aeolian origin. Digenetic alteration.	The land manager's concern for paleontological resources on Class 2 acres is low. Ground disturbing activities are not likely to require mitigation.
3	Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence. Also sedimentary units of unknown fossil potential.	Units with sporadic known occurrences of vertebrate fossils. Vertebrate fossils and significant invertebrate fossils known to occur inconsistently; predictability known to be low. Poorly studied and/or poorly documented. Potential yield cannot be assigned without ground reconnaissance.	The land manager's concern for paleontological resources on Class 3 acres may extend across the entire range of management. Ground disturbing activities will require sufficient mitigation to determine whether significant paleontological resources occur in the area of a proposed action. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.

Table 3.5-1 Potential Fossil Yield Classification with Management Guidance

Class	Description	Basis	Comments
4	Class 4 geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.	Significant soil/vegetative cover; outcrop is not likely to be impacted. Areas of any exposed outcrop are smaller than 2 contiguous acres. Outcrop forms cliffs of sufficient height and slope that is out of reach by normal means. Other characteristics that lower the vulnerability of both known and unidentified fossil localities.	The land manager's concern for paleontological resources on Class 4 acres is toward management and away from unregulated access. Proposed ground disturbing activities will require assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action will impact the paleontological resources. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.
5	Highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant invertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.	Vertebrate fossils and/or scientifically significant invertebrate fossils are known and documented to occur consistently, predictably, and/or abundantly. Unit is exposed; little or no soil/vegetative cover. Outcrop areas are extensive; discontinuous areas are larger than 2 contiguous acres. Outcrop erodes readily; may form badlands. Easy access to extensive outcrop in remote areas. Other characteristics that increase the sensitivity of both known and unidentified fossil localities.	The land manager's highest concern for paleontological resources should focus on Class 5 areas. Mitigation of ground disturbing activities is required and may be intense. Areas of special interest and concern should be designated and intensely managed.

Sources: BLM 2008, 2007a.

3.5.2 Fossil Potential in the Application Area

Table 3.5-2 summarizes the paleontological resource potential and sensitivity of geologic formations in the proposed Application Area. The bedrock geologic map in Section 3.3 (**Figure 3.3-2**) shows the locations of these formations within the Application Area. The fossils listed for each geologic unit are likely to be found regionally in those units, but does not necessarily imply that such fossils would be found in the Application Area. Some of the formations listed on the table have a high potential for scientifically valuable fossils (Niobrara, Cloverly, and Morrison Formations) and fossil localities have been found within the Application Area (Uinta Paleontological Associates, Inc. 2006).

Table 3.5-2 Summary of Paleontological Resources Potential in the Application Area

Geologic Formation (Fm)/Deposit (Map Symbol)	BLM PFYC System Class/Types of Fossils[1]	Acreage within the Application Area
Alluvium (Qal), slopewash; terrace and bench deposits, playa (Qp), landslide (Qls)	Class 2[2]/types of fossils not determined	6,475
Undefined tertiary rocks (Tm)	Class 2[3]	43,617
Lewis Shale (Kle)	Class 3/bivalves, cephalopods, gastropods, trace fossils. Less common are fish scales and shark teeth	17,373
Mesaverde Group (Kmv)	Class 3/vertebrates (dinosaurs and mammals), plants, bivalves	73,860
Steele Shale (Ks)	Class 3/invertebrates	49,280
Niobrara (Kn)	Class 5/oysters, cephalopods, fish	16,380
Steele Shale and Niobrara Formations Undivided	As above	7240
Frontier Formation (Kf)	Class 3/fish, plants, and invertebrates (ammonites)	4,374
Frontier Formation/Mowry Shale/Thermopolis Shale undivided (Kft)	Class 3/same as above	7,130
Cloverly Formation; Morrison and Sundance Formations undivided	Class 5/dinosaurs, reptiles, and early mammals	2,793
Chugwater Formation	Class 3/invertebrates	555
Total		**229,077**

[1] Except as noted the PFYC system rank taken from BLM 2008b.

[2] Based on PFYC system criteria.

[3] Classification based on Vine and Prichard 1959. Fossils are present, but they described no specific species.

Sources: Hallberg and Case 2006a,b; Hallberg et al. 1998; Love and Christiansen 1985; Perman 1990; Slattery 2007; Vine and Prichard 1959; Watson 1980; Wilson et al.2001.

3.6 Range Resources

The entire Application Area is currently used for grazing by livestock (primarily cattle) on several grazing allotments. Grazing by big game wildlife species within the Application Area consists of mule deer, elk, and pronghorn.

3.6.1 Grazing Allotments

Range resources within the Application Area consist of intermingled private, state, and public lands administered as grazing allotments (**Figure 3.6-1**). The Chokecherry area includes portions of the Pine Grove/Bolten Allotment. The Sierra Madre area includes portions of 12 allotments, including the Pine Grove/Bolten, Cottonwood Draw, Grizzly, McCarty Canyon, Middlewood Hill, Sage Creek, Doolittle, Emigrant, Fillmore, North Savery, Platte River, Sixteen Mile, Beaver Dams, and Sulphur Springs allotments. The proposed transmission line is contained within the Pine Grove/Bolten Allotment. Land ownership within the allotments is outlined in **Table 3.6-1** and the allotment permittees are listed in **Table 3.6-2**. Not all of the above-mentioned allotments will incur surface impacts. The Pine Grove/Bolten, Cottonwood Draw, Grizzly, McCarty Canyon, Middlewood Hill, and Sage Creek allotments will receive surface impacts as a result of project activities under the various action alternatives, and will be the focus of further discussion.

3.6.2 Range Management Systems

As indicated in **Table 3.6-2**, the Pine Grove/Bolten, Cottonwood Draw, Grizzly, McCarty Canyon, Middlewood Hill, and Sage Creek allotments are managed on intensive rotation systems in which grazing is rotated during the growing season among several pastures within each allotment to provide complete growing season rest for all pastures on alternate years. This has resulted in soil stabilization, decreased runoff, increased infiltration, and enhanced riparian vegetation health; all of which have improved water quality in affected streams.

3.6.3 Range Improvements

In the Application Area, considerable efforts have been made to improve rangeland conditions in the Upper Colorado River Basin and Lower North Platte Watershed. These improvements include fences, wells, developed springs, and sagebrush treatments. Discussions regarding improvements on allotments will be limited to the Pine Grove/Bolten Allotment due to the fact that this allotment makes up the vast majority of the Application Area (approximately 98 percent). Within the Pine Grove/Bolten Allotment, TOTCO has developed an intensive rotation grazing plan designed to distribute grazing pressure so as to give a full season of rest to individual pastures on alternate years. Current rangeland improvements within the overall allotment include the development of the following:

- 70 wells;
- 18 springs;
- 11 new built or repaired reservoirs;
- 9 water diversions;
- 11 canals and ditches;
- 32 miles of pipeline;
- 55 miles of new cross-fencing creating 24 new pastures;
- 15 miles of road repairs and upgrades; and
- 15,622 acres of vegetation treatments.

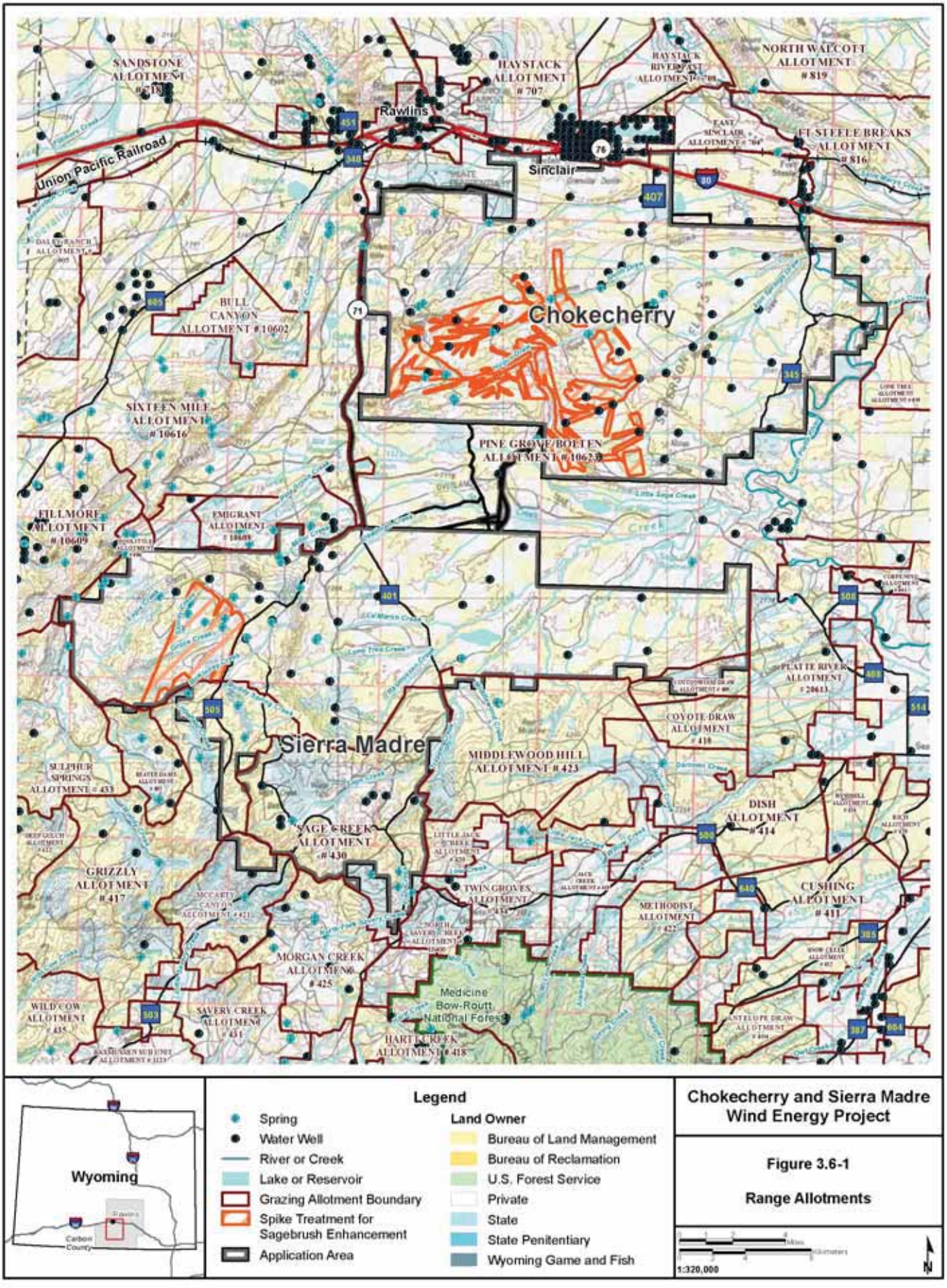

SANDSTONE ALLOTMENT # 713
HAYSTACK ALLOTMENT # 707
HAYSTACK RIVER EAST ALLOTMENT # 708
NORTH WALCOTT ALLOTMENT # 819
Rawlins
Union Pacific Railroad
EAST SINCLAIR ALLOTMENT # 704
FT STEELE BREAKS ALLOTMENT # 816
Sinclair
BULL CANYON ALLOTMENT # 10602
Chokecherry
SIXTEEN MILE ALLOTMENT # 10616
PINE GROVE/BOETEN ALLOTMENT # 10623
FILLMORE ALLOTMENT # 10609
EMIGRANT ALLOTMENT # 10605
PLATTE RIVER ALLOTMENT # 20613
COYOTE DRAW ALLOTMENT # 410
Sierra Madre
MIDDLEWOOD HILL ALLOTMENT # 423
SULPHUR SPRINGS ALLOTMENT # 433
DISH ALLOTMENT # 414
SAGE CREEK ALLOTMENT # 430
GRIZZLY ALLOTMENT # 417
TWIN GROVES ALLOTMENT
METHODIST ALLOTMENT # 422
CUSHING ALLOTMENT # 411
MORGAN CREEK ALLOTMENT # 425
Medicine Bow-Routt National Forest
WILD COW ALLOTMENT # 435
SAVERY CREEK ALLOTMENT # 431
HART CREEK ALLOTMENT # 418
Wyoming
Carbon County
Legend
Spring
Water Well
River or Creek
Lake or Reservoir
Grazing Allotment Boundary
Spike Treatment for Sagebrush Enhancement
Application Area
Land Owner
Bureau of Land Management
Bureau of Reclamation
U.S. Forest Service
Private
State
State Penitentiary
Wyoming Game and Fish
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.6-1
Range Allotments
1:320,000
N

Table 3.6-1 Grazing Allotments within the Application Area[1]

	Allotment #	BLM Acres within Application Area	State Acres within Application Area	Private Acres within Application Area	Total Acres within Application Area	Average Acres/AUM[2]	AUMs for Application Area[3]
Chokecherry Area							
Pine Grove/Bolten	10623	49,835	1,937	56,808	108,580	10	10,858
Sierra Madre Area							
Pine Grove/Bolten	10623	37,929	3,408	41,946	83,283	6	13,881
Cottonwood Draw	00409	312	636	674	1,622	6	270
Grizzly	00417	6,682	604	104	7,390	5	1,478
McCarty Canyon	00421	1,042	121	0	1,163	7	166
Middlewood Hill	00423	491	320	8	819	5	164
Sage Creek	00430	13,383	3,288	7,308	23,979	4	5,995
Sulphur Springs	00433	0	0	5	5	6	1
Sixteen Mile	10616	57	0	50	107	10	11
Doolittle	00606	0	0	1	1	3	<1
North Savery	10400	0	0	2	2	4	1
Emigrant	10608	0	0	90	90	6	15
Fillmore	10609	0	0	18	18	5	4
Platte River	20613	5	0	9	14	5	3
Beaver Dams	00405	11	0	153	164	6	27
Haul Road/Transmission Line Corridors							
Pine Grove/Bolten	10623	11	30	135	175	6	29

[1] Acreage data were taken from GIS files provided by the BLM.

[2] Average acres/AUM derived from public land and federal AUMs in entire allotment.

[3] AUMs for Application Area based on dividing total acres by average acres/AUM.

Table 3.6-2 Potentially Affected Grazing Permits due to Surface Disturbances within the Application Area[1]

Allotment Name	Allotment #	Permittee	Class of Livestock	On Date	Off Date	Grazing Management System
Pine Grove/Bolten	10623	Overland Trail Cattle Company	Cattle	1-Mar	31-Dec	Rotation
Cottonwood Draw	409	TA Ranches	Cattle	1-Jun	18-Sep	Rotation
Grizzly	417	Stratton Sheep Company and others	Cattle/Sheep	1-Jun	15-Sep	Rotation
McCarty Canyon	421	McCarty Ranch Company LLC	Cattle	15-May	25-Sep	Rotation
Middlewood Hill	423	TA Ranches	Cattle	1-May	31-Oct	Rotation
Sage Creek	430	Overland Trail Cattle Company	Cattle	10-May	25-Sep	Rotation

[1] Tabular data obtained from BLM 2009e, 2008b.

These improvements and the intense rotation grazing program have created an upward trend in two of the six standards used by the BLM for evaluation; standards #2 – Riparian/Wetland Health and #4 - Wildlife/threatened and endangered (T&E). A more complete discussion of these standards for evaluation is included in Section 3.6.4. This has resulted in reduced sediment loads and improved water quality, thereby allowing the removal of Sage Creek from WDEQs list of impaired or threatened waters in 2008 (WDEQ 2010) as well as delisting of the upper portions of McKinney Creek.

3.6.4 Allotment Evaluation Status

The BLM began evaluating lands by watersheds rather than by allotments in 2001. These evaluations, called Standards and Guidelines Assessments, review land resources for more than grazing considerations and now apply to all uses and resources. As stated in the 2008 Rawlins RMP (BLM 2008b), the objectives of the rangeland health regulations are to "promote healthy sustainable rangeland ecosystems; to accelerate restoration and improvement of public rangelands to properly functioning conditions and to provide for the sustainability of the western livestock industry and communities that are dependent upon productive, healthy public rangelands."

Properly functioning conditions refers to the primary method used in evaluating this standard, which is through a qualitative assessment procedure called proper functioning condition (PFC) (BLM 1998b). This process evaluates physical functioning of riparian/wetland areas through consideration of hydrology, vegetation, and soil/landform attributes. A properly functioning riparian/wetland area will provide the elements contained in the definition:

- Dissipate stream energy associated with high water flows, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid floodplain development;
- Improve flood-water retention and ground water recharge; and
- Develop root masses that stabilize streambanks against cutting action. It is important to note that the PFC assessment provides information on whether an area is physically functioning in a manner that allows maintenance or recovery of desired values (e.g., fish habitat, neotropical bird habitat, or forage) over time. PFC assessments are used along with other existing information such as stream cross-sections, photo-points, and habitat assessments to evaluate this standard of rangeland health (BLM 1998b).

The Application Area falls within two assessment areas consisting of Upper Muddy Creek and Savery Creek watersheds in the Colorado River drainage and North Platte River-Cow Creek, Jack Creek, Sage Creek, North Platte-Iron Springs Draw, Pass Creek, and Sugar Creek watersheds in the North Platte River drainage. A Standards and Guidelines Assessment was conducted for the Colorado River drainage in 2001 and for the North Platte drainage in 2003. The standards used for evaluation are:

1) Watershed;

2) Riparian/Wetland Health;

3) Uplands;

4) Wildlife/T&E/fisheries Habitat/weeds (Wildlife/T&E);

5) Water Quality; and

6) Air Quality.

The results that apply to rangeland resources are summarized below.

3.6.4.1 Colorado River Drainage

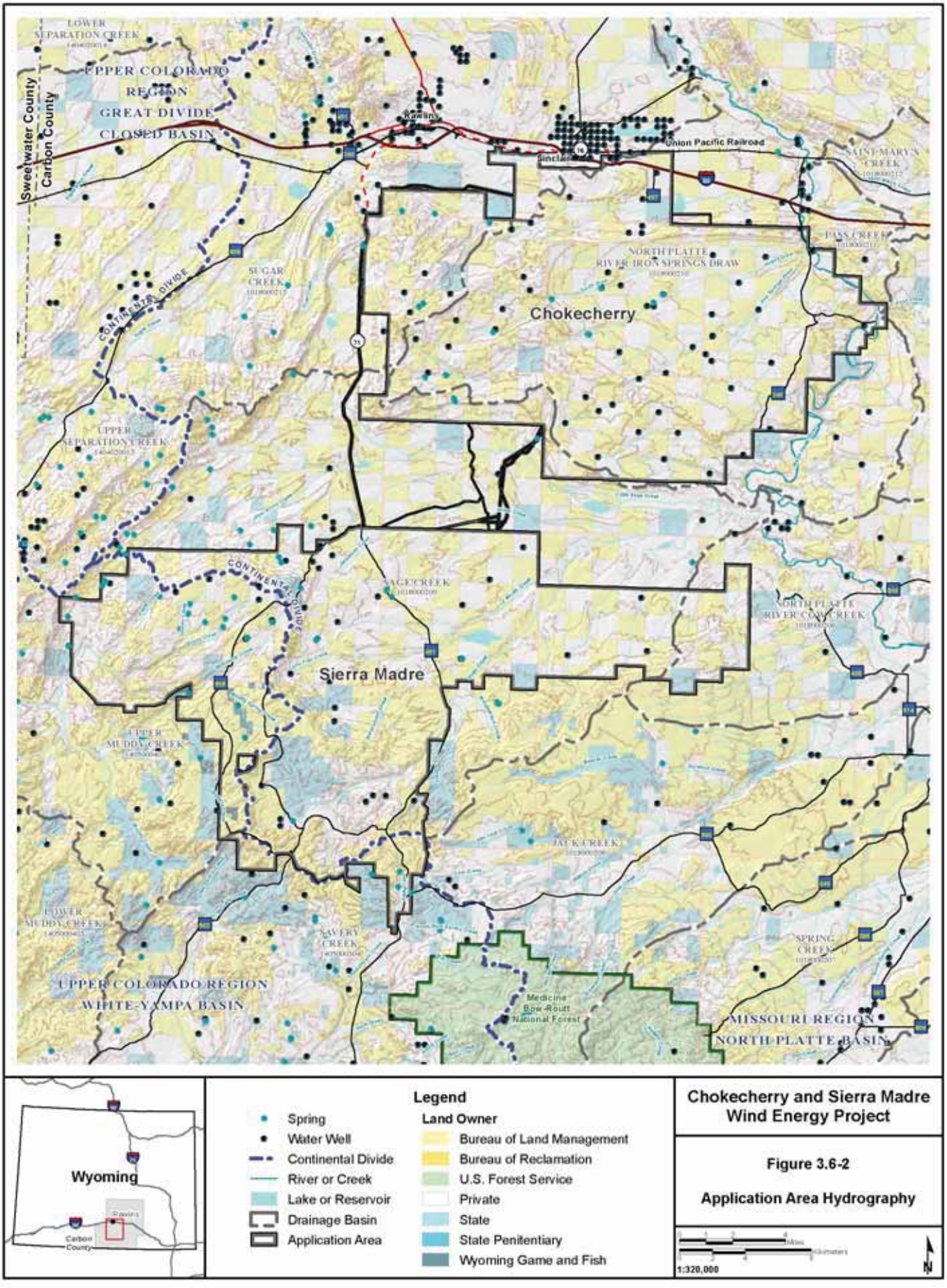
Within the Colorado River drainage, the Sulphur Springs and Grizzly allotments are included in the Upper Muddy Creek Watershed. The McCarty Canyon, North Savery, and the southern tip of the Sage Creek Allotment are within the Savery Creek Watershed (**Figure 3.6-2**).

The 2001 Standards and Guidelines Assessment showed the overall trend of both watersheds within the basin to be moving upward. This is largely due to funding that was granted to the LSRCD. Implemented projects focused on erosion and stream channel stabilization and water quality improvement. Livestock grazing BMP's, cross fencing, more than 20 off-stream water developments, improved road and stream crossings, vegetation manipulation, and prescribed burning of over 6,000 acres were implemented to improve livestock distribution (Ellison et al. 2009). Similarly, the Muddy Creek Resource Management Group (MCRMG) along with the Natural Resources Conservation Service (NRCS) have made significant improvements by addressing issues related to water quality, road based erosion, and habitat. Successful results have allowed for the reintroduction of Colorado River cutthroat trout (BLM 2002b). Stream morphology is generally improving in the basin with narrowing of stream channels and floodplain expansion. Perennial vegetation is stabilizing stream banks and preventing bank sloughing. However, the Pine Grove/Bolten Allotment is failing to meet Standard #2 – Riparian/Wetland Health, and Standard #5 – Water Quality. Efforts are being made to meet these failing standards through grazing management practices that include intensive rotations, cross fencing, and additional water developments. All of which will serve to improve livestock distribution and grant riparian vegetation longer periods of rest and reduced grazing pressure.

Muddy Creek watershed is, for the most part, lacking beaver ponds and experiencing faster flow events and reduced water storage in their absence. MCRMG is experimenting with in-stream structures that provide gradient control and assist overall riparian health by reducing channelization and raising the water table along destabilized stretches. It should be noted that channel and upland gully erosion is a natural occurring process along Muddy Creek and was observed in historical accounts of the area. Vegetation treatments, such as prescribed burns and herbicide use, have been applied to improve the diversity of the vegetation structure for enhanced hydrologic function. Erosion from increased roads across the watershed has been mitigated through improved construction and management techniques. Installation of water bars and culverts and graveling of road surfaces have minimized the impacts of erosion on Muddy Creek. However, one area of concern along the county road in McCarty Canyon that follows Little Savery Creek was a source of significant erosion in 2002 (BLM 2002b). Increased recreational off-highway vehicle use has contributed to erosion in this area.

Wetland and riparian systems in the Colorado River drainage include riparian grassland, willow-waterbirch shrublands, aspen woodlands cottonwood woodlands, aquatic vegetation, ephemeral drainages, manmade reservoirs, seeps/springs, and playa lake beds. Most (63 percent) of these areas are in PFC. Many (36 percent) are functioning at risk and 1 percent was evaluated as non-functioning. A new Allotment Management Plan and several range improvements have been implemented to improve land conditions. Fish Creek in the Sage Creek Allotment was evaluated to be functioning at risk and one part as non-functioning. New management and grazing practices (intensive rotation systems that provide longer periods of rest for riparian areas) have been improving the functionality of Fish Creek. McKinney Creek in the Pine Grove/Bolten Allotment did not meet riparian health standards as of 2002. This area has highly erosive soils of heavy shale and clay that have hampered riparian restoration efforts.

The dominant vegetation communities in the Colorado River drainage are sagebrush/grassland and sagebrush-mountain shrub/grassland. More specifically, lower elevations receiving little precipitation tend to support salt desert shrub vegetation while higher elevations support sagebrush-bunch grass communities. Mesic upland sites may include aspen and some conifer species, and riparian communities are comprised primarily of sedges and willows.


Sweetwater County
Carbon County
UPPER COLORADO REGION
GREAT DIVIDE CLOSED BASIN
Rawlins
Sinclair
Union Pacific Railroad
SAINT MARYS CREEK
PASS CREEK
NORTH PLATTE RIVER/IRON SPRINGS DRAW
SUGAR CREEK
CONTINENTAL DIVIDE
Chokecherry
UPPER SEPARATION CREEK
SAGE CREEK
NORTH PLATTE RIVER/COAL CREEK
Sierra Madre
UPPER MUDDY CREEK
JACK CREEK
LOWER MUDDY CREEK
SAVERY CREEK
SPRING CREEK
UPPER COLORADO REGION
WHITE-YAMPA BASIN
Medicine Bow-Routt National Forest
MISSOURI REGION
NORTH PLATTE BASIN
Wyoming
Carbon County
Legend
Spring
Water Well
Continental Divide
River or Creek
Lake or Reservoir
Drainage Basin
Application Area
Land Owner
Bureau of Land Management
Bureau of Reclamation
U.S. Forest Service
Private
State
State Penitentiary
Wyoming Game and Fish
Chokecherry and Sierra Madre Wind Energy Project
Figure 3.6-2
Application Area Hydrography
1:320,000
N

Efforts have been made to improve the overall health of the Colorado River drainage rangelands in and around the Application Area. The LSRCD, BLM, and WGFD have spent significant time and resources on improvement projects within the Grizzly Allotment including:

- Livestock rotation plan designed for short duration grazing;
- Fencing to allow for rotational grazing;
- Water development for livestock distribution;
- Planting trees and shrubs, especially in riparian areas;
- Roadwork intended to minimize erosion that reduces water quality of nearby streams and creeks;
- In-stream support structures; and
- Aquatic monitoring.

A monitoring program that ran from 1992 to 1998 showed improvements in wildlife and riparian habitat. This was observed in the proper functioning condition of creeks, narrowing of stream channels, and increased densities in willow communities (BLM 1998c). Similar improvements and the intense rotation grazing in the Pine Grove/Bolten Allotment have created an upward trend in Standard #2 – Riparian/Wetland Health and #4 – Wildlife/T&E for the portion of the allotment within this watershed. This has resulted in improved water quality and allowed for the delisting of the upper portions of McKinney Creek (NRCS 2005).

The Grizzly Allotment contains the Red Rim-Grizzly WHMA which is managed according to a cooperative agreement between the BLM, WGFD and local Conservation Districts to maintain and enhance wildlife habitat in conjunction with livestock grazing (see Section 3.4 for more information regarding the Red Rim-Grizzly WHMA). Approximately 1, 037 acres of the Sierra Madre portion of the Application Area overlaps with the Red Rim-Grizzly WHMA and is referred to as the area of interest, which would be subject to proposed turbine and road construction. This portion exists within the Denison pasture of the Grizzly Allotment. Livestock grazing is managed through an intensive rotation system that utilizes several pastures during the growing season and allows for complete rest during the growing season on alternate years. This rotation system has resulted in soil stabilization, decreased runoff, increased infiltration, enhanced riparian health, and improved water quality in associated streams. Upland vegetation treatments to thin sagebrush (prescribed burns and chemical treatments) were applied to enhance herbaceous plant production and relieve grazing pressures in the riparian areas and valley bottoms; however this occurred outside of the area of interest. Within the area of interest, only fence improvements have occurred. The majority of the vegetation in this area is mountain big sagebrush (*Artemesia tridentata ssp. vaseyana*). A small portion (>1 %) consists of wet meadow vegetation located along a stream.

The Upper Muddy Creek Watershed/Grizzly WHMA was designated and is managed by the BLM. The goals for this WHMA as defined in the BLM Rawlins Field Office RMP are to promote management of habitat for the Colorado River fish species unique to the Muddy Creek watershed and crucial winter habitat for elk and mule deer, as well as to seek cooperation of adjacent land owners in the management of wildlife habitat. To offer protection to the above mentioned wildlife species, the WHMA has been designated as a wind energy avoidance area and has been closed to new oil, gas, and coal leasing. Approximately 838.6 acres of the Sierra Madre portion of the Application Area overlaps with the WHMA in the Pine Grove/Bolten Allotment and would be subject to proposed turbine and road construction.

3.6.4.2 North Platte River Drainage

Within the North Platte River drainage, the Middlewood Hill, Sage Creek, Doolittle, Emigrant, Sixteen Mile, and north-central portion of the Pine Grove/Bolten Allotment are included in the Sage Creek Watershed. The Cottonwood Draw, Platte River, and the southeast corner of the

Pine Grove/Bolten Allotment are within the North Platte River-Cow Creek Watershed (**Figure 3.6-2**). The 2003 Standards and Guidelines Assessment showed the overall trend of the basin to be moving upward. This is due to healthy upland vegetative cover, good overall health of upland vegetation communities, and improvement in riparian/wetland health and functionality (BLM 2004a).

Conditions within the Application Area in the North Platte River drainage are, for the most part, similar to the Colorado River drainage. Stream morphology is generally improving due to better grazing practices and range improvements. Improved stream morphology is seen in the narrowing of stream channels and floodplain expansion. Perennial vegetation is stabilizing stream banks and preventing bank sloughing. Local, state, and federal government agencies along with private individuals, livestock operators, and non-profit organizations have made significant improvements by addressing issues regarding riparian condition, erosion, wildlife habitat, and noxious weed infestation. Fifty-five miles of cross-fencing; over 14 miles of road repairs; 15,622 acres of vegetation treatments; and water development projects consisting of wells, pipelines, spring developments, reservoirs, diversions, canals, and ditches have been implemented to facilitate improved grazing management practices and achieve better livestock distribution as a tool for better land management. The results have been documented at over 30 photopoints and 20 other monitoring sites. Additionally, there has been a noticeable increase in willow communities along intermittent and ephemeral drainages due to the above mentioned grazing management techniques.

Wetland and riparian systems within the Application Area of the North Platte River drainage include desert springs and seeps and their associated streams; snow supported seeps, springs; and streams that flow from higher elevations; man-made impoundments; and man-made wetlands around artesian wells. Noxious weeds have become the most important issue affecting riparian areas in the associated drainages. The main species of weeds that affect the watershed are leafy spurge (*Euphorbia esula*), Canada thistle (*Cirsium arvense*), perennial pepperweed (*Lepidium latifolium*), and Russian knapweed (*Acroptilon repens*). In the area of Kindt and Rasmussen reservoirs, salt cedar (*Tamarix* sp.) also has become widespread. These weeds can be spread naturally by disturbance from livestock and wildlife, wind, and surface water runoff or by human activities such as construction/development activities, recreational use, or by irrigation practices. Sixteen Mile, Middlewood Hill, and Platte River allotments failed Standard #2 – Riparian/Wetland Health at the time of the evaluation. The Middlewood Allotment has seen modifications in livestock management and the reintroduction of fire has increased the health of Beaver Creek. The Sixteen Mile Allotment failed the riparian standard in multiple areas, but these issues have been addressed through cross-fencing, prescribed burning, and numerous spring developments. The Platte River Allotment also failed this standard due to the condition of a spring in Second Cottonwood Draw. This spring has been developed and fenced and has improved tremendously.