CHAPTER 3—AFFECTED ENVIRONMENT

The affected environment is the baseline (see Table 3-1 at the end of Chapter 3) against which potential impacts caused by the planning alternatives are assessed. This chapter focuses on the natural and physical human environment that has the potential to be affected by implementing land management decisions.

The approach to defining the baseline was first to identify potential issues and concerns of the proposed land management decisions. The region of influence potentially affected by these decisions is primarily the three-county area in which Jack Morrow Hills (JMH) lies (Map 1). From this information, relevant environmental and economic conditions then were identified and described using geographic information systems data, existing databases and literature, previous reports and studies, field investigations, and personal and professional knowledge of the planning area.

3.1 LAND AND WATER RESOURCES

Land and water resources include the physical and biological features of the planning area and the land use programs that affect those features.

3.1.1 Fire Management

The Fire Management Implementation Plan for Bureau of Land Management (BLM)-administered public lands in the State of Wyoming (USDI 1998b) guides the use and suppression of fire as a management tool in the JMH planning area. The planning area lies in two geographic fire management areas: (1) the Big Sandy and Steamboat Mountain area, and (2) the Red Desert area.

Fire management planning objectives for the Big Sandy and Steamboat Mountain area are as follows: to reduce conifer and sagebrush encroachment into aspen and mountain shrub communities, improve habitat for big game and the Greater Sage-Grouse, improve forage for livestock and wild horses, and protect public and private property by reducing hazardous fuels near BLM-administered recreation sites and range improvements. Both wildland and prescribed fires could be used to meet resource management objectives throughout the entire fire management area. Steamboat Mountain contains unique vegetative communities and high-value wildlife habitat. Wildland fire is not desired in this area, and thus suppression techniques would be implemented here.

The Red Desert fire management area includes the portion of the Red Desert Watershed Area located within the planning area. Fire management planning objectives for this area are, as follows: to improve wildlife habitat, improve forage for livestock and wild horses, and reduce conifer encroachment into aspen and mountain shrub communities. Prescribed fire would be used to achieve resource management objectives throughout the entire fire management area.

The use of heavy equipment for fire management purposes would be restricted, and other minimal impact suppression techniques would be followed in areas of critical environmental concern (ACEC), in wilderness study areas (WSA), and along historic trails. Chemical and dye retardants for fire suppression would be restricted in the vicinity of petroglyphs within the Big Sandy and Steamboat Mountain fire management areas.

Wildland fires in the fire management areas have been infrequent. Over the past decade, less than 900 acres have burned in 29 recorded fires, with the majority occurring in the Big Sandy and Steamboat Mountain area.

3.1.2 Water Resources

Water resources include surface and groundwater sources and water quality.

3.1.2.1 Watersheds and Surface Waters

The JMH planning area lies within the Great Divide Basin, Colorado-Green River, and Platte-Sweetwater River watersheds. These watersheds have been further delineated into sub-basins by the State of Wyoming, as shown on Map 61. The upper reaches of the Colorado-Green River Basin drains the western portion of the planning area and occupies the majority of the area. It contains the Pacific Creek, Jack Morrow Creek, and Killpecker Creek subwatersheds. A small portion of the Platte-Sweetwater River Basin occupies the northeast corner of the planning area. The Great Divide Basin, which occupies the southwestern corner of the planning area, is a closed basin with no hydrological connection to any major river system.

Most surface water features in the planning area are ephemeral or intermittent streams, except for a few perennial streams and wetlands. Peak flows occur in the spring and summer during storm events. Flow in ephemeral streams is directly dependent on precipitation, because the channel is above the water table at all times, whereas intermittent streams carry seasonal flow generated by water from springs or from some other surface source. Perennial streams flow continuously and are generally associated with a water table in the localities through which they flow.

Riparian areas are those areas that show vegetative and morphologic influences as a result of their proximity to water features. They are important to fish and wildlife species as well as to livestock. Riparian and wetland areas can affect the health of entire watersheds by dissipating water energy; filtering sediments; reducing stream bank erosion; increasing groundwater supplies; maintaining habitat and forage for wildlife and livestock; and providing locations for recreationists to fish, camp, and picnic.

Ecologically important wetland resources include the melt water-fed ephemeral ponds (flockets) located in the sand dunes region of the planning area. These standing waters and their aquatic communities create an important early season resource base for the production of food organisms (invertebrates) and for nesting sites for waterfowl and other birds common to the aquatic environment.

3.1.2.2 Proper Functioning Condition

Proper Functioning Condition (PFC) is the minimum acceptable level of the ecological condition for flowing (lotic) and still (lentic) surface waters. It is a qualitative method for assessing the physical functioning of riparian and wetland areas and is a term that defines on-the-ground condition. The PFC assessment considers hydrology, vegetation, soil, and landform attributes to reduce erosion and improve water quality during high flows. PFC is a state of resiliency that would allow a riparian-wetland system to remain stable during a 25- to 30-year flow event, sustaining that system’s ability to produce values related to both physical and biological attributes such as fish and wildlife habitat, forage, and erosion control.

Riparian areas that are not in PFC are either classified as functioning at risk or nonfunctional. A riparian area functioning at risk may perform some degree of riparian function but still has a high probability of degradation associated with high-flow events. Apparent trend is also determined for riparian areas functioning at risk. An upward trend indicates that although the area has limited stability, it is showing signs of becoming more stable. A downward trend indicates that the resource is showing signs of becoming increasingly unstable. In some cases the trend is not apparent. Nonfunctional riparian areas clearly lack the attributes and processes necessary to maintain stability.

BLM conducted PFC assessments in the planning area on approximately 520 acres of wetlands and 80.5 miles of riparian areas. As shown in Table 3-2, approximately 21 percent of riparian areas and 13 percent of wetland areas surveyed are in PFC, with the remaining areas functioning at risk. Approximately half of the riparian areas functioning at risk exhibit an upward trend, while the other half of riparian areas and the remaining wetland areas exhibit a downward trend and show signs of becoming increasing unstable (Tables 3-3 and 3-4).

Table 3-2. PFC Assessment

Rating	Riparian Areas		Wetland Areas	
	Miles	Percent of Total Miles	Acres	Percent of Total Acres
Proper Functioning Condition	16.5	21	66	13
Functioning at Risk	64.0	79	454	87
Nonfunctional	0.0	0	0	0
Total	**80.5**	**100**	**520**	**100**

Table 3-3. JMH Stream PFC Summary for Lotic Systems

Year Surveyed	Stream	Reach	Rating					Reach Length (in miles)
			PFC	Functioning at Risk (FAR)			NF	
				Up	N/A	Down		
1995	Jack Morrow Creek	All		X (90%)		X (10%)		20.00
1995	Rock Cabin Creek	All		X (80%)		X (20%)		16.00
1995	Pacific Creek	Segment 1	X					1.50
1995	Pacific Creek	Segment 2		X				1.20
1995	Pacific Creek	Segment 3				X		2.00
1995	Parnell Creek	Segment 1– upper	X					2.00
1995	Parnell Creek	Segment 2– lower				X		8.00
1995	Pacific Creek	Segment 4				X		11.00
1997	Sand Creek	All			X			1.25
1997	Dickie Springs Creek	All	X					0.50
1997	Oregon Slough Creek	All	X					1.00

Table 3-3. JMH Stream PFC Summary for Lotic Systems (Continued)

Year Surveyed	Stream	Reach	Rating					Reach Length (in miles)
			PFC	Functioning at Risk (FAR)			NF	
				Up	N/A	Down		
1999	Robin Creek (BLM name)	All	X					1.50
1999	Oregon Buttes Creek (BLM name)	All	X					2.50
1999	Pacific Creek	Project area			X			4.00
1999	Bear Creek	All	X					7.50
2000	Nitche Creek					X		0.50
Total								**80.45**

Table 3-4. JMH Stream PFC Summary for Lentic Systems

Date of Survey	Lentic Area	Legal Description	Rating					Size of Area (acres)
			PFC	Functioning at Risk (FAR)			NF	
				Up	N/A	Down		
1997	Oregon Slough		X					60
1977	Long Slough					X		35
6/17/99	Dunder Pond (BLM name)		X					6
7/26/99	15-mile spring				X			10
7/26/99	Ox Yoke spring				X			2
9/7/99	Flocketts (dune pond area)	Part 1				X		362
9/7/99	Flocketts (dune pond area)	Part 2			X			45
Total								**520**

The waterways in PFC are primarily located in the upper reaches, where much of the stability is attributed to rocky substrates. Waterways in PFC include Dickie Springs Creek, Oregon Slough Creek, Robin Creek, Oregon Buttes Creek, Bear Creek, and portions of Pacific Creek and Parnell Creek. The waterways located in areas of lower elevation are more susceptible to degradation because of their reliance on vegetation for channel stability. Waterways that are functioning at risk include Jack Morrow Creek, Sand Creek, Rock Cabin Creek, and the lower reaches of Pacific Creek and Parnell Creek. Channel instability results in a greater than natural loss of soil and elevated levels of sediment and salinity in the water.

3.1.2.3 Groundwater

Locally elevated areas such as Steamboat Mountain and the highly permeable Killpecker Dunes provide the right conditions for locally fed seeps and springs to occur. Groundwater overlain by impermeable rock creates confined or artesian conditions. Such confined aquifers may be accessed in different locations throughout the planning area, but the quality and quantity of the water is highly variable.

Aquifers are not well defined in the planning area because of the nature of the geologic layers. Limited information is available from development of water wells for domestic, livestock, and agricultural use, and from oil and gas development. On the Green River Basin side of the Rock Springs Uplift, a number of water wells have been known to produce or are still producing from the Tertiary, Green River Formation. On the Great Divide Basin side, groundwater data indicate usable water in the Tertiary, Wasatch Formation, and the Green River Formation. Figure 1 shows the location of these formations.

Water from the Cretaceous, Almond, and Ericson formations, at shallow depths on the Rock Springs Uplift, is usable for livestock, irrigation, and/or domestic use. Other stratigraphic units that may have usable groundwater within the planning area include the Tertiary, Bridger Formation, and the Lewis Formation where it crops out. Quaternary sand dune deposits are likely to contain usable water but more importantly may act as a recharge zone for underlying aquifers and may produce seeps and springs used by wildlife.

3.1.2.4 Water Quality

Surface water and groundwater quality in the planning area are influenced primarily by the amount of total dissolved solids (TDS) in the water. There are no known point sources of water pollution within the planning area, thus surface water quality is influenced by nonpoint sources such as soil erosion and runoff.

Most of the planning area is subject to the Colorado River Salinity Compact. The seven basin states that make up the Colorado River Salinity Control Forum take a basinwide approach for controlling salinity in the waters that naturally drain into the Colorado River. BLM provides input to the Forum for the review of water quality standards for salinity in the Colorado River Basin.

Pacific, Jack Morrow, and Killpecker Creeks are all subject to the Colorado River Salinity Compact and have therefore been sampled to measure levels of TDS and other constituents. Based on sample results, these waterways tend to be suitable for livestock water and are within the range for agricultural water (Table 3-5). There are no known perennial surface flows in the Great Divide Basin.

Table 3-5. Suggested Use For Streams Within the JMH Planning Area

Stream	Suggested Use
Pacific Creek	Agricultural
Jack Morrow Creek	Livestock
Killpecker Creek	Agricultural[1]
Sweetwater River	Domestic

[1]The TDS average for Killpecker Creek is toward the high end of the agricultural range. Several samples showed TDS levels greater than 2,000 ppm. Therefore Killpecker Creek is not an ideal agricultural water source.

In general, groundwater quality decreases away from the basin margin and with increased depth. In both the Green River and Great Divide basins, the highest-quality groundwater would be expected in Quaternary deposits of alluvium along major drainages, Quaternary dune fields, Cretaceous and Tertiary sediments along the basin margins, and in the fine to medium grain sandstones of the Wasatch Formation away from the basin margin.

Groundwater quality can be measured by TDS levels in well-producing aquifers and compared against the Wyoming Department of Environmental Quality guidelines for

acceptable uses. Groundwater containing TDS levels below 500 milligrams per liter (mg/l) is acceptable for domestic use; TDS levels between 500 and 2,000 mg/l are acceptable for agricultural use; and TDS levels between 2,000 and 5,000 mg/l are acceptable for livestock use. Acceptable concentrations of constituents for each use category are shown in Table 3-6 at the end of Chapter 3.

Quaternary aquifers generally contain the highest-quality water, with TDS ranging from 100 to 200 mg/l in the headwaters, to 700 mg/l along the Green River. Within the planning area, it is anticipated that TDS levels would be on the high end of the range because of local influences of the Green River Formation. On the Great Divide Basin side of the Rock Springs Uplift, the shallow Tertiary aquifers (depths from less than 500 to 1,500 feet) have TDS levels ranging from 400 to 1,800 mg/l. The Wasatch Formation varies from 100 to 6,600 mg/l TDS, depending on the distance from the basin margin.

3.1.3 Wild Horses

The first wild horses in the area were most likely with the Native Americans who traveled through or inhabited southwest Wyoming. As white settlers arrived in the mid-1800s, horses often escaped or were turned loose on the open range. Many local ranchers managed these herds for their own use, introducing studs to improve the stock. Thus several different breeds can be found in the planning area, including large draft horses, quarter horse mixtures, and some American saddle horses.

With the passage of the Wild Free-Roaming Horse and Burro Act in 1971, BLM was given the responsibility to protect, manage, and control wild horses and burros. The primary objectives of the act are: to manage wild horses and burros as an integral part of the natural system of public lands under the principal of multiple use; to protect wild horses and burros from unauthorized capture, branding, harassment or death; and to provide humane care and treatment of wild horses and burros.

3.1.3.1 Herd Management Area

BLM establishes herd management areas (HMA) for the maintenance of wild horse herds. HMAs are based on the appropriate management level for the herd, the habitat requirements of the animals, the relationships with other uses of the public and adjacent private lands, and constraints to management.

The Great Divide Basin Wild Horse HMA is located 40 miles east of Rock Springs and north of Interstate 80. It encompasses an area from the boundary of the Rawlins and Rock Springs Field Offices west to the Continental Divide. The area consists of 772,915 acres, of which 73 percent is public land, 2 percent is state land, and 25 percent is private land.

Approximately 222,000 acres of the Great Divide Basin Wild Horse HMA cover the eastern one-third of the JMH planning area, which is predominately public land (Map 62). The western branch of the Continental Divide forms the western boundary of the HMA. This boundary is unfenced, and the topographic feature does not provide an effective barrier to the movement of wild horses. Wild horses are often found outside the HMA yet within the JMH planning area, primarily in the Steamboat Mountain ACEC and the Rock Cabin Creek/Oregon Buttes area. These horses are by definition “excess” and are subject to annual removal.

3.1.3.2 Appropriate Management Level

BLM develops herd management plans that identify management objectives and the tasks required to meet those objectives. Objectives may include maintaining certain herd characteristics, numbers, and genetic stock. Management tasks primarily focus on monitoring both the land and the herds, removing excess animals, preparing animals for adoption, adopting animals to the general public, compliance, and titling. By law BLM must limit its activities to those necessary to get the job done.

In 1979 an agreement with the Rock Springs Grazing Association, the International Society for the Protection of Mustangs and Burros, and Wild Horses Yes established a total population of 1,600 wild horses for the Rock Springs District. In 1982 BLM accepted this management level, and numbers for each wild horse HMA were designated. The appropriate management level (AML) established for wild horses in the Great Divide Basin Wild Horse HMA was set at 500 horses.

Because wild horse gatherings are expensive and the law requires a minimum level of management possible, BLM allows the horse populations to fluctuate so that the number of gatherings for any one herd is minimized. BLM allows the AML for the Great Divide Basin Wild Horse HMA to fluctuate between 415 to 600 wild horses at any given time. The 2001 projected population in the Great Divide Basin Wild Horse HMA was approximately 900 horses.

BLM analyzes inventory and monitoring information to determine whether the herds are healthy and if the animals are damaging rangelands within the HMA. When monitoring data and environmental analyses indicate that the population is in excess of the AML, BLM prepares gather plans detailing the methods and timing for gather and removal. After removing the animals, BLM's main goal is to place the animals through its adoption program.

3.1.4 Livestock Grazing

Congress enacted the Taylor Grazing Act in 1934 to provide for the orderly use, improvement, and development of public rangelands. The act allows the establishment of grazing districts and the issuance of permits to graze livestock. The Public Rangelands Improvement Act of 1978 further provides for the improvement of range conditions for watershed protection, livestock grazing, wildlife habitat, and other rangeland values.

3.1.4.1 Grazing Allotments

Livestock grazing is authorized within the JMH planning area in 15 allotments of various sizes, as shown on Map 63. Nine of these allotments are entirely within the JMH planning area, whereas the boundaries of the other six allotments extend outside the planning area. Approximately 92 percent of the land in the allotments within JMH is public, five percent is state, and the remaining three percent is under private ownership.

Most allotments contain some lands unsuitable for livestock grazing and areas suitable only for certain classes of livestock. Livestock grazing is authorized and occurs within WSAs in the JMH planning area. The interim management guidelines for WSAs outline minimum data requirements and maximum acceptable impacts for range developments and livestock grazing increases.

An animal unit is a unit of measure for rangeland livestock equivalent to one mature cow or five sheep, all over 6 months of age. An animal unit month (AUM) is the standard measure of forage utilization. An AUM is the amount of dry forage or feed required to feed a mature beef cow, or its equivalent, for 1 month. The equivalent of a cow for forage purposes is approximately one horse or five sheep.

The total AUMs for the JMH planning area are estimated based on the active permitted use by each permittee and the percent of the allotment that falls within the planning area. For discussion purposes, if half the allotment is within the JMH planning area, then half the AUMs are included in the total for JMH. The active permitted use within the JMH planning area is approximately 26,830 AUMs, of which approximately 12 percent is sheep (3,203 AUMs) and 88 percent is cattle (23,627 AUMs). Livestock grazing within these allotments has varied over time because of available forage, environmental conditions, business decisions made by permittees, and livestock prices. Thus the historic use over the past 5 years has averaged approximately half the active permitted use totals, as shown in Table 3-7 at the end of Chapter 3.

Congress enacted a grazing fee for public lands to be established each year. The fee is based on the value of livestock, the base economic value of grazing on public rangeland established by the 1966 Western Livestock Grazing Survey, livestock production costs, and the average costs of grazing on private lands. The grazing fee for the 2002 grazing season was set at $1.43 per AUM. Surcharge rates are charged for nonpermittee grazing on public lands. Permittees may lease to other livestock operators that do not have a permit with BLM for a particular allotment. The surcharge cost for these operators for the 2002 season was set at $4.01 per AUM plus the grazing fee of $1.43 for a total of $5.44 per AUM.

BLM develops individual allotment management plans (AMP) in cooperation with the permittees. The AMPs deal with specific units of rangeland and are based on multiple use resource management objectives. The plans include terms and conditions to achieve specific resource condition objectives. The AMPs consider livestock grazing in relation to other uses of rangelands in addition to watershed, vegetation, and wildlife. An AMP establishes the seasons of use, number and class of livestock, and rangeland improvements, and provides for a monitoring program to evaluate the effectiveness of management actions in achieving resource condition objectives.

3.1.4.2 Rangeland Monitoring and Improvements

The rangeland program in the planning area is based on the Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management developed for BLM-administered land (Appendix 10). The program emphasizes multiple use management of forage for livestock and wild horses, and incorporates needs for wildlife habitat and protection of riparian and watershed values. The specific goals and objectives of the program have been and continue to be accomplished through careful planning at the activity level, with attention given to proper placement of rangeland improvements, distribution of livestock, kind and class of livestock, season of use, suitable grazing systems, plant and animal requirements, and vegetative land treatments.

Rangeland monitoring information has been analyzed for the allotments in the planning area. Monitoring data include actual use, utilization, rangeland trend, and field observations. The allotments meet the standards for healthy rangelands, but no information is available to date supporting the state water quality standard for any of the allotments.

A number of range improvement projects have been constructed both for the enhancement and protection of watershed and wildlife values and for the management of domestic livestock grazing. These projects include water developments, vegetation treatments, windmills, and fences (Map 63). Range improvement projects are authorized under cooperative agreements or permits, depending on overall benefits and objectives and private investment levels.

3.1.5 Vegetation

The ecosystem of JMH has been assigned the highest biodiversity significance rating by the Wyoming Natural Diversity Database. This is because of the presence of the largest known occurrence of the Basin big sagebrush/lemon scurfpea association in the State of Wyoming, the occurrences of several vascular plant species endemic to the intermountain Semi-Desert Province of Wyoming, and the importance of the vegetation communities as habitat for the pygmy rabbit and desert elk.

The high-elevation, cold desert vegetation of the planning area is composed predominantly of Wyoming big sagebrush/grass and Gardner saltbush vegetation communities. Also found within the planning area are patches of mountain big sagebrush on slopes and escarpments; Basin big sagebrush on sand dunes; cushion plant communities on rims above mountain shrub communities; Utah junipers on the steeper, mainly south-facing slopes; sparse patches of true mountain mahogany on sandstone outcrops; and aspen and limber pine mainly on north- and east-facing slopes of buttes and mesas. Table 3-8 provides information on the vegetation communities within the planning area.

Table 3-8. Vegetation Communities and Associated Species

Community	Association	Location	Prominent Features
Wyoming Big Sagebrush	Western Wheatgrass Bluebunch Wheatgrass	Lower parts of easterly slopes, benches, and valley bottoms. Exposed sites on southerly or westerly slopes, upper parts of easterly slopes.	Dominant vegetation community in planning area.
Gardner's Saltbush–Winterfat	None	Alkaline soils of benches, flats, and gentle slopes.	Second most abundant in planning area; large-fruited bladderpod (BLM sensitive species) occupies habitat within this community.

Table 3-8. Vegetation Communities and Associated Species (Continued)

Community	Association	Location	Prominent Features
Mountain Shrub Communities			
Basin Big Sagebrush	Basin Wildrye Lemon Scurfpea Western Wheatgrass	Southeast-facing escarpments and valley bottoms on terraces above floodplains. Southwest of Steamboat Rim and south of Essex Mountain. Mesa east of Alkali Draw on northwest-facing slope and near Essex Mountain.	Basin big sagebrush-lemon scurfpea is a unique association rarely found anywhere else in the Western United States. Important for cover and crucial habitat for elk.
Mountain Big Sagebrush	Utah Snowberry/Basin Wildrye Bluebunch Wheatgrass	Slopes steeper than 10 percent on northerly and south-southeasterly aspects. Northeast face of Pacific Butte.	Aspen seedlings which provide cover and crucial habitat for elk grow around the edges of this shrub stand.
True Mountain Mahogany/ Bluebunch Wheatgrass	None	Steep slopes on or near sandstone outcrops.	Sparse, small stands throughout the planning area which are browsed by elk and deer.
Utah Juniper/Bluebunch Wheatgrass	None	East- and south-facing slopes and outcrops.	Sparse, small stands throughout the planning area which contain an understory with rich species diversity, but sparse vegetation.

3.1.5.1 Rare Plant Communities and Associations

There are two rare plant communities (cushion plant and woodlands) and one rare plant association (Basin big sagebrush/lemon scurfpea) within the planning area (Map 15).

3.1.5.1.1 Cushion Plant Community

Cushion plant communities are areas with low-growing, matlike tufts of vegetation with bare soil and gravel between the individual plants. These areas occur on ridgetops that experience extreme weather conditions. Cold winters, little rainfall, and strong winds contribute to the development of these specialized communities. The communities are very vulnerable to surface disturbance and have a slow recovery time. Usually 50 years or more are needed to restore the communities to their original native state after disturbance. The cushion plant community contains uncommon and regional endemic plant species. Typical associates found in these areas include different species of phlox, twinpods, bladderpods, and many legume species. The communities are prime habitat for the mountain plover, a species proposed for federal listing, which utilizes the low-growing vegetation areas for nesting.

3.1.5.1.2 Woodlands Community

Tree species are a very minor component of the vegetation in the planning area. In addition to the Utah juniper community, small isolated stands of limber pine and aspen occur at the higher elevations of Oregon Buttes and Steamboat Mountain. The presence of these stands is

attributable to snow accumulation and to the location of springs and seeps on the slopes of the buttes. In addition, sparse patches of Douglas fir and lodgepole pine occur on Oregon Buttes.

The woodlands community provides cover and calving habitat for big game species in the planning area.

3.1.5.1.3 Basin Big Sagebrush/Lemon Scurfpea Association

The Basin big sagebrush/lemon scurfpea community is a unique assemblage found on stabilized sand dunes. This is the largest of the few known occurrences of this association. Most locations are within the JMH area, and the association is not known elsewhere in Wyoming. The association is only rarely found in small patches elsewhere in the Western United States.

This vegetation type provides crucial calving habitat and cover for the desert elk herd, and important habitat for the pygmy rabbit, a BLM Wyoming sensitive species. The Wyoming Natural Diversity Database (WYNDD) considers this area to be a unique habitat deserving protection from unnecessary disturbances. WYNDD also recommends that the boundary of the Steamboat Mountain ACEC be adjusted to include the unprotected part of the occurrence.

3.1.5.2 Special Status Plant Species

Special status plants are those species that are federally listed as threatened or endangered (T&E), proposed for listing, or candidates for listing under the Endangered Species Act (ESA). They also include species designated by each BLM State Director as sensitive and those listed or proposed for listing by a state in a category implying potential endangerment or extinction. BLM is mandated to protect and manage threatened, endangered, candidate, proposed, and sensitive plant species and their habitat. BLM is also required to protect and manage sensitive species jointly identified with the appropriate state agency. The State of Wyoming does not have an official list of sensitive, threatened, or endangered plant species.

A significant amount of information on the vegetation and plant associations of the JMH area has been accumulated by BLM to date. General floristic inventories were conducted in the Continental Divide region, and a specific survey of plant communities and species of special concern was performed in the planning area in 1994 and 1995.

3.1.5.2.1 Federal Threatened and Endangered Species

Two plant species federally listed under the ESA have the potential to occur within the planning area. The blowout penstemon (*Penstemon haydenii*) is listed as endangered, and the Ute ladies'-tresses (*Spiranthes diluvialis*) is listed as threatened. These species are described further in the Biological Assessment (Appendix 3). No proposed or candidate plant species have the potential to occur in the planning area.

The blowout penstemon occurs in the Sand Hills of central Nebraska and a recently discovered location in south-central Wyoming in the Ferris Mountains. Potential high-elevation sand dune habitat in the Killpecker Dunes in the planning area was surveyed in 2000, but no new population of the blowout penstemon was documented.

The Ute ladies'-tresses is known to occur near the base of the eastern slope of the Rocky Mountains in southeastern and central Wyoming. Although BLM-authorized searches for the

species have been performed at several locations along the Green River and its tributaries (including Pacific Creek), the species has not been found in southwest Wyoming. Potential suitable habitat in the planning area may be found on Jack Morrow Creek and its tributaries, Pacific Creek, the meadows at Crookston Ranch (located on Nitchie Creek), Sweetwater River and its tributaries, sand dune ponds (flockets), and the perennial and intermittent streams in the Red Desert area.

3.1.5.2.2 Wyoming BLM Sensitive Plant Species

Instruction Memorandum (IM) No. WY-2001-040 lists the Wyoming BLM sensitive species and management policy. The policy emphasizes planning, management, and monitoring of sensitive species and directs management of these species to avoid or minimize adverse impacts. It is not the intent of the policy to create severe restrictions on activities such that other multiple use activities cannot occur. The policy goals of this instruction memorandum are to:

- Maintain vulnerable species and habitat components in functional BLM ecosystems.
- Ensure sensitive species are considered in land management decisions.
- Prevent the need for species listing under the ESA.
- Prioritize needed conservation work with an emphasis on habitat.

Table 3-9 lists the Wyoming BLM sensitive species that grow in the planning area (Map 15). The Nature Conservancy ranks the meadow pussytoes (*Antennaria arcuata*), Nelson's milkvetch (*Astragalus nelsonianus*), and large-fruited bladderpod (*Lesquerella macrocarpa*) as very vulnerable to extirpation both globally and statewide.

Table 3-9. Wyoming BLM Sensitive Plant Species

Common Name	Scientific Name	Habitat
Meadow pussytoes	*Antennaria arcuata*	Moist, hummocky meadows, seeps or springs surrounded by sage/grasslands
Nelson's milkvetch	*Astragalus nelsonianus*	Alkaline clay flats, shale bluffs and gullies, pebbly slopes, and volcanic cinders in sparsely vegetated sagebrush, juniper, and cushion plant communities
Large-fruited bladderpod	*Lesquerella macrocarpa*	Gypsum-clay hills and benches, clay flats, and barren hills

Source: BLM (Wyoming) Sensitive Species Policy and List, IM No. WY-2001-040, April 9, 2001.

Meadow pussytoes has been found in 20 sites in Fremont County, with two populations consisting of approximately 5 acres located within the planning area. One of the 20 populations is known to extend into the Rock Springs Field Office management area at Long Slough, near South Pass City. Trend data for the State of Wyoming show the population to be stable to slightly declining since 1982. However a status survey of meadow pussytoes conducted for BLM in 1995 discovered a single new population in the Oregon Gulch drainage, approximately 4 miles west of Continental Peak (Fertig 1996a). Surveys in other areas of potential habitat along Dickie Springs, Alkali Creek, and West Pacific Creek did not locate any plant populations.

Nelson's milkvetch is regionally endemic to southwest and central Wyoming. Its distribution includes the Wind River, Green River, Washakie, southern Powder River, Great Divide Basins, Owl Creek Mountains, and the Rock Springs Uplift in Fremont, Natrona, and Sweetwater counties. The population size of Nelson's milkvetch is not known and trend data

are not available; however, it is presumed that populations are stable at present (Fertig and Beauvais 1999).

The large-fruited bladderpod was thought to be endemic to the northern Great Divide Basin in Sweetwater and Fremont counties; however, it was located in Lincoln County during a vegetation survey in 1992 (Culwell 1992). Most of the known populations occur on public land northeast of Steamboat Mountain on Bush Rim, near Continental Peak, and in the Oregon Buttes area. Large-fruited bladderpod population sizes fluctuate from year to year, apparently in response to moisture availability. The species is much more vulnerable to impacts during dry years when populations are small.

3.1.5.3 State Species of Concern

The Wyoming Natural Diversity Database lists other species of concern that occur within the planning area (Appendix 11). These species lack formal federal or state status or protection but are potentially threatened within the ecosystem. They include annuals and biennials that have fluctuating population sizes in response to favorably moist years. Several rare species of the JMH have small global ranges but are often locally abundant within areas of suitable habitat. Such species require little or no formal protection as long as areas of representative habitat are maintained in good condition.

3.1.5.4 Noxious and Invasive Weeds

Federal agencies are directed by Executive Order 13112, Invasive Species, to expand and coordinate efforts to prevent the introduction and spread of invasive plant species (noxious weeds) and to minimize the economic, ecological, and human health impacts that invasive species cause. Weed management is an integral part of maintaining ecosystem health.

Fremont, Sublette, and Sweetwater counties have official lists of noxious and invasive weeds that occur within county limits. Those species that are known to occur within the planning area are listed in Table 3-10. Most of the weeds are found along County Road 21 (Tri-Territory Road) and County Road 74 (Oregon Buttes Road).

Table 3-10. Noxious and Invasive Weeds

Common Name	Scientific Name	Location	Other Characteristics
Halogeton	*Halogeton glomeratus*	Roadsides, borrow ditches, disturbed areas	Decreases if native grasses and shrubs are allowed to recolonize; moderately toxic to livestock.
Kochia	*Kochia scoparia*	Roadsides, borrow ditches, disturbed areas	Decreases if native grasses and shrubs are allowed to recolonize; moderately toxic to livestock.
Russian Thistle	*Salsola kali*	Roadsides, borrow ditches, disturbed areas	Decreases if native grasses and shrubs are allowed to recolonize; moderately toxic to livestock
Perennial Pepperweed	*Lepidium latifolium*	Stream banks on lower portions of Jack Morrow Creek/Pacific Creek	Causes loss of native grass communities in riparian areas.
Black Henbane	*Hyoscyamus niger*	Tri-territory road, north and south Table Mountain, sand dunes, Bar X Ranch road, disturbed locations of Pacific Creek and Rock Cabin Creek	Causes occasional livestock poisoning and is poisonous to humans

Table 3-10. Noxious and Invasive Weeds (Continued)

Common Name	Scientific Name	Location	Other Characteristics
Whitetop	*Cardaria spp.*	Disturbed alkaline soils of sagebrush-grass or riparian communities	Highly competitive with native species once established
Musk Thistle	*Carduus nutans*	Rock Cabin Creek, Chicken Springs, Dickie Springs, seep areas on east side of Steamboat Mountain	Aggressive invader which forms dense stands to crowd out desirable species
Canada Thistle	*Cirsium arvense*	Rock Cabin Creek, Chicken Springs, Dickie Springs, seep areas on east side of Steamboat Mountain	Aggressive invader which forms dense stands to crowd out desirable species
Leafy Spurge	*Euphorbia esula*	West of Pinnacles	Aggressively outcompetes native rangeland species

Weed populations are generally found along main dirt roads and two-tracks (especially those that cross meadows and drainage bottoms), in areas of livestock concentration (stock reservoirs, riparian areas, and sheep camps), and in areas of intense recreational use (frequently used dispersed camping areas). Motorized vehicles transporting seeds in tire treads are a significant source of new infestations of weed species. Other ways weed species are spread include untimely road blading (spreading mature weed seeds along roadbanks), transportation of nonlocal livestock into the area, use of contaminated hay for stock animals, and overuse and damage of native plant communities.

3.1.6 Wildlife

There are a variety of wildlife habitats supporting over 350 different species within the planning area, from sand dunes and dunal ponds in the western portion of the planning area to small woodlands in the higher elevations of Oregon Buttes and Steamboat Mountain. The term “wildlife” refers collectively to mammals, birds, fish, amphibians, and reptiles.

BLM manages wildlife habitat on public lands, while the Wyoming Game and Fish Department (WGFD) manages the wildlife populations. BLM and WGFD have officially coordinated their management activities since 1976. An “umbrella” Memorandum of Understanding (MOU) adopted in March 1990 (replacing a previous MOU from August 1976) is the basis for all cooperative efforts between BLM and WGFD. The MOU directs each agency to conduct a coordinated program of wildlife resource administration, participate in each other’s planning efforts, advocate a wildlife management strategy that focuses on total ecosystem management, maintain a cooperative-based wildlife information gathering and exchange system, provide consideration for management or mitigation of wildlife resources in other BLM programs, and promote improved public understanding of wildlife management on public lands (BLM and WGFD 1990).

3.1.6.1 Mammals

The WGFD manages big game populations in herd units. Herd unit boundaries generally do not match BLM field office boundaries, making analysis and correlation of resource data and big game population data difficult. The WGFD revises its population objectives for each big game species based on new habitat information, population trends, recreation demand, and public input.

Table 3-11 details the big game species within the planning area, habitat use by big game, acreage of crucial habitat and birthing areas within the planning area, WGFD herd units and size, and population levels set by WGFD for each herd unit.

Table 3-11. Big Game Habitat Use and Size

Common and Scientific Name	Habitat Use in Planning Area (acres)	WGFD Herd Unit and Size (million acres)	WGFD Herd Unit in Planning Area (acres)	WGFD Population Objective[1]
Mule Deer (*Odocoileus hemionus*)	Crucial winter range = 132,900 Birthing = 36,300	Steamboat = 2.6 South Wind River Deer = 1.4	Steamboat = 563,256 South Wind River Deer = 59,074	Steamboat = 4,000 South Wind River Deer = 13,000
Rocky Mountain Elk (*Cervus elaphus*)	Crucial winter range = 194,900 Birthing = 91,500	Steamboat = 2.6	Steamboat = 622,330	Steamboat[2] = 500
Pronghorn Antelope (*Antilocapra Americana*)	Crucial winter range = 81,500	Red Desert = 2.2 Sublette = 6.7	Red Desert = 79,700 Sublette = 542,630	Sublette = 48,000 Red Desert = 15,000
Moose (*Alces alces*)	Migrant	Lander = 2.7	Lander = 55,100	Lander = 450

[1]Population objectives are for entire herd unit area.
[2]Herd objective is being reevaluated and is expected to increase to 1,200 in November 2002

Crucial habitat (winter range) for mule deer, elk, and antelope covers approximately 40 percent of the JMH planning area. Crucial habitat is generally the component of a species habitat that has been documented as the determining factor in a population's ability to maintain itself at a certain level over the long term. The elk and mule deer winter range overlaps primarily in the south-central part of the planning area, whereas the antelope winter range is in the western portion. Birthing areas for mule deer and elk are also located in the planning area, with most of the birthing areas overlapping with the winter range (Map 51).

An area of big game habitat, the connectivity area, was established for the original JMH Coordinated Activity Plan (CAP) draft EIS effort in 2000 to maintain habitat connectivity between important habitats within the planning area. The connectivity area (Map 51) is a key wildlife habitat area that connects and includes crucial big game habitats. The area includes topographic relief for escape cover, important year-round forage, crucial winter range, and birthing areas for a majority of the deer and elk populations. The area also allows for free movement of animals among the various habitat components and provides an important migratory corridor throughout the year. Maintaining the integrity of the area is considered paramount to sustaining viable big game herds and other wildlife populations.

Water is a large factor in influencing big game distribution. Most mule deer activity within the planning area is dependent its availability. Studies have shown that in arid regions during the driest months, mule deer seldom move more than 1 to 1.5 miles from water. Lack of surface water in some areas also influences migration of pronghorn antelope and their season of use on particular ranges.

3.1.6.1.1 Mule Deer

Mule deer population levels are currently below objective for both herd units within the planning area. Winter range is a limiting factor for deer populations over much of their habitat, as shrubs, which make up approximately 75 percent of the winter diet, are covered by

snow in many areas. Drought conditions and competition with elk for preferred birthing areas may also be affecting the overall population and mule deer fawning success.

3.1.6.1.2 Pronghorn Antelope

Pronghorn antelope populations of the herd units in the planning area are currently at or near objective. However weather can be an important factor affecting population levels. Severe winters with deep, crusted snow and below-zero temperatures cause high antelope mortalities, and fences affect antelope movement with direct and indirect effects to mortality. Antelope habitat is generally represented by water and low-growth (2 to 3 feet) sagebrush in combination with rabbitbrush and bitterbrush.

3.1.6.1.3 Rocky Mountain Elk

The Steamboat elk herd is a unique component of the wildlife resources in the southwestern part of Wyoming. This elk herd exists on the sagebrush desert ecosystem, which contains very little conifer or aspen cover.

Historically, elk migrated to the planning area from Jackson, Wyoming and Yellowstone National Park, with the last major migration occurring in 1913. Records indicate that this movement was so large that portions of the area were proposed as a winter elk refuge. Historical information shows a remnant population of elk lived within the planning area until around 1940. Transplants to reestablish elk began in 1944 and continued until around 1967. These transplant efforts were successful in reestablishing the resident elk herd.

Elk population estimates for the Steamboat herd unit area have varied over time. A population objective of 500 was first established in the early 1970s, then increased to 700 in 1977, then lowered to 500 in 1984. Current estimated population counts show that the herd is approximately at 1,800 to 2,000 elk. The WGFD is currently reevaluating the herd objective; preliminary indications are that the objective be increased to 1,200 to better fit the increased herd unit area.

Most research on elk habitat utilization has been conducted in forested habitat because of limited elk populations in sagebrush-steppe habitats. It is known that elk habitat selection patterns are strongly influenced by security and thermal needs (Irwin and Peek 1979; Thomas et al. 1979), and therefore that disturbance may be a larger issue in an open environment versus a forested environment. Typically cover is provided by timber stands with vegetation types such as aspen (*Populus tremuloides*) and conifer species. This type of vegetation is severely limited within the JMH planning area, therefore the elk use scattered stands of tall sagebrush (*Artemsia tridentata*), aspen, and limber pine (*Pinus flexilus*), in addition to topography, for cover. This limited amount of cover seems sufficient for the elk as long as the level of human disturbance is low.

Approximately 175,000 acres within the planning area are classified as crucial habitat (winter range), and 91,500 acres are classified as elk birthing (calving) areas. Most of the birthing area overlaps with the winter range. Approximately 67 percent of the winter range and 86 percent of the birthing areas for the Steamboat elk herd unit are in the JMH planning area.

The JMH Desert Elk Study, which was initiated in 1999, is currently being conducted through the Wyoming Cooperative Research Unit, with funding from BLM, WGFD, and the Rocky Mountain Elk Foundation. The objectives of the study are to document elk

distribution and seasonal habitat use patterns and determine the effects of human disturbance on elk behavior and habitat use within the planning area. The study has been a 3-year effort, with a report of findings expected in fall 2002. Preliminary findings in January 2002 from the elk study include the following:

- Elk selected habitats offering security cover during calving and summer seasons, including tall sage, aspen, and mountain shrub habitat types.
- Mountain mahogany habitats were selected during winter; no selection was made of badlands/outcrops or dunes.
- Aspen, tall sage, and mountain shrub habitats were selected during calving season and badlands/outcrops and sand dunes were selected against. No selection was apparent for sage-grass or saltbush-greasewood.
- Elk avoided areas within 2 kilometers (km), or approximately 1.25 miles, of active gas/oil wells, showed no preference for areas 2 to 4 km of active gas/oil wells, and selected areas between 4 to 5 km from active gas/oil wells.
- Elk avoided areas within 1.5 km of major roads and used areas 3 to 5 km from major roads.
- Areas within 2 km of wells and 1.5 km of major roads received 60 percent and 63 percent less use, respectively.
- Forty-two percent of all locations within roadless areas occurred during the 2-month fall hunting season.
- Mean daily movements of treatment elk were significantly greater than those of control elk prior to and after disturbance.
- Significantly fewer pellet groups were counted in disturbed calving areas than areas not disturbed.

Preliminary findings outlined in January 2002 are used in the analysis of impacts for this planning effort and would aid in determining mitigation measures as needed. It is important to note that the analysis and mitigation are subject to change once the final report is published.

3.1.6.1.4 Other Mammals

Mountain lions have been observed in the Steamboat Mountain and Oregon Buttes areas, however indications show that their distribution and abundance in the planning area is very limited. Although black bear have been observed in the planning area, such sightings are rare and likely involve migrating or displaced animals. Other mammals that may be present in the planning area include moose (*Alces alces*), coyote (*Canis latrans*), white-tailed jackrabbit (*Lepus townsendi*), mountain cottontail rabbit (*Sylvilagus nuttalli*), pygmy rabbit (*Brachylagus idahoensi*), porcupine (*Erethizon dorsatum*), raccoon (*Procyon lotor*), red fox (*Vulpes fulva*), swift fox (*Vulpes velox*), beaver (*Castor canadensis*), striped skunk (*Mephitis mephitis*), white-tailed prairie dog (*Cynomys leucurus*), various rodents, bats, and weasel (*Mustela spp.*).

3.1.6.2 Birds

Avian species in the JMH planning area include waterfowl, upland game birds, raptors, and songbirds.

3.1.6.2.1 Waterfowl

Most of the planning area lies within the Pacific Flyway, with a very small portion occurring within the Central Flyway. Most waterfowl located in the planning area are migratory, short-term occupants because of the lack of available open water and riparian cover. Nesting in the Pacific Flyway occurs below 8,500 feet and is dependent on cover in riparian areas. Nesting occurs within the planning area on the dunal ponds and in Pacific Creek and Oregon Slough areas.

Waterfowl use every form of available open water in the planning area, from flowing wells and stock ponds to playa lakes and potholes. Northern shoveler (*Anas clypeata*), gadwalls (*Anas strepera*), mallards (*Anas platyrhynchos*), pintails (*Anas spp*.) and teal (*Anas spp*.) are the most common summer resident species. Some species only migrate through the area on their way to breeding or nesting grounds farther north or to winter areas farther south. Other species, such as the Barrow's goldeneye (*Bucephala islandica*), are resident for only part of the year, wintering in western Wyoming.

3.1.6.2.2 Greater Sage-Grouse

Greater Sage-Grouse (*Centrocercus urophasianus*) are found throughout the planning area wherever suitable habitat exists. Long-term trends from sage grouse harvest questionnaires and lek ("strutting ground") surveys show a gradual population decline. This decline is attributed to multiple factors, such as drought; oil and gas wells and their associated infrastructure; powerlines; mammalian predators; and a decline in the quantity and quality of sagebrush habitat due to livestock grazing, range management treatments, and development activities (Connelly et al. 2000). The decline has led to petitions to list the Greater Sage-Grouse under the ESA. A draft Wyoming Greater Sage-Grouse Conservation Plan has also been prepared and is undergoing review for adoption and implementation.

The reproductive characteristics and habits of Greater Sage-Grouse significantly limit their adaptability to human disturbance and habitat alteration. Birds can return to historic "strutting grounds" or breeding complexes as early as February. Strutting grounds, referred to as "leks," may be located at a point intermediate between the winter range and summer range or, in some cases, the summer and winter range may be the same area (Map 17). Leks are usually small open areas from 0.1 acre to 10 acres in size, but they may be as large as 100 acres or more. Snow conditions play a part in the suitability of an area for strutting, as does the amount of vegetation. The lek is generally in an area supported by low vegetation or in open areas surrounded by sagebrush (Connelly et al., 2000).

Peak breeding season is early to mid-April. Birds are active in courtship displays during early morning darkness until sunrise. On overcast or foggy days, strutting grounds may remain active until midmorning. Strutting can take place all night during full moon periods.

Information on Greater Sage-Grouse nesting indicates that 53 percent of nesting occurs within a 2-mile radius of strutting grounds, and 77 percent occurs within a 4-mile radius (Holloran 1999; Lyon 2000; Autenrieth 1982; Wakkinen 1992; Fisher 1994; Hanf 1994).

Recent radiotelemetry data gathered by Rocky Mountain Energy biologists show that some grouse move up to 11 miles to nest, while most range 1 to 4 miles. Studies conducted by the University of Wyoming Cooperative Research Unit have consistently shown that the most successful nests are located beyond 2 miles (Anderson 1999).

3.1.6.2.3 Raptors

There are 20 different species of hawks, eagles, and owls that are nesting, assumed to be nesting, or that have the potential of nesting in the planning area (Map 17). Other species are wintering populations, migrants, or possible migrants. Approximately 70 percent of the planning area has been surveyed for nesting raptors. In 1979, about 40 percent of the planning area was surveyed for "special habitat features," with most potential cliff-nesting habitat identified. A raptor inventory was conducted from 1980 to 1981 by BLM biologists and survey crews to satisfy coal leasing suitability criteria. Raptor surveys are currently driven by specific development projects, and data are collected to determine raptor management conflicts. Raptor species commonly seen in the planning area and their respective habitats are shown in Table 3-12.

Table 3-12. Raptor Species

Common Name	Scientific Name	Habitat
Prairie falcon	*Falco mexicanus*	Low rock outcroppings to tall vertical cliffs (Rock Springs Uplift, Steamboat Mountain)
American kestrel	*Falco sparverius*	Dead snags, clay stream banks, rimrock
Ferruginous hawk	*Buteo regalis*	Low cliffs, buttes, tresses, on the ground, artificial nesting platforms, sheepherder monuments
Red-tailed hawk	*Buteo jamaicensis*	Riparian zones and timbered areas
Swainson's hawk	*Buteo swainsoni*	Dry plains, open foothills, open forest, sparse trees, river bottoms
Northern harrier	*Circus cyaneus*	Wetlands and open fields
Burrowing Owl	*Athene cunicularia*	Grasslands and mountain parks near prairie dog towns and steppes, deserts, and prairies
Raven	*Corvus corax*	Mountains and deserts
Golden eagle	*Aquila chrysaetos*	Cliffs, ledges, pinnacles
Great-horned owl	*Bubo virginianus*	Cliff holes, rock crevices, trees

3.1.6.3 Aquatic Species

Aquatic wildlife in the planning area is primarily found in the waterways that cross through the area. Coldwater game fish exist in some portions of the waterways except Jack Morrow Creek, which contains only nongame species. Amphibian species such as the Great Basin spadefoot toad (*Spea intermontana*), spotted frog (*Rana pretiosa*), and tiger salamander (*Ambystoma tigrinum*) are located within ponds, spring seeps, and permanent and temporary waters within the planning area. Ponds or lentic habitats, locally referred to as the dunal ponds or flockets, are found in the sand dunes region of the planning area. Table 3-13 lists the waterways with fish life within the planning area.

Table 3-13. Waterways and Fish Species

Fish Species	Sweetwater River[1]	Harris Slough[2]	Oregon Slough[2]	Pacific Creek[2]	Jack Morrow Creek[3]
Rainbow trout (*Oncorhynchus mykiss*)	X				
Brown trout (*Salmo trutta*)	X	X			
Brook trout (*Salvelinus fontinalis*)	X	X	X	X	
Yellowstone cutthroat (*Oncorhynchus clarki bouvieri*)	X				
Snake River cutthroat (*Oncorhynchus clarki subspecies*)	X				
White sucker (*Catostomus commersoni*)	X		X	X	X
Longnose sucker (*Catostomus catostomus*)	X		X		
Mountain sucker (*Catostomus platyrhynchus*)	X			X	X
Flannelmouth sucker (*Catostomus latipinnis*)				X	
Creek chub (*Semotilus atromaculatus*)	X		X		
Lake chub (*Couesius plumbeus*)	X		X	X	X
Longnose dace (*Rhinichthys cataractae*)	X				
Fathead minnow (*Pimephales promelas*)	X			X	X
Bonneville redside shiner (*Richarsonius balteatus*)				X	X
Speckled dace (*Rhinichthys osculus*)				X	X
Utah Chub (*Gila atraria*)					X

[1]WGFD Classification 3: Important trout water; fisheries of regional importance.
[2]WGFD Classification 4: Low production trout waters; fisheries frequently of local importance but generally incapable of sustaining substantial fishing pressure.
[3]WGFD Classification 5: Very low production waters.

The Sweetwater River represents the highest-value coldwater fishery in the planning area, with water quality generally suitable for most other aquatic organisms. Overall quality tends to decline as conductivity, temperature, and turbidity levels progressively increase across the desert plains. Lack of full bank development and an adequate riparian shade canopy also result in a progressive deterioration of fish habitat downstream.

The portion of Pacific Creek above state lands has brook trout and fair pool habitat. Spawning potential is limited, but bank protection and cover are better than in lower reaches of the creek, where bank instability, poor habitat, and high summer temperatures limit salmonid spawning. Sixty to 100 percent of the bottom is silted, making the lower reach most suited to cyprinids, which populate the lower half of the creek.

Spring sources on Steamboat Mountain feed Jack Morrow Creek, which flows northwest to its confluence with Pacific Creek. Jack Morrow Creek is not suitable for salmonids because of low flows that only maintain pool habitat in the lower 10 miles, but it provides suitable habitat for nongame fish, mostly minnow species.

Water flowing into the Green River Drainage is considered a direct contributor to the habitat for four endangered fish species in the upper Colorado River. Water flowing into the Platte River Drainage (including the Sweetwater River) is also considered a direct contributor to threatened and endangered fish species and shorebirds using the Platte River in Nebraska. Although no threatened or endangered aquatic species have been identified within drainages of the planning area, all water withdrawals from these tributaries are considered to adversely affect these species and require ESA Section 7 consultation with the U.S. Fish and Wildlife

Service (USFWS). Water depletions and their effect on protected species are discussed in the Biological Assessment (Appendix 3).

3.1.6.4 Reptiles

Reptile species within the planning area are primarily located among rocky outcrops, cliffs, and boulders. Species include the Northern plateau lizard (*Sceloporus undulates*), Northern tree lizard (*Urosaurus ornatus*), short-horned lizard (*Phrynosoma douglassii*), and sagebrush lizard (*Sceloporus graciosus*).

3.1.6.5 Special Status Wildlife Species

Special status wildlife species include species federally listed as T&E, proposed for listing, or candidates for listing under the ESA. They also include species designated by each BLM State Director as sensitive and those listed or proposed for listing by a state in a category implying potential endangerment or extinction. BLM is mandated to protect and manage threatened, endangered, candidate, proposed, and sensitive wildlife species and their habitat. BLM is also required to protect and manage sensitive species jointly identified with the appropriate state agency. The State of Wyoming does not have an official list of sensitive, threatened, or endangered wildlife species.

3.1.6.5.1 Federal Threatened and Endangered Species

Five wildlife species protected by the ESA have the potential to occur within the planning area. These species are listed in Table 3-14 and described further in the Biological Assessment (Appendix 3).

Table 3-14. Threatened and Endangered Wildlife Species

Common Name	Scientific Name	Federal Status	Occurrence in Planning Area
Bald eagle	*Haliaeetus leucocephaulus*	Threatened	Casual migrant
Black-footed ferret	*Mustela nigripes*	Endangered	Historical sightings and potential habitat exists
Whooping crane	*Grus Americana*	Endangered	Rare migrant
Mountain plover	*Chadrius montanus*	Proposed	Nesting and brooding
Yellow-billed cuckoo	*Coccyzus americanus*	Candidate	Unknown

Source: USFWS, Jack Morrow Hills Updated Species List, January 2, 2002

Bald eagles are found primarily along rivers and inland lakes, where their nests are usually located in large coniferous or deciduous trees. Streams and rivers with trees, especially conifers, are uncommon to nonexistent in the planning area. The bald eagle is classed as a casual migrant in the planning area and has been observed feeding on carrion near Pacific Butte and Jack Morrow Creek. Currently the only known active bald eagle nesting site near the planning area is on the Green River on Seedskadee National Wildlife Refuge.

Historical documentation indicates the presence of black-footed ferrets in the Farson/Eden area adjacent to the planning area as late as 1984. Other areas where ferrets are presumed to have occurred are Sublette Flats, Seedskadee National Wildlife Refuge, and the Red Desert. Potential areas of ferret habitat can be delineated because of their association with prairie dogs and prairie dog colonies. Few formal surveys and inventories of prairie dogs have been conducted in the planning area.

Whooping cranes from the Gray's Lake flock were observed in the Rock Springs Field Office area in the late 1980s and early 1990s. In 1986, a lone whooping crane was observed on several occasions near Farson. The USFWS captured the bird to be used for mating with the Gray's Lake flock. During the summers of 1987 and 1988, a pair of whooping cranes were observed near Farson in crop fields and wetlands. Two observations of whooping cranes were made along Pacific Creek wetlands in 1991 and 1992.

The mountain plover inhabits the high, dry, short-grass plains and prairies east of the Rocky Mountains and the sagebrush grasslands throughout Wyoming, northern Utah, and northwestern Colorado. In Wyoming, the mountain plover is most often found in areas used either historically or currently by prairie dogs and pronghorn antelope. Breeding activity within Wyoming occurs from central-north Albany County west to Lincoln and Sublette Counties (USDI 2001). Mountain plovers are known to summer and nest in areas of low vegetation within the planning area (Map 17).

The yellow-billed cuckoo inhabits open, streamside deciduous woodland with low scrubby vegetation and generally prefers cottonwood stands for foraging and willow thickets for nesting. This type of habitat is limited within the planning area, which has no cottonwoods and only small thickets of coyote willow near the Sweetwater River. Formal surveys have not been conducted, and no reported sightings of cuckoos have occurred within the planning area.

3.1.6.5.2 Wyoming BLM Sensitive Wildlife Species

Similar to the discussion of BLM sensitive plant species, the IM also lists Wyoming BLM sensitive wildlife species and management policy. The policy emphasizes planning, management, and monitoring of sensitive wildlife species and directs their management to avoid or minimize adverse impacts and prevent the need for species listing under the ESA. Table 3-15 lists the Wyoming BLM sensitive wildlife species that may inhabit the planning area.

Table 3-15. Wyoming BLM Sensitive Wildlife Species

Common Name	Scientific Name	Habitat
Mammals		
Dwarf shrew	*Sorex nanus*	Rock fields, prairies, high-elevation forests
Long-eared myotis	*Myotis evotis*	Coniferous forests; roosts in caves, buildings, or mines near a body of water
Fringed myotis	*Myotis thysanodes*	Elevations less than 7,500 feet in forests and shrublands
Spotted bat	*Euderma maculatum*	Desert and coniferous habitats
Townsend's big-eared bat	*Corynorhinus townsendii*	Coniferous forest; desert shrubland
Pygmy rabbit	*Brachylagus idahoensis*	Big, dense sagebrush
White-tailed prairie dog	*Cynomys leucurus*	Plains
Wyoming pocket gopher	*Thomomys clusius*	Dry ridgetops; gravelly, loose soil; greasewood
Idaho pocket gopher	*Thomomys idahoensis*	Stony, shallow soil
Swift fox	*Vulpes velox*	Shortgrass prairie

Table 3-15. Wyoming BLM Sensitive Wildlife Species (Continued)

Common Name	Scientific Name	Habitat
Avian		
Ferruginous hawk	*Buteo regalis*	Basin-prairie shrub, grassland, rock outcrops
Peregrine falcon	*Falco peregrinus*	Tall cliffs
Greater Sage-Grouse	*Centrocercus urophasianus*	Basin-prairie shrub, mountain-foothill shrub
Long-billed curlew	*Numenius americanus*	Grasslands, plains, foothills, wet meadows
Burrowing owl	*Athene cunicularia*	Grasslands, basin-prairie shrub
Sage thrasher	*Oreoscoptes montanus*	Basin-prairie shrub, mountain-foothill shrub
Loggerhead shrike	*Lanius ludovicianus*	Basin-prairie shrub, mountain-foothill shrub
Brewer's sparrow	*Spizella breweri*	Basin-prairie shrub
Sage sparrow	*Amphispiza billineata*	Basin-prairie shrub, mountain-foothill shrub
Fish		
Roundtail chub	*Gila robusta*	Colorado River drainage; mostly large rivers, streams, and lakes
Bluehead sucker	*Catostomus discobolus*	Colorado River drainage; large rivers, streams, and lakes
Flannelmouth sucker	*Catostomus latipinnis*	Colorado River drainage; large rivers, streams, and lakes
Amphibians		
Great Basin spadefoot	*Spea intermontana*	Springs; seeps; permanent and, temporary waters
Spotted frog	*Ranus pretiosa*	Ponds, sloughs, small streams

Source: Wyoming BLM Sensitive Species Policy and List, IM No. WY-2001-040, April 9, 2001.

3.1.6.6 State Wildlife Species of Concern

The Wyoming Natural Diversity Database lists other wildlife species of concern that occur within the planning area (Appendix 11). These species are lacking formal federal or state status or protection but are potentially threatened within the ecosystem.

3.2 HERITAGE RESOURCES

Heritage resources are archeological, historical, paleontological, and Native American items, places, or events considered important to a culture, community, tradition, religion, or science. Archeological and historic resources are locations where human activity measurably altered the earth or left deposits of physical or biological remains. Examples of prehistoric resources include arrowheads and other stone tools and debris from tool making, fire hearths, hunting and gathering camp locations, Native American trails and rock art sites, whereas examples of historic resources include livestock tending camps, pioneer roads and trails, and homesteads. Paleontological resources include vertebrate, invertebrate, and plant fossils. Native American resources can include tribal burial grounds, habitations, religious ceremonial areas or instruments, or anything considered essential for the preservation of Native American traditional culture.

The JMH planning area is named after Jack Morrow, who had the reputation of being a common thief, swindler, and gunfighter. Although a limited formal cultural resources inventory has been conducted in the planning area, several significant resources and some

important patterns of spatial distribution of archaeological resources have been identified (Map 64). Important historical resources and localities important to Native Americans have also been identified.

Legislative mandates require that cultural resources be considered during all actions on BLM land and that proposed land uses initiated or authorized by BLM avoid inadvertent damage to federal and nonfederal cultural resources. Authority to protect heritage resource sites is prescribed by numerous legislative mandates (Section 1.6.5), of which the National Historic Preservation Act (NHPA) of 1966, the Antiquities Act of 1906, the National Trails System Act of 1968, the American Indian Religious Freedom Act (AIRFA) of 1978, and the Archaeological Resources Protection Act of 1979 are a few of the key statutes.

The AIRFA and the NHPA are procedural statutes requiring agency officials to take into account concerns of Native Americans regarding management of places of concern for religious, cultural, or historical reasons. These laws encourage a proactive consultation process between agency officials and Native American representatives. However the legislation also recognizes that agency officials will not always be able to completely accommodate the wishes of Native American peoples.

The intent of consultation efforts is to foster respectful discussion aimed at resolving potential conflicts by avoiding areas of concern or by developing mitigation strategies that will lessen adverse effects to the extent possible. Both the AIRFA and the NHPA recognize that total avoidance of areas of concern will not always be possible. However the laws and their implementing regulations encourage federal agencies to accommodate the needs of Native American peoples, especially where religious practices are concerned, to the extent possible without violating existing laws, regulations, and other preexisting mandates.

Native American consultation with tribal elders is appropriate when identifying resources that may be important to the people the tribal elders represent. A dialog has developed among the tribal governments of the Eastern Shoshone Nation, Uintah-Ouray bands of the Northern Ute Tribe, Shoshone-Bannock Tribes, and Northern Arapaho Tribe and the Rock Springs Field Office. In some cases other tribal entities may also be involved in consultation with BLM.

The Programmatic Agreement (PA) among BLM, the Advisory Council on Historic Preservation, and the National Council of State Historic Preservation Officers and its corollary protocol (Appendix 7) between BLM and the Wyoming State Historic Preservation Office (SHPO) require that certain procedures be followed prior to authorizing federally licensed, funded, or assisted undertakings. Procedures include some level of inventory to identify historical, archaeological, and culturally significant resources, assessing the potential effects of actions upon these resources, and the implementation of actions to ameliorate or mitigate adverse effects that an undertaking may have upon cultural resources.

3.2.1 Historic Trails

The National Park Service administers National Historic Trails found in the planning area (Map 64). However, management of federal lands containing congressionally recognized trails is left to those agencies that have jurisdiction over the lands on which the trails occur (in this case BLM). BLM approved the Oregon/Mormon Pioneer National Historic Trails Management Plan in 1986, which governs management of these resources in consultation with the Wyoming SHPO and the National Park Service.

3.2.1.1 Indian Gap Trail

A site of concern to traditional elders is the historic Native American Trail between the Ute Reservation in Utah and the Eastern Shoshone Reservation in the Wind River Basin. The name "Indian Gap Trail" was derived from the gap between Essex Mountain and Steamboat Mountain through which the trail passes. The precise antiquity of the trail is unknown, but historical records show the trail on the 1884 General Land Office plat for the area known as Indian Gap, and it is mentioned by a Native American historian as having been used until about 1906. Another informant advised that Shoshone traveled the trail to haul coal from Rock Springs to their reservation at Fort Washakie in the early years of the 20th century. The Indian Gap Trail is a significant historic resource and may or may not also be a Traditional Cultural Property. To date, aerial reconnaissance has revealed a potential route of the trail; however the route has not been verified on the ground, nor has it been mapped.

3.2.1.2 South Pass

Beginning in the winter of 1812–1813, the South Pass, located in the northeastern part of the planning area (Map 64), "became indelibly written in the annals of American history." (Devoto 1943) The gradual ascent of South Pass from the east along the Sweetwater River provided a relatively easy route across the towering Rocky Mountains. South Pass would allow hundreds of thousands of emigrants to move from the nation's eastern seaboard and central prairies to the fertile farmlands of western coastal valleys and rich hardrock mining bonanzas throughout the west. Historically, South Pass was used first by fur traders for easy entry into the river basins of the central Rocky Mountain regions. Eventually over one-half million people and probably five times that many livestock traversed South Pass in their migration to the west coast.

3.2.1.3 Oregon and California Trails

The drive to settle the Pacific Northwest and California would eventually give the United States an upper hand in control of territory claimed by the British Empire and the newly independent nation of Mexico. Beginning in 1838, people moved into Oregon to claim fertile farmlands in the Willamette Valley. Meddling in local political affairs by American citizens living in Mexico's territory of Alta California soon saw California fall under the influence and eventual political domination of the United States. The discovery of gold near Sutter's Fort in northern California and the resulting swarm of settlers during the gold rush of 1849 for all intents and purposes cemented California's future as an American possession. The Oregon Trail and California Trail, which are located in the same corridor over South Pass and pass through about 20 miles of the planning area, were designated by Congress as National Historic Trails in 1978 and 1992, respectively.

3.2.1.4 Mormon Pioneer Trail

In 1847, several hundred pioneers of the Church of Jesus Christ of Latter-Day Saints, better known as Mormons, traveled over South Pass to settle in the valley of the Great Salt Lake in present-day Utah. This was the beginning of the migration of over 70,000 Mormons and the colonization of the vast area that was to be known as Deseret. Eventually Mormons came to dominate the economy and politics of what would eventually become the states of Utah and Nevada, as well as significant portions of present-day Idaho, Wyoming, Arizona, and even California. The pioneer route of the Mormon Trail, used by Brigham Young's initial party in 1847, was designated a National Historic Trail by Congress in 1978.

3.2.1.5 Pony Express Trail

The Pony Express route was designated a National Historic Trail in 1992 in recognition of its significance, but more so because of the romance of this short-lived operation to carry the United States mail from settlements in the east to the west coast during the Civil War. This helped to preserve political control over western regions by the United States government.

3.2.2 Native American Sites

University of Wyoming professor emeritus George Frison (1971) postulates that pottery recovered from the Eden-Farson site was made by Shoshone people. Whether this is the camp described by Jedediah Smith is impossible to say, but it is known that several Native American tribes were present in this region in the late 18th and early 19th centuries, including the Shoshone, Ute, Bannock, Crow, Blackfoot, and Arapaho. Tribes from the Northern Plains, Great Basin, and Columbia Plateau, as well as European Americans participated in fur trade rendezvous held along the Green River, located within 100 miles of the planning area. It is also likely that other groups, including Athapaskan-speaking ancestors of the modern-day Navajo and Apache people of the Southwest, passed through this region only a few hundred years before Europeans arrived in North America.

The White Mountain Petroglyphs site, located in the southwest corner of the planning area, contains historic and prehistoric images carved into rock. Images of human figures in several different styles may indicate some time depth to the site, although all the rock art is thought to have been drawn in the past 500 or so years (Tanner and Vlcek 1995) during what archaeologists call the Firehole Phase. Native American traditional elders have expressed interest in the White Mountain site and several other rock art locations in the greater Killpecker Creek area. At the request of tribal elders, the exact locations of sensitive Native American sites and the religious practices they represent are kept confidential to protect them.

3.2.3 Unique Geological Features

The unique setting of mountain vistas, volcanic cones, and flat top mesas against a backdrop of white drifting sand dunes provides a spiritual experience for Native Americans. Several areas are identified as having landscape characteristics that typically are associated with respected sites. Although these areas have been roughly delineated, no attempt has been made to identify specific sites that may be of concern to traditional Native American peoples. Traditional elders have expressed interest in several landforms, including Killpecker Sand Dunes, Steamboat Mountain, Steamboat Rim, White Mountain Rim, Essex Mountain, Monument Ridge, and Boars Tusk within the planning area; the North and South Table Mountains and the Luecite Hills immediately to the south of the planning area; and Pilot Butte west of the planning area. Consultation visits with traditional elders indicate that these landmarks and the landscape vista of which they are a part are associated with the physical remains of a number of “respected places” associated with Native American religious practices.

The Pinnacles are a well-known natural landmark of the Red Desert. Geologically the Pinnacles are formations that are unique to this area because of their pyramid-like structure. The many small geologic microsites that are found in the area consist of small sandstone structures, volcanic intrusive dikes, badland, and windblown-type features. The Pinnacles themselves are nesting grounds for the ferruginous hawk. Antelope, elk, deer, and wild

horses can also be found in the area. Recreational opportunities include big game hunting, rock hounding, camping, and hiking.

3.2.4 Paleontological and Archaeological Resources

The limited inventory of the planning area has identified approximately 1,000 cultural resources localities within the region, estimated to represent 2 percent of potential localities in the region. Despite this, some important patterns of resource distribution are apparent, particularly for archaeological sites.

3.2.4.1 Finley and Krmpotich Sites

A region of soil deposition dating back over ten thousand years to the end of the Pleistocene Ice Age occurs in the western portion of the planning area. Indications suggest that this depositional pattern may also extend across the southern edge of the planning area along the flanks of the Killpecker sand dune field, as well as along the Pacific Creek drainage basin in the northern part of the planning area. A number of extremely significant archaeological resources, including the Finley and Krmpotich sites, are located here. Because the soil unit occurs across broad regions of the planning area, similar sites of great antiquity and scientific significance should be expected where this stable soil regime is preserved.

The Finley and Krmpotich archaeological sites are not typical of archaeological sites in this region. They hold cultural evidence from some of the earliest inhabitants of the North American continent and are some of the most intact manifestations of such archaeological evidence known anywhere on the continent (Frison 1998). Many of these sites are deeply buried and have little if any surface manifestation. An array of archaeological methodologies will need to be implemented if resources like Finley and Krmpotich are to be located before they are impacted by development. Unless scientists (geomorphologists and archaeologists) understand the genesis of the Killpecker dune field and the broad ancient soil deposit associated with it, they will never be able to fully understand its significance, much less that of the archaeological material it contains. Predicting the location of archaeological remains within these deposits is beyond the grasp of science at the present time.

3.2.4.2 Archaic Sites

The planning area also has a number of archaeological sites that are younger than the PaleoIndian-aged Finley and Krmpotich sites. “Archaic” sites ranging from 2,000 to 7,000 years in age are known to occur in the region. The CK Adams site, as an example, contains a series of archaeological manifestations that were located both on the surface and buried in stratigraphic contexts. A limited excavation of the site was undertaken to salvage several hearth features that were rapidly eroding and to test the area for in-place buried materials. Since the effort was undertaken in an emergency situation, BLM has not fully studied and reported the results of the effort. The state archaeologist who conducted part of the salvage reported his results, which are due to be published in the near future (Miller 1998).

Perhaps the most important information gleaned from the CK Adams site is that stratified sites dating from the late prehistoric period through the archaic period should be expected in the Pacific Creek drainage basin. This portion of the planning area contains buried soils that are being crosscut by modern drainage channels, including Pacific Creek, resulting in the exposure of archaeological manifestations.

The stable soil deposit in the Pacific Creek basin seems somehow associated with the Killpecker dune field, but the nature of that association is not fully understood. However, while sites along Pacific Creek do hold archaeological deposits dating back 7,000 years, they do not appear from present evidence to have PaleoIndian deposits (i.e., from 7,000 to 12,000 years before present). Because stratified deposits are the best source of information about changes in human behavior over long periods of time, sites like the CK Adams site are quite significant.

3.2.4.3 Eden-Farson Site

The protohistoric Eden-Farson site is another kind of archaeological manifestation observed in the planning area. The site sits on top of the stable soil deposit in the area where the Finley and Krmpotich sites are located, rather than being buried within those soils. The Eden-Farson site contains archaeological evidence of a large hunter-gatherer winter encampment, including remains of winter shelters, pottery, and a wide array of stone tools and bones from antelope that were apparently a major portion of the winter food supply.

Radiocarbon dates from the Eden-Farson site indicate the site was probably occupied immediately before Euro-Americans first came into direct contact with Native Americans in this region (about 200 to 300 years ago). No Euro-American artifacts were recovered from the Eden-Farson site. It is assumed that direct contact between Native American and Euro-American cultures had not occurred in this region at the time the Eden-Farson site was occupied. However, journals (Morgan 1964) from early Euro-American traders, including William Ashley's men, especially Jedediah Smith, mention the presence of two large Native encampments in this region. Smith identifies one camp as Crow and the other as Shoshone.

3.2.5 Other Cultural and Historical Resources

Other cultural and historic resources include items such as landmarks, parks, and roads.

3.2.5.1 South Pass National Historic Landmark and South Pass Historic Landscape

The significance of South Pass in the development of the United States as a nation was cause for designation as a National Historic Landmark in 1959. Upon its designation, no attempt was made to designate precise boundaries for landmark.

In 1984, the National Park Service proposed a boundary encompassing approximately 5,500 acres, of which nearly 1,000 acres were privately owned. Local landowners, fearing the preservation mandate of the National Park Service, protested the proposal, which eventually was not pursued by that agency. It was then up to BLM to develop management prescriptions designed to protect the South Pass National Historic Landmark, which lies within its land management jurisdiction.

To ensure that the intent of the Congressional National Historic Landmark designation was not compromised, BLM developed the South Pass Historic Landscape within the Green River Resource Management Plan (RMP) (USDI 1997). Management prescriptions for the South Pass Historic Landscape ACEC prohibit development that would be visible within 3 miles of the historic trails corridor. The Geographic Information System (GIS) analysis of the vista indicates that within an arbitrary 3-mile distance from the main National Historic Trail

corridor, about 24,000 acres are visible from the trails, while about 26,000 acres are shielded from view by topography.

3.2.5.2 South Pass Historic Mining Region

Immediately following the Civil War, a rather significant discovery of gold was made in the South Pass region. By 1869, hundreds of prospectors had converged on the area and several small communities had been developed. The most important of the settlements was South Pass City, which today is a State Historical Park. Because the transcontinental railroad had just been completed between Omaha, Nebraska and Sacramento, California, commerce with the new gold fields could be linked with the larger national economy much more easily than for the earlier historic trails network. This certainly did not mean, however, that wagon roads were obsolete. A network of roads soon developed to connect railheads on the Union Pacific Railroad in southern Wyoming within the South Pass region. South Pass City is located a few miles east of the planning area, but some historic resources associated with mining activity and community development, such as roads, are located in the JMH planning area.

3.2.5.3 Expansion Era Roads

By 1870, roads to the gold fields had been started from three railheads on the Union Pacific: Point of Rocks, Green River, and Bryan. These became known as Expansion Era roads, linking communities along the railroad with newly developing mining, agricultural, and military settlements in the central Rocky Mountains (Map 64). Remnants of the three Expansion Era roads to the South Pass region cross the planning area, as do roads to ranching communities (such as New Fork in the upper Green River Basin). Expansion Era roads also run through the planning area from Rock Springs to military posts established to administer the Wind River Indian Reservation. Several stage stations and freighter's camp locations associated with these Expansion Era roads are known, including Freighter's Gap, Fourteen Mile, and The Wells within the planning area. Although the general routes of the Expansion Era roads are known, and some are marked on General Land Office plats, the physical integrity and historical significance of these resources have generally not been evaluated.

3.2.5.4 Ranching-Related Historic Sites

Soon after the Expansion Era road network began to develop, cattle and sheep ranching became important to the region's economy. Several early ranching-related historic sites are located within the planning area. The best-known of these is the Halter and Flick Ranch at Pacific Springs, which is on private land. Pacific Springs was also an important watering spot on the historic trails corridor. The best-preserved ranching-related site on BLM lands is the Crookston Ranch, which includes several historic structures. The Green River RMP designates this site for special management for the interpretation of the region's ranching history. Numerous other less impressive sites related to the history of pastoral agriculture, including small, mostly unsuccessful homesteaders sites; sheepherder camps and shearing corrals; horse trapping facilities; and irrigation systems to support production of wild grass hay, are represented in the planning area. Examples are the stone building at Rock Cabin Creek, the Chilton and Houghton Ranch sites, the Washington Homestead, and Charlie Jameson's horse trap and cabin. However, the most ubiquitous agricultural-related site is the common sheepherder or cowboy campsite, which today consists of only a small scattering of historic artifacts across the landscape.

3.2.5.6 The Tri-Territory Marker

The Tri-Territory Marker is located on the northeast side of Steamboat Mountain within the core area of the JMH planning area. This monument marks the site where the Oregon Territory, Mexican Territory, and the Louisiana Purchase had a common boundary in the 19th century. A modern structure marks the site, commemorating its important national historical geographical location within Wyoming. The marker was placed and is maintained by the Rock Springs Kiwanis Club in cooperation with BLM. BLM has received a number of requests for information about this location, and it should be more strongly integrated into the Rock Springs Field Office cultural and recreation management programs.

3.3 TRAVEL MANAGEMENT, ACCESS, AND REALTY

This resource management category includes the land use programs of transportation, off-highway vehicle (OHV) use, lands and realty management, rights-of-way (ROW), access routes and issues, and transport of hazardous materials.

3.3.1 Travel Management

Travel management includes the description of the existing roads and trails network to and through the JMH planning area and the planning for manageable transportation routes.

3.3.1.1 Existing Network

The existing transportation network within the planning area is shown on Map 65. The network includes state, county, and BLM access roads. Historic and current uses of the roads have been primarily by livestock operators, recreationists, and mineral developers. Numerous trails and tracks cross the planning area and are referred to as census track trails. These trails are from remote sensing data files and have not been verified as to status. They are inaccessible to vehicular use, and they can include wildlife trails, access roads to wellheads, and pipeline or communication ROWs.

The primary paved access routes to the JMH area are U.S. Highway 191 and Wyoming Highway 28. Unpaved county roads off the two main highways to the planning area include Superior Cutoff Road, Eden area roads, Chilton Road, Freighter Gap Road, Bar X Road, Oregon Buttes Road, and Nine Mile Road. Tri-Territory Road, a BLM road, also provides access to the planning area. Most of these roads have some degree of gravel or aggregate surface and are periodically maintained, but they can become impassable when wet or during winter months. County roads are maintained, but generally there is no snow removal during winter.

County roads provide public access across private land, whereas BLM roads or other roads that cross private lands may not provide such access. Although BLM roads are administered by a public agency and open to use by the general public, they are not public roads, and permission is needed to cross private lands.

3.3.1.2 Transportation Planning

Transportation planning involves the reasoned and organized development of a plan which provides access to the planning area for multiple uses, including recreation, mineral development, and livestock operations. Transportation planning provides direction for future

road development and a basis for future exploration, development, and production transportation activities. The transportation planning area includes U.S. Highway 191; Wyoming Highway 28; and county, BLM, and undeveloped roads and routes within and adjacent to the area.

Roads are classified according to ownership, use, size, and traffic volume. These classifications, listed in Table 3-16, are used in the development of a transportation plan, particularly for well field development.

Table 3-16. Road Classifications

Arterial	State highways or county roads Provides primary access High traffic volume
Collector	BLM roads Connects with public road system Provides access to large blocks of land Accommodates mixed traffic and serves many uses High traffic volume within BLM road system
Local	BLM roads or industry/operator roads on BLM-administered lands Connects with collector roads of public road system One- or two-lane roads Provides access to multiple well locations Accommodates fewer traffic types and serves fewer users Low traffic volume
Resource	BLM roads or industry/operator roads on BLM-administered lands Connects with local roads or collector roads One-lane spur roads Provides access to the individual well location Accommodates and serves industry/operator users Low traffic volume

A draft transportation plan for the JMH area proposes specific access and travel routes in areas of particular concern as a result of anticipated development and use (Appendix 12). Road and ROW corridors and transportation standards would be described in a technical support document for specific projects occurring within these areas. The criteria to be considered in transportation planning include existing access rights, coordination with other jurisdictions (i.e., counties and state), seasonal limitations, and location of sensitive resources including Native American respected places and threatened and endangered species.

3.3.2 Off-Highway Use

Access to public lands is governed by the BLM Wyoming Management Strategy for Motorized Off-Highway Vehicle Use on Public Lands. This strategy recommends actions to improve motorized vehicle management on BLM lands to conserve soil, wildlife, water quality, native vegetation, air quality, and heritage resources while providing for appropriate recreational opportunities and promoting the safety of all users.

The use of OHVs on BLM lands has increased in popularity in recent years and accounts for approximately 17,000 annual recreation visitor days in the JMH area. Recreationists, hunters, livestock operators, and oil and gas surveyors and inspection crews account for the majority

of OHV users in the planning area. The Greater Sand Dunes Special Recreation Area provides over 10,000 acres of open area for OHV users.

Off-highway access is designated to protect resources and the landscape from damage, to ensure public safety, and to minimize conflict among users. The three main designations are "open," "limited," or "closed" to OHV use and are described in Table 3-17. Designations are made through the land use planning process and are updated and revised as necessary to meet resource management objectives and to mitigate OHV-related impacts.

Table 3-17. OHV Use Designations

Designation	Use
Open	Area of intensive OHV use with no resource, user, or public safety conflicts Vehicle travel permitted both on and off roads Vehicle must be operated responsibly and must not cause significant damage to resources or to other authorized uses of public land
Limited	Restricted OHV use to meet specific resource management objectives Vehicle travel permitted only on existing roads and trails in existence prior to the designation Vehicle travel permitted only on designated roads and trails that are identified, signed, and mapped by BLM Vehicle travel limited by the number and type of vehicle Vehicle travel limited by time or season Vehicle travel limited to licensed or permitted use
Closed	Prohibited OHV use to protect resources, ensure visitor safety, or reduce conflicts Vehicle travel not allowed both on or off roads and trails Access by non-motorized vehicle is generally allowed

The limited designation allows for parking within 300 feet from the edge of the road surface to accommodate recreationists, provided no damage occurs to the resources or hazard is imposed on public safety. Motorized vehicle use within 300 feet of roads and trails is also allowed to retrieve big game and trophy game animal kills.

The OHV use designations for the JMH area were made in the Green River RMP (Map 9). The WSAs, Boars Tusk, and Crookston Ranch are closed to OHV use. Official designations for the areas identified as limited to designated roads and trails would be completed through site-specific activity planning with public input. Until that designation is completed, the areas are managed as limited to existing roads and trails.

3.3.3 Access and Realty Actions

The BLM road network in the JMH area provides access to public and private lands for different management activities and recreation. It is BLM policy to provide reasonable access to public facilities and resources to meet the needs of private landowners, visitors, and users, including those with disabilities, while minimizing conflicts among users, promoting visitor safety, and preventing damage to resources.

Livestock operators use the many two-track roads and trails within the planning area to access water developments and other range improvements; recreationists use the routes for hiking, camping, hunting, sightseeing, rockhounding, and wildlife and wild horse viewing. Some existing roads are not passable during inclement weather or during winter months. Consequently winter access is subject to seasonal road closures, and plowing of these roads is

considered only on a case-by-case basis. Access is also subject to non-weather-related seasonal closures to protect resources during more sensitive times of the year, including birthing and wintering.

3.3.3.1 Rights-of-Way

A ROW grants the use of a specific piece of public land for specific facilities for a specific period of time. It is the policy of BLM to authorize all ROW applications at the discretion of the authorized officer in the most efficient and economic manner possible. The majority of ROWs are authorized under Title V of the Federal Land Policy and Management Act (FLPMA) and the Mineral Leasing Act. The ROWs under FLPMA are for structures, pipelines, and facilities to store and transport water, electrical power, communication systems, and solid materials, and for highways, roads, railroads, and other means of transportation. Under the Mineral Leasing Act, ROWs are granted for oil and natural gas gathering, distribution, and transmission pipelines and related facilities.

Management objectives address the designation of ROW corridors for public lands that currently accommodate existing authorized ROWs consistent with natural resource planning decisions. The realty program in the JMH area is driven by the local mineral industry, and the majority of the ROWs issued are in support of oil and gas development and for county roads. No utility corridors have been designated in the planning area; however an east-west window for underground utility lines is located along the southern border. New ROW corridors would be considered and designated for interstate and intrastate ROW facilities to meet demand forecasts for utility commodities. A communication line, power line, and abandoned railroad line cross the width of the planning area, and two communication sites are also located on public lands.

Portions of JMH are designated as avoidance or exclusion areas for ROWs. Avoidance areas are public lands where future ROWs may be granted only when no feasible alternative route or designated ROW corridor is available; exclusion areas would permit future ROWs only when mandated by law. The ROW avoidance and exclusion areas for the JMH planning area were established in the Green River RMP (Map 8).

3.3.3.2 Exchanges, Withdrawals, and Ownership Adjustments

The majority of the planning area (surface and mineral) is comprised of solid blocks of public lands administered by BLM. Nonfederal landowners include the State of Wyoming and private individuals. No communities are located within the area. Rock Springs and Superior are the nearest incorporated cities, and Eden-Farson is the nearest unincorporated populated area.

BLM provides for acquisition, use, disposal, and adjustment of land resources when it is in the public interest and consistent with approved land use plans. Acquisition can be by exchange, purchase, easement, or donation. The land acquisition program is designed to improve management of natural resources through consolidation of federal, state, and private lands and to secure land necessary to protect endangered species, promote biological diversity, increase recreational opportunities, and preserve heritage resources. Exchanges are only pursued with willing landowners and are the preferred method of obtaining lands, as federal purchase dollars are limited. Lands to be exchanged must be of equal monetary value and located within the same state. BLM is proposing the exchange of state inholdings in the Sand Dunes WSA, in the Greater Sand Dunes ACEC, and on Steamboat Mountain.

Withdrawals are used to protect sensitive environmental values, protect major federal investments in facilities, support national security, and provide for public health and safety. A withdrawal removes an area from settlement, sale, location, or entry under the general land laws for the purpose of limiting activities and to maintain other public values. Public land orders provide for the initiation, modification, extension, or revocation of land withdrawals.

Existing withdrawals in the planning area include lands classified as prospectively valuable for oil shale and coal. This classification indicates that oil shale and coal have priority for mineral resource development over location of mining claims. Oil shale and coal are leasable minerals, and therefore withdrawals to protect these minerals from speculation through mining claim activity are no longer applicable. Prior to revocation, withdrawn lands will be reviewed to determine whether any other resource values require withdrawal protection. Upon revocation, the area would be open to filing mineral claims, exploration, and development of locatable minerals. The White Mountain Petroglyphs located in the oil shale classification lands and Greater Sand Dunes ACEC, special status plant sites, Crookston Ranch, public water reserves, Tri-Territory Marker, and South Pass Summit located in the coal classification lands would be withdrawn from mineral location prior to the revocation.

3.3.4 Hazardous Materials

Hazardous materials are transported through the JMH planning area and used primarily by mineral developers. There are no known hazardous materials sites within the planning area other than the materials kept and used by the minerals industry at individual well locations. A few old abandoned reserve pits remain scattered throughout the area but have not been tested for the presence of hazardous materials or hazardous waste. Small oil and gas fields within the planning area could potentially contribute hazardous materials to the environment. Any spills or leakages of hazardous materials are reported by the operator and are controlled and removed as necessary in accordance with BLM regulations. The materials spilled or leaked are exempt from federal hazardous materials rules under the Resource Conservation and Recovery Act of 1976.

3.4 RECREATION RESOURCES

Recreation activities available on BLM-administered lands in the planning area are many and varied. A brief listing includes hunting for elk, deer, antelope, and Greater Sage-Grouse; camping, backpacking, and hiking; horsepacking and riding; OHV use; mountain biking; rock and petrified wood collecting; sightseeing of historic trails and places; wild horse viewing; wildlife viewing; and photography. Recreation use in the planning area predominantly occurs between May and October, as lack of maintained roads in the winter restricts year-round recreational access.

Major recreation locations include the Greater Sand Dunes area; Steamboat Mountain; Oregon Buttes; White Mountain Petroglyphs; Honeycomb Buttes; Tri-Territory Marker; and the Oregon, Mormon Pioneer, California, and Pony Express National Historic Trails (Map 2).

Estimated recreational use within the planning area is summarized in Table 3-18. Recreational use was estimated by using recreational visitor days (RVDs) (each RVD defined as a 12-hour period) as a unit of measure. RVDs for the planning area were estimated from two different sources. Hunting activities were estimated with data from WGFD; all other activities were estimated using data from the BLM Recreational Management Information System (RMIS).

Table 3-18. Estimated Annual Recreational Visitor Days

Activity	Recreational Visitor Days
OHV	16,308
Archery	60
Backpacking	180
Mountain Biking	120
Camping	1,398
Driving for Pleasure	1,448
Environmental Education	50
Gather Non-Commercial Products	120
Hiking/Walking/Running	500
Nature Study	64
Picnicking	100
Reenactment Events/Tours	50
Rockhounding/Mineral Collection	240
Target Practice	60
Viewing Cultural Sites	89
Viewing Wild Horses	240
Viewing Wildlife	256
Viewing Interpretive Exhibit	444
Total Recreational Visitor Days	**21,727**

BLM tracks recreational use for several areas within Wyoming; however, visitor day estimates are not available specifically for the JMH area. Therefore, estimated RVDs were extrapolated from the RMIS database for the Rock Springs Field Office. The RMIS database was queried for the number of RVDs per activity for the Rock Springs Field Office for the time period October 1, 1998 to September 30, 2001. The JMH planning area accounts for 19 percent of the land area under the jurisdiction of the Rock Springs Field Office; as a first estimate it was assumed that RVDs associated with JMH would account for 19 percent of those recorded within the field office. The estimated RVDs per activity were then modified using information specific to JMH. For example, it was assumed that very little fishing, cross-country skiing, or snowmobile activity occurs in the planning area. In addition, camping RVDs were revised downward given the lack of developed campsites within the JMH area.

The results summarized in Table 3-18 show that OHV use is the most popular recreational activity, accounting for over 16,000 RVDs per year. Additionally it was estimated that visitors enjoyed approximately 5,400 RVDs associated with other dispersed recreational activities.

3.4.1 Off-Highway Vehicle Use

OHV use is the most popular recreational activity within the planning area. Most of this activity takes place within the Greater Sand Dunes Recreation Area, which carries an “open” OHV designation on 10,500 acres. BLM estimates that an average of 14,000 RVDs occur in this area on an annual basis. In addition, OHV recreation occurs in other areas that fall within the “limited” use category. The limited category includes areas limited to existing roads and trails, areas limited to designated roads and trails, areas limited by number and type of vehicle, areas limited to licensed or permitted use, and areas with seasonal limitations. Using the RMIS database for the Rock Springs Field Office, it was estimated that OHV use in other areas of the planning area account for approximately 2,400 RVDs per year.

3.4.2 Hunting

Hunting is the second most popular activity within the planning area and includes elk, antelope, mule deer, and Greater Sage-Grouse hunting. The season of use and limitations are summarized in Table 3-19. Hunting days reported under this section are not comparable with BLM recreation days given the differences in estimation procedures and the definition of a recreation day. Because of the migratory nature of game herds, it is difficult to estimate the total RVDs associated with hunting in the planning area; therefore total hunting activity estimated by WGFD within hunting units that partially include the planning area were considered.

The Wyoming Game and Fish Annual Report of Big Game Harvest and the Upland Game & Furbearer Harvest Annual Report published for the last 10 years were used to estimate the average hunting days per species within the planning area. Residents and nonresidents of Wyoming spend approximately 3,100 days hunting in the planning area on an annual basis, as summarized in Table 3-20. Wyoming residents dominate hunting use in the planning area, accounting for over 80 percent of the hunting days on average. Antelope is the most popular hunting activity, with over 1,300 hunting days, followed by Greater Sage-Grouse, mule deer, and elk.

Table 3-19. Hunting Seasons [2000]*

Species	Hunt Area	Seasons		Limitations
		Opens	Closes	
Antelope	92	9/10	10/14	Limited Quota: 750 licenses any antelope
		9/10	10/14	Limited Quota: 705 licenses doe or fawn valid only in that portion of Area 92 within the Pacific Creek Drainage
		9/10	10/14	Limited Quota: 150 licenses doe or fawn valid only in that portion of Area 92 in the Farson-Eden Irrigation Project
	107	9/10	9/30	Limited Quota: 200 licenses any antelope
		9/10	9/30	Limited Quota: 500 licenses doe or fawn
		8/20	9/9	Limited Quota: 125 licenses any antelope; muzzleloading, firearms, and handguns using legal cartridges
	60	9/16	10/14	Limited Quota: 100 licenses any antelope
		9/16	10/14	Limited Quota: 50 licenses doe or fawn
	64	9/16	10/14	Limited Quota: 150 licenses any antelope
		9/16	10/14	Limited Quota: 300 licenses doe or fawn
Mule Deer	95	10/15	10/22	General license; antlered mule deer or any while-tailed deer
	131	10/1	10/8	General License; antlered deer
		11/4	11/12	Limited Quota: 25 licenses antlerless deer valid only in that portion of Area 131 north of Wyoming Highway 28 and west of the Lower Farson Cut Off Road (Sweetwater County Road 8)

Table 3-19. Hunting Seasons [2000]* (Continued)

Species	Hunt Area	Seasons		Limitations
		Opens	Closes	
Elk	100	10/15	10/31	Limited Quota: 100 licenses antlered elk
		10/15	10/31	Limited Quota: 110 licenses antlerless elk
		10/21	10/31	Limited Quota: 90 licenses antlerless elk
		10/15	10/31	Limited Quota: 50 licenses cow or calf valid only in that portion of Area 100 east and north of the Three Forks/Atlantic City Road (BLM Road 2317) and west of the Bison Basin Road (Fremont County and BLM Road 3221)
Greater Sage-Grouse	1	9/16	10/1	Daily Bag Limit: 3; Possession: 6

*WGFD 2000 Annual Report of Big and Trophy Game Harvest.

Table 3-20. Estimated Annual Average Hunting Days

Hunter Type	Elk[1]	Antelope[2]	Mule Deer[3]	Greater Sage-Grouse[4]
Resident	144	1,289	334	695
Non-Resident	38	68	319	185
Total	**183**	**1,357**	**652**	**880**

[1]Estimated with data from WGFD Hunt Area 100 (Steamboat); assumed that 70 percent of the hunting within Hunt Area 100 occurred in the JMH planning area.
[2]Estimated with data from WGFD for Hunt Area 92 (Steamboat), 107 (Upper Sweetwater), 60 (Table Rock), and 64 (Bison Basin); assumed that 58 percent of the hunting within Hunt Area 92, 23 percent within Hunt Area 107, 4 percent within Hunt Area 64, and 6 percent within Hunt Area 60 occurred in the JMH planning area.
[3]Estimated with data from WGFD for Hunt Area 131 (Steamboat) and 95 (South Pass); assumed that 22 percent of the hunting within Hunt Area 131 and 13.5 percent within Hunt Area 95 occurred in the JMH planning area.
[4]Estimated with data from WGFD for Hunt Area 7 (Eden) and 8 (Beaver Rim); assumed that 25 percent of the hunting within Hunt Area 7 and 5 percent within Hunt Area 8 occurred in the JMH planning area.

3.4.3 Other Dispersed Uses

The JMH planning area offers several other recreational opportunities, some of which are listed in Table 3-18. Using the RMIS database, it was estimated that individuals spend approximately 11,800 RVDs participating in these dispersed recreational activities in the planning area on an annual basis.

3.4.4 Special Recreational Management Areas

There are three Special Recreation Management Areas (SRMAs) within the planning area, including the Greater Sand Dunes; Continental Peak/South Pass Connecting Side Trail; and the Oregon, Mormon Pioneer, California, and Pony Express National Historic Trails. These areas are discussed in further detail in Section 3.7, Special Management Areas.

3.5 MINERALS AND ENERGY RESOURCES

3.5.1 Regional Geologic Setting

The planning area falls within a broad region of subdued relief that has been termed the Wyoming Basin physiographic province (Fenneman 1931). The Greater Green River Basin lies within this province, and the planning area lies in the north-central part of this basin (Figure 1). The planning area includes the north end of the Rock Springs Uplift, extends east into the Great Divide Basin, west into the main part of the Green River Basin, and northward

across the southern end of the Wind River Range. Surface features reflect erosion by wind and water in an arid, cold temperature environment. Landforms in portions of the planning area have been modified by sand movement, faulting, and volcanic activity. Figure 2 lists formations present in the planning area and gives a brief lithologic description of each unit.

Precambrian era rocks in the planning area include outcrops of granitic rock in the Wind River Range (dated at 2.6 billion years) and metamorphic rocks that may be more than 3 billion years old. Precambrian rocks are the deepest buried rocks in the planning area, forming the crystalline basement, and are also found near the surface in the area to the north of the thrust fault bounding the Wind River Range.

For most of the Paleozoic era, the planning area was covered by shallow seas at the eastern margin of a marine basin. The area was also close to the equator and was frequently covered by warm shallow seas where limestone and fine-grained sediments were deposited. Mississippian and Permian age strata were deposited in the area during this time, including the Madison Limestone and the Phosphoria Formation. These units do not outcrop in the planning area, as they are buried under younger sedimentary rocks. The Phosphoria Formation is exposed west of the planning area and has been mined for phosphate minerals in districts along the Wyoming-Utah border and in central Idaho. The Phosphoria Formation has not been considered for mining in the Green River Basin due to the depth of occurrence and related costs that would be required to mine phosphate. The Phosphoria Formation also contains significant organic matter, and this unit may also be a source for oil and gas accumulations in southwest Wyoming. Madison Limestone well tests in the area have yielded carbon dioxide-rich gas.

Most of the Mesozoic era rocks within the planning area were deposited in a northern subtropical region. Sea level fluctuated during this period because of periods of eastward fault movement in the Thrust Belt and mountain-building events in surrounding areas. Deposition of sediment took place in alternating marine and nonmarine environments. At the end of the Mesozoic era, mountain building caused the complete withdrawal of the sea, and the North American continent was approaching its present-day latitudes.

Most of the Mesozoic sequence is comprised of Cretaceous-age strata, including the Dakota Sandstone, Frontier Formation, Baxter Shale, Mesaverde Group, Lewis Shale, and Lance Formation. The Baxter Shale is a thick marine shale with lenses of fine-grained sandstone. The Mesaverde Group includes marginal marine and nonmarine deposits of the Blair Formation, Rock Springs Formation, Ericson Sandstone, and Almond Formation. The Rock Springs and Almond Formations contain significant coal seams, however most of the coal beds in Cretaceous rocks in the planning area are at depths below practical limits for mining. The uppermost part of the Cretaceous section is composed of the Lewis Shale and the embedded sandstone and shale of the Lance Formation, which also contains thin coal seams.

At the onset of the Cenozoic era, the Thrust Belt was in a late stage of development, and the ancestral structures of the Uinta Mountains, Wind River Range, Sierra Madre Range, and Granite Mountains had formed on the margins of the Green River, Great Divide, and Washakie Basins (Figure 1). These basinal areas were then largely filled with river and lake deposits, nearly burying the surrounding mountain ranges. The lake deposits and other nonmarine strata formed the Fort Union, Wasatch, and Green River formations. The Fort Union and Wasatch formations are both coal bearing, and the Green River Formation contains oil shale. Coal is mined south of the planning area at the surface and in underground

mines, but Tertiary coal resources have not been economically viable for mining in the planning area.

3.5.2 Present-Day Land Forms

During the late Tertiary and Quaternary periods, uplift of the region continued, and igneous activity approximately 1.1 million years ago resulted in the formation of lava flows, volcanic necks, and cinder cones. The igneous rocks are resistant to erosion and have resulted in some of the prominent landforms in the area, including Boars Tusk, Steamboat Mountain, and the Leucite Hills. The rocks are potassium rich and were mined as a source of potassium at nearby Zirkel Mesa during World War I.

The widespread erosion that has shaped the planning area has resulted in the development of considerable areas of badlands. The main area of badlands is within the Honeycomb Buttes and Oregon Buttes WSAs. Badlands are best developed in soft, weak mudstones, which are relatively impervious and preclude infiltration of rainwater. As a result, runoff erodes intricate networks of rills and gullies. As the gullies deepen, the ground surface becomes highly dissected. Erosion and aerial deposition have produced sand dunes in other parts of the planning area. Dune activity ranges from active migration with loose sand present at the ground surface to stabilized dunes that are vegetated and not migrating. Other surficial deposits include alluvium in stream valleys and debris and landslide deposits along steep slopes in the area. These deposits have been weathered to produce the soils present across most of the planning area. Where the water table is present in these surficial deposits, they form the uppermost aquifer in the planning area.

3.5.3 Geologic Hazards

Several types of geologic hazards are present within the planning area (Map 66). Hydrogen sulfide, earthquakes, landslides, and windblown sand hazards are of primary concern. Hydrogen sulfide is present with the hydrocarbons in some deep producing oil and gas wells farther south on the Rock Springs Uplift and could be present in the planning area in formations deeper than those that presently produce hydrocarbons. Additional discussion of this hazard is on file in the Rock Springs Field Office (USDI 1992).

The only significant fault that demonstrates recent displacement is the Continental Fault area on the north perimeter of the planning area. Historical seismicity shows no major earthquakes within the planning area; however earthquakes in adjacent regions may directly affect this area. Hazard assessments including seismic modeling have ranked the planning area as having the potential for ground movement at 4 to 8 percent of the acceleration due to gravity. This is a relatively moderate ground motion risk; the highest classification in the continental United States is up to 32 percent of the acceleration due to gravity.

Active landslides are relatively scarce in the planning area because of the relatively arid climatic conditions and the competent rocks underlying most steep slopes. The area of steep slopes around Steamboat Mountain and Oregon Buttes has the most potential for landslides or rock falls. These areas have been impacted by past landslides and are susceptible to development of unstable slope conditions where the ground surface is disturbed. The areas that are vulnerable to earth movement are shown on the map of potential landslide areas (Map 66).

Windblown sand deposits occur throughout the southern part of the planning area. The Killpecker Dune field encompasses about 170 square miles, extending beyond the planning area boundary. Prevailing wind direction is from the west-northwest, and dune migration follows prevailing winds. Hazards are increased when dunes are migrating. No volcanic hazards exist within the area (Wright and Pierson 1992).

Several mappable faults occur in the planning area. The Continental Fault is approximately 55 miles long and roughly parallels the buried thrust fault (Wind River thrust fault) at the north edge of the planning area (Figure 1).

3.5.4 Leasable Minerals

Fluid minerals such as oil and gas are leased under the Mineral Leasing Act of 1920 and its amendments of 1987. Leases are offered by competitive bid. Leases within the planning area include stipulations to mitigate impacts of development on wildlife, including seasonal restrictions on drilling activity. Other lease stipulations include restrictions on surface disturbances, wildlife, special resources (i.e., recreational areas and historic features), and no surface occupancy requirements. The purpose of these stipulations is to protect the environment and to inform the lessee about special requirements that may restrict development. Additional information about wells that have produced can be found in the Hydrocarbon Occurrence and Development Potential Report (Appendix 13). Methods and procedures for conducting geophysical exploration leasing, well permitting, drilling operations, development, production, and subsurface practices are described in Appendix 14.

3.5.4.1 Oil and Gas

Oil and natural gas are fluid minerals available for lease within the planning area (Map 67).

3.5.4.1.1 Historical and Current Production

Between 1900 and 1916, a number of shallow oil exploration wells were drilled on the Rock Springs Uplift. A number of oil and gas shows were encountered, but no wells were productive. The first production in the region occurred with the discovery of the South Baxter Basin field in August 1922. Exploration continued in the JMH area, and the first producing well in the planning area was drilled in 1961. This Frontier Formation well was the discovery well for the Nitchie Gulch Field. Development of Nitchie Gulch and other producing units occurred through the early 1990s. Petroleum exploration and development is active in the Greater Green River Basin, and there is interest in additional development in the planning area. Through July 2001 there have been 153 wells drilled in the planning area. The well locations, unit designations, depths, and target formations are listed in Table 3-21 at the end of Chapter 3.

Five active producing units have been designated in the planning area: Buccaneer, Nitchie Gulch, Rim Rock, Steamboat Mountain, and Treasure units (Map 68). Three exploratory units have been designated in the planning area. The Gold Coast Exploratory Unit was approved effective January 30, 1998. The first well commenced drilling in the fall of 1998 and is temporarily shut in. The Johnson Gap Exploratory Unit was approved effective February 2, 1994. The West 187 Exploratory Unit (Map 68) was approved effective February 25, 1998. Development of these exploratory units has been deferred until management actions for the JMH planning area are selected.

Three exploratory units that were partially within the planning area were approved, and exploration wells were drilled outside the planning area in the 1990s. The Riva Exploratory Unit extended across the eastern boundary of the planning area; the Lewis Shale was tested and abandoned in this unit. The Encore Exploratory Unit extended into the southeast part of the planning area. This unit was terminated in 1998 after an exploration well was tested in the Almond Formation, Lewis Shale, and Ericson Sandstone. The Jade Exploratory Unit extended into the eastern part of the planning area and was tested in the Almond Formation and the Lewis Shale.

All other units listed in Table A13-1 originally were part of exploratory unit proposals that were later terminated because economic quantities of oil and gas were not discovered. The large number of producing units and exploratory unit wells drilled in the planning area shows that unitization has been a popular method for exploration and orderly development.

Five producing units are classified by the Wyoming Oil and Gas Conservation Commission as "fields." The limits of these fields may extend beyond the unit boundaries. Other fields in the planning area are Pine Canyon Field south from the edge of the planning area, Essex Mountain and unnamed fields, and the abandoned Freighter Gap and Saddle Bag fields. In addition three other wells have bee completed as coalbed methane wells but have not generated production in an unnamed field. The wells in each of these fields are listed in Table A13-1.

All fields in the planning area are developed over stratigraphic traps and produce gas and occasionally some oil or condensate from the lower Cretaceous Frontier, Dakota, and Mowry formations. Only four other productive wells have been drilled, all in the upper Cretaceous section. Three of these were coalbed methane wells completed in the Mesaverde Group, and one oil well was completed in the Rock Springs Formation. A number of other younger Tertiary formations and older Mesozoic and Paleozoic age formations produce oil and gas outside the planning area in other parts of the Greater Green River Basin.

3.5.4.1.2 Undeveloped Reserves

Oil and gas development potential (Map 69) was determined for the Green River Final EIS RMP (USDI 1996) by geologic analysis of data from United States Geologic Survey publications and databases and a survey of industry interest in development within the planning area. The map has been updated to show increased potential for development based on the drilling of a well with a significant show of gas just outside the northwest boundary of the planning area. The area of high potential for oil and gas development has been extended north from areas of existing production to the northwest part of the planning area based on the results of exploration activity in 2001 and 2002. Resource estimates, potential recovery rates, and possible development scenarios are evaluated in the Hydrocarbon Occurrence and Development Potential Report that has been prepared for the planning area.

3.5.4.1.3 Existing Facilities

An extensive natural gas transmission system now exists in Wyoming and the Rocky Mountain region. Gathering lines and compression stations within the planning area are used to deliver gas to regional transmission pipelines. Most producers sell gas directly to local gas distribution companies, with the pipeline acting as a "common carrier" of natural gas.

3.5.4.2 Coal and Coalbed Methane

The southern part of the planning area is within the Coal Occurrence and Development Potential area. The focus of this designation is on the late Cretaceous and early Tertiary coal-bearing formations around the Rock Springs Uplift. Current information indicates that significant coal-bearing formations are present in the planning area. However, the depth to these formations and the thickness of the seams within the formations reduce the economic viability of mining. Map 56 shows the area with coal development potential that has been identified in the planning area. Coalbeds in this area are buried by overlying sediments. Exploration drilling data in this area indicate numerous coal seams, with thickness ranging from 0.3 to 8 feet at depths from 8 to 428 feet. One notable coalbed ranges in thickness from 3 to 8 feet and occurs at depths ranging from 11 to 283 feet in depth.

Presently there are no coal operations within the planning area boundary. Coal seams with sufficient thickness and suitable overburden ratios are present south of the planning area to support active mining. It is anticipated that future coal development in this part of Wyoming would focus on the extension of existing mining activities to develop additional resources. These resources would be economically favorable over coal mining within the JMH boundaries.

Potential for the occurrence of Tertiary coalbed methane and the occurrence of Upper Cretaceous coalbed methane were determined by Stilwell (1991) for the Green River RMP (1996). New information obtained while preparing this EIS caused modification of the area development potential for coalbed methane (Map 70). Information provided by the Wyoming Geological Survey was used to identify coalbed methane potential areas based on the occurrence and distribution of coal seams in Cretaceous and Tertiary formations in the planning area.

3.5.4.3 Sodium

The planning area is not within any Known Sodium Leasing Area. Sodium brines exist in the Wilkins Peak Member of the Green River Formation near Eden and are open to exploration and consideration for leasing and development. However, previous efforts to process the brines for marketable commodities have not proved economically viable, and extensive trona resources are actively mined outside the planning area in other parts of the Green River Basin.

3.5.4.4 Oil Shale

Deposits of oil shale are known to occur in the Tipton, Wilkins Peak, and Laney members of the Green River Formation. The western part of the planning area officially has been classified as prospectively valuable for oil shale. This classification indicates that oil shale has priority for mineral resource development and that this area has been withdrawn from location of mining claims for other minerals under the Mining Act of 1872. However, development of oil shale has not proven economically viable, and there has been no interest in leasing oil shale resources in the planning area since the mid 1980s.

3.5.4.5 Potash

The Leucite Hills, including Boars Tusk and Steamboat Mountain, are known to contain potash. Schultz and Cross (1912) estimated that approximately 10 percent of over 206

million tons of rock at Steamboat Mountain was potash. Boars Tusk was estimated to contain 2.9 million tons of potash. Potash was mined during World War I by the Liberty Potash Company on Zirkel Mesa, located south of the planning area. Potassium chloride was processed in a plant in Green River for fertilizer (Hausel, Sutherland, and Gregory 1995). Other sources of potash have been successfully developed in other areas where this commodity can be produced at lower costs than potash resources in the planning area. Based on these economic factors, potash mineral development is not anticipated in the planning area.

3.5.5 Salable Minerals

Salable minerals are those materials such as sand, gravel, and construction material that are sold or permitted under the Mineral Materials Sale Act of 1947.

3.5.5.1 Sand and Gravel

Lands open to development of salable minerals within the planning area lack good quality construction material, except for Steamboat Mountain, which is capped by volcanic lava. The South Pass Historic Landscape, Sweetwater River plus one quarter-mile buffer, and the Sand Dunes contain quality construction materials. However the Green River RMP (USDI 1997) prohibits development of salable minerals in these areas.

Nearly all material used for construction and maintenance of constructed gravel and paved roads comes from outside the planning area. The exception is a Wyoming Transportation Department borrow site along Wyoming Highway 28. Approximately 4 acres of disturbance has occurred at this site.

3.5.5.2 Clay

The Cretaceous Lance Formation, Lewis Shale, and Mesaverde Group may contain clays and shales suitable for use in the manufacturing of structural clay products (Construction Materials Survey 1965). Potential products include brick tile, sewer pipe, and other items used in construction. Little testing of these clays and shales has been conducted. The sediments containing the potentially usable clays occur in the southern portion of the planning area. The scarcity of water supplies and lack of infrastructure in this part of the planning area would probably make clay mining and related manufacturing uneconomic.

3.5.6 Locatable Minerals

Locatable minerals are those that can be located and claimed under the Mining Act of 1872, including gold, diamonds, and uranium. Mining for these minerals requires staking a claim rather than receiving a lease issuance. In special management areas, a plan of operations is required for all mining activities. The plan of operations must describe surface disturbing activities, provide for mitigation of impacts to other resources, and provide for reclamation of surface disturbances. Outside of special management areas, plans of operation are required where mining activities disturb more than 5 acres of land. Casual use mining does not require a plan of operations for mining activity that does not use motorized equipment or powered hydraulic mining in streambeds.

3.5.6.1 Gold

Historically gold has been the primary locatable mineral explored for in the planning area. At present, active mining claims are located east of Dickie Springs, south of the Sweetwater River, and northwest of Honeycomb Buttes (USDI 1997). These claims are placer claims except for one lode claim on the pre-Cambrian outcrop in Section 4, Township 27 North, Range 100 West. Active mining claims are those that have been properly recorded and have annual filings completed for the current year, and may or may not have exploration and/or mining operations in progress (Map 71).

In the recent past, a few claims have been explored by trenching with a backhoe, but most exploration is done with pick and shovel. One notable exception is a small-scale trommel operation that is run by claimants in their free time. Weather restricts activity to the snow-free months, generally from May to mid-November. Current exploration activity disturbs less than 5 acres and is reflective of the amount of activity seen in the area since the placers were first worked in 1863.

Reconnaissance investigations of placer gold deposits in the northern part of the planning area have indicated that a significant quantity of gold may be present in the area, and it has been estimated that over 28 million troy ounces of gold may be present in the Dickie Springs and Oregon Gulch areas. Later investigations have determined that the placer gold deposits are restricted to a thin stratigraphic zone approximately 1 foot thick within the gold-bearing sequence of sedimentary deposits. In addition, the lateral extent and continuity of the gold-bearing zone has not been determined. The initial resource estimate assumed that the gold is present throughout the thickness of the host sand and gravel deposits. The restricted vertical section of gold-bearing material revealed by detailed sampling at discreet depth intervals indicates that the actual resource in the area is probably significantly less than previous estimates, and revised estimates have been developed that indicate a maximum of 1 million troy ounces of gold may be present in these deposits.

3.5.6.2 Diamonds

Diamonds could potentially occur in association with the Quaternary volcanic rocks (lamproites) found in the southern part of the study area (Hausel et al. 1995, 1997). Although no diamonds have ever been recovered from these lamproites, they exhibit characteristics similar to diamond-bearing lamproites found in Arkansas, Western Australia, and India. Additional exploration is needed to further define these structures and to search for diamonds. Detailed petrographic and geochemical analyses and evaluation of larger sample volumes will be necessary to determine the presence of diamonds in this rock type.

3.5.6.3 Uranium

Wyoming has been a major producer of uranium in the United States (Harris and King 1993). Harris and King report that uranium mineralization is widespread in Wyoming. Large deposits of uranium occur outside the planning area in several districts. In the northern part of the planning area, the U.S. Geological Survey (Patterson et al. 1987) reports the occurrence of uranium within coalbeds of the Wasatch Formation (Tertiary) and possible deposits within the conglomeratic lenses of the Cathedral Bluffs Tongue of the Wasatch Formation. Uranium exploration has occurred on claims staked in the northern part of the planning area and south of the planning area around the Rock Springs Uplift. These claims targeted the Rock Springs Formation and/or Ericson Formation of the Cretaceous Mesaverde

Group. Based on results of previous exploration activity, the potential for development of uranium within the planning area is very low.

3.5.7 Alternative Energy Resources

Alternative energy resources include development of wind power and solar power.

3.5.7.1 Wind

The Wind Energy Resource Atlas of the United States (Pacific Northwest Laboratory 1986) provides wind power classifications on a regional basis. The planning area is generally within wind power class 6 (ranging from 1 to 7), with wind power densities of 300 to 400 watts per square meter. These data indicate that some locations within the planning area may be suitable for wind power development provided that suitable topographic locations could be developed and that access to the power grid and transmission line ROWs could be developed. However, interest in developing wind power facilities within the planning area has not been expressed to date.

3.5.7.2 Solar

The University of Oregon maintains a series of solar power research stations throughout the northwestern United States, including a station located at Green River, Wyoming (http://solardat.uoregon.edu/). Data from this station indicate that average daily photovoltaic cell output measured in kilowatt-hours per square meter per day range from 3.21 in January to 8.18 in June, based on data collected from 1994 to 2000. These data indicate that the area has some development potential for solar power conversion to electricity. Development of solar power facilities would depend on accessibility to suitable locations and ROW access to power distribution lines, along with technological developments to decrease the costs and increase the efficiencies of photovoltaic cells. However, interest in developing solar power facilities within the planning area has not been expressed to date.

3.6 VISUAL RESOURCES

Visual resources include the physical (natural and artificial) and biological features of the landscape that contribute to the scenic quality of an area. Scenic quality is a measure of the visual appeal of the landscape and is perhaps best described as the overall impression retained after driving through, walking through, or flying over an area. Although relative values can be used to evaluate scenic quality, visual appeal is subjective and can vary among observers.

3.6.1 Visual Resource Inventory

Scenic value is one of the resources for which public lands are to be managed in accordance with FLPMA. BLM manages this resource by determining visual values through a resource inventory process. The inventory consists of a scenic quality evaluation, sensitivity level analysis, and distance zones mapping.

Visual resources are best described using the physiographic provinces, which are large-scale geographical units of land. The scenic quality is evaluated against seven factors or common characteristics within the province. These factors include landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. The physiographic province helps

establish a frame of reference with which to classify the relative scenic quality. Areas with more variety and harmonious composition tend to have greater scenic value.

The JMH planning area lies mostly within the Wyoming Basin physiographic province. The landscape within the Wyoming Basin province is varied and characterized by highly erodible soils and multicolored, horizontally layered sedimentary bedrock. Colorful badlands landscapes are common throughout the planning area and are interspersed with low rolling or flat-topped hills. Low precipitation levels and localized occurrence of surface water provides for the following distinct vegetative communities: riparian vegetation found along perennial streams, intermittent surface water locations, and rivers; sparse vegetation located on well-drained soils of side slopes and hillsides; and alkaline vegetation in localized areas where evaporation rates exceed the volume of infiltrating surface water.

Scenic quality includes cultural modifications, which are artificial (human-made) changes to the land, water, or vegetation, or the addition of a structure that creates visual contrast to the natural character of the landscape. Cultural modifications within the physiographic province are primarily associated with oil and gas production (such as well facilities, pipelines, roads, and power distribution lines) and with livestock grazing operations (such as fences and water developments).

Evaluation of visual resources also considers sensitivity levels or measures of public concern for the maintenance of scenic quality. Sensitivity factors include type of user, amount of use, public interest, adjacent land use, and special management areas.

Scenic quality can also depend on sight distances. Landscapes are divided into distance zones based on relative visibility from travel routes or observation points. These zones are foreground-middle ground, background, and seldom seen. Distance zones are used to adjust visual classes in areas of overlapping resource uses. Foreground-middle ground zones are more visible to the observer and are more sensitive to change.

Lands are placed into one of four visual resource inventory classes. These classes represent the relative value of the visual resource as determined through the inventory process. Inventory Class I and Class II are the most valued, and Class III and Class IV represent moderate value and least value, respectively. Class I is assigned to areas where a management decision was made to maintain a natural landscape. The other classes are based on the combination of scenic quality, sensitivity level, and distance zones.

3.6.2 Visual Resource Management

The visual resource classes serve as a management tool in making land use decisions. Visual Resource Management (VRM) classes (I, II, III, IV) set standards for planning, designing, and evaluating projects by identifying various permissible levels of landscape alteration while protecting overall regional scenic quality. Management objectives for the classes are presented in Table 3-22.

Table 3-22. Visual Resource Management Class Objectives

Class	Objective
I	Preserve existing character of the landscape. Provide for natural ecological changes (does not preclude very limited management activity). Level of change to characteristic landscape should be very low and must not attract attention.
II	Retain existing character of the landscape. Level of change to characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in predominant natural features of the characteristic landscape.
III	Partially retain existing character of the landscape. Level of change to characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of characteristic landscape.
IV	Provide for management activities that require major modifications of the existing character of the landscape. Level of change to characteristic landscape can be high. Management activities may dominate the view and be the major focus of viewer attention. Minimize the impact of activities through careful location, minimal disturbance, and repeating the basic elements.

The VRM classes in the JMH planning area are shown on Map 13. In accordance with recent BLM policy (Instruction Memorandum No. 2000-096), WSAs are assigned to VRM Class I. VRM Class II areas include the southern portion of Steamboat Mountain ACEC, Greater Sand Dunes ACEC, South Pass Historic Landscape ACEC, White Mountain Petroglyphs ACEC, and areas adjacent to the WSAs. Land areas included in VRM Class III include the northern portion of Steamboat Mountain ACEC, the northern portion of the White Mountains (Petroglyphs Area), Split Rock, Eden Valley, and the western part of the Red Desert Watershed Area. The remainder of the JMH planning area is classified as VRM Class IV.

3.7 SPECIAL MANAGEMENT AREAS

A special management area is any area where an authorized officer has determined resources require special management and control measures for their protection. Special management areas within the JMH planning area include WSAs, ACECs, SRMAs, and other areas such as watershed areas (Map 14).

3.7.1 Wilderness Study Areas

WSAs are roadless areas that have been inventoried and found to have wilderness characteristics as defined in Section 2(c) of the Wilderness Act of 1964. These characteristics require an area to generally appear in a natural state and be substantially unaffected by the actions of humans. The area should encompass at least 5,000 acres to make practicable its preservation and to offer opportunities for solitude or a primitive and unconfined type of

recreation. Although not a required characteristic, the area may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value.

Section 603 of FLPMA directed BLM to inventory, study, and recommend to Congress by 1991, through the Secretary of the Interior and the President, public lands suitable or unsuitable for wilderness designation. BLM lands in the Green River Resource Management Area were inventoried for wilderness characteristics, and 13 areas were evaluated in the Final Rock Springs Wilderness Environmental Impact Statement for suitability as WSAs (USDI 1990). Within the JMH planning area, seven WSAs were determined to meet wilderness characteristics: Buffalo Hump, Sand Dunes, Alkali Draw, South Pinnacles, White Horse Creek, Oregon Buttes, and Honeycomb Buttes (Map 14). The following table outlines the results of these determinations.

Table 3-23. Wilderness Study Area Determinations

WSA	Wilderness Criteria Met (acres)	Suitable for Designation (acres)	Unsuitable for Designation (acres)
Buffalo Hump	10,300	6,080	4,220
Sand Dunes	27,109	21,304	5,805
Alkali Draw	16,990	0	16,990
South Pinnacles	10,800	0	10,800
Honeycomb Buttes	41,404	37,287	4,117
Oregon Buttes	5,700	5,700	0
Whitehorse Creek	4,002	0	4,002
Total[1]	**116,305**	**70,371**	**45,934**

Source: Final Rock Springs Wilderness Environmental Impact Statement, 1990.
[1]Total acres vary from GIS files.

The BLM Interim Management Policy and Guidelines for Lands Under Wilderness Review provides direction for managing the WSAs so as not to impair their suitability for designation as wilderness, subject to valid existing rights. Permissible activities under interim management guidelines are temporary uses that create no new surface disturbance nor involve permanent placement of structures. Temporary, nondisturbing activities, as well as activities governed by valid existing rights, may generally continue in WSAs.

Only Congress can designate areas as wilderness or release from interim management the areas that were placed under wilderness study. All wilderness recommendations within the JMH planning area are pending congressional decision.

3.7.1.1 Buffalo Hump

Buffalo Hump WSA has no private or state inholdings. The primary topographic relief consists of sand valleys, blowouts, hills, and dunes with individual dunes exceeding heights of 100 feet. The interdunal areas contain ponds, grass covered marshes, and playas. The WSA exhibits a natural condition of undisturbed sagebrush-grassland ecosystem intermingled with active sand dunes. The recreation values are outstanding, with opportunities for hiking, backpacking, nature study, photography, hunting, and rockhounding.

3.7.1.2 Sand Dunes

Sand Dunes WSA comprises a large part of the Killpecker Sand Dunes and contains large areas of barren active dunes, wet meadows, greasewood, big sagebrush, and rabbit brush

communities. A unique feature of the WSA is the Aeolian ice-cells that feed pools at the base of many of the large sand dunes. The naturalness of this WSA is considered exceptional because of the lack of humanmade intrusions. The flowing dunes virtually eliminate any evidence of human activity in the area. The Steamboat elk herd uses this area.

3.7.1.3 Alkali Draw

Alkali Draw WSA contains a remnant of the Great Divide Basin-Red Desert area. A series of draws or canyons extend through the WSA, creating a "washboard" topographic effect. Alkali Rim dominates the southern aspect and exhibits colorful blue rock escarpments. Big sagebrush is the dominant vegetation community, with greasewood common along the major drainages. The WSA contains habitat for mule deer and elk. The WSA is in a natural condition, and the humanmade intrusions are substantially unnoticeable and undergoing natural revegetation. However, the value of the area for oil and gas production and the degree of the wilderness values were deemed unsuitable for wilderness designation.

3.7.1.4 South Pinnacles

South Pinnacles WSA contains mostly flat topography with an exposure of broken rim rocks and ridges. Greasewood communities occupy the draws, with big sagebrush in the open areas. The WSA is natural in character and provides opportunities for solitude and varied recreation. However, the potential for gas production and the manageability of the area were determined unsuitable for wilderness designation.

3.7.1.5 Honeycomb Buttes

Honeycomb Buttes WSA contains several terrain types, ranging from sagebrush hills and greasewood flats surrounding the badlands to eroding buttes, colored bluffs, and side canyons. This area is one of the best examples of badlands topography in the state and of fossil- and fossil cast-bearing formation in the region. These highly colorful and rugged desert badlands provide outstanding opportunities for solitude. The WSA is natural in character and relatively free of human activities because of the severe topography of the area.

3.7.1.6 Oregon Buttes

Oregon Buttes WSA contains no private or state inholdings. The buttes are a prominent feature rising out of the Red Desert, with historical significance as the major landmark for travelers of the Oregon Trail. Resources of the area consist of limber pine stands, small aspen stands, prime raptor habitat, and valuable big game habitat. Visibility from the buttes extends for miles and provides scenic vistas of the mountain ranges to the north and south. The WSA is in a natural state and provides outstanding recreation opportunities for birdwatchers and photographers.

3.7.1.7 Whitehorse Creek

Whitehorse Creek WSA contains no private or state inholdings. A large portion of the area contains eroding red, green, and gray buttes. The area supports various habitats and landscapes, including aspen and limber pine stands, sheer sandstone cliffs, and badland topography. The WSA contains important raptor habitat. Opportunities for solitude and primitive recreation are high in areas of the WSA where large escarpments and buttes are located. The potential for gas production and the manageability of OHV use in the area of

little topographic relief contributed to the determination of unsuitability for wilderness designation.

3.7.2 Areas of Critical Environmental Concern

ACECs are areas of BLM-administered lands where special management attention is needed to protect and prevent irreparable damage to important resources. To be designated an ACEC, the area must meet the criteria of relevance and importance (43 CFR §1610.7-2 and BLM Manual 1613). Areas meeting the relevance criterion possess significant historic, cultural, or scenic values, fish or wildlife resources including threatened and endangered species, or natural hazards. To meet the importance criterion, the resource must have substantial significance and value. This generally requires qualities of more than local significance and special worth, consequence, meaning, distinctiveness, or cause for concern. A natural hazard can be important if it is a significant threat to human life or property.

There are five ACECs within the JMH planning area: Greater Sand Dunes, Oregon Buttes, South Pass Historic Landscape, Steamboat Mountain, and White Mountain Petroglyphs (Map 14). Another ACEC within the Green River Resource Management Area, the Special Status Plant Species ACEC, does not currently contain acreage within the JMH planning area; however there is potential for other sensitive species within the planning area to be added.

3.7.2.1 Greater Sand Dunes

The Greater Sand Dunes ACEC met the relevance and importance criteria in 1982 for outstanding geologic features, prehistoric and historic values of national significance, and recreation values of region and national importance. Management objectives preserve and protect the integrity of these unique values in the area for future public use and enjoyment. The ACEC is unique to the Wyoming Basin and contains values that are “geologically, aesthetically and biologically interesting” (McGrew et al. 1974).

The Greater Sand Dunes are part of the larger Killpecker dune field, the largest active dune field in North America. The Killpecker dune field encompasses approximately 109,000 acres, extending 55 miles east from the Green River Basin across the Continental Divide into the Great Divide Basin. The ACEC comprises about 38,650 acres (approximately 38 percent of the Killpecker dune field). Boars Tusk, a remnant volcanic neck, is an unusual geologic feature that lies within the Greater Sand Dunes ACEC.

The dunes within the Greater Sand Dunes ACEC help to support the Steamboat elk herd known to occupy this unique desert habitat. Elk occupy the area during the spring and fall, using dunal ponds (flockets) as a source of water. The dunal ponds generally are not as alkaline as other water sources in the area and are known to provide an oasis for plants and animals. The dunal ponds also provide excellent habitat for waterfowl, amphibians, songbirds, and small mammals.

The western portion of Greater Sand Dunes ACEC encompasses some of the Sand Dunes and Buffalo Hump WSAs. These WSAs are managed under the BLM Interim Management Policy for Lands Under Wilderness Review (BLM Manual H-8550-1), as discussed above. The eastern portion of Greater Sand Dunes ACEC contains the Greater Sand Dunes SRMA, which offers outstanding motorized and nonmotorized recreational values. The historic Crookston Ranch is also located within the ACEC.

3.7.2.2 Oregon Buttes

Oregon Buttes ACEC was designated in 1982 to protect its scenic integrity as a historic landmark and to protect the significant wildlife values found in the area. The ACEC lies on a structural platform that joins the Rock Springs Uplift to the Wind River Mountain Range (Zeller and Stephens 1969). At Oregon Buttes, the Continental Divide splits into east and west rims, which rejoin at Bridgers' Pass, south of Rawlins, and encloses an area known as the Great Divide Basin.

The Buttes are a dominating landform and were often noted by emigrants using the Oregon Trail, marking the halfway point in their journey from Independence, Missouri to the Pacific Ocean. The buttes also denoted the Continental Divide and the point where they crossed into the Pacific watershed.

The ACEC provides excellent wildlife habitat. The area is used heavily by big game species, and the buttes themselves are occupied by many raptors. Deer fawning and elk calving also occur in the area.

Honeycomb Buttes, Oregon Buttes, and Whitehorse Creek WSAs overlap the ACEC, thus the ACEC is managed under the BLM Interim Management Policy for Lands Under Wilderness Review (BLM Manual H-8550-1).

3.7.2.3 South Pass Historic Landscape

The South Pass Historic Landscape ACEC was designated in 1997. Management priority and emphasis was given to maintaining and enhancing the visual and historic integrity of the historic trails and their surrounding viewscape.

South Pass is located on the northwest edge of the Wyoming Basin. The pass was the site where emigrant travelers traversed the Continental Divide, and thus it roughly marks the halfway point in the epic westward journey. The scenic vista of South Pass is among the most important historic landscapes, because South Pass served as the primary mountain gateway to the West along the Oregon, Mormon Pioneer, Pony Express, and California National Historic Trails. This viewscape includes the top rim of Pacific Butte on the south and the divide between waters flowing to Pacific Creek and the Sweetwater River on the north and east.

The site on the pass where several commemorative markers have been placed is listed on the National Register of Historic Places. In 1959 the National Park Service designated South Pass a National Historic Landmark. The National Park Service proposed a boundary for the landmark in 1984; however an official boundary has not been delineated.

3.7.2.4 Steamboat Mountain

The Steamboat Mountain ACEC was designated in 1997 to protect wildlife and cultural values of national significance and unique habitat features. The area is the year-round home of the Steamboat desert elk herd and has highly varied topographic features and unique habitats of stabilized sand dunes that are found nowhere else in the resource area.

Tall sagebrush of up to 8 to 12 feet provides escape cover, shelter, thermal protection, and birthing areas for big game. Limber pine and aspen communities provide habitat to a wide

variety of wildlife but are limited in size and localities. Other mountain shrub communities, such as serviceberry and mountain mahogany, provide forage in deep snow conditions. Grass-covered ridgetops offer additional forage for elk during crucial winter periods.

The Steamboat Mountain ACEC, along with a portion of the Greater Sand Dunes ACEC and overlapping crucial winter range, is part of what is called the "core area" within the planning area. The core area is approximately 80,400 acres in size and is considered the most crucial habitat for many of the species (especially elk and deer) that inhabit the planning area.

3.7.2.5 White Mountain Petroglyphs

The White Mountain Petroglyphs ACEC was designated in 1982 to protect cultural values of national significance. Native American drawings associated with the early ancestors of the present Shoshone tribe and perhaps other tribes are contained within the ACEC. Common drawings include human figures, elk, buffalo, feather headdresses, and human stick figures.

3.7.2.6 Special Status Plant Species

The Special Status Plant Species ACEC was designated in 1997. Special status plants are those listed, proposed for listing, or candidates for listing as threatened or endangered under the ESA, identified by the state in a category implying potential endangerment or extinction, or species designated by the BLM State Director as sensitive.

Management priority and emphasis for the ACEC was given to maintain or enhance these species and their habitats. Although no species associated with the ACEC occur within the planning area, there is potential for other sensitive species to be added to the ACEC as provided in the Green River RMP.

3.7.3 Special Recreation Management Areas

SRMAs include areas where a commitment has been made to provide specific recreation activity and experience opportunities. These areas usually require a high level of recreation investment and management. There are three areas within the planning area designated as SRMAs: Greater Sand Dunes; Continental Peak/South Pass Connecting Side Trail; and Oregon, Mormon Pioneer, California, and Pony Express National Historic Trails.

3.7.3.1 Greater Sand Dunes

The Greater Sand Dunes SRMA lies within the eastern portion of the Greater Sand Dunes ACEC and provides outstanding motorized and non-motorized recreational values. In 1983, an ACEC management plan was completed that also serves as the Recreational Activity Management Plan for the SRMA. The SRMA contains an OHV parking lot and camping area that were built in the mid-1980s.

3.7.3.2 Oregon, Mormon Pioneer, California, and Pony Express National Historic Trails

The National Trails System Act provides for the designation and protection of original trails or routes of travel of national historic significance and historic remnants and artifacts for public use and enjoyment. National Historic Trails are designated through criteria established

in the act, and only those parts of the trail that meet the criteria and are contained on federal lands are provided protection.

The Rock Springs Field Office manages hundreds of miles of the best traces of 19th Century emigration trails, including the Oregon, Mormon Pioneer, California, and Pony Express trail systems. These trails represent the main overland routes of people, property, and information available during the Nation's westward expansion. The National Historic Trails SRMA is within the South Pass Historic Landscape ACEC and is managed for a range of visitors, from local dedicated OHV users to the transient visitor that is simply passing through the area. The National Park Service prepared a comprehensive management and use plan in 1999 for the California and Pony Express National Historic Trails and an update to the Oregon and Mormon Pioneer National Historic Trails Management Plan. The trails are described in Section 3.2, Heritage Resources.

3.7.3.3 Continental Divide National Scenic Trail

The National Trails System Act of 1968 provides for designation and conservation of trails that provide maximum outdoor recreation potential in areas of nationally significant scenic, historic, natural, or cultural qualities. In 1978, as an amendment to the National Scenic Trail System Act, Congress designated the Continental Divide National Scenic Trail (CDNST). This trail route traverses approximately 3,100 miles of the length of the Rocky Mountains, in proximity to the Continental Divide, through the states of Montana, Idaho, Wyoming, Colorado, and New Mexico. The Forest Service published a comprehensive management plan for the trail in 1985 that set broad goals and policy for local trail management.

In 1998, BLM issued an Environmental Assessment for the designation of the proposed on-the-ground route for the trail. The Continental Peak/South Pass Connecting Side Trail (35 miles) was proposed and analyzed. However, designation of the route was deferred pending completion of the JMH Environmental Impact Statement (EIS) to analyze the side trail along with other related resource issues. About 25 miles of existing roads and routes have been identified as a side trail for the CDNST. The remainder of the route would require cross-country travel. This route would partially occur in the South Pass Historic Landscape area (Map 64).

Allowable uses of the Continental Peak/South Pass Connecting Side Trail include hiking, mountain biking, horseback riding, and limited motor vehicle use. Approximately 95 percent of the trail is primitive two-track roads, 4 percent is improved roads, and 1 percent requires cross-country travel. Cross-country segments are closed to motorized vehicles.

3.7.4 Red Desert Watershed Special Management Area

The Red Desert Watershed was identified as a watershed management area in the Green River RMP. The management objective established for the watershed is management of all resource values in the Red Desert area, with emphasis on protection of visual resources, watershed values, and wildlife resources, and the provision of large areas of unobstructed views for enjoyment of scenic qualities.

The Red Desert Watershed comprises one of the last undeveloped high desert regions in the west. It contains unique landforms, colorful badlands, and shifting sand dunes. Much of the Red Desert Watershed still looks the same as when the pioneers passed through the Continental Divide on the Oregon and Mormon pioneer trails. The Red Desert Watershed

also contains portions of four WSAs within the planning area: Alkali Draw, Honeycomb Buttes, Oregon Buttes, and South Pinnacles. Portions of Oregon Buttes and Steamboat Mountain ACECs are also within the Red Desert Watershed.

The Red Desert Watershed falls within the Great Divide Basin, which is a hydrologically closed basin. Most streams are intermittent and flow toward the center of the basin into playa lakes where they either recharge the aquifers or evaporate. Artesian groundwater and unconfined groundwater are found throughout the watershed area.

The Great Divide Basin is a cold, high-elevation desert environment that provides habitat for a variety of wildlife species. Along Bush Rim, Freighter Gap, and other rims surrounding the Basin, vegetation is highly variable and provides the most cover and forage. Aspen and limber pines provide cover for big game. South-facing slopes containing serviceberry, mountain mahogany, and currants are favored as big game winter range. Raptors can also be found throughout the watershed area, although most are concentrated in the Oregon Buttes ACEC and the Honeycomb Buttes WSA.

3.8 AIR RESOURCES

Air resources are affected predominately by existing concentrations of various pollutants and the climatic and meteorological conditions that influence their fate and transport in the atmosphere.

3.8.1 Climate and Meteorology

The climate of the JMH area is classified as semi-arid steppe (Trewartha and Horn 1980). Steppe climate is characterized by large seasonal variations in temperature (cold winters and warm summers) and precipitation that is slight but still sufficient for the growth of short sparse grass. The dryness of the mid-latitude steppe climate of southwestern Wyoming is due to the distance from the Pacific Ocean, the main source of precipitable water for North America. This aridity is further intensified by the Rocky Mountains, which block the eastward flow of humid coastal air. In addition, annual rainfall amounts vary greatly from year to year (Trewartha and Horn 1980).

Weather stations in the planning area include those located in Rock Springs and Farson in Sweetwater County, Wyoming. Rock Springs is at an elevation of 6,741 feet and is about 15 miles south of the JMH planning area. Farson is at an elevation of 6,675 feet and is about 4 miles northeast of the JMH planning area.

3.8.1.1 Temperature

Mean annual temperatures range from 36 degrees F in Farson to 43 degrees F in Rock Springs. Summer highs are usually in the 70s and 80s but may reach the high 90s. Winter lows are generally in the minus single digits but may reach the minus 20s in Farson. Rock Springs winter lows are generally in the teens.

3.8.1.2 Precipitation

Mean annual precipitation is 8 and 9 inches in Farson and Rock Springs, respectively. Annual precipitation ranges from 3 or 4 inches in drought years to as much as 17 inches in wet years. Mean monthly precipitation is greatest in spring. Mean annual snowfall in Farson

averages about 3 feet, with most snow occurring from November through April. Mean annual snowfall in Rock Springs averages just under 4 feet, with most snow occurring from October through April. Average snow depth is 2 or 3 inches.

3.8.1.3 Dispersion

Atmospheric stability is a measure of the atmosphere-s capacity to disperse pollutants. Mean annual stability at Rock Springs is high (leading to low dispersive capacity) less than 20 percent of the time, low (leading to high dispersive capacity) about 20 percent of the time, and neutral (leading to fair dispersive capacity) more than 60 percent of the time (USDI 1999a).

3.8.1.4 Wind Velocity

Winds in Rock Springs are relatively strong and are generally from the west and west-southwest.

3.8.2 Air Quality

Elements of air quality addressed in this study include concentrations of air pollutants, visibility, and atmospheric deposition. See Appendix 15 for more detailed information.

3.8.2.1 Pollutant Concentrations

Pollutant concentration refers to the mass of pollutant present in a volume of air, and is reported in units of $\mu g/m^3$. Air quality in the planning area is considered excellent, however current and complete criteria air pollutant concentration data for JMH and the immediate vicinity are not available. The State of Wyoming has used monitoring to determine that the JMH region is in compliance with Wyoming Ambient Air Quality Standards (WAAQS) and National Ambient Air Quality Standards (NAAQS) (Table 3-24, Figure A14-9, and Figure A14-10).

Table 3-24. Concentrations of Criteria Air Pollutants

Pollutant	Averaging Time	Monitored and Modeled Concentration ($\mu g/m^3$)	Percent NAAQS (%)	Percent WAAQS (%)
Carbon Monoxide (CO)	8 hour	1,500	15	15
	1 hour	3,500	9	9
Nitrogen Dioxide (NO_2)	Annual	3.4	3	3
Sulphur Dioxide (SO_2)	Annual	9	11	5
	24 hour	43	12	17
	3 hour	132	10	19
Ozone (O_3)	8 hour	147	94	94
	1 hour	169	72	72
Particulate Matter (PM_{10})	Annual	16	32	32
	24 hour	40	27	27
Fine Particulate Matter ($PM_{2.5}$)	Annual	5	33	33
	24 hour	13	20	20

Carbon Monoxide
Carbon monoxide data were collected in Colorado in conjunction with the proposed oil shale development in the 1980s (USDI 1983). Because CO data are generally collected only in urban areas where automobile traffic levels are high, recent data are often unavailable for rural areas.

Nitrogen Dioxide
Nitrogen dioxide data were collected at the Green River Basin Visibility Study site from January 1 to December 31, 2001. Monitoring of other nitrogen-containing pollutants shows that concentrations at Pinedale, Wyoming of nitric acid (HNO_3), nitrate (NO_3), and particulate ammonium (NH_4) are low and not increasing over time.

The Clean Air Status and Trends Network (CASTNet) has measured concentrations of nitric acid, nitrate, and ammonium, as well as ozone, sulphur dioxide, and sulfate, in the United States since the late 1980s. There are three CASTNet stations in Wyoming: Centennial, Yellowstone National Park, and Pinedale. Figure A14-1 shows mean annual concentrations of nitrogen-containing pollutants in Pinedale from 1989 through 1999 to be 0.5 $\mu g/m^3$ or less.

The Wyoming Air Resources Monitoring System (WARMS) has measured concentrations of nitrate and particulate ammonium, as well as sulphur dioxide and particulate sulfate, in Wyoming since 1999. There are five WARMS stations in Wyoming: Centennial, Buffalo, Sheridan, Newcastle, and Pinedale. Weekly concentrations of NO_3 are below 1.5 $\mu g/m^3$, and concentrations of NH_4 are below 0.5 $\mu g/m^3$.

Because the chemistry of nitrogen-containing pollutants is very complex, it would be inappropriate to infer NO_2 concentrations from concentrations of HNO_3, NO_3 and NH_4. However it would be unlikely that high NO_2 concentrations would occur with low concentrations of other nitrogen-based pollutants.

Sulphur Dioxide
Sulphur dioxide data were collected at the La Barge study area in the 1980s. More recent SO_2 data were collected by CASTNet and WARMS in Pinedale. Figure A14-1 shows mean annual CASTNet concentrations of SO_2 in Pinedale from 1989 through 1999 to be about 0.5 $\mu g/m^3$. Weekly WARMS concentrations of SO_2 from mid-1999 through 2001 are approximately 1.5 $\mu g/m^3$ or less. Although it may not be appropriate to compare mean annual CASTNet SO_2 concentrations with national or Wyoming standards, the CASTNet concentrations do suggest that SO_2 concentrations are well below NAAQS and WAAQS.

Ozone
Ozone concentration data were collected at the Green River Basin Visibility Study site from June 10, 1998 to December 31, 2001. Ozone data were also collected by the CASTNet station at Pinedale. Concentrations are relatively high but in compliance with NAAQS and WAAQS. Figure A14-2 shows mean annual O_3 concentrations have remained steady from 1989 through 1999.

Particulate and Fine Particulate Matter
Particulate matter (PM_{10}) data were collected at the Carbon County Underground Coal Gasification site in 1994 and 1995. Fine particulate matter ($PM_{2.5}$) data were estimated at half PM_{10} concentrations as recommended by the Environmental Protection Agency (EPA). Mean annual PM_{10} concentrations were 32 percent of NAAQS and WAAQS, and mean annual $PM_{2.5}$ concentrations were 33 percent of NAAQS.

3.8.2.2 Visibility

The Inter-Agency Monitoring of Protected Visual Environments (IMPROVE) has measured visibility in national parks and wilderness areas in the United States since the 1980s. Six IMPROVE stations are located in Wyoming. The IMPROVE station closest to the JMH area is in the Bridger Wilderness. The best visibility monitored in the contiguous United States is at this station.

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, about a 10 percent change in light extinction. Monitored aerosol concentrations are used to reconstruct visibility conditions.

- 20 percent cleanest: mean visibility for the 20 percent of days with the best visibility
- Average: the annual median visibility
- 20 percent haziest: mean visibility for the 20 percent of days with the poorest visibility.

Figure A14-3 shows annual visibility in Bridger Wilderness from 1988 through 1999. Visibility on the 20 percent cleanest days varies from 5 to 3 dv (visual range of about 136-168 miles). Average visibility varies from 8 to 6 dv (about 96 to 114 miles). Visibility for the 20 percent haziest days varies from 12 to 10 dv (about 56-76 miles). Trend analysis of Bridger visibility data reveals no significant trend of worsening visibility from 1989 through 1999.

3.8.2.3 Atmospheric Deposition

Atmospheric deposition refers to the processes by which air pollutants are removed from the atmosphere and deposited on terrestrial and aquatic ecosystems, and is reported as the mass of material deposited on an area (kilogram per hectare). Air pollutants are deposited by wet deposition (precipitation) and dry deposition (gravitational settling of particles and adherence of gaseous pollutants to soil, water, and vegetation). Substances deposited include:

- Acids such as sulphuric acid (H_2SO_4) and nitric acid (HNO_3), sometimes referred to as “acid rain”
- Air toxics such as pesticides, herbicides, and volatile organic compounds (VOC)
- Nutrients such as nitrate (NO_3) and ammonium (NH_4).

Estimation of atmospheric deposition is complicated by the contribution to deposition of several components: rain, snow, cloud water, particle settling, and gaseous pollutants. Deposition varies with precipitation, which in turn varies with elevation and time.

Wet Deposition

The National Atmospheric Deposition Program (NADP) assesses wet deposition by measuring the chemical composition of precipitation (rain and snow). Figure A14-4 shows the precipitation pH in Pinedale from 1982 through 2000. The natural acidity of rainwater is generally represented by a range of pH values from 5.0 to 5.6. Mean annual pH at Pinedale is generally within this range, although from 1994 through 1998 pH values dropped. During this period, pH ranged from 4.9 to 5.0. These lower values may be the result of anthropogenic acidification of precipitation in Pinedale, Wyoming.

Figure A14-5 shows mean annual wet deposition of ammonium (NH_4), nitrate (NO_3), and sulfate (SO_4). Deposition values are low: approximately 0.5 kg/ha for NH_4^+, less than 3 kg/ha for NO_3, and less than 4 kg/ha for SO_4. Deposition values from 1982 through 2000 are low and steady, indicating that deposition has not worsened during that time.

Dry Deposition

Dry deposition refers to the transfer of airborne gaseous and particulate material from the atmosphere to the Earth=s surface. CASTNet measures dry deposition of ozone (O_3), sulphur dioxide (SO_2), nitric acid (HNO_3), sulfate (SO_4), nitrate (NO_3), and ammonium (NH_4). Figure A14-6 shows mean annual dry deposition of sulphur- and nitrogen-containing compounds for Pinedale, Wyoming from 1990 through 1999. Deposition values are low and steady, indicating that deposition has not worsened during this time.

3.8.2.4 Lake Chemistry

Acid deposition can cause acidification of lakes and streams. One expression of lake acidification is change in acid neutralizing capacity (ANC), the lake=s capacity to resist acidification from acid rain. Acid neutralizing capacity is expressed in units of micro-equivalents per liter (µeq/l). Lakes with ANC values of from 25 to 100 µeq/l are considered to be sensitive to acid rain, while lakes with ANC values of less than 25 µeq/l are considered to be extremely sensitive.

3.8.2.5 Summary of Existing Air Quality

Table 3-25 provides a summary of air quality monitoring and dispersion modeling, which shows that air quality in the JMH region is generally good.

Table 3-25. Air Quality Summary

Air Quality Component	Status
Air Pollutant Concentration	
Criteria Air Pollutants	Concentrations are in compliance with NAAQS and WAAQS
Nitrogen Compounds	• Nitric Acid (HNO_3): Concentrations are slightly higher than typical for remote areas • Nitrate (NO_3) and Ammonium (NH_4): Concentrations are typical for remote areas
Sulfur Compounds	• Sulfur Dioxide (SO_2): Concentration are well below concentrations typical in remote areas • Sulfate (SO_4): Concentrations are typical for remote areas
Visibility	
Bridger Wilderness	• 20% cleanest: 136–168 miles • Average: 96–114 miles • 20% haziest: 56–76 miles
Atmospheric Deposition	
Precipitation pH	Slight acidification from 1994 to 1998 (pH varied from 4.9 to 5.0)
Total Deposition	• Nitrogen: Deposition from ammonium (NH_4) and nitrate (NO_3) is less than 2.6 kg/ha[1] • Sulfur: Deposition from sulfate (SO_4) and sulfur dioxide (SO_2) is less than 1.7 kg/ha[2]

[1]Proposed acceptable level of total nitrogen deposition is 3 to 5 kg/ha/year (USFS 1989)
[2]Proposed acceptable level of sulfur deposition is 5 kg/ha/year (USFS 1989)

3.9 SOCIOECONOMICS

The JMH are located in southwest Wyoming in portions of Sweetwater, Fremont, and Sublette counties. Activities in the planning area have the potential to affect all three counties, thus the socioeconomic study area includes these three counties. Data on economic characteristics have been obtained where possible for the last 20 years to examine trends in the study area.

3.9.1 County Characteristics

The planning area is very reflective of the State of Wyoming as a whole. All three counties encompass a rather large landmass with a dispersed population and few urban areas. Federal public lands also dominate this area, as summarized in Figure 3. Within the three counties, federal agencies control 65 percent of the surface acreage, with BLM managing the majority of these acres. The JMH area comprises approximately 622,000 surface acres, which is 4 percent of the socioeconomic study area. Land ownership within JMH is split between federal, state, and private entities, as shown in Figure 3.

3.9.2 Demographic Characteristics

Demographic characteristics include a description of the study area population trends and trends in personal income levels.

3.9.2.1 Population

Annual population estimates for each of the three counties for 1980 to 2000 are plotted in Figure 4. Population within the study area declined over 9 percent during the 1980s, unlike the State of Wyoming as a whole which experienced a population increase. The opposite situation occurred during the 1990s, when population in the study area increased by 5.2 percent, exceeding population growth in the state.

Population changes occur from both “natural changes” (i.e., the net result of births and deaths) and from “net migration” (i.e., the net result of persons moving in and out of the area). The study area population as a result of natural changes increased by nearly 14 percent in the 1980s and by 6.6 percent during the 1990s. However, net migration led to more people leaving this same area over the past two decades. All three counties reported significant decreases in population due to net migration during the 1980s, with nearly 20,000 people leaving the area. Net migration lead to increases in population in Sublette and Fremont counties during the 1990s, while Sweetwater County reported a nearly 7 percent decline.

3.9.2.2 Personal Income Trends

Personal income data were obtained for each of the counties in the study area from the U.S. Bureau of Economic Analysis. Table 3-26 summarizes components of personal income for 1979 and 1999 for the three combined counties in inflation-adjusted dollars for 2001. Total personal income was over $2 billion in 1999, up from $1.7 billion in 1979. During this 20-year period, personal income grew by over 14 percent, with all the growth occurring during the 1990s.

Personal income can be broken down into three categories: labor income, investment income, and transfer payments income. Labor income is derived through wages, salaries, and self-

employment income. Investment income includes income in the form of rents, dividends, and interest earnings. Transfer payments income is largely derived from Social Security benefits, Medicare and Medicaid benefits, and other income support and assistance.

Table 3-26. Estimated Personal Income

Personal Income by Source ($1,000)			Percentage of Total Personal Income	
(1)	(2)	(3)	(4)	(5)
	1979	1999	1979	1999
Transfer payments	$111,686	$273,353	6.4%	13.5%
Manufacturing	$47,485	$110,045	2.7%	5.4%
Mining	$574,033	$332,537	32.9%	16.5%
Investment Income	$67,002	$135,760	3.8%	6.7%
Agriculture	$2,961	$4,620	0.2%	0.2%
Federal and State Government	$64,793	$91,243	3.7%	4.5%
Total Income Earned from Basic Industries and Outside Sources	$867,960	$947,558		
Total Personal Income	**$1,742,472**	**$2,019,817**	**49.8%**	**46.9%**

Source: U.S. Department of Commerce, Bureau of Economic Analysis, Regional Accounts Data, Table CA05 Personal Income by Major Source and Earnings by Industry, 1979–1999.

The study area is showing signs of shifting patterns of income growth. Labor income now accounts for 64 percent of total personal income, down from nearly 81 percent in 1979. Income from nonlabor sources has grown from 19 percent in 1979 to 36 percent in 1999. This change in how individuals earn income is not unlike national or state trends. For the nation as a whole, labor income fell from 73 percent in 1979 to 68 percent in 1999. Similarly, labor income as a percentage of total income in Wyoming fell from 82 percent in 1979 to 66 percent in 1999.

The study area has consistently reported lower than average per capita income than the national and state averages. By 1999, per capita income for the study area was $24,836, which was below the national ($27,358) and state ($27,528) averages.

3.9.3 Economic Characteristics

This section focuses on trends associated with certain economic characteristics in the study area. This includes changes in the labor force and unemployment and trends in employment and earnings by industry.

3.9.3.1 Labor Force and Unemployment

Change in the labor force and unemployment can provide information on the health of the local economy. The average annual unemployment rates for each of the three counties, for Wyoming, and for the United States are summarized in Figure 5. Unemployment in the study area has consistently been higher than unemployment for the State of Wyoming during the 1990s. In addition unemployment in this area has been higher than the national average since 1993. Fremont County reported the highest unemployment during this time, followed by Sweetwater County. Sublette County consistently reported unemployment levels below the state and national averages during the 1990s.

3.9.3.2 Employment and Earnings by Industry

The U.S. Bureau of Economic Analysis (BEA) estimates annual employment and earnings for counties throughout the United States. Total annual employment includes both full-time and part-time jobs, so individuals with more than one job would be counted twice. Employment estimates include people employed by businesses and public entities, as well as individuals that are self-employed. Data were obtained from BEA for total annual employment for each county within the study area, for Wyoming, and for the United States for 1979, 1989, and 1999 to examine trends in employment by industry over this 20-year period. A summary of this information is provided in Appendix 16.

Total employment in the study area increased by 9 percent over the 20-year period, from 45,028 jobs in 1979 to 49,048 jobs in 1999. This lags behind the employment growth rate for the State of Wyoming and the United States as a whole. For example, over the same 20-year period, total employment grew by 19 percent in Wyoming and 36.4 percent nationwide.

Employment by industry for 1999 is summarized in Figure 6. Services, government, and trade comprise the largest percentage of total employment for this area. These three industries accounted for over 60 percent of total employment in 1999. Industries showing the greatest increase in employment between 1979 and 1999 include services, government, and retail trade. Manufacturing also reported an increase in employment during this same period. Industries showing the greatest decline in employment between 1979 and 1999 were mining, construction, and farming.

Typically, rural areas such as southwest Wyoming are more dependent on traditional natural resource-based industries, such as mining and agriculture. The study area is more dependent on mining for employment than the State of Wyoming. Mining jobs accounted for 10 percent of total employment in the study area in 1999, compared to 5.5 percent throughout the State. However this area is slightly less dependent on farm employment than the rest of the state. In 1999, farm employment accounted for 3.5 percent of total employment in the study area, and 3.8 percent throughout Wyoming.

Total earnings by industry in the study area, in Wyoming, and in the United States for 1979, 1989, and 1999 were also obtained from BEA (Appendix 16). Total gross earnings for all industries (private nonfarm, farm, and government) fell by 8 percent between 1979 and 1999, with all the decrease occurring during the 1980s. However, earnings have been increasing over the last decade.

Figure 7 provides a summary of gross earnings by industry for the study area in 1999. Mining provided the largest percentage (24 percent) of earnings of any industry in the area. This category includes metal, nonmetallic, coal mining, and oil and gas operations. Of these subcategories, oil and gas operations comprised approximately 45 percent of mining earnings in 1999 for this area.

Although mining remains important in terms of earnings for this area, the industry has reported significant declines in earnings between 1979 and 1999. Over the last 20 years, mining earnings declined by 90 percent, with most of this decline occurring during the 1990s. Other industries reporting declines in earnings between 1979 and 1999 include construction and farm services. Other industries important to this area in terms of earnings during 1999 include government, services, and trade. Industries reporting positive gains in earnings for the study area include manufacturing; finance, insurance, and real estate; and services.

However, these three industries combined only accounted for 14 percent of total earnings for the study area in 1999.

3.9.3.3 Economic Base

An area's economic base is comprised of industries primarily responsible for bringing outside income into the local economy. Certain sectors within the economy are thought to be "basic" in nature, in that most of their sales are tied to outside markets or customers. These industries include manufacturing, mining, and agriculture. In addition certain government sectors, such as federal and state government, are considered basic in nature because employees are paid from sources outside the local area.

Outside sources of income can also be derived from nonlabor sources (investment income and transfer payments). For example transfer payment income can become an "economic driver" for the area's economy, because many transfer payment programs are sustained by sources outside the local area. Therefore income of this type is received, spent, and respent in the area, which generates additional income for the local economy. This is also true for investment income, though it is not known for certain what percentage of investment income is generated from outside sources. An assumption therefore was made that 30 percent of investment income is generated from outside sources.

Using these definitions of basic industries and outside sources of income, an analysis was conducted on the components of the economic base of the economy in the study area. Table 3-26 provides a breakdown of the components of the study area's economic base and outside sources of income for 1979 and 1999.

Columns 4 and 5 show that the percentage of total income earned from outside sources declined by three percent between 1979 and 1999. In addition there appears to be a shift in the sources of outside income during the study period. Mining remains the largest percentage of outside income, at 16.5 percent, but it has declined in importance since 1979, when the industry accounted for 33 percent of outside income. Transfer payments are now the second largest source of outside income, followed by investment income, manufacturing, and government. Transfer payments now make up more than 13 percent of personal income for the study area, up from 6.4 percent in 1979. Agriculture has consistently provided a very small percentage of outside income for the study area.

Examination of this data indicates that the economy in the study area is lacking diversity, with a heavy dependence on one industry: mining. The mining industry has experienced declines over the last 20 years, thus other sources of income are now becoming more important. Data indicate that the study area is becoming more dependent on nonlabor sources of income, such as transfer payments and investment income, which now account for over 20 percent of outside income.

However this data does not shed light on how the economy may be diversifying into other industries that are capable of bringing in outside income to the local economy. For example other industries, such as construction, real estate, and some service sectors, will bring outside income into the economy. It is possible that certain service sectors and the financial, insurance, and real estate sector have brought in additional outside income because of the nature of their business and modest growth during the study period. The construction sector is likely not contributing to any economic diversification given its decline in the study area.

3.9.4 Property Valuation and Taxation

Total property valuation for each of the three counties in the study area for 2001 is summarized in Figures 8 and 9. This valuation includes property assessed by the State of Wyoming and locally assessed property. The State of Wyoming assesses taxes on both mineral and nonmineral property. Nonmineral property assessed by the state includes airlines, utilities, pipelines, and gas distribution systems, railroads, and phone service (Wyoming Department of Revenue Annual Report, 2001). During fiscal year 2001, the valuation of property assessed by the state was $2.2 billion for the study area. Local government also assesses four categories of property: agricultural land, residential and commercial land, improvements and personal property, and industrial property. The value of property assessed by local governments in the study area exceeded $584 million, whereas the total value of assessed property during fiscal year 2001 was $2.9 billion.

Mineral production in the study area is a major source of tax revenue for government entities. During fiscal year 2001, minerals accounted for 80 percent of the property value assessed in the study area. In addition oil and gas production and operations provide a significant percentage of the assessed value of minerals. Table 3-27 summarizes the assessed value of oil and gas production and property for fiscal year 2001 for each of the counties in the study area. Oil and gas production accounted for 85 percent of all mineral valuation for 2001 as assessed by the state. For Fremont and Sublette counties, oil and gas production accounted for nearly 100 percent of all assessed mineral production. Physical assets of the oil and gas industry (property) comprised 19 percent of all property assessed by local governments. Of all property and production assessed by state and local governments, oil and gas operations accounted for 67 percent of assessed value in the three-county study area during fiscal year 2001.

Table 3-27. Assessed Value of Oil and Gas Production and Property Fiscal Year 2001

County	Oil and Gas Valuation–Production	Oil and Gas Valuation as % of Total Mineral Valuation	Oil and Gas Valuation–Property	Oil and Gas Property as % of Total Property Valuation	Oil and Gas Valuation as % of Total State and Local Assessed Property Valuation
Fremont	$352,327,499	99.92%	$26,556,445	16%	70%
Sublette	$736,577,260	99.95%	$42,147,672	39%	91%
Sweetwater	$670,371,775	68.39%	$42,161,137	17%	51%
Total for Study Area	**$1,759,276,534**	**85.00%**	**$110,865,254**	**19%**	**67%**

3.9.4.1 Ad Valorem Taxes–Counties

Estimated ad valorem taxes from mineral production for each county during fiscal year 2001 is summarized in Table 3-28. The counties generated more than $129 million in tax revenues from mineral production, of which $110 million, or 85 percent, was derived from oil and gas production. Table 3-29 provides an estimate of the ad valorem taxes assessed on property associated with oil and gas operations. During fiscal year 2001, the three counties generated an estimated $7 million in property taxes associated with oil and gas extraction assets.

Table 3-28. Estimated Mineral Ad Valorem Tax Revenues Fiscal Year 2001

County	Natural Gas	Crude Oil	Stripper Oil	Coal	Trona	Sand and Gravel	Total
Fremont	$19,307,950	$4,016,437	$837,264	$0	$0	$20,468	$24,182,119
Sublette	$38,224,451	$4,734,654	$387,730	$0	$0	$19,830	$43,366,665
Sweetwater	$35,541,587	$6,938,002	$51,925	$6,544,036	$13,083,494	$28,479	$62,187,523
Total for Study Area	**$93,073,988**	**$15,689,093**	**$1,276,919**	**$6,544,036**	**$13,083,494**	**$68,777**	**$129,736,307**

Table 3-29. Estimated Ad Valorem Tax Revenues on Oil ond Gas Property Fiscal Year 2001

County	Assessed Valuation	Average Tax Levy*	Estimated Ad Valorem—Property
Fremont	$26,556,445	68.58	$1,821,168
Sublette	$42,147,672	58.85	$2,480,348
Sweetwater	$42,161,137	63.44	$2,674,899
Total for Study Area	**$110,865,254**		**$6,976,415**

*Tax levy applied to every $1,000 of assessed value.

Table 3-30 estimates the importance of oil and gas operations in terms of local government property tax revenues. The three counties in the study area generated $117 million in tax revenues from oil and gas operations, which accounted for approximately 66 percent of property taxes generated for fiscal year 2001.

Table 3-30. Oil and Gas Tax Revenues As Percentage of Total County Property Taxes Fiscal Year 2001

County	Ad Valorem Tax Revenue–Oil and Gas	County Property Tax Revenues	Oil and Gas Tax Revenue as % of County Property Tax Revenues
Fremont	$25,982,819	$37,234,045	70
Sublette	$45,827,184	$49,800,369	92
Sweetwater	$45,206,413	$89,145,656	51
Total for Study Area	**$117,016,416**	**$176,180,070**	**66**

3.9.4.2 Mineral Severance Taxes

Local government entities also benefit from severance taxes collected on mineral production throughout the State of Wyoming. The state assessed $2.1 billion for mineral production in the three-county study area. However, severance taxes collected on mineral production are distributed within the state according to a formula published in the state statutes. Severance tax revenues are distributed to a variety of sources, including the state general fund, water development account, state highway fund, counties, and cities and towns. Therefore government entities will only benefit from a percentage of severance taxes collected on production within the study area, but these entities will also benefit from severance taxes collected on mineral production occurring in other parts of the state as well. Table 3-31 summarizes the total severance tax revenues that were distributed to the local government entities within the study area during fiscal year 2001.

Table 3-31. Total Severance Tax Distributions For Government Entities Fiscal Year 2001

Area	Severance Tax Distributions
Counties in Study Area	$2,313,489
Total Severance Taxes Distributed to All Counties in WY	$13,843,706
Percentage Distributed to Study Area Counties	17%
Cities and Towns in Study Area	$5,518,054
Total Severance Taxes Distributed to All Cities and Towns in WY	$35,370,306
Percentage Distributed to Study Area Cities/Towns	16%

Source: Annual Report of the Treasurer of the State of Wyoming, June 30, 2001.

Table 3-32 estimates the severance taxes that are generated from mineral production originating within the study area. The estimated severance taxes for each mineral type are based on production and assessed values and the effective tax rates, all which were obtained from the Wyoming Department of Revenue, Mineral Tax Division. Natural gas production generated the most severance tax revenue in the study area, accounting for approximately 75 percent of all severance taxes generated.

Table 3-32. Severance Tax Revenue Fiscal Year 2001

County	Natural Gas	Crude Oil	Stripper Oil	Coal	Trona	Sand and Gravel	Total
Fremont	$16,893,022	$3,514,084	$488,363	$0	$0	$5,969	$20,901,438
Sublette	$38,972,065	$4,827,257	$263,542	$0	$0	$6,739	$44,069,603
Sweetwater	$33,611,891	$6,561,310	$32,737	$7,220,190	$8,248,759	$8,978	$55,683,865
Total	**$89,476,978**	**$14,902,651**	**$784,642**	**$7,220,190**	**$8,248,759**	**$21,686**	**$120,654,906**
% Severance Tax	74.2	12.4	0.7	6.0	6.8	0.02	100

3.9.4.3 Federal Royalties

Mineral production occurring on federally owned public lands is also assessed a federal mineral royalty. Production is assessed at 12.5 percent of value after allowable deductions. The federal government returns 50 percent of the total royalties collected to the state where the mineral production occurred. In Wyoming, distribution of the federal royalties is based on a formula promulgated by the Wyoming State Statutes (W.S. 9-4-601). The state allows a percentage of the federal royalties to be distributed to cities and towns for planning, construction, and maintenance of public facilities, for capital construction funds, and for transportation projects. Local school districts may benefit from federal royalty payments through advanced entitlement grants for capital construction funds. Total federal royalties distributed to local government agencies in the study area for fiscal year 2001 were $3.28 million (Wyoming State Treasurer, 2001).

3.9.4.4 Mineral Taxation of Production—Jack Morrow Hills

Tables 3-33 through 3-35 provide an estimate of the mineral tax revenues associated with oil and gas production within the planning area for production year 2000. Actual production was obtained from the Wyoming Oil and Gas Conservation Commission and used in combination with the average taxable valuation per unit and average tax and royalty rates to estimate ad valorem taxes (county), severance taxes (state), and federal royalties. Oil and gas production occurring within the planning area generated an estimated $1.58 million in mineral tax revenues to the county, state, and federal government during fiscal year 2001.

Figure 10 shows an estimate of the ad valorem taxes generated from gas production throughout the study area and JMH. This graph demonstrates that JMH has historically accounted for a small fraction of gas production in the study area, which equates to a small percentage of ad valorem taxes generated in these counties. In addition, production has been declining over time in the planning area, making it less important to the counties as a source of mineral tax revenues relative to other producing areas.

Table 3-33. Estimated Ad Valorem Tax-Production From JMH

Product	Annual Production (BBLs/MCF)	Taxable Valuation Per Unit	Assessed Valuation	Average Tax Levy	Estimated Ad Valorem
(1)	(2)	(3)	(4) = (2)*(3)	(5)	(6) = (4)/1000*(5)
Oil	302	$24.47	$7,390	63.445	$469
Natural Gas	2,012,000	$2.60	$5,231,200	63.445	$331,892
Total			**$5,238,590**		**$332,361**

Source: Wyoming Department of Revenue Annual Report–Fiscal Year 2001, Cheyenne, WY; Wyoming Taxpayers Association, Wyoming Property Taxation 2001, Cheyenne, WY.

Table 3-34. Estimated Severance Tax–Production from JMH

Product	Annual Production (BBLs/MCF)	Taxable Valuation Per Unit	Assessed Valuation	Average Tax Per Unit of Production	Estimated Severance Tax
(1)	(2)	(3)	(4) = (2)*(3)	(5)	(6) = (4)*(5)
Oil	302	$24.47	$7,390	0.060	$443
Natural Gas	2,012,000	$2.60	$5,231,200	0.060	$313,872
Total			**$5,238,590**		**$314,315**

Source: Wyoming Department of Revenue Annual Report–Fiscal Year 2001, Cheyenne, WY.

Table 3-35. Estimated Federal Royalties Production From JMH

Product	Annual Production (BBLs/MCF)	Taxable Valuation Per Unit	Assessed Valuation	Federal Royalty Rate	Estimated Federal Royalties
(1)	(2)	(3)	(4) = (2)*(3)	(5)	(6) = (4)*(5)
Oil	302	$22.92	$6,921	0.125	$865
Natural Gas	2,012,000	$2.10	$4,234,656	0.125	$529,332
Total			$4,241,577		$530,197

Source: Wyoming Department of Revenue Annual Report–Fiscal Year 2001, Cheyenne, WY.
Note: The taxable valuation for oil and gas was decreased to account for allowable cost deductions taken by operators prior to paying federal royalties. Therefore the taxable valuation per barrel of oil is 93.66% of total valuation and 80.95% of total valuation per mcf of natural gas.

3.10 ENVIRONMENTAL JUSTICE

Federal agencies are directed to consider the effects of their actions on minority populations and to determine the potential for the federal action to have disproportionately high and adverse human health or environmental impacts on such populations. Executive Order (EO) 12898, Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations, guides this determination.

An environmental justice (EJ) population is defined by minority or low-income status. A minority is defined as Black or African American, Hispanic or Latino, Asian American,

Native American, Alaskan Native, Native Hawaiian and other Pacific Islander. Low-income is defined using annual statistical thresholds from the Bureau of the Census Current Population Reports.

The first step in evaluating potential environmental justice issues associated with land management actions taken by BLM is to identify potential minority or low-income populations within the affected study area. Census data for Sublette, Fremont, and Sweetwater counties and for the State of Wyoming were used to identify minority and low-income status. To determine whether the minority or low-income populations residing within the three counties constitute an EJ population, the following criteria were considered:

- At least one-half of the population is of minority status.
- At least one-half of the population is of low-income status.
- Minority status population in the study area is at least 10 percentage points higher than for the State of Wyoming.
- Low-income status population in the study area is at least 10 percentage points higher than for the State of Wyoming.

The population distribution by minority status in the three counties is summarized in Table 3-36. Figure 11 shows the minority population for each county in the State of Wyoming. Fremont and Sweetwater counties have minority populations above the state average, whereas the minority population in Sublette County is well below the state average.

Table 3-36. Percent Population By County

County	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Hispanic or Latino
Sublette	97.5	0.2	0.5	0.2	0.1	1.9
Fremont	76.5	0.1	19.7	0.3	0.0	4.4
Sweetwater	91.6	0.7	1	0.6	0.0	9.4
Wyoming	92.1	0.8	2.3	0.6	0.1	6.4

Source: U.S. Bureau of Census, 2000.

The minority population of Fremont County is more than 10 percentage points above the state average because of the Native American population that resides in the county on and near the Wind River Reservation. Further analysis of the population by race by census track for 2000 indicated that the Native American population within Fremont County is concentrated in the northeast corner of the county, and that minority populations in census tracks nearest the planning area are very small. Although portions of Fremont County would be defined as an EJ population, these areas are not likely to be impacted by actions within the planning area given the geographic distance between the reservation and the planning area. Sublette and Sweetwater counties do not meet the criteria of an EJ population in terms of minority communities.

Figure 12 summarizes the median household income and poverty rates for each county in Wyoming based on the 2000 Census. The median household income in Sublette and Sweetwater counties is above the state average, while poverty levels are lower than elsewhere in the state. This indicates the absence of low-income populations within these two counties.

Fremont County has a lower median household income and higher poverty rates than throughout Wyoming. However the low-income population in Fremont County does not meet one of the four criteria to be classified as an EJ population.

It is concluded that the study area does not support an EJ population, and thus no such population would be affected by any management alternative in a disproportionately high or adverse manner when compared to the general population. Therefore no further discussion or analysis of impacts will be conducted.