CHAPTER 4—ENVIRONMENTAL CONSEQUENCES

The purpose of this chapter is to determine the potential for significant impact of the "federal action" on the "human environment." The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act of 1969 (NEPA) states that the "human environment" shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment (40 Code of Federal Regulations [CFR] §1508.14). The "federal action" is the Bureau of Land Management's (BLM) selection of a resource management plan (RMP) on which future land use actions will be based.

This chapter objectively evaluates the environmental impacts of implementing each alternative described in Chapter 2. This chapter forms the analytic basis for the comparative summary of impacts presented in Chapter 2 (Table 2-34, p. 2-183). Chapter 3 describes the existing conditions of the resources and resource uses that would be affected by the alternatives. The organization of this chapter parallels that of Chapter 3, in that the resource programs are presented in the same order. Because resources and resource uses are often interrelated, one section may refer to another.

4.1 ANALYSIS METHODS

BLM manages public lands for multiple uses in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA). Land use decisions are made to protect the resources while allowing different uses of those resources, such as livestock grazing, energy development, and recreation. To ensure that BLM meets its mandate of multiple use in land management actions, the impacts of the alternatives on resources and resource uses are identified and assessed as part of the planning process.

The analysis of the alternatives is focused on identifying the types of impacts anticipated to occur and estimating their potential intensity. The analysis is organized by resource program and discloses the potential impacts on each resource program from implementing each of the proposed alternatives. The impact analysis for Alternative 1 was prepared first to serve as the baseline for alternative comparison. Impacts that are common to all alternatives are addressed in a separate subsection to reduce analysis redundancy. Because this subsection applies to all the alternatives, it should be reviewed in conjunction with the alternative-specific impact analyses. It is important to note that management prescriptions for each resource or resource use directly or indirectly relate to each other; therefore, impacts on one particular resource program may also apply to other programs. It is therefore recommended that the reader review all impact analyses to attain a comprehensive description of the impacts on the resource or resource use in question.

Potential impacts of certain land use activities can be compared visually and numerically among the alternatives by using geographic information system (GIS) data. The locations of resources and overlapping resource issues are shown in Maps 1-1 through 4-17. The geographic implications associated with each management alternative are presented in Tables 2-25 through 2-33 in Chapter 2. These tables and maps should be reviewed in conjunction with the impact analyses.

Acreage calculations used in this analysis are approximate values for alternative comparison and analytic purposes only and do not reflect exact measurements of on-the-ground resources and actions. For analysis purposes, acreage figures were rounded to the nearest tenth. These acreage values were calculated using ESRI's ArcGIS Desktop 9.1 software. The projection of GIS data that were analyzed to provide the acreage calculations is Universal Transverse Mercator (UTM) Zone 12N (UTM12N), based on the North American Datum of 1983 (NAD83).

4.1.1 Types of Impacts

Throughout this chapter, the terms “impact” and “effect” are used interchangeably. Impacts can be direct, indirect, or cumulative. Impacts may be perceived as positive (beneficial) or negative (adverse). Some impacts would be positive for some individuals and negative for others; for example, road closures could benefit hikers but be a detriment to off-highway vehicle (OHV) users. For this reason, impacts are generally not labeled as beneficial or adverse in this chapter. Table 4-1 provides an overview of the general types of impacts discussed in this chapter.

Table 4-1. Types of Impacts

Type	Description
Direct Impacts	Direct impacts occur at the same time and place as the action responsible for the impact. For example, removal of vegetative cover caused by facility construction would be considered a direct impact on vegetation resources.
Indirect Impacts	Indirect impacts are temporally and spatially removed from the action responsible for the impact, but are related to the action through a process of cause and effect. For example, removal of vegetative cover caused by facility construction that consequently results in increased surface runoff and sedimentation of nearby streams would be considered an indirect impact on riparian resources. Indirect impacts may reach beyond the natural and physical environment (i.e., environmental impact) to include growth-inducing effects and other effects related to induced changes to resource uses (i.e., nonenvironmental impact).
Cumulative Impacts	Cumulative impacts result from the incremental impact of an action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions that take place over time.

4.1.2 Availability of Data and Incomplete Information

The best available information pertinent to the management decisions was used in the development of the RMP. Considerable effort has been taken to acquire and convert resource data into digital format for use in the plan.

Certain information was unavailable for use in developing this plan, because inventories either have not been conducted or were incomplete. Some of the major types of incomplete and unavailable data include, but are not limited to—

- Incomplete soil survey information for the planning area
- Incomplete hydrogeologic information for the planning area
- Incomplete information on range site conditions and vegetation production
- Unavailable data on forest stand composition, age, and distribution
- Incomplete information on the location and size of white-tailed prairie dog towns
- Incomplete information on the location and size of greater sage-grouse winter concentration areas
- Unavailable data on the oil and gas reasonably foreseeable development (RFD) for the Bridger-Teton National Forest.

As a result of these missing data, some of the impacts that result from the proposed management of certain resources cannot be quantified. In these cases, impacts are projected in qualitative terms. Subsequent project-level analyses will provide the opportunity to collect and examine the site-specific inventory data necessary for determining the appropriate application of the RMP-level guidance. In addition, ongoing inventory efforts within the planning area will serve to update and refine the information used to implement this plan.

4.1.3 Analysis Assumptions

Assumptions for analysis are made to assist in determining the potential environmental, social, and economic impacts of the alternatives (Chapter 2) on the affected environment (Chapter 3). They are based on expected trends (e.g., population growth or decline within the planning area), expected demands (e.g., increases in certain kinds of recreational use), and the likelihood of resource development (e.g., the RFD scenario for oil and gas).

Assumptions are for the purpose of analysis only. They are presumed true for the purpose of equitably comparing the alternatives. Assumptions do not constrain or define management; they are based on observations, historical trends, and professional judgment. Assumptions are generally made for the expected life of the RMP, unless otherwise stated.

General assumptions applicable to all resources and resource uses are described below. Resource-specific assumptions are described under each resource program in the sections that follow.

- The decisions proposed in the alternatives apply to public lands only. However, cumulative impact analyses may also consider decisions made for resources managed by other entities or individuals.
- The planning criteria described in Chapter 1 (Section 1.4.2) apply to all alternatives.
- The alternatives will be implemented as described in Chapter 2.
- Implementation actions will comply with valid existing rights and all federal laws, regulations, and policies.
- Sufficient funding and personnel will be available to implement the RMP.
- Appropriate maintenance will be carried out to maintain the functional capability of all developments (e.g., roads, fences, and other projects).
- Monitoring will be completed as indicated, along with any needed adjustments or revisions.
- Mitigation measures will be applied as described in Chapter 2 and applicable appendices.
- The Hazard Management and Resource Restoration Program (HMRRP) (Appendix 25) will manage the hazardous materials associated with all alternatives in accordance with laws, policies, and regulations. The objectives of the HMRRP are to—
    - Protect public health, safety, and the environment on public lands
    - Emphasize waste reduction for BLM-authorized and -initiated actions
    - Comply with applicable federal and state laws
    - Prevent waste contamination from BLM-authorized actions

  - Minimize federal exposure to the liabilities associated with hazardous materials management and waste management on public lands
  - Integrate pollution prevention, hazardous materials and waste management, and waste reduction policies and controls into all BLM programs.

- The introduction of invasive invertebrates, vertebrates, microorganisms, and pathogens can threaten the stability of ecosystems, create serious human health consequences, and cause substantial economic burdens. Large majorities of native and non-native species do not pose a threat to natural or human systems. However, if any of these species were to become a concern, the Pinedale Field Office (PFO) would cooperate and coordinate with appropriate government agencies, private industry, and other interested parties involved in public education efforts and control, management, and research of invasive species.

- Surface disturbance projections for leasable minerals development assume one well per well pad with a support road and pipeline, for a disturbance projection of 7.1 acres. For each additional well added to a well pad, the total (planning area-wide) surface disturbance projection would decrease by almost 6 acres (i.e., a pad with two wells, support road, and pipeline would have a projected disturbance of 8.4 acres, whereas two individual pads with a single well, road, and pipeline would disturb 14.2 acres). With four wells on a pad, the total projected disturbance would be decreased by 18 acres (i.e., a pad with four wells, support road, and pipeline would have a projected disturbance of 10.4 acres, whereas four individual pads with a single well, road, and pipeline would disturb 28.4 acres). One hundred pads with four wells each and support roads and pipelines would disturb 1,040 acres, whereas 400 individual wells with a single well, road, and pipeline would disturb 2,840 acres. Some wells may be developed with less disturbance than these projections, while other wells may result in substantially greater disturbance rates.

4.2 AIR RESOURCES

This section presents the potential impacts on air quality from BLM management actions. Section 3.2 presents existing air quality conditions.

4.2.1 Assumptions

Assumptions applied to the description of potential air quality impacts include the following:

- Emission factors recommended by the U.S. Environmental Protection Agency (EPA) (EPA 1995) are appropriate for all activities, except for those emission factors that have been provided by the Wyoming Department of Environmental Quality-Air Quality Division (WDEQ-AQD) concerning best available control technology (BACT) requirements.
- Activity factors (or the quantification of activity for each resource provided by the PFO) are appropriate for the base year and future time frames.
- Any anticipated recreational growth would follow growth trends for Wyoming that have been seen during the past 10 years.
- The qualitative analysis includes only emissions from BLM-administered activities. The cumulative analysis (Section 4.19.3) includes emissions from other federal and nonfederal actions throughout the state, as calculated by TRC Mariah Associates, Inc.
- The calculations include criteria pollutants and hazardous air pollutants (HAP).
- No trona mining activity would occur on BLM land within the planning area.
- Prescribed and wildland fire emissions are estimated using the Simple Approach Smoke Estimation Model (SASEM) (Sestak and Riebau 1988).

4.2.2 Methods of Analysis

A qualitative emission comparison approach was selected for analysis of impacts on air quality. Quantitative analysis will be required for specific proposals as development projects are defined in the future. The WDEQ-AQD will require any future development projects to demonstrate compliance with federal and state air quality regulations and standards. Given the uncertainties concerning the number, nature, and specific location of future emission sources and activities, the emission comparison approach provides a sound basis on which to compare the potential air quality impacts of each alternative. The Air Quality Technical Support Document (AQTSD), presented in Appendix 19, provides a detailed list of all assumptions used in this impact assessment.

The emissions inventory was developed for the planning area by using best available information on activities on BLM land that was provided by the PFO and summarized in the AQTSD. The calculations used emissions factors accepted and recognized by state and federal regulatory agencies. To evaluate future emissions, three different time frames were selected for this analysis. The time frames reflect the current base-year conditions and both short-term and long-term impacts. It is assumed that any emission growth will be constant and linear in time. The inventory time frames are—

- Current emissions (using the year 2001 as a basis)

- Ten-year potential emissions for the short term (2011)
- Twenty-year potential emissions for the long term (2021).

4.2.3 Impacts Common to All Alternatives

Components of air quality that could be impacted include visibility, air pollutant concentration, and atmospheric deposition.

Upward trends in population growth within the planning area create the potential for long-term additional increases in air pollutant emissions from all other resource management programs under all alternatives. Particulate matter (PM) emissions from vehicles traversing unpaved roads, as well gaseous tailpipe emissions from vehicles would occur. The maintenance of unpaved roads and shoulders of paved resource roads would also cause PM emissions and tailpipe emissions (refer to Figure 4-1 and Tables A19-6, A19-7, and A19-8 in Appendix 19).

Several of the resource areas listed below (air quality monitoring, cultural management, paleontology, special designations and management areas [SD/MA], livestock grazing, wild horses, wildlife and fish, socioeconomics) would have minimal impacts on air quality (refer to Figure 4-1 and Tables A19-6, A19-7, and A19-8 in Appendix 19).

Air quality monitoring activities, including building monitoring stations and vehicular travel to and from the monitoring stations to service them, would have minimal impact on air resources. Information obtained from monitoring would add to the knowledge base from which future decisions related to air quality would be made.

Very short-term, localized, and increased fugitive dust emissions would occur during excavations for data recovery at cultural resource sites. Short-term, localized, and increased vehicular fugitive dust emissions would occur during excavations at and travel to and from paleontological sites.

The use of heavy equipment such as logging trucks during timber hauling operations on paved and unpaved roads would cause emissions of PM, carbon monoxide (CO), nitrogen oxide (NO_x), and volatile organic compounds (VOC). The burning of slash piles after timber harvest would cause short-term emissions of PM and CO. During timber harvest, the use of skidders or tractors for skidding timber materials from the harvesting area to the loading or decking area would produce some of the same emissions, but to a lesser degree.

The various construction activities (such as wind power facilities, communications sites, transmission lines, and pipeline projects) authorized under lands and realty management would produce emissions of PM. The main causes of these emissions would be disturbing the soil and traveling on unpaved roads. Construction activities would result in tailpipe emissions from vehicular travel and emissions from equipment use.

Vehicular travel associated with moving livestock and constructing and maintaining range improvements would generate tailpipe emissions and dust.

Air emissions from combustion processes and construction activities would be produced from all the activities associated with oil and gas development and mineral mining.

All phases of oil and gas development (including exploration, well pad construction, well development, drilling, production, well abandonment, and road closures) would produce air emissions. Oil and gas

exploration, development, and production activities would have the greatest impact on air quality of BLM activities. During exploration and development activities, traffic on unpaved and paved roads would cause emissions of PM, CO, NO_x, sulfur dioxide (SO_2), and VOCs. During well development and completion, well flaring would cause PM, CO, NO_x, SO_2, and VOC emissions (including HAPs). In addition, during well development, drilling activities and construction activities would cause particulate emissions and tailpipe emissions as a result of heavy equipment usage.

Emissions of NO_x and CO from compression activities (burning of compressor engine fuel) would occur. PM, CO, NO_x, and VOCs would be produced from any glycol operations and flashing. Any flaring would cause PM, CO, NO_x, SO_2, and VOC emissions (which includes HAPs).

PM from travel over unpaved roads and demolition activities would result from well abandonment and road closure activities. Fugitive PM would also result from truck travel during well pad construction, gas well drilling, and production phases.

The use of OHVs would cause both fugitive dust emissions of PM from traffic on unpaved trails and emissions of PM, CO, NO_x, and VOCs directly from the tailpipe. In the winter, tailpipe emissions would occur primarily from snowmobiles.

Trucks and heavy equipment (chainsaws, fire engines, bulldozers) used in vegetation management and control would cause dust as they travel over unpaved roads. In addition, prescribed fires used for vegetation treatment would cause particulate and gaseous emissions. Trucks and equipment used to conduct and control prescribed fire would cause tailpipe emissions. Areas receiving vegetation treatment would add short-term increases in PM until vegetation recovered sufficiently to stabilize exposed soil.

No direct impacts on air resources would occur from visual resource management (VRM). Management practices and mitigation measures designed to retain visual quality in VRM Class I and II areas would reduce or eliminate emissions from development and OHV use. Management as VRM Class III and IV areas would create the potential for long-term increases in emissions in those areas.

Trucks, heavy equipment, and helicopters used to gather wild horses would cause a short-term increase in tailpipe and fugitive dust emissions.

Wildland and prescribed fires would cause short-term emissions of PM and CO, which could in turn spread out over large portions of the planning area, depending on the size of the fire and on wind conditions. In addition, the use of heavy equipment during fire suppression activities would result in particulate emissions, CO, NO_x, and hydrocarbons (VOC and HAPs). Also, recent studies have suggested that mercury can be released from fire activities. Emissions would be generated by internal combustion engines through vehicular exhausts (referred to as tailpipe emissions) and directly by machinery engines (chainsaws and others).

Construction activity to manage wildlife and fish habitat would contribute to emissions of PM. To a lesser degree, CO, NO_x, SO_2, and VOCs would be generated from tailpipes. These impacts would be short term.

Impacts on air quality would result from activities in SD/MAs that cause exhaust emissions and fugitive dust. Those activities associated with the management of SD/MAs (e.g., fire management and project construction) are covered under the other resource topics.

Please see Section 4.19.3 for a discussion of global climate change impacts.

4.2.4 Impacts Under Alternative 1, Continuation of Existing Management

Figure 4-1 summarizes total and specific pollutant emissions under each of the alternatives. Alternative 1 emissions have been estimated for the base year (2001), 2011, and 2021. Under this alternative, the total NO_x emissions from BLM activities would increase over time from the base-year level of 7,724 tons per year to 23,524 tons per year by 2021.

4.2.5 Impacts Under Alternative 2

Figure 4-1 summarizes total and specific pollutant emissions under each of the alternatives. Alternative 2 emissions have been estimated for the base year (2001), 2011, and 2021. Under this alternative, the total NO_x emissions from BLM activities would increase over time from the base-year level of 7,724 tons per year to 25,050 tons per year by 2021, the highest of any alternative.

4.2.6 Impacts Under Alternative 3

Figure 4-1 summarizes total and specific pollutant emissions under each of the alternatives. Alternative 3 emissions have been estimated for the base year (2001), 2011, and 2021. Under this alternative, the total NO_x emissions from BLM activities would increase over time from the base-year level of 7,724 tons per year to 18,877 tons per year by 2021, the lowest of any alternative.

4.2.7 Impacts Under Alternative 4, Proposed RMP

Figure 4-1 summarizes total and specific pollutant emissions under each of the alternatives. Alternative 4 emissions have been estimated for the base year (2001), 2011, and 2021. Under this alternative, the total NO_x emissions from BLM activities would increase over time from the base-year level of 7,724 tons per year to 23,170 tons per year by 2021.

4.3 CULTURAL RESOURCES

This section presents potential impacts on cultural resources management from BLM management actions for other resource programs. Chapter 3 (Section 3.3) describes existing conditions concerning cultural resources.

4.3.1 Assumptions

The analysis is based on the following assumptions:

- There will continue to be discoveries of cultural resources throughout the planning area.
- There is a direct correlation between the number of sites that could be impacted by various actions and the degree, nature, and quantity of surface-disturbing activities within the planning area, coupled with the degree of increased human presence.
- There is a direct relationship between the frequency of human use in an area and the potential for cultural resources to be impacted.
- When referring to cultural resources, the term "significant" is used instead of "eligible for listing on the National Register of Historic Places (NRHP)," so that the nontechnical reader can more easily understand the relative importance of a site.
- Protection of cultural resources will accord with State Historic Preservation Office (SHPO) coordination requirements; with input from local publics, other interested parties, and Native American groups; and with applicable federal regulations.

4.3.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, reviews of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 software. Effects are quantified when possible; in the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

The criteria for assessing impacts were those stipulated in the regulations for Protection of Historic Properties (36 CFR §800), which state that an undertaking may have an effect when it—

> *May alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association [36 CFR §800.5(a)(1)].*

Examples of effects include—

- Physical destruction, damage, or alteration of all or part of the property
- Property alteration that is not consistent with the United States Department of the Interior (USDI) Secretary's Standards for the Treatment of Historic Properties (36 CFR §68) and applicable guidelines

- Removal of the property from its historic location
- Changes to the character of the property's use or to physical features within the property's setting, which contribute to the property's historic significance
- Introduction of visual, atmospheric, or audible elements that are out of character with the property or that alter its setting
- Neglect of a property that causes its deterioration, except when such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization
- Transfer, lease, or sale of the property out of federal ownership or control without adequate and legally enforceable restrictions or conditions for ensuring long-term preservation of the property's historic significance [36 CFR §800.5(a)(2)].

All of the alternatives discussed below may have direct and indirect effects on cultural and historic resources. Some of these impacts can be short term and with some activities are limited to the duration of construction periods. Other impacts can be long term or permanent, such as those effects that result from development or other ongoing activities.

There would be impacts on cultural resources if any of the following were to happen:

- Implementation of management actions that (1) result in impacts on properties either listed or determined to be eligible for listing in the NRHP, or on properties that are considered important to Native American groups; and (2) cannot be satisfactorily mitigated as determined through consultation with the SHPO and other interested parties.
- Implementation of management actions that result in impacts on the viewshed of select historic trails and historic sites, on properties considered important to Native American groups, or on properties whose setting contributes to the importance of the site.

4.3.3 Impacts Common to All Alternatives

Standard management procedures for cultural resources include on-the-ground inventories, site recordation and evaluation, data recovery excavations, archival research, informant interviews, Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) documentation, stabilization, consultation with Native American groups, condition assessments, photographic recordation, and historic research. These procedures would protect most cultural properties from significant damage or data loss stemming from BLM-permitted or otherwise authorized activities, and such procedures would result in an expansion of the cultural resource database and in further understanding of the area's history and prehistory.

Impacts on cultural resources discovered during other management activities (e.g., archeological features found during but not prior to permitted surface-disturbing activities) could be greater and more damaging than impacts on cultural resources that had been identified prior to the start of other management activities. This is because damage to a site on which a cultural resource is discovered usually occurs prior to that site's recordation and evaluation, thereby complicating evaluation and mitigation procedures. Such impacts on prehistoric site discoveries could often be mitigated through data recovery excavations, which would increase understanding of prehistory to varying degrees, depending on the nature and extent of the discovery and the damage to it.

Cultural resources potentially affected by viewshed impacts are generally property types eligible for the NRHP under Criteria A, B, or C, for which integrity of setting is a contributing factor to those resources' NRHP eligibility.

There would likely be increased impact on cultural resources from management activities that promote an increased human presence in the planning area (for example, the creation of new roads or the development or enhancement of recreational uses).

Continued implementation of the Shell/Ultra Lander Trail Programmatic Agreement (PA) would provide ongoing management directions for Shell and Ultra that are germane to their Anticline Field oil and gas development in the vicinity of the Lander Trail. As Shell and Ultra intensify or expand their Anticline developments, the PA may need to be amended accordingly.

Maintaining proper air quality helps protect and preserve atmospherically sensitive cultural resources such as rock art, aspen art, and historic and prehistoric wooden structures. Air quality management actions such as the development of air quality monitoring stations would have relatively minor effects on cultural properties. A general downward trend in air quality would affect viewshed-sensitive cultural resources.

Implementation of the cultural resource management program's objectives and management actions would generally protect cultural properties from those impacts resulting from the permitted activities of other management programs. The increased knowledge that comes from cultural resource inventories, site recordation, evaluation, archival research, informant interviews, and data recovery efforts would further enhance understanding of the cultural resources in the planning area. Data recovery excavations, however, could remove all or part of the in situ cultural materials at a site, thereby causing potential data loss in the future if new data recovery and analysis techniques are developed. Site damage, data loss, and other nonmitigated impacts would occur throughout the planning area by means of various types of road maintenance, as well as from trespassing, illegal collecting and looting of artifacts, and both natural and human-caused erosion and deterioration.

Timbering, logging, clear-cutting, building access roads, and moving heavy equipment would all have the potential to directly impact historic and archeological resources both on and below the surface. The greatest amount of ground disturbance would be caused by activities associated with clear-cut harvesting on commercial forestland. Soil erosion resulting from logging activities could accelerate deterioration of cultural properties. Noncommercial firewood gathering could result in unmitigated impacts on cultural properties, including tree carvings and historic and prehistoric wooden structures in or near areas where firewood is gathered, and these cultural properties could be damaged or destroyed by cutting and gathering activities.

Construction activities that disturb the ground surface and subsurface in right-of-way (ROW) corridors, and which are the result of ROW approvals, would have the potential to directly impact cultural resources, particularly if the resources were not identified prior to the construction activity. It is relatively common for road and pipeline construction through culturally sensitive sediments to lead to subsurface prehistoric discoveries. Data recovery excavations that enhance understanding of prehistory could often mitigate the impact on discoveries. There would likely be considerable impacts where undocumented NRHP-eligible archeological sites are affected but have not been recognized (and therefore are not being treated as a discovery).

Lands and realty actions that result in construction of structures visible on or above the surface (e.g., communication towers, compressor stations, tanks, and wind turbines) would have the potential to

directly impact the visual integrity of those classes of cultural properties that derive their significance from natural settings and settings relatively devoid of modern intrusion.

Land exchanges and ownership adjustments could have effects on cultural resources located on the affected parcels. Transfer of lands from federal ownership would remove cultural properties from BLM jurisdiction and control and would allow these properties to be impacted by private or state-sponsored activities. Cultural resource inventories and evaluations would be required prior to transferring lands from federal jurisdiction, ensuring that identified sites have been adequately documented, evaluated, and mitigated prior to ownership changes. Sites that are not identified prior to transfer from public ownership would be subject to the effects of management by future landowners. Cultural properties on lands transferred to federal ownership would be subject to greater protection from surface-disturbing actions. BLM could retain or obtain lands containing important cultural and historic resources, providing protection under federal management policies.

Management actions associated with livestock grazing would have both direct and indirect impacts on cultural resources. Implementing healthy rangeland standards and achieving proper functioning condition (PFC) and rangeland health objectives would contribute to improved range conditions and soil and vegetation stability, thereby protecting cultural resources.

Range improvements that disturb the ground surface could result in impacts on cultural resources. Subsurface prehistoric discoveries that are a result of reservoir, water well, or fence construction would occasionally occur in culturally sensitive sediments. Data recovery excavations could mitigate the impacts of these discoveries.

Livestock trampling and wallowing could directly impact cultural artifacts and features on or just below the surface by breaking or scattering these artifacts. Alternatively, cattle trails and other heavily trampled and exposed areas could unearth otherwise undetected cultural resources and allow them to be identified and recorded. Livestock scratching and rubbing would impact certain types of cultural properties, including historic and prehistoric structures and rock art sites. In most instances, these types of animal behaviors would result in minimal or localized impacts. There would be long-term impacts from grazing through repeated trampling on cultural sites over time; for example, in established stock driveways, along fence lines, on rock alignments, near water sources, and in sheltered or shaded areas. Springs are especially sensitive areas, because they have a high potential for being prehistoric sites. Range improvement activities that include construction of structures visible on or above the surface could directly affect the visual integrity of cultural properties deriving their significance from natural settings or from settings relatively devoid of modern intrusion.

Subsurface prehistoric discoveries resulting from well pad construction are relatively common in culturally sensitive sediments. For example, cultural resources located in portions of the Jonah Field, particularly along portions of Sand Draw within the San Arcacio soil type, have been impacted during energy extraction activities. There are similar soils and discovery situations in the Southern Anticline along Bull and Mud Springs Draws. There have been discoveries of large, complex, and abundant prehistoric sites in the sensitive sediments along the New Fork River and in the upland sagebrush steppe south of the Piney Cutoff (the Meridian Site, 48SU1751), despite implementation of standard inventory and evaluation strategies. Impacts on cultural resources discovered during construction activities would be minimized either by relocating the surface-disturbing activity away from the sensitive sediments or through appropriate mitigation of the activity. Nonmitigated impacts would likely occur where undocumented NRHP-eligible archeological sites are impacted but have not been recognized (and therefore are not being treated as a discovery).

Minerals management actions resulting in construction that is visible on or above the surface would have the potential to directly impact the visual integrity of cultural properties that derive their significance from natural settings or from settings relatively devoid of modern intrusion. For example, portions of the Lander Trail and Sublette Cutoff viewshed, in particular, have been affected by oil and gas development. Traffic relating to development of the Middle Anticline has resulted in the introduction of visual, audible, and atmospheric conditions that are out of character with the Lander Trail, a National Historic Trail.

Locatable and salable minerals actions generally would affect only small and localized areas. Impacts on cultural resources from locatable and salable minerals extraction activities would be similar to those impacts occurring from leasable minerals activities, but on a much smaller scale.

Paleontological inventories, excavations, and collections generally do not create large areas of surface disturbance that would significantly impact cultural resources. In addition, most paleontological resources are located in areas of pre-Holocene depositions or in bedrock exposures that are not conducive to the presence of cultural resources. Impacts on cultural resources from management of paleontological resources, if they occur, would be minor.

Recreational activities within the planning area would have direct and indirect effects on cultural resources. Special recreation management area (SRMA) actions that encourage recreation and development of facilities could impact cultural resources directly through ground disturbing activities and indirectly through the ongoing presence of more extensive human activity. Subsurface prehistoric discoveries occasionally would occur as a result of SRMA actions. Increased public exposure to cultural resource issues would increase the awareness and knowledge of the overall importance of cultural resources. Historic trails would be impacted by recreational use, because travel, camping, and historic reenactments all affect the physical integrity of trails through modification of their original ruts and swales and displacement of associated historic artifacts and features.

Subsurface prehistoric discoveries occasionally would occur as a result of camping area, parking area, and trail construction. Impacts on cultural resources discovered during construction activities would be minimized by relocating the surface-disturbing activity or through appropriate mitigation of the activities.

The soils management program generally would provide a long-term, indirect benefit to cultural resources by minimizing soil erosion, thereby preserving cultural properties.

In general, OHV travel on improved roads would not directly impact cultural properties. Increased transportation access would result in more visitors, thereby increasing the potential for inadvertent damage to cultural properties. Road closures would help to protect cultural resources by reducing or eliminating traffic through sites. Construction and maintenance of roads would have the potential to directly impact cultural resources, particularly if the cultural resources were not identified prior to those activities. Subsurface prehistoric discoveries resulting from road and trail construction are relatively common. Significant impacts would likely occur where undocumented NRHP-eligible archeological sites are impacted but not recognized (and therefore have not been treated as a discovery). Generally, more roads translate into more impacts on cultural resources and to unmitigated cumulative effects. Off-road travel on nondesignated routes could also impact cultural resources through increased erosion and direct artifact and archeological feature displacement. The majority of impacts on cultural resources from OHV travel would result from repeated use and subsequent erosion of two-track roads through archeological sites.

Seasonal use of over-the-snow recreational motorized equipment would have little impact on cultural resources. The seasonal closures to protect winter habitats and restrictions on nonwinter motorized vehicles would generally result in less surface disturbance and prevent erosion and resource degradation.

Vegetation manipulation efforts (e.g., aspen rejuvenation, sagebrush manipulation, chaining, winter range enhancement, experimental vegetation efforts) could have direct and indirect effects on cultural resources commensurate with the amount of surface disturbance from those activities. Some vegetation treatments would generally enhance surface exposure (at least in the short term), allowing otherwise undetected cultural materials to be identified and recorded. Soil erosion from loss of vegetation could accelerate deterioration of cultural properties. The use of chemical treatments could protect flammable cultural resources that otherwise might be impacted if prescribed burning was used. However, the effect of chemical treatments on archeologically sensitive soils (or on soil characteristics such as pH) is not fully understood at present.

Cultural resources eligible for the NRHP under Criteria A, B, or C for which integrity of setting is a contributing factor to their eligibility (as well as Native American sacred or respected sites) would be protected by VRM Class II designation. Any cultural properties within a VRM Class I area would benefit from the prohibition of surface disturbance. However, fewer cultural resources would be identified, documented, and recorded in VRM Class I areas because of the limitations placed on development activities and the consequent reduction in the need for cultural resource inventories. VRM Class II designations would help protect cultural resources by limiting visual impacts. Cultural properties benefiting from VRM Class II designations would generally include national historic trails (e.g., the Lander Trail) and certain archeological features or places considered sacred to or respected by Native Americans (e.g., rock features and alignments; rock art; burials; natural, historic, and cultural landscapes).

Management actions associated with watershed and water quality would have direct and indirect impacts on cultural resources. Controlling or preventing surface-disturbing activities in riparian habitat would contribute to improved range conditions and to soil and vegetation stability, thus protecting cultural resources. Certain development projects would have surface-disturbing potential that could expose and impact cultural sites, particularly if cultural resources were not identified during required inventories prior to the development activity.

Fire management actions would have direct and indirect impacts on cultural resources. Direct damage to cultural resources would occur as a result of the wildland fires themselves and through surface disturbances caused by fire suppression activities (e.g., construction of fire lines, bulldozing access roads, and general movement of heavy equipment). Ground disturbing and postfire rehabilitation activities could also have a direct impact on cultural resources. Fire management actions that minimize the potential for devastating wildland fires would have the added benefit of protecting flammable cultural resources such as historic and prehistoric wooden structures, rock art, and aspen carvings. Fire, either wildland or prescribed, can damage surficial cultural materials such as wood and ceramic artifacts. Surficial lithic materials can also be affected by fire. Fire retardants and other chemicals could affect soil chemistry, which would in turn impact the analysis of subsurface archeological deposits. Rock art, either Native American or Euro-American, could be damaged by smoke and soot, as well as by rock exfoliation or spalling caused by extreme heat.

Wildland fires would generally enhance surface exposure for postfire inventory (at least in the short term), allowing otherwise undetected and nonflammable cultural materials to be identified and recorded. Soil erosion from the loss of vegetation as a result of the fire could accelerate deterioration of cultural properties.

Management actions associated with wildlife and fisheries habitats could have direct and indirect impacts on cultural resources. Controlling or preventing surface-disturbing activities in sensitive wildlife habitats would contribute to improved range conditions and soil and vegetation stability, thus protecting cultural resources. Protection of wildlife habitats (such as greater sage-grouse leks, white-tailed prairie dog towns, riparian habitats, and fisheries) would also help to preserve cultural sites located in those protected areas.

Certain wildlife and fisheries development projects would create surface disturbances that could expose and impact cultural sites.

In general, cultural resources would be more protected through area of critical environmental concern (ACEC) and SD/MA designations and associated management prescriptions. Impacts on cultural resources within the Scab Creek wilderness study area (WSA), for example, would be minimal because occupancy restrictions and restrictions on surface-disturbing activities would continue. Restrictions on OHV use, seasonal closures, and other surface disturbance restrictions would all have impacts on cultural resources. SD/MA designations driven by or in support of proactive cultural resource initiatives would provide the greatest degree of cultural resources protection.

4.3.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 1.

Mineral development (locatable, leasable, and salable) would result in both direct and indirect impacts on cultural resources located in the planning area during the next 20 years. It is anticipated that 7,192 oil and gas wells would be drilled through 2020, disturbing an estimated 43,022 acres.

Establishing the Pinedale Glacial area as a National Natural Landmark (NNL) would aid in preserving or more proactively managing cultural resources located within that area. The Pinedale Glacial area contains important paleosols, the study of which can add greatly to the understanding of Pleistocene environments and early man's adaptation to this changing environment.

Soil erosion resulting from OHV use could accelerate deterioration of cultural properties. Cultural resource sites within the Desert General Use Area would be impacted by the open OHV use designation. Cultural resources in areas closed to OHV use (e.g., within sensitive historic trails areas or WSAs) would be better protected.

The strategic placement of roads, wells, and storage tanks in the vicinity of historic properties and significant trail segments would partially mitigate the visual resource impacts of those constructed structures. Surface-disturbing activities would not be allowed within one-quarter mile of a National Historic Trail segment. Although this would provide protection for the historic trail "rut" in the immediate trail area, it would not adequately mitigate the impact on the overall trail setting.

4.3.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 2.

Implementation of a Cultural Resource Management Plan (CRMP) would add only minimal additional protection to cultural properties from impacts resulting from other management programs. Under this alternative, impacts on cultural resources from cultural resource management actions would generally be greater than those under Alternative 1. Some cultural resources could be affected by activities in areas not withdrawn or acquired.

Under this alternative, portions of the Lander Trail and Sublette Cutoff Trail (and associated Site 48LN300) would receive greater protection from visual intrusions than under Alternative 1. Cultural

properties in the vicinity of the trails could also be affected by increased surface-disturbing activities in the area. There would be little protection afforded to those sites considered sacred or sensitive to modern Native Americans, because viewshed preservation efforts such as no surface occupancy (NSO) restrictions would be eliminated for sites (other than the Lander Trail) that derive partial significance from their natural settings.

Commercial logging and forest product extraction would likely increase under this alternative. Logging activities such as skidding trees and building access roads, which involve the movement of heavy equipment, would therefore have somewhat more potential to directly impact historic and archeological resources on and below the surface. Logging activities would increase soil erosion, thereby increasing impacts on cultural properties.

Significant impacts on most cultural resources from lands and realty actions would continue to be avoided. However, the potential for significant impacts on previously undocumented and unrecognized cultural resources in culturally sensitive soils would be the greatest under this alternative and therefore greater than under Alternative 1, because more land would be disturbed. The 5,000 acres of BLM land administratively available for disposal consideration would result in impacts on cultural resources, because cultural properties are known to exist on some of those parcels. This impact would be less than under Alternative 1. Restrictions on the height and placement of communication towers would reduce direct and visual impacts on cultural properties.

Under this alternative, impacts on cultural resources from the management of livestock grazing would increase from those levels identified under Alternative 1. Increasing the available animal unit months (AUM) within the planning area could result in increased rates of erosion and other disturbances. Direct ground disturbances and viewshed impacts would be greater because of the likely increase in range improvement projects in support of livestock productivity. Impacts from livestock trampling, wallowing, rubbing, and scratching, as well as from soil erosion, would also be likely to increase.

Leasable minerals resource development would create more ground disturbance than any other management action and directly affect the greatest number of cultural properties. It is anticipated that 7,804 oil and gas wells would be developed under this alternative, disturbing 46,739 acres of land. Potential impacts on cultural resources would increase, because more acreage would be open to oil and gas leasing, and there would be fewer constraints. Areas that are unavailable for leasing or are otherwise restricted from development, surface-disturbing activities, or surface occupancy would be greatly reduced. Geophysical activities with fewer constraints would be allowed over a larger area, and impacts from vehicle travel would thereby increase.

Under this alternative, there would be a greater potential for oil and gas development to cause direct impacts on cultural resources, owing to the increased likelihood of unmitigated effects on previously undocumented and unrecognized NRHP-eligible archeological sites. Greater impacts on sensitive cultural resource areas would generally result from increased development.

A greater number of cultural resource inventories and site mitigations (e.g., excavations) would result from the likely increase in leasable minerals development and associated ground disturbances, which would in turn increase the archeological (and potentially historic) knowledge base.

Under this alternative, the potential impacts on cultural resources from paleontology actions would be similar to those outlined under Alternative 1. However, NNL, research natural area (RNA), and ACEC designations for areas of unique natural history would not be pursued, and therefore any cultural resources within these areas would not benefit from the surface disturbance restrictions that are applied with these designation categories.

Soils management actions under this alternative would continue to provide long-term, indirect benefits to cultural resources by acting to minimize soil erosion, thereby preserving cultural properties. However, under this alternative, measures to protect soils from erosion would not be as intensive in some areas as those measures would be under Alternative 1. This could result in increased impacts on cultural sites from soil erosion.

Under this alternative, transportation and access management impacts from road development would generally be greater than under Alternative 1, because there would be an increase in road, pipeline, and access projects. ROWs would not be limited to common routes, but could include riparian/wetlands, 100-year flood plains, and other such areas with a high density of cultural resource sites; this would potentially increase the impacts on cultural resources by creating additional ground disturbance as a result of these ROW projects.

The types and degree of impacts on cultural resources from OHV use within the planning area would increase overall as compared to the types and degree of impacts under Alternative 1, except in the Desert General Use Area, which would be limited to existing roads and trails. Travel within the planning area would be allowed with fewer stipulations, resulting in a greater potential for impacts. Impacts on cultural resources would increase as a result of erosion, because the number of trails and two-track roads through areas containing archeological sites would increase. Limiting OHV use to existing roads and trails on the 237,360 acres in the Desert General Use area would minimize soil disturbance, thus reducing damage to previously unexposed cultural properties.

Under this alternative, the impacts on cultural resources from VRM actions would be greater than those outlined under Alternative 1. Because VRM Class II and Class III areas would be greatly reduced in size, more acreage would be subject to disturbance. This could directly impact cultural resources that would no longer be situated within VRM Class I, II, or III areas. Cultural resources such as the Lander Trail, the Sublette Cutoff, and certain Native American sites would be more prone to such impacts, because the integrity of their natural setting, one aspect of integrity that contributes to consideration of National Register eligibility, would be more prone to impacts. A VRM Class IV designation involving 717,390 acres of the planning area provides very little nonindustrialized viewshed, and this affects those classes of sites for which integrity of natural setting is an important aspect of their overall integrity.

Most actions from the water quality and watershed program would affect cultural resources. Discharge of produced water onto public lands could have an impact on cultural resources because of increased erosion and changes in soil chemistry. An increase in impacts could occur because of the management of riparian areas for livestock benefit, which could lead to increased trampling around and erosion of cultural sites. Actions that directly disturb the ground surface (such as facilities construction) could increase in flood plains and wetland/riparian areas under this alternative, which could increase direct impacts on cultural resources.

Under this alternative, there would probably be fewer wildland fires (that could impact cultural resources) suppressed than under Alternative 1, which could increase the damage to unknown flammable cultural resources, including (but not limited to) historic and prehistoric wooden structures and aspen carvings. Damage to unknown rock art from extreme heat and smoke would also be slightly more likely to occur under this alternative. Impacts on cultural resources through surface disturbances caused by fire suppression activities (e.g., construction of fire lines, bulldozing of access roads, and general movement of heavy equipment) would be diminished. Short-term enhanced surface exposure would increase because burning would remove vegetation, and additional nonflammable cultural resources would likely be exposed for identification and recordation.

Most management actions designed to manage and protect wildlife and fish habitats would have some impact on cultural resources. Under this alternative, there would be reduced restrictions on surface disturbances in wildlife habitat areas and especially on winter ranges. Additional impacts on cultural resources could result from increases in allowable surface disturbance. Restrictions on oil and gas leasing to protect wildlife migrations in the potential Trapper's Point ACEC and the Upper Green River bottleneck area would reduce surface disturbances and human presence in these areas.

Reducing the number of SD/MAs under this alternative could result in increased cultural resource impacts, because an SD/MA designation and activity plan implementation generally result in reduced surface disturbance and greater land use restrictions. Establishing the Trappers Point ACEC would have effects on cultural resources because of the density of National Register eligible historic properties and sites considered sacred or important to modern Native Americans located within the 550 acres of this ACEC.

4.3.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be expected under Alternative 3.

The impact on cultural resources from air quality and paleontological resources management would be similar to that under Alternative 1.

The management objectives of the cultural resource program would be oriented toward enhancing the value of cultural resources. Under this alternative, the impact on cultural resources from cultural resource management actions would be less than under Alternative 1 and far less than under Alternative 2. A greater number of cultural properties and their values would be preserved because more proactive efforts would be implemented. Actions such as not leasing for oil and gas development in sensitive cultural resource areas, using NSO restrictions at cultural sites, preparing CRMPs, and conducting proactive (Section 110) inventories would all have impacts on the cultural resource program. Focusing on the avoidance and confidentiality of cultural resources would serve to further reduce overall impacts. Identification and inventory of cultural program–derived priority areas before other management actions are proposed would help to preemptively protect cultural resources from both direct and indirect impacts, and additional cultural properties would be added to the cultural resource database.

Areas unavailable for oil and gas leasing would reduce potential impacts on highly significant, highly sensitive cultural properties. The boundary of Site 48SU301 would be expanded, which would provide greater protection to and lessen the impacts on related Site 48SU1755. A CRMP would be written specifically to manage impacts on Archeological District 48SU4000, which would provide the most effective management for this resource in light of the infill development of the Jonah gas field. The archeological district could undergo excavations and other mitigations if or when surface-disturbing activity is pursued in the area or in a proactive Section 110 preservation effort.

A VRM Class II designation within 3 miles of the Lander Trail and Sublette Cutoff, and a prohibition on construction activities within the viewshed of NRHP-contributing segments of both the Lander Trail and the Sublette Cutoff, would be implemented under this alternative. Further, the area within 1 mile of these trails, as well as several National Register-quality sites, would be unavailable for oil and gas leasing. Compared to Alternatives 1 and 2, these stipulations would provide greater protection from direct and indirect impacts on the sites, greatly reduce visual impacts on the trails, and decrease the potential impacts on other cultural resources within the buffer zones by reducing surface-disturbing activities in the areas. Cultural resource inventories conducted prior to surface-disturbing actions would be reduced in these

protection areas, though much of this area is already inventoried. The implementation, as necessary, of CRMPs specifically to manage impacts on historic trails would further benefit trail preservation.

Commercial logging and forest product extraction would likely decrease under this alternative compared to Alternatives 1 and 2. Logging activities, such as skidding trees, building access roads, and moving heavy equipment, would therefore have somewhat less potential to directly impact historic and archeological resources. Soil erosion resulting from logging activities would be slightly reduced, which could increase the preservation of cultural properties. More selective cutting would occur in favor of clear-cutting, which would reduce the overall threat to cultural resources.

Lands and realty actions that disturb the ground surface or viewshed could impact cultural resources, just as under Alternative 1. The withdrawals proposed under this alternative (65,750 acres) are greatly increased from those proposed under Alternative 1, which would substantially reduce the potential effects on cultural properties, because less land would be available for development. The smaller acreage (790 acres) available for disposal consideration under this alternative could result in fewer impacts on cultural resources, because a larger number of cultural properties would remain under BLM protection. ROW avoidance areas would be expanded and fewer new ROW routes would be allowed, which would potentially decrease the impact on cultural resources that would have occurred if additional ground disturbance from the construction of new ROWs were allowed to continue.

Similar to Alternative 2, restrictions on communication towers' height and placement could reduce direct and visual impacts on cultural properties. Further, any additional communication facilities would be restricted to existing developed sites, which would also reduce potential impacts on cultural properties. Prohibiting wind energy development in certain sensitive areas could protect cultural properties from direct ground disturbance and visual effects related to this type of development, particularly from wind turbine placements.

Under this alternative, the potential would remain for significant impacts on previously undocumented and unrecognized cultural resources in culturally sensitive soils as a result of lands and realty actions, but this potential would be less than that anticipated under Alternative 1. Under this alternative, cultural resource inventories conducted in support of other program proposals could be performed less frequently, because fewer ground disturbing actions implemented or areas where ground disturbing activity would be allowed would be more spatially restricted. Fewer cultural properties would be recorded, and the cultural resource database would not be increased as greatly as under Alternative 2.

Under this alternative, impacts on cultural resources from livestock grazing management actions would be reduced from those under Alternative 1. There would probably be fewer direct ground disturbances and less impact on viewsheds, because maximum livestock production would not be pursued, and the number of range improvement projects would probably decrease accordingly. Impacts from livestock trampling, wallowing, rubbing, and scratching, as well as from associated soil erosion, would also be likely to decrease to a certain extent because of reductions in livestock populations. Reductions in allowable grazing in sensitive areas and in areas of conflicting activities could reduce the potential impacts on cultural properties in these areas.

The potential impacts from oil and gas exploration and development would be greatly reduced under this alternative compared to the other alternatives, because less acreage would be open to oil and gas leasing and greater constraints would be placed on the leasable areas. It is anticipated that 5,209 oil and gas wells would be developed under this alternative, disturbing 31,139 acres of land. There would be a substantial increase in the area closed to leasing or with stipulations restricting development, surface-disturbing activities, or surface occupancy. Under this alternative, the Lander Trail and Sublette Cutoff, as well as sites considered important to modern Native Americans, would directly and indirectly benefit from these

constraints. In particular, portions of the Ryegrass and Squaretop regions would directly benefit, with important protection afforded to the Native American traditional cultural property (TCP) found at Site 48SU285, as well as to other sites with Native American importance that abound in the Ryegrass region. Restrictions on well pad density would reduce impacts on cultural resources in newly developed areas. Management actions under this alternative would place greater constraints on geophysical activities, and some areas would be entirely closed to geophysical exploration. Impacts on cultural resources from geophysical undertakings (primarily from vehicle travel, but also from illegal artifact collecting) would be reduced.

Under this alternative, 723,200 acres would be made unavailable for oil and gas leasing, which would benefit cultural resources, because the major threats to these resources would be greatly reduced or eliminated.

Under this alternative, there would be a lower potential for significant direct impacts on cultural resources from minerals actions because of the decreased likelihood of unmitigated effects on previously undocumented and unrecognized NRHP-eligible archeological sites. Further, the impacts on the viewshed of certain NRHP-eligible historic sites and sensitive Native American properties would likely be less significant under this alternative than under Alternative 1, and additional viewshed impacts would not occur.

Fewer cultural resource inventories and site mitigations (e.g., excavations) would result from leasable minerals development and associated ground disturbances. Fewer cultural resource inventories would limit expansion of the cultural resource database, however, and understanding of the prehistory of the planning area would therefore be somewhat less under this alternative than under Alternatives 1 and 2.

Existing SRMAs would be managed for the protection of primitive recreational values and more limited access, and development activities and facilities construction would decrease. The related decrease in ground disturbances could potentially reduce the effects on cultural properties to a greater degree than would occur under Alternative 1.

Soils management actions under this alternative would continue to minimize soil erosion, which would help to preserve cultural properties. Measures to protect soils from erosion would be more intensive in some areas of the planning area as compared to under Alternative 1. Restrictions on oil and gas and other development in particularly sensitive soils areas would reduce or eliminate ground disturbing activities, minimizing the potential for impacting unknown or buried cultural resources.

Impacts on cultural resources from transportation, travel, and access actions would be substantially diminished from those under Alternatives 1 or 2, as a result of closing more land to OHV use and greater restrictions on OHV travel where it is allowed. Closing Sites 48SU285, 48SU2019, 48SU4100, 48LN300, and the Wardell Buffalo Trap to OHV use would protect cultural resources from the effects of erosion and would also prevent direct artifact displacement resulting from OHV use. Impacts on the Trapper’s Point area and on the sensitive cultural resources that abound in this area would decrease as a result of OHV closure and the corresponding decreased human presence. Under this alternative, opportunities to acquire access to isolated public land parcels would be pursued, which could slightly increase impacts on cultural resources if more roads were constructed or upgraded. Closing a number of sensitive cultural resource sites and trail areas to OHV use would have important direct and indirect impacts by restricting public access in these sensitive areas. Similarly, not establishing OHV Open areas has both direct and indirect effects, by reducing direct vehicular impacts, erosion, and the human-caused effects discussed above.

Prescribed burning would be the preferred method of vegetation treatment, and more sensitive vegetation areas would be restricted from surface-disturbing activities. If prescribed fire were used instead of

chemical treatments, certain cultural property types, such as historic and prehistoric wooden structures, aspen carvings, and rock art, would likely be impacted to a greater extent. Conversely, there would be a reduction in impacts associated with chemical treatments. Expanded avoidance of sensitive vegetation communities under this alternative would benefit cultural resources by reducing the potential for surface-disturbing impacts.

Under this alternative, the impacts on cultural resources from VRM actions would be less than under Alternative 1. Because VRM Class II areas would be larger (an additional 319,830 acres) under this alternative, less acreage would be subject to surface disturbance, which would thereby directly benefit any cultural properties in the area. VRM classifications would continue to be modified, as necessary, and impacts on cultural properties would vary accordingly.

Under this alternative, the potential impacts on cultural resources from water quality and watershed management actions would be less than under Alternative 1. Most actions from this program would have effects on cultural resources. Impacts could be less significant under this alternative because riparian areas would be managed for wildlife and watershed protection rather than for the benefit of livestock. The result would be less livestock trampling and less erosion of cultural sites. Management actions that directly disturb the ground surface (such as construction of facilities) would decrease in flood plains and wetland/riparian areas under this alternative, which could decrease the direct impacts on cultural resources.

Fewer wildland fires that could impact cultural resources would be suppressed under this alternative than under Alternative 1. An increased emphasis on wildland fire use for resource benefit (WFURB) would mean that more fires would be allowed to continue burning. This would potentially increase the damage to unknown cultural resources that are flammable, including historic and prehistoric wooden structures and aspen carvings, especially in areas where BLM lands abut the Bridger-Teton National Forest. There could also be increased damage to unknown rock art from extreme heat and smoke. Emergency stabilization and rehabilitation actions would also increase potential impacts through additional surface disturbances. Short-term enhanced surface exposure caused by the burning of vegetation would be increased, and more nonflammable cultural resources would be exposed, which could then be identified and recorded. Soil erosion from loss of vegetation and consequent deterioration of cultural properties could also increase.

Many management actions designed to protect wildlife and fish habitats would generally have impacts on cultural resources as well. In the Intensively Developed Fields, impacts would be similar to those described under Alternative 2. Additional sites would be recorded and evaluated, and additional sites would probably be disturbed.

There would be a substantial increase in the area unavailable for leasing, with less direct and indirect impacts from far fewer surface disturbances. Unavailable for leasing or NSO restrictions could reduce the direct and indirect impacts on cultural resources from these constraints, because viewsheds would remain unspoiled or natural. In particular, portions of the South LaBarge, Miller Mountain, Ryegrass, and Squaretop regions would experience fewer impacts, with important protections afforded to the Native American TCP found at Site 48SU285 as well as to other sites with Native American importance that abound in these regions.

Restrictions on surface disturbances under this alternative would increase in most wildlife habitat areas compared to those under Alternative 1. The unavailability of oil and gas leasing to protect wildlife migrations in the potential Trapper's Point ACEC and the Upper Green River bottleneck area could reduce impacts on cultural resources by further reducing surface disturbances in these areas. Prohibiting permanent and high-profile structures (e.g., buildings, storage tanks, well pads, and wind turbines) within

a greater distance from active raptor nests could help protect cultural properties from visual impacts from these structures, as well as from the direct impacts from constructing these types of structures. Surface-disturbing activities would also be further reduced to protect greater sage-grouse leks, which could also increase protections to cultural resources in these areas.

In general, cultural resources would be more protected by management prescriptions for SD/MAs under this alternative. The Trapper's Point area would be designated an ACEC that would include 9,540 acres and would receive far greater cultural resource protection under this alternative because there would be a nearly complete restriction on surface-disturbing activities, which would substantially reduce effects on the many and diverse cultural properties located in that area. Implementing management actions associated with the designation of the Ross Butte ACEC would help to preserve the abundant sensitive surficial (and buried) archeological resources in that area, which consist of many surface-occurring rock alignment sites, stone circles, cairns, and the Cora Butte Alignment site complex. Other management areas (MA) would focus on preservation rather than development, which would lessen impacts on cultural properties by limiting ground disturbing actions and human presence. Similarly, cultural resources would benefit from management prescriptions within the Miller Mountain MA that protect open space, natural landscape values, and prehistoric sites such as the National Register-quality Lanning Archeological Site (48LN2085). Under this alternative, there would be an increase in proactive cultural resource management initiatives.

Establishing the Upper Green River ACEC with its emphasis on increasing recreational development would potentially have some impact on cultural resources associated with increased human presence, site disturbance, and erosion.

Most surface-disturbing activities would be restricted within the Wind River Front MA (358,400 acres, including the U.S. Air Force Seismic Monitoring Station), and the protected area would be larger than that proposed under Alternative 1. In general, these actions would reduce potential direct impacts on cultural properties in the area. However, there would be fewer cultural resources identified, documented, and recorded in the area, as compared to under Alternative 1, because of the limitations this alternative would place on development activities and the consequent reduction in cultural resource inventories, unless this area was specifically targeted for proactive cultural resource investigations.

4.3.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 4.

Impacts from land tenure adjustment and wildland fire and fuels management would be similar to those under Alternative 3.

More proactive management of cultural resources overall would provide for a more positive orientation toward Native American consultation and the types of sites they consider sacred or important, and it would also provide for more aggressive management of sites and locales whose importance is derived in part from retention of their undisturbed or natural settings. In general, there would be more preservation of cultural properties and their values, because more proactive efforts would be developed and implemented. The focus on avoidance and confidentiality of cultural resources would serve to further reduce impacts overall. Identification and inventory of priority areas before the proposal of other management actions would help to preemptively protect cultural resources from both direct and indirect impacts, and there would be more cultural properties added to the cultural resource database. Implementation of the cultural resource management program under this alternative would offer greater

protection to cultural properties from impacts that result from other management programs, similar to under Alternative 3. Select, highly sensitive cultural properties would be better protected, because the cultural resource management program would place greater restrictions on other management actions.

Under this alternative, the integrity of the setting of the Lander Trail and Sublette Cutoff would be preserved through intensive viewshed analysis that would determine the necessary width and type of protective buffers required to avoid affecting the intact portions of the trails. Under this alternative, the impacts on the viewshed of the Lander Trail and Sublette Cutoff would be less than under Alternatives 1 and 2, but the impacts would be greater than under Alternative 3.

A slightly higher number of cultural properties could be affected because of a slight projected increase in commercial logging activity.

Lands and realty actions that disturb the ground surface or viewshed would impact cultural resources to a lesser extent than under Alternative 1. ROW avoidance areas would be expanded, which would potentially decrease impacts on cultural resources in the new ROW exclusion areas.

Restrictions on the height and placement of communication towers could reduce direct and visual impacts on cultural properties. Further, most additional communication placements would be restricted to existing sites, which would also reduce potential impacts on cultural properties.

Restrictions placed on wind energy development in certain sensitive areas would protect cultural properties from direct ground disturbance and visual effects related to this type of development, particularly from wind turbine placements. The potential would remain for significant impacts on previously undocumented and unrecognized cultural resources in culturally sensitive soils as a result of lands and realty actions, but they would be less likely to occur than under Alternative 1.

The degree of potential impacts on cultural resources in the Intensively Developed Fields would be greatest with both direct and indirect impacts on cultural resources. Reducing and eliminating wildlife resource-driven timing limitations in this area could result in more soil disturbance and discovery and in possible damage to previously unrecorded sites. Construction during winter (or during periods of winter-like conditions) in sensitive cultural resource areas (e.g., the San Arcacio soils of the Jonah gas field, the Anticline, and the foothills/breaks of the Mesa and the eolian sediments of the Big Piney/LaBarge oil and gas field) could affect cultural resources, because it is virtually impossible to conduct any meaningful or professional cultural resource investigations with frozen ground or with snow cover.

Cultural resources in Traditional Leasing Areas would be less protected than those in NSO or unavailable for leasing areas, but these resources would also be less directly threatened than those in the Intensively Developed Fields. Outside of specific cultural resource sites that merit or warrant special stipulations, such as site-specific NSO areas, there would be wildcat drilling and exploration activities in Traditional Leasing Areas, with new roads penetrating areas where access had previously been restricted (e.g., miles-long improved roads into areas where previously only two-track access existed). There could be indirect effects expected from this new access. Conversion of Traditional Leasing Areas into Intensively Developed Fields would make the management of intact viewsheds and natural settings more difficult. The potential for unexpected discoveries is greater in Traditional Leasing Areas because of the poor understanding of the dynamics of buried site potential and preservation in these largely unstudied areas.

Areas made administratively unavailable for leasing or that have NSO or other stipulations restricting development or surface-disturbing activities would provide for far greater cultural resource protection. Viewsheds and natural settings would be maintainable in NSO/unavailable for leasing areas, protecting

sites whose importance derives from such conditions. Sites and locales considered sacred, sensitive, or important to modern Native Americans would receive greater protection.

Under this alternative, management actions would place insufficient constraints on geophysical activities to protect cultural and Native American resources, especially in NSO/unavailable for leasing areas and the Trapper's Point ACEC. Impacts on cultural resources from geophysical undertakings (primarily from vehicle travel, but also from illegal artifact collecting) would continue.

Some SRMAs and other recreational areas would be managed for maximum recreational use, with a corresponding increase in development activities and construction of recreational facilities. The increase in ground disturbance resulting from these actions could potentially affect cultural properties to a greater degree than under Alternative 1. In particular, the proposed Boulder Lake SRMA could threaten abundant cultural resources, as has been identified in the Boulder Lake CRMP (USDI, BLM 1992).

Impacts on cultural resources from OHV use within the planning area would be substantially less than under Alternative 1, as a result of more closures and restrictions on OHV travel (particularly within SD/MAs and other sensitive areas) and the limitation of OHV travel in the Desert General Use, Mt. Airy, Big Piney, and LaBarge OHV areas to existing roads and trails. Closing big game kill sites and Native American burial locales to OHV use would help protect these highly sensitive cultural locales without impacting other legitimate multiple uses. However, the level of protection under this alternative would not be as great overall as that proposed under Alternative 3. For example, Sites 48SU285, 48SU2019, and 48LN300 would have OHV use limited to designated roads and trails, rather than being closed to OHV use (as is the case under Alternative 3), potentially leading to impacts from vehicle travel and human presence and activities.

Not establishing OHV Open areas would have both direct and indirect effects, by reducing direct vehicular impacts, erosion, and the human-caused effects discussed above.

Proposing common ROWs would be desirable for overall cultural resource management, as this would reduce surface impacts. Opportunities to acquire access to isolated public land parcels would be pursued, which could slightly increase impacts on cultural resources if more roads were constructed or upgraded.

Under this alternative, the impact on cultural resources from VRM actions would be less than that under Alternative 1, especially for those cultural resources whose setting contributes to their significance. Because VRM Class II areas would be larger (an additional 166,090 acres), there would be less acreage subject to surface disturbance, thereby directly benefiting any cultural properties that derive their importance from natural settings and nonimpacted landscapes in the area. VRM classifications would continue to be modified in areas slated for development as appropriate, and impacts on cultural properties would vary accordingly. Cultural properties within VRM Class IV areas that derive their importance from natural settings and nonimpacted landscapes could have this component of site significance affected.

Impacts on cultural resources from wildlife and fish management actions would be directly related to the management identified in the oil and gas management areas. In NSO/unavailable for leasing areas, there would be far greater protection of cultural resources, in that one primary agent of site impact would be greatly reduced or eliminated. There would be a commensurate loss of scientific data, because fewer inventories and site evaluations would be conducted, unless proactive inventory and site evaluation is performed. In the Traditional Leasing Areas, standard cultural resource inventory and evaluation techniques would be used to reduce or eliminate unmitigated effects on cultural resources. The Intensively Developed Fields would also rely on standard cultural resource inventory and evaluation techniques to reduce or eliminate cultural resource impacts. Past experience in the Jonah and Anticline Intensively Developed Fields indicates there could be impacts because of the nature of intensive

development, with unexpected discoveries and increased human presence resulting in both direct and indirect effects on cultural resources. Most management actions designed to protect wildlife and fish habitats also have impacts on cultural resources. Cultural properties that derive their importance from natural settings and nonimpacted landscapes would have this component of site significance affected.

ROW restrictions and making oil and gas leasing unavailable in order to protect wildlife migrations in the potential Trapper's Point ACEC could greatly benefit cultural resources by further reducing surface disturbances in this area.

The Trapper's Point ACEC designation, which would contain 4,160 acres, would have many important cultural resource benefits. The core of the Trapper's Point area, which contains National Register-eligible Site 48SU350, the Trapper's Point Interpretive Site and Site 48SU1006, the Trappers Point (prehistoric) Site, the Green River Ranching TCP, and related sites, would be afforded maximum protection. Protection would also be afforded to numerous unrecorded but recognized sites within the ACEC. Site types protected include several rock alignments, stone circles, and other rock features known to be in the area. These site types are frequently considered sacred, important, or of interest to modern Native Americans. The ACEC designation would also protect the site setting of Site 48SU1006 and the Trapper's Point (prehistoric) Site, which was formally nominated to the NRHP in 2007. The NRHP status of the Trapper's Point Site is derived in part from the intact site setting, which is conducive to communal pronghorn hunting techniques. While there would be a continued impact on this ACEC area from illegal artifact collection, limiting OHV use to designated roads and trails in this area would reduce many direct and indirect impacts on the surface features that are abundant in the ACEC. Proactive cultural resource management initiatives would increase under this alternative. Those sites associated with Trapper's Point but located on adjacent private land would not be protected.

In general, cultural resources would receive more protection from the management prescriptions for SD/MAs (such as Miller Mountain) than these resources would under Alternative 1. Fewer ground disturbing activities would occur in most SD/MAs. The Ross Butte MA would receive greater cultural resource protection under this alternative because of NSO restrictions, which could significantly reduce direct effects on the cultural properties in the area. An "unavailable for leasing" decision for the southern Wind River Front MA along the Lander Trail would provide important protection for this contributing segment to the national historic trails system.

Minerals leasing would be unavailable within the Wind River Front MA (201,240 acres). This action would have positive effects on cultural resources by significantly reducing the potential for direct impacts on cultural properties in the area. However, fewer cultural resources would be identified, documented, and recorded in the area, as compared to under Alternative 1, because of the limitations this alternative would place on development activities, and the consequent reduction in cultural resource inventories, unless this area was specifically targeted for proactive cultural resource investigations.

4.4 FORESTRY

This section presents potential impacts on forest management from management actions for other resource programs. Chapter 3 (Section 3.4) describes existing conditions concerning forestry.

4.4.1 Assumptions

The analysis is based on the following assumptions:

- The long-term, sustained yield capacity of the forestlands is approximately 9 million board feet (MMBF) per decade, based on management restrictions.
- The Healthy Forests Restoration Act (HFRA) will provide guidance in managing designated old-growth stands, within both forested stands and woodlands.
- Forest health, forest restoration, and hazardous fuels reduction objectives will be the major determining factors in forest management.
- Approximately 6 MMBF of timber is being harvested per decade. There would be potential for higher demand if the infrastructure for harvesting were available to meet it.
- The forested areas within the planning area have a fire regime of III, IV, and V. Fire Regime III is defined as mixed severity with a return interval of 35 to 100 years; the Douglas fir stands are primarily within this fire regime. The whitebark pine and limber pine association and the aspen forests/woodlands are in Fire Regime III. The lodgepole pine and spruce-fir stands are within Fire Regime IV, which is defined as an infrequent (return interval of 35 to 200+ years) stand replacement fire. Because of this, clear-cut units approximating natural disturbance patterns are acceptable within established Wyoming BLM guidelines. Primary management options will emphasize thinning, removal of insects and diseases affecting trees, and partial overstory removals, where appropriate.
- Clearcut areas, which average between 10 and 25 acres, would be reforested with tree seedlings (either natural regeneration or planted if no natural establishment) within 5 to 7 years after harvest. No new permanent roads would be approved for timber harvest unless the roads were also needed for other resource management activities. Temporary roads would be revegetated within 3 to 5 years after closure.
- Up to 700 acres of woodland (aspen, juniper, and limber pine) could be treated on an annual basis, which would assist in restoring woodlands to their historic place on the landscape and with rejuvenating aspen stands for wildlife, VRM, and the creation of natural fuel breaks.
- Public demand sales for firewood, Christmas trees, posts and poles, and other forest products would continue. The actual number of permits issued and estimated volumes would vary yearly based on public demand, but would not exceed 25 wildings, 16,300 cubic feet (200 cords) of firewood, 350 Christmas trees, 700 cubic feet of posts and poles per year, and 1,250 cubic feet of personal use saw timber per year. No new road construction would take place to meet this demand.

4.4.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, reviews of existing literature, and information from other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate. Forest inventory data were collected during Stage 2 inventories conducted in the early 1980s.

4.4.3 Impacts Common to All Alternatives

Impacts on forestry are not anticipated as a result of implementing management actions for the following resources and resource uses: paleontology and natural history, and transportation management.

Management of cultural resources could potentially result in indirect effects on the forest management program by restricting forest management activities in areas where there are substantial cultural resources requiring protection.

Forest management techniques, including logging, would contribute to forest health by removing dead and dying trees, reducing the number of diseased trees and the spread of insects, and reducing the likelihood of large wildland fires. The sale of forest products would also provide economic benefits to nearby communities.

Consolidation of land ownership would have a long-term effect on forest resources through facilitation of management actions within blocks of forestland. If implemented, forest management activities would not be constrained by ownership boundaries.

Easement acquisition and land adjustments would help enhance access and would aid in implementing forest management actions. Objectives for acquiring or maintaining access to forested areas would keep these areas open to active forest management.

Grazing and browsing by both livestock and large ungulate wildlife could affect forest management actions. The regeneration of aspen and other deciduous trees and shrubs in forested, woodland, and riparian areas could be reduced by livestock and wildlife gazing and browsing. Fluid mineral development could impact forestry. Most of this development would take place outside forest and woodland areas. However, the forested and woodland areas along the Wyoming Range contain active natural gas wells and have the potential for increased production. Portions of the Wyoming Range forest/woodland area have a high potential for coalbed natural gas (CBNG) development (ENSR and Booz Allen Hamilton 2003). Impacts from mineral resource development on forest management could include the removal of forest cover and the development of localized barriers or impediments to travel that could limit access to potential harvest areas. These areas would be taken out of production for the life of the well or mineral project. These impacts would be about the same for leasable, locatable, and salable minerals, although mineral development is primarily situated in nonforested to lightly forested areas of the planning area.

The extension of new access roads within forested/woodland areas could allow for better access to resources, which could impact timber sales. Expanded road access could also mean easier access for wood cutters and other users of forest products, thereby increasing the demand for forest products.

The presence of recreational use areas such as campgrounds within forested areas would preclude timber harvest, thereby reducing the range of forest management options available to maintain forest health and public safety.

Soil type and condition could affect forest management. Timber harvest could be restricted in areas with unstable soils or particularly steep terrain.

VRM Class II management objectives require that the visual resource contained within these forested areas be maintained or that changes to the visual resource not be noticeable to the casual observer. VRM constraints would restrict timber harvests in these areas. Other forested areas within the planning area would be managed as VRM Class III, which would impose few restrictions on forest management actions.

In areas of high water resource values, timber harvesting would be limited. Modification of timber sales, stand improvement, or forest health projects would be necessary in these areas.

Management of Special Status Plant Species and communities could preclude timber harvest and fuel reduction projects in places where such species occur. This would be a minor impact, particularly considering that most of the Special Status Plant Species in the planning area are found in desert habitats.

Fire management can affect forestry activities. Fuel treatment projects may be done in forested areas to reduce the potential hazard of fire by reducing the fuel source. These projects can reduce the amount of woody material on the ground and also alter the structure of both the understory and overstory of trees, changing the composition and structure of the stand.

WFURB could also affect forestry. In areas where WFURB is allowed, wildland fire could alter the stand composition, structure, and function. Wildland fire could change the seral state of the forest or woodland. Potential commercial material could be burned and therefore no longer be salvageable.

The management of sensitive, threatened, and endangered species and their habitats would impact forestry activities. This management would include precluding timber harvest and forest health treatments in areas where habitat for these species, such as the lynx, is located.

SD/MA management would limit forest treatments within WSAs and ACECs. Restrictions would include permitting no timber harvest or mechanical treatments within the WSA and restricting these activities in ACECs.

4.4.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

Fire management could affect forestry activities under this alternative. The fire management plan calls for a response commensurate with the resource values at risk. In areas where the forest/woodland vegetation has a low resource value, the response could be to allow larger acreages to be burned. WFURB (also called prescribed fire or unplanned ignition) would also be allowed, which could impact the forest and woodlands stands by allowing fire to play its role in the ecosystem and return the forested lands to an earlier seral or successional state.

4.4.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 2.

Because of the emphasis on commercial productivity, more commercial timber would be harvested and forest health actions would be directed toward sustaining a greater yield of forest products.

Aspen stands would be managed for early seral aspen communities to maximize commodity benefits, which would facilitate the management of aspen as a commodity.

Fire management would affect forestry activities under this alternative. Fuel treatments would be focused on the Wildland Urban Interface (WUI) areas, including the industrial interface, and on meeting specific nonforestry-related objectives such as fuels reduction and habitat management. Using wildland fire to restore forest stands would not be an option.

Fewer acres of land designated as ACECs would result in fewer acres of land with added restrictions on forest management practices. Elimination of the Beaver Creek ACEC (3,590 acres) would allow forest management practices on steeper slopes and in areas closer than 1,000 feet from streams, or on slopes in excess of 25%. Elimination of the Rock Creek ACEC would have no impact on forestry practices as the Lake Mountain WSA designation would remain.

4.4.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 3.

Fire management would affect forestry under this alternative. WFURB would be a management tool to reintroduce natural fire back into the ecosystem. This would allow the use of fire to revitalize unhealthy forest in such areas as decadent forest stands and stands infested with insects or disease, and to control conifer encroachment in aspen stands.

Aspen stands would be aggressively managed to bring them within their historic range of variability, increasing stand sizes and the number of stands throughout the area. Increases in the number and size of aspen stands would also result in generally younger stands and more age diversity among stands.

Under this alternative, oil, gas, and mineral development would have the least impact on forestry. Minimizing road development would leave more areas of the analysis area unroaded and inaccessible to commercial and noncommercial forest products users.

Forestlands within SD/MAs would be increased by 3,550 acres. This could result in SD/MA-related restrictions on timber harvest and forest treatments over a larger area.

4.4.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4.

Aspen stands would be aggressively managed to bring them within their historic range of variability.

Oil, gas, and mineral development under this alternative could impact forestry. The level of proposed development would create more roads into the forest stands and woodlands, increasing the accessibility of these areas to commercial and noncommercial forest products users.

The use of WFURB in fire management would re-introduce wildland fire into forest stands and woodlands of the analysis area. This would allow fire to be a component in restoring the composition, structure, and function of forests and woodlands to presuppression conditions.

Fire management would also affect forestry by emphasizing the use of mechanical, chemical, and prescribed fire treatments to restore the ecosystem to its presuppression composition, structure, and function, and also by reducing hazardous fuel buildups.

Under this alternative, the Miller Mountain and Wind River Front MAs would be open to forest management consistent with the HFRA, which would allow for more proactive management of forest resources and restoration of forested areas to old-growth composition, structure, and function. It would also address ecosystem health.

4.5 LANDS AND REALTY

This section describes potential impacts on lands and realty management from management actions for other resource programs. Lands and realty management includes management of ROWs and leases and permits, administration of withdrawals, and land tenure adjustments. Chapter 3 (Section 3.5) describes existing conditions concerning lands and realty.

The lands and realty program is a support program rather than an environmental component. The program responds to requests for authorizations, permits, leases, and land tenure adjustments from other programs or outside entities. The following discussion of the effects on lands and realty focuses on the constraints and opportunities for ROW authorizations (e.g., for pipelines, power lines, transmission lines, roads, and communication sites). Specifically, this analysis will determine whether the implementation of management actions for other resource programs influences or modifies the location, size, or design of a given ROW proposal or, in some cases, precludes approval of the proposal. Such impacts would primarily occur from the implementation of management actions designed to protect natural resources and limit impacts on those resources from surface-disturbing activities. Therefore, the type and degree of limitations and restrictions placed on ROW proposals depend on the location of sensitive or high-value resources and the potential for environmental impacts on those resources. Land use restrictions that result in the relocation or redesign of proposed ROWs would increase management efforts and costs related to proposals submitted by ROW applicants, which are administered by the lands and realty program. This impact would be further increased if relocation resulted in longer linear routes or placement of ROWs in areas that are difficult to develop. If avoidance of sensitive resources is not possible, other mitigation measures would be required, such as application of height and color specifications that serve to redesign ROWs to meet the goals and objectives for other resources.

4.5.1 Assumptions

The analysis is based on the following assumptions:

- ROWs for energy-related facilities (e.g., roads, pipelines) are anticipated to increase.
- Interest in community expansion and other land tenure adjustments is anticipated to increase during the planning period.
- Before any disposals are made, lands will be examined for the presence of high-value resources. Lands containing high-value resources will not be disposed of, or the disposal would allow for those resources to be preserved.
- The installation of power lines, telephone lines, fiber-optic cable, and communication sites is anticipated to increase.
- Existing withdrawals would continue and would be reviewed to determine the need for continuation, modification, revocation, or termination.
- The effects of designation and development of transportation and utility ROW corridors would be mitigated on a case-by-case basis.
- Prior to any potential land disposal, the mineral development potential would be evaluated according to sections 206 and 209 of FLPMA.

4.5.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, reviews of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

4.5.3 Impacts Common to All Alternatives

Impact on the lands and realty program are not anticipated as a result of implementing management actions for the following resources and resource uses: forest management and fire and fuels management.

Air quality management would affect how lands and realty authorizations are stipulated to alleviate air quality impacts. As an example, stipulations could be placed on pipeline or road ROWs that call for dust suppressants. The requirement to use dust suppressants could increase construction costs. Formal consultation would be required for any project-related activity (dust suppression) that would cause a depletion of the Colorado River system.

Implementing protective measures for cultural and paleontological resources could require avoidance and other mitigation measures for ROWs proposed near these resources. These measures could result in the relocation or redesign of proposed ROWs. Because known cultural and paleontological resources occur throughout the field office, and because it is likely that additional cultural and paleontological resources will be discovered in the future, impacts could be substantial and occur in varying degrees throughout the field office.

Development of ROWs in forested areas would cause habitat fragmentation and visual impacts. ROW widths would be up to 150 feet for major power lines. Trees would not be reclaimed in ROW corridors, resulting in permanent impacts on wildlife habitat and visual resources.

Land tenure adjustments would serve to benefit the overall management of the lands and realty program and to improve and protect future management of all resources and associated resource values. If impacts occurred that were not beneficial or that could not be mitigated appropriately, a land tenure adjustment would not be considered. Certain lands would not be considered for disposal unless exchanged with lands of equal or greater value, including functional resource value or monetary value. This would include lands with aquatic resources and wetland/riparian habitat, because of their limited presence in the planning area. Avoiding land exchanges of this type would be beneficial to the resource. Through the lands and realty program, lands within the planning area would be acquired or disposed of through exchange or sale, or through Recreation and Public Purpose Act of 1926 (R&PP) patents, for the purposes of community expansion, consolidation of public lands, acquisition of important resources, or accommodation of public and private needs. These actions would help to facilitate the location of ROWs by providing for a more contiguous public land base and by encouraging such developments near communities.

Transportation planning and access needs would impact lands and realty management by increasing the number of ROWs issued per year to provide reasonable access to state and privately held lands.

Minimal impacts on lands and realty would be anticipated as a result of implementing management actions for livestock grazing. Livestock grazing activities would cause short-term impacts on reclamation efforts conducted under lands and realty management, because the areas reclaimed are often used by livestock as forage and travel corridors. The use of best management practices (BMP) to meet the

Wyoming Standards for Rangeland Health (USDI, BLM 1997) criteria would minimize any long-term effects.

The minerals program would have a very large impact on lands and realty. Impacts would include but not be limited to ROWs required for road systems and transportation systems for natural gas and other produced liquids, as well as for oil and gas facilities. In addition, areas that are closed to mineral leasing, have NSO stipulations, or are otherwise identified as unsuitable for surface disturbance or occupancy would be managed as ROW avoidance or exclusion areas. Minerals management actions, because they are so numerous in specific parts of the planning area, would potentially affect the location of subsequent ROWs. Existing leases and minerals activity and facilities could preclude the ability to sell or exchange public land parcels. The duration of the impact would be directly related to the level of potential mineral production on these parcels.

Recreation-related demands on public lands could increase the need for land exchanges to consolidate public land ownership. In addition, the presence of recreational sites would preclude the location of certain ROWs, thereby impacting the lands and realty program. Overall, there would be minimal impacts on lands and realty from recreation management.

Implementing management actions for vegetation and soil could place land use restrictions on some areas. Achieving a high level of species diversity, meeting the Wyoming Standards for Rangeland Health for vegetation, and preventing or minimizing soil erosion could result in the relocation or redesign of ROWs. These potential impacts would be small scale and localized in sensitive vegetation and soil areas.

Managing the field office to meet VRM objectives could affect the location, route, height, and color of proposed ROWs and associated facilities. Additional effort would be required to design projects to meet the objectives of the specific VRM class designation of an area in which a ROW is proposed. Because ROWs would generally be compatible with VRM Class IV objectives, this classification would allow increased opportunities for ROW authorizations. This is also true for VRM Class III objectives; however, some additional project planning may be necessary within VRM Class III areas to ensure that the landscape is partially retained. Any ROWs proposed in VRM Class II areas would be subject to intensive mitigation and, in some cases, could be precluded.

Management of fish and wildlife habitat and Special Status Species would impact uses administered by the lands and realty program through the implementation of mitigation measures designed to protect species and wildlife habitat. Implementing species-specific conservation measures for BLM-Sensitive plant and animal species and prohibiting actions that affect threatened or endangered species could result in the relocation of proposed ROWs to avoid these habitat areas.

Potential impacts from all SD/MAs, whether existing or proposed, would usually be minimal and would vary by the management prescriptions associated with each designated SD/MA. Intensive management of SD/MAs would potentially affect the lands and realty program by altering ROW locations. WSAs would cause the greatest restriction on lands and realty management actions, while the other SD/MAs would place fewer restrictions on such actions.

4.5.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 1.

There would be impacts from minerals management as a result of the RFD of 7,192 wells. The demands for ROW authorizations for oil and gas facilities, including but not limited to pipelines and roads, would impact lands and realty management.

VRM classifications would affect the location of new ROWs and facilities. ROW projects would be designed to meet the objectives of the VRM class established for the project area. Most ROWs and facilities would be compatible with VRM Class III (187,070 acres) and VRM Class IV (641,140 acres). In VRM Class I (21,290 acres) and VRM Class II (73,430 acres) areas, ROW actions would be limited and would require mitigation to ensure that the project or surface disturbance did not attract the attention of the casual observer (Map 2-14).

Mitigation measures to protect wildlife resources, threatened and endangered (T&E) species, and habitats would impact the potential disposal of lands. Seasonal closures would result in short-term impacts on lands and realty actions in sensitive areas such as the big game crucial winter range (approximately 501,620 acres) and greater sage-grouse nesting habitat (approximately 392,880 acres). Year-round restrictions and no surface-disturbing activities in areas such as sensitive aquatic and critical habitats would restrict the location of ROWs and land disposal actions over the long term. Areas with NSO restrictions would not meet the disposal criteria.

Sensitive wildlife habitats, such as white-tailed prairie dog towns, would be avoided to the extent possible, thereby limiting placement of ROWs and facilities. However, ROW avoidance and exclusion areas would be considered on a case-by-case basis, based on their level of sensitivity.

ACECs would be managed as ROW avoidance or exclusion areas. Geophysical exploration would be limited to portable methods and/or existing roads and trails. Both of these actions could cause the lands and realty program to reroute ROWs, and these actions would also limit the effectiveness of geophysical exploration.

4.5.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 2.

Cultural resource management would prohibit lands and realty actions on communal big game kill sites, Oregon Trail inscription sites, rock shelters, and Native American burial locales and TCP sites. Lands actions would be prohibited or would require special mitigation measures within one-quarter mile or the visual horizon (whichever is nearer) of the Lander Trail and the Sublette Cutoff Trail and also within one-quarter mile of contributing segments of these trails. This could result in the rerouting of ROWs and in additional costs to ROW proponents and could also result in prohibiting other lands and realty authorizations. Under Alternative 1, these restrictions do not occur; therefore, this alternative would be more restrictive and have more impact on the lands and realty program.

Under this alternative, land tenure adjustments would be considered on a case-by-case basis, according to the criteria in Appendix 13. This action would increase the ability to exchange land, thereby increasing the potential for community and economic expansion. This action might also increase the potential for sale or exchange of isolated tracts of land, thereby facilitating management of the lands and realty program. Proposals for water disposal pits would also be considered on a case-by-case basis, whereas under Alternative 1, no water disposal would be authorized. This would affect the number and type of ROW applications.

Impacts resulting from minerals management would be more extensive and would impact a larger portion of the planning area than under Alternative 1, because under this alternative, there would be both fewer restrictions on use and increased development opportunities (RFD of 7,804 wells). This alternative would provide the greatest opportunity for mineral development and production, allowing more areas to be open to all types of mineral development, which would increase land use. This would in turn impact lands and realty management through the increased demand for ROW authorizations.

Impacts from VRM would be similar to those under Alternative 1, except approximately 13,720 more acres would be designated as VRM Class II, which would increase the level of restrictions designed to protect visual resources and subsequently would decrease opportunities for ROW authorizations.

Impacts resulting from wildlife and fisheries management would be more restrictive on lands and realty programs. For greater sage-grouse, big game, sensitive species, and raptors in Intensively Developed Fields, Traditional Leasing Areas, and Unavailable Areas, the restrictions placed on development would result in more impacts and restrictions to lands and realty programs. The placement of ROWs, as well as the windows of opportunity for constructing them, could be affected by both seasonal restrictions and the presence of NSO areas.

Surface-disturbing activities would be prohibited at the Trapper's Point ACEC. All new ROWs would need to be routed around the ACEC. Routing for all new ROWs would need to go to the north side of the highway.

4.5.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 3.

Cultural resource management, as under Alternative 2, would prohibit lands actions on communal big game kill sites, Oregon Trail inscription sites, rock shelters, and Native American burial locales and TCP sites. Lands actions would be prohibited or would require special mitigation measures within 1 mile or the visual horizon (whichever is nearer) of the Lander Trail and the Sublette Cutoff Trail and also within 1 mile of contributing segments of these trails. This is an additional three-quarter mile area over that proposed under Alternative 2, and these restrictions could result in the rerouting of ROWs and in additional costs to ROW proponents and could also result in prohibiting other lands and realty authorizations. Under Alternative 1, these restrictions would not occur, and under Alternative 2, the restriction would be for one-quarter mile; thus, this alternative would be more restrictive and would therefore have more impact on the lands and realty program.

Under this alternative, only 790 acres of land would be considered for disposal through sale or exchange (Appendix 14), and 65,750 acres would be proposed for withdrawal (Table 2-26, p. 2-159; Map 2-23 and Map 2-25). These two actions would decrease the ability to sell land, thereby decreasing the potential for community and economic expansion. No lands would be suitable for Desert Land Entry (DLE). This action would not have much effect, because no DLEs have been authorized in the PFO for the past 20 to 30 years. Under this alternative, communication sites and alternative energy development would be authorized with more stipulations in place than under Alternatives 1 or 2. This could raise the cost for any proponents of either action. The additional stipulations would place more emphasis on resources such as wildlife and VRM.

Impacts resulting from minerals management would be less extensive and would impact a smaller portion of the planning area than under Alternative 1, because under this alternative, there would be both

increased restrictions on use and decreased opportunities for development. This alternative would provide the least opportunity for mineral development and production (RFD of 5,209 wells), thereby decreasing land use. This would in turn impact lands and realty management through the decreased demand for ROW authorizations.

The increase of 319,830 acres for VRM Class II impacts from visual resource management actions would increase the level of restrictions designed to protect visual resources and would subsequently decrease opportunities for ROW authorizations.

Impacts resulting from wildlife and fisheries management would be greater than under Alternative 1 because of an increased emphasis on habitat enhancement and protection, and because of additional restrictions on surface-disturbing and other disruptive activities. For greater sage-grouse, big game, sensitive species, and raptors in Intensively Developed Fields, Traditional Leasing Areas, and Unavailable Areas, the restrictions placed on development would result in more impacts on and restrictions to lands and realty. The placement of ROWs, as well as the windows of construction opportunity for building pipelines, roads, and so forth, could be affected by both seasonal restrictions and the presence of NSO areas. These restrictions would also affect structure types, heights, and locations. This would either decrease opportunities for ROW authorizations or increase the stipulations placed on ROW authorizations, which could increase cost to the proponents of these actions.

Under this alternative, SD/MAs would restrict opportunities for development and associated ROWs. There would be nine ACECs under this alternative. The emphasis of the ACECs would be to protect natural resources. Along with that emphasis, there would be more restrictions on ROWs. The Rock Creek ACEC would be a ROW exclusion area. In the Beaver Creek ACEC, all new roads and ROWs would be required to follow existing ROW alignments. The Trapper Point and New Fork Potholes ACECs would be closed to all surface-disturbing activities except those activities that benefit the natural resources, so these would also be ROW exclusion areas for all types of commercial activity. The Upper Green River ACEC would require the closure of the same length of road as is built, so that there is no net gain in road mileage. The White-tailed Prairie Dog ACEC would have intensive management for surface-disturbing activities and would also have more mitigation of and stipulations on all ROWs. The Ross Butte ACEC would prohibit new communication sites and would require new ROWs to follow existing disturbances. The Civilian Conservation Corps (CCC) Ponds ACEC would require proposed projects to be designed to maintain the integrity of big game migration routes. This would not affect underground ROWs, but it could have a large impact on aboveground ROWs. The East Fork River Wild and Scenic Rivers (WSR) Unit would be an exclusion area for ROWs. The Green River WSR Unit would be an avoidance area for ROWs; in other words, a ROW could go through this ACEC but only with intensive management in the form of mitigation and stipulations placed on the grant. Power projects would be prohibited immediately next to the WSR segment. Other ROWs within the WSR unit would be avoided. In addition, there would be consideration given to the exchange of state lands in SD/MAs such as WSAs and ACECs, which could further impact the disposal of lands over the long term by further expansion and permanent establishment of SD/MAs. However, these exchanges could also benefit the lands and realty program by consolidating appropriate lands to enhance the value of lands within the planning area.

4.5.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 4.

As under Alternatives 2 and 3, under this alternative, cultural resource management would prohibit lands actions on communal big game kill sites, Oregon Trail inscription sites, rock shelters, and Native

American burial locales and TCP sites. Also, lands actions would be prohibited or would require special mitigation measures within either one-quarter mile or the visual horizon (whichever is nearer) of the Lander and Sublette Cutoff Trails and also within one-quarter mile of contributing segments of these trails, except for linear crossings. This could result in the rerouting of ROWs and in additional costs to ROW proponents and also in prohibiting other lands and realty authorizations. Under Alternative 1, these restrictions would not occur; under Alternative 2, the restriction would be for one-quarter mile; under Alternative 3, the restriction would be for 3 miles. Thus, this alternative would be between Alternatives 2 and 3, as far as restricting and impacting the lands and realty program. The rerouting of a ROW could cause additional surface disturbance if it results in longer routes.

Under this alternative, only 790 acres of land would be considered for disposal through sale or exchange (Appendix 14), and 13,770 acres would be proposed for withdrawal (Table 2-26, p. 2-159; Map 2-31 and Map 2-34). These two actions would decrease the ability to sell land, thereby decreasing the potential for community and economic expansion, as compared to under Alternative 1. No lands would be suitable for DLE. This action would not have much of an effect, since no DLEs have been authorized in the PFO in the past 20–30 years. Communication sites and alternative energy development would be authorized with more stipulations in place than under Alternative 1. This could raise the cost for any proponents of either action. The additional stipulations would place more emphasis on resources such as wildlife and VRM.

Impacts resulting from minerals management would be less extensive and would impact a smaller portion of the planning area than under Alternative 1, because under this alternative there would be both increased restrictions on use and decreased opportunities for development. This alternative would provide slightly fewer opportunities for mineral development and production (RFD of 7,136 wells), thereby decreasing land use. This would in turn impact lands and realty management by decreasing the demand for ROW authorizations.

Under this alternative, impacts from VRM actions would be similar to those under Alternative 1, except that 166,090 more acres would be designated as VRM Class II, which would increase the level of restrictions designed to protect visual resources and subsequently decrease opportunities for ROW authorizations.

Under this alternative, impacts from wildlife and fisheries management would be greater than under Alternative 1 because of an increased emphasis on habitat enhancement and protection and additional restrictions on surface-disturbing and other disruptive activities. For greater sage-grouse, big game, sensitive species, and raptors in Intensively Developed Fields, Traditional Leasing Areas, and Unavailable Areas, the restrictions placed on development would result in more impacts and restrictions to lands and realty. The placement of ROWs, as well as the windows of construction opportunity for building pipelines, roads, and so forth could be affected by both seasonal restrictions and the presence of NSO areas. These restrictions would also impact structure types, heights, and locations. This would either decrease opportunities for ROW authorizations or increase the stipulations placed on ROW authorizations, which could increase cost to the proponents of these actions.

SD/MAs would restrict development opportunities and associated ROWs. There would be four ACECs under this alternative. The emphasis of the ACECs would be to protect natural resources. Along with that emphasis, there would be more restrictions on ROWs. The Rock Creek ACEC would be a ROW exclusion area. In the Beaver Creek ACEC, all new roads and ROWs would be required to follow existing ROW alignments. The Trapper's Point and New Fork Potholes ACECs would be closed to all surface-disturbing activities except those activities that benefit the natural resources, so these would also be ROW exclusion areas for all types of commercial activity. The Ross Butte MA would prohibit new communication sites and would require new ROWs to follow existing disturbance. The East Fork River WSR Unit would be an exclusion area for ROWs. The Green River WSR Unit would be an avoidance

area for ROWs; in other words, a ROW could go through this ACEC but only with intensive management in the form of mitigation and stipulations placed on the grant. In addition, there would be consideration given to the exchange of state lands in SD/MAs such as WSAs and ACECs, which could further impact the disposal of lands over the long term by expanding and permanently establishing the SD/MA areas further. However, these exchanges could also benefit the lands and realty program by consolidating appropriate lands to enhance the value of lands within the planning area.

4.6 LIVESTOCK GRAZING

This section presents potential impacts on livestock grazing from management actions for other resource programs. Chapter 3 (Section 3.6) describes existing conditions concerning livestock grazing.

4.6.1 Assumptions

The analysis is based on the following assumptions:

- Livestock grazing would occur throughout most or all of the planning area.
- Livestock grazing would be managed to meet the Wyoming Standards for Rangeland Health (USDI, BLM 1997).
- The type of grazing use would remain about the same.
- Range improvement projects would continue to be used to achieve rangeland management goals.
- Increasing oil and gas development may provide funding to mitigate impacts on livestock grazing.
- Range improvements would include the following types of projects: spring/seep development and protection, reservoirs and pits, wells, new or modified fencing, vegetation treatments, and pipelines.
- Reclamation efforts would be designed to provide sufficient livestock forage that maintains or exceeds current allocations. Livestock grazing stocking rates for the allotment could increase if warranted by increased forage and water availability.
- Large predators (gray wolf, grizzly bear) would increase their range and would impact livestock grazing on BLM allotments.
- Any changes in grazing management, including changes in grazing preference, would be based on rangeland monitoring and documented field observations, in accordance with grazing regulations (43 CFR §4110.3).
- Population increases in the Upper Green River Valley would result in additional subdivision of ranchlands.
- Population increases in the Upper Green River Valley would result in increased recreational use within grazing allotments.
- Livestock grazing is not considered a surface-disturbing activity.

4.6.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of rangeland resources within the planning area, existing rangeland health and range monitoring data, reviews of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of

quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

4.6.3 Impacts Common to All Alternatives

Environmental impacts associated with the alternatives would be caused by management activities within the planning area. Impacts on livestock grazing activities would generally be the result of activities affecting forage levels within grazing allotments. Other impacts could be those that affect actual grazing operations, such as impediments to allotment access and water access.

In general, management actions associated with cultural and paleontological resources affect relatively small, localized areas and would not have a measurable effect on livestock forage.

Increased understory production would occur as a result of timber harvest, by opening the forest canopy and increasing sunlight penetration to herbaceous vegetation, which would effectively increase available forage for livestock. Timber harvest activities, such as sawing, skidding, and road building, would displace livestock and remove forage. Most roads and skid trails would be reclaimed, thereby reestablishing forage. However, a few roads would remain following logging activities, which would cause a minimal permanent loss of forage, along with better access for livestock within an allotment. These impacts would be minor and localized because of the limited amount of forested area overall.

Disturbance of 3.6 acres per mile of pipeline construction would occur, assuming the ROW width is 30 feet. Pipeline construction generally would result in a temporary loss of forage, because reclamation would restore herbaceous vegetation within 2 to 5 years following construction activities.

Loss of AUMs would occur if large blocks of land were disposed of or if land exchanges resulted in acquisition of lands distant from affected allotments. Most land disposals and land exchanges would be on isolated tracts. Large acreages of land disposal or exchange are not anticipated. This would have only a minor impact on livestock grazing operations.

Impacts from livestock grazing would primarily be related to annual forage removal by grazing livestock. Pasture and herd rotational grazing and other BMPs are intended to improve livestock dispersal throughout the rangelands; to control the season, duration, and intensity of grazing; and to achieve range condition objectives. The intent of any applied practices and projects would be to improve the condition (quality or quantity) of the forage, thereby enhancing grazing management flexibility. Indirect effects of using grazing BMPs would include increased conception rates among livestock, higher weaning weights, lower animal veterinary costs, and reduced stress on livestock. These practices could also increase costs to the livestock operator associated with increased livestock herding and maintenance of improvements.

Applying appropriate guidelines to grazing operations to comply with the Wyoming Standards for Rangeland Health would affect livestock operators on those allotments for which there is a documented determination of not meeting the Standards for reasons attributable to grazing. Such adjustments could include season-of-use changes, changes in stocking rates, implementation of improved grazing management practices (e.g., growing season deferment, riparian pastures, and exclosures), forage utilization limits, and conversions in kind or type of livestock. Such management changes could typically result in increased operating costs to the livestock operator. Meeting the Standards could result in increased water availability and forage production, which would benefit livestock through improved animal distribution, more animals gaining weight, and increased conception rates.

Range improvements would enable the implementation of grazing plans, which would generally improve the distribution of livestock and achievement of long-term livestock and resource management goals.

Disturbances related to oil and gas drilling and related operations could result in short-term forage loss. Disturbed areas would undergo reclamation efforts as soon as practical following the disturbance. Reclamation practices would be designed to restore any loss of forage. Typically, livestock concentrate on newly reclaimed areas and forage utilization decreases on the native rangeland. Temporary adjustments of active use or temporary closures may be warranted when the realization of reclamation objectives is slow. The construction and improvement of roads would provide livestock operators with better access to their livestock and would enhance their ability to maintain improvements. Dust from these roads would coat forage adjacent to the roads, which would reduce the palatability of the forage. In addition, airborne dust could cause respiratory problems for nearby livestock. During the construction of pipelines, livestock could possibly fall into construction trenches, causing injury or death. If water quality were sufficient, produced water from oil and gas activities could be made available for livestock use in some areas, consistent with the State of Wyoming's objective to utilize produced water for livestock, wildlife, and other uses.

Oil and gas development activities, including the construction of well pads, pipelines, facilities, and transportation systems, could result in significant disturbance to soils and vegetation. The potential for considerable acres of vegetation disturbance could result in a long-term loss of significant amounts of available forage in the absence of adequate reclamation, especially where surface well spacing exceeds 16 wells per section. Reclamation efforts associated with projects of this magnitude could require more than 10 years to achieve success. Even with successful reclamation, there could be permanent loss of available forage in the form of limited or lost access to grazing areas because of the development of roads and industrial facilities. This could result in temporary or long-term closure of affected allotments or in significant reductions in grazing preference in developing or producing gas fields.

Geophysical exploration activities would disturb only a minimal amount of livestock forage.

Mining of other leasable, salable, and locatable minerals could result in loss soil and vegetation, which could result in a loss of forage. Reclamation of these lands would return the grazing lands to the production levels found prior to development.

Recreational activities would impact livestock grazing management through direct human disturbance. Human disturbance could include animal displacement and injury or death to animals caused by vehicle collisions and shooting.

Soil management actions would generally enhance vegetation through reducing erosion and improving soil conditions, which would increase forage available for livestock. Where rangeland monitoring data indicate that accelerated erosion exists or that soil cover (vegetation and litter) is insufficient and could be improved through changes in livestock management, appropriate changes would be required to improve vegetation cover and reduce impacts on soils to meet the Wyoming Standards for Rangeland Health. Effects on livestock operations would result from the implementation of grazing management practices designed to protect vegetation and soil resources. These impacts would be site-specific, but would generally increase management actions and short-term costs for livestock operators, while preserving the long-term viability of soil and vegetation resources.

OHV use would impact livestock grazing management through direct human disturbance. These impacts could include animal displacement and injury or death to animals caused by vehicles. It is also expected that incidental damage to range improvements and unplanned livestock movement as a result of gates left open would occur as a result of OHV use.

Vegetation management actions designed to enhance vegetation production, age class, structural diversity, and plant community health would benefit livestock grazing by increasing forage availability and improving livestock distribution and animal performance. Vegetation manipulation projects would be designed to reach or maintain rangeland health requirements outlined in the Wyoming Standards for Rangeland Health, but could also result in short-term reductions in available forage. Vegetation management could also result in grazing management adjustments to the season and duration of use, affecting the operators' overall grazing operation.

Prevention and treatment of invasive species and noxious weeds would maintain or improve plant community health. These actions could temporarily displace livestock and reduce the available forage. BMPs for livestock grazing would be implemented to discourage the introduction and spread of invasive species.

Projects designed to enhance watershed health would enhance vegetation resources by reducing erosion and improving water quality, thereby increasing forage levels for livestock. However, adjustments in livestock management could be needed to meet or maintain riparian habitat requirements, PFC, and water quality objectives. These adjustments could include grazing deferments, season-long rest, and fencing of riparian areas, or other adjustments determined appropriate for the specific area in question. These activities could reduce management flexibility and increase costs in areas where streams are not properly functioning or where water quality objectives are not being met until these goals are obtained. The potential long-term effect of meeting these goals would be an increase or maintenance of forage and water availability.

Wildland fire would have varying effects on livestock grazing, depending on fire size and intensity, the time of year the fire occurs, and fuel moisture content. Wildland fire would initially displace livestock, and depending on the proximity of livestock to the wildland fire, livestock could be stressed, injured, or killed. Wildland fire would remove vegetation and decrease forage levels over the short term. However, over the long term, fire would generally improve forage production, especially when effective postfire management efforts are implemented. Wildland fire could also damage livestock improvements, such as fences and corrals, which would necessitate short-term management changes.

Prescribed fire would be used to reduce or rejuvenate shrub cover and increase the herbaceous forage available for grazing animals. Over the long term, this action would increase management flexibility and improve grazing distribution. Prescribed fire would result in the short-term deferment of livestock grazing to allow for vegetation recovery. However, for a period of time after a fire, enhanced forage availability and production would be realized as herbaceous vegetation would temporarily replace woody shrub species.

Wildlife habitat management activities would generally affect livestock grazing through potential grazing management changes intended to control livestock distribution and utilization of crucial habitats. Uneven distribution of big game would cause some grazing allotments to receive a disproportionate amount of use by wildlife within the entire planning area, which could further necessitate adjustments in livestock management. Sensitive wildlife habitats (e.g., greater sage-grouse leks, white-tailed prairie dog towns, and big game crucial winter ranges) would also influence location, design standards, the timing of construction, and the cost of range improvements.

Water developments designed to provide new water sources for wildlife would increase water availability for livestock and would promote improved distribution of both livestock and wildlife. Large reservoirs capable of supporting fisheries provide a reliable source of water to livestock through drought periods. Protection of springs, seeps, and adjacent riparian areas from grazing animals would provide cleaner and more dependable water sources for livestock.

Fisheries management actions, such as stream restoration and fish reintroduction, have the potential to impact livestock grazing through the construction of exclosures and riparian pastures. In addition, adjustments in livestock management such as in the timing and duration of pasture use could be needed to ensure adequate fish habitat. These adjustments could reduce the amount of forage available for livestock use.

4.6.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 1.

Additional forage would be available for livestock grazing in forested areas, which could improve distribution of use across forested allotments.

Pipeline construction would disturb an average of 430 acres per year. Therefore, disturbance from pipelines over 20 years would total of 8,613 acres. About 51 AUMs for forage could be lost to pipeline construction in any one year. Most of these losses would be short term, because reclamation would replace livestock forage within 3 years of pipeline construction. About 153 AUMs at a time could be lost to pipeline construction if the success rate of reclamation remains the same.

Under this alternative, 6,300 acres would be available for disposal, which could result in a loss of approximately 741 AUMs if all of these disposals were to proceed. These losses would be reduced if exchanges were conducted, and the areas acquired were suitable for and offered for livestock grazing.

Under this alternative, the level of forage removal from livestock grazing is expected to maintain existing rangeland conditions, including a sustainable forage base.

The 20,991 acres of unallocated forage in the planning area would be available for livestock allocation on a case-by-case basis. This could increase the number of available AUMs by 2,470, distributed over small parcels. The actual increase in forage availability would be less because livestock are already using many of these areas; often the unallocated areas are the result of fences not being located along landownership lines. Most of these parcels are too small to be used as alternative pastures following a wildland fire or during times of drought. In many cases, the costs for fencing the parcels to control livestock use would far exceed the fees that would be received from authorized grazing use.

Closing vegetation treatment areas for two growing seasons after such treatment to allow vegetation to recover would reduce livestock management flexibility and increase costs to livestock operators during the time of closure, but it could result in long-term benefits to the forage base.

Maintaining six elk feedgrounds on public lands in the planning area would continue the separation of elk and livestock on winter feed lines and limit the destruction of private hay by elk, to the extent that success is currently being achieved. Keeping elk and cattle separated would help to prevent the transmission of brucellosis from elk to cattle, although concentrating elk on the feedgrounds could encourage spread of the disease among the elk.

4.6.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 2.

The additional timber harvesting proposed under this alternative would increase the benefits to livestock grazing and would enable the historic stocking level to continue. There would be 9,467 additional forested acres actively managed to reach these levels. This would include intensive management of aspen woodlands, which would prevent conifer encroachment and allow greater herbaceous production in the understory. Precommercial thinning of 50 acres per year would also prevent the forest canopy from completely closing, allowing for additional herbaceous forage growth.

Road construction resulting from oil and gas development would disturb 11,256 acres (1,317 AUMs), and pipeline construction would disturb 9,351 acres (1,094 AUMs). The impacts from pipeline construction and borrow areas of roads would be temporary, because reclamation would return herbaceous vegetation to the disturbed areas following construction. Long-term disturbance would remain on 7,434 acres (870 AUMs) across the planning area.

A total of 5,000 acres would be available for disposal by sale under this alternative. Disposal of all these areas could result in the loss of 588 AUMs, unless lands suitable for livestock grazing were received in exchange for the disposed lands and then offered for grazing.

Suspended nonuse AUMs (Table A20-1) would be activated, resulting in more livestock grazing on public lands in the planning area. Up to 55,000 AUMs would be restored from suspended status to active use. This could result in a downward trend in rangeland condition, which from a general standpoint would be measured through changes in plant community composition. Forage increases realized through grazing management prescriptions and range improvement practices would likely be consumed by the increase in permitted livestock use.

Fewer areas would be available for OHV travel (Map 2-21) as compared to under Alternative 1, resulting in fewer incidences of displaced livestock and of damage to range improvements. Fewer land use restrictions and greater opportunities for access would result from increased development and an expanded road network within the planning area.

Permitting livestock grazing in riparian and other exclosures and removing existing exclosures would provide additional forage in these areas and could increase livestock management flexibility. Up to 100 AUMs (about 0.1% of the currently available grazing use) could be made available for livestock grazing across the planning area through removal of exclosures (approximately 75 acres, mostly in riparian areas). This would be a negligible benefit.

The additional fire suppression efforts under this alternative would lessen the area of wildland fire effects, temporary forage losses, and postfire livestock management problems. The protection of range improvements would take precedence over the benefits of natural fire, reducing the potential for fire to destroy range improvements. The long-term enhancements in forage availability and production produced by wildland fire would be realized over fewer areas. Lack of rest of treated areas could lead to unsatisfactory vegetation recovery or to the spread of undesirable or noxious species.

Elimination of elk feedgrounds located on BLM-administered public lands (six elk feedgrounds) would result in more elk wintering out on sagebrush ridges and other native winter ranges. The increase of livestock grazing AUMs under this alternative could result in less forage available in elk crucial winter habitats. Winter survival and reproductive rates among elk could be reduced, potentially resulting in reductions in elk populations. It is also likely that many elk would resort to feeding on private haystacks and commingling with livestock on feed lines. The risk of brucellosis transmission between the species would thereby increase.

An increase in SD/MA designations and associated management actions would increase effects on livestock grazing compared to those under Alternative 1. Management of the Trapper's Point ACEC would include limitations on surface disturbance, which would limit development of range improvements in these areas. This would be a minor impact on the livestock grazing program.

4.6.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be expected under Alternative 3.

Impacts resulting from fire and fuels management would be similar to those under Alternative 2, except that there would be an emphasis on restoring the natural role of fire to the ecosystem. This would enable a long-term balance of herbaceous and woody vegetation, thereby providing for a stable forage source for livestock.

Under this alternative, less timber would be harvested than under either Alternatives 1 or 2. The same amount of thinning would occur under this alternative as under Alternative 2. These factors would result in less overall herbaceous forage in forested areas.

Approximately 790 acres would be available for disposal. Disposal of all designated areas could result in a loss of 93 AUMs, unless there were lands suitable for livestock grazing received in exchange for the disposed lands. This would not result in a considerable number of AUMs in any given allotment.

Active AUMs would be reduced to 84,000. This would result in fewer animals grazing on public lands within the planning area and could represent a significant reduction of utilized AUMs in some areas. This would reduce operating flexibility for permittees. The Wyoming Standards for Rangeland Health could be more easily achieved in some areas under reduced grazing pressure. While a large reduction, using the average actual use since 1988 as a basis for the reduction would mean that larger voluntary reductions had been taken roughly half the time during the last 18 years. In practicality, the reduction would not require a sudden change in physical livestock numbers, but a paper documenting the amount of use during a cycle of drought and wet years over almost 2 decades.

Designing range improvements to principally support wildlife and waterfowl habitat and watershed objectives and generally not impact big game winter ranges would increase design and construction costs of improvements. This would also affect the location of the improvements; some proposed projects could not be placed in the most optimal location for livestock benefit but would be placed to benefit other programs instead. This could require more intensive livestock management and could increase construction and maintenance costs.

Closing the Rock Creek ACEC to livestock grazing would remove livestock from the Rock Creek pasture of the Upper North LaBarge individual allotment. Approximately 290 AUMs would be lost to the grazing permittee, necessitating a reduction in livestock numbers or a shorter season of use in the Upper North LaBarge individual allotment.

Incorporating deferments and/or periods of rest into allotments where grazing begins prior to June 1 would result in operating changes for permittees, including delayed turnout onto allotments, increases in project maintenance, and increased herding activities. These changes would allow for forage species to complete their reproductive cycles, which would maintain the health of the rangeland and its ability to support livestock numbers. There would be increased operating costs for livestock permittees.

Establishment of forage reserve allotments would increase the flexibility and opportunity to conduct vegetation treatments. Benefits of a more intensive vegetation treatment program would include greater diversity in vegetation species and age classes over the landscape and increased perennial herbaceous forage production and vigor in the long term. Livestock management on more productive range sites could become less labor intensive. Conversely, resting allotments following treatment would temporarily decrease the overall AUMs available to livestock operators.

Closing campgrounds and recreational sites to livestock grazing would result in minimal loss of forage in certain allotments and would remove about 15 AUMs of forage from availability for livestock grazing across the planning area. This impact would be negligible.

Additional seasonal and year-round OHV closures could further inhibit livestock operators from accessing livestock and range improvements for maintenance and construction.

More restrictions and fewer opportunities for access would result from decreased development and a limited road network within the planning area.

Construction of new exclosures to help achieve riparian and vegetation objectives would result in small losses of forage to the livestock grazing program. New exclosures would also increase the fence maintenance needs in allotments where they are built, and could create obstacles to moving livestock efficiently through and between allotments.

Eliminating the use of chemicals to control noxious weeds would result in a greater rate of spread of weeds, because most mechanical and biological controls are not effective or rapid enough to control the spread of weeds. Invasion and establishment of noxious weeds could result in decreased hydrologic function and loss of grazing capacity.

Resting vegetation treatment areas for 1 year prior to treatment and 2 years posttreatment would result in short-term limitations in livestock management options and temporary reductions of livestock grazing in treated areas. Vegetation community and production recovery in treated areas would be enhanced, increasing the posttreatment grazing capacity of treated lands in the long term. Designing vegetation treatments to reestablish the natural role of fire in the ecosystem would generally enhance forage availability for livestock grazing in the long term. Strict livestock management would be needed in the short term following wildland fire, to enable prescribed fires to occur.

Management emphasis on Special Status Plant Species and their habitats could alter grazing management through restrictions on placement of improvements, utilization patterns, season and duration of use, or other aspects of livestock management.

Designating 169,570 acres near the Lander Trail as VRM Class II would inhibit the development of some range improvements. Range improvements that would affect the viewshed or the setting of the trail would not be allowed within 3 miles of the trail, which would restrict the use of fences and water developments and would potentially alter grazing management practices. Because the trail crosses the entire planning area, this impact would be widespread over many allotments.

Making approximately 21,000 acres of unallocated parcels of public lands unavailable for livestock grazing would necessitate fencing most of the parcels to control ongoing unauthorized use. This intensity of fencing around mostly small (2- to 5-acre) parcels would create impediments to wildlife movement, would be difficult to maintain, and would cost more than the value of the forage on those parcels.

Actions designed to reduce the need for elk feedgrounds through habitat improvement would result in increased management of livestock grazing in these areas. Less available forage for livestock in historic elk wintering areas could result.

The exclusion of livestock from elk parturition areas between May 1 and June 30 would require fencing, management actions such as herding, changes in season of use, or closure of allotments. This would increase rangeland management costs. This seasonal restriction could reduce the risk of transmission of brucellosis between elk and cattle.

Prohibiting range improvements in the WSR units would have little or no impact on livestock grazing in the Scab Creek, Silver Creek, and East Fork River WSR areas, as these areas are seldom reached by livestock and are generally unsuitable for most range improvements. The requirement that new range improvements enhance the outstandingly remarkable characteristics of the WSR would make development of range improvements more difficult in the Green River WSR Unit. The combined impacts of WSR designation and recreation management in the Green River access sites could make livestock grazing difficult to manage in the Spade allotment.

4.6.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 4.

Impacts resulting from forest management would be the same as those identified under Alternative 2.

The impacts from the following activities would be similar to those impacts described under Alternative 3: fire and fuels management, transportation and access management, establishment of forage reserve allotments, the closure of campgrounds and recreational sites to livestock grazing, the closure of existing and new exclosures to livestock grazing, the incorporation of deferments and/or periods of rest into allotments where grazing begins prior to June 1, measures to improve elk habitat adjacent to elk feedgrounds, the exclusion of livestock from elk parturition areas between May 1 and June 30, and designation of the WSR units.

Range improvements would be evaluated for their impact on the viewshed of the Lander Trail. These restrictions could inhibit construction of fences and water developments, which would potentially alter grazing management and result in a reduction of utilized AUMs.

Resting vegetation treatment areas for 2 years after treatment would result in limited short-term livestock management options associated with prescribed burning and temporary reductions of livestock grazing in treated areas. Vegetation community and production recovery in treated areas would be enhanced, increasing the posttreatment grazing capacity of treated lands in the long term.

Livestock could be excluded from unallocated public lands, which would result in a loss of potential forage for livestock.

Management actions to achieve or maintain a seral stage appropriate for the maximum benefit of Colorado River cutthroat trout (CRCT) could alter the management of livestock in CRCT habitat areas. Livestock management strategies could include reduced forage allocation, deferred or shortened grazing periods, the use of riparian pastures, increased cattle herding, increased fencing, and development of upland water.

Increased emphasis on maintaining and improving habitats for sensitive species would result in limited range improvements and adjustments in livestock management where grazing activities impact the integrity of the species or their habitat.

4.7 MINERALS

4.7.1 Leasable Minerals

Mineral resources include fluid and solid minerals leased for development under the Mineral Leasing Act of 1920 and amendments; locatable minerals that may be claimed and patented under the 1872 Mining Law; and common-variety mineral materials that may be purchased by private parties or used for free by public agencies and nonprofit groups under the Materials Act of 1947 (as amended). The preceding laws apply only to federal-owned minerals and are not intended to suggest or give BLM jurisdiction over state-owned or privately owned minerals.

This section describes potential impacts on the management of mineral resources from management actions for other resource programs. Chapter 3 (Section 3.7) describes existing conditions concerning mineral resources.

Assumptions

The analysis is based on the following assumptions:

- Oil and gas leasing, exploration, and development would continue to occur in the planning area during the planning period.
- Leaseholders have the right to explore, develop, and produce mineral resources from any valid, existing lease, even if the area containing the lease were proposed to be closed to future leasing.
- A valid, existing mineral lease is a legally issued lease secured by a leaseholder before the effective date of the record of decision (ROD) for this RMP/Environmental Impact Statement (EIS).
- Surface use restrictions, including timing limitation stipulations (TLS), NSO stipulations, and controlled surface use (CSU) stipulations, as well as unavailable for leasing designations, cannot be retroactively applied to valid, existing oil and gas leases or to valid, existing use authorizations (e.g., Application for Permit to Drill [APD]). Postlease actions/authorizations (e.g., APDs, road/pipeline ROWs), however, could be encumbered by TLS and CSU restrictions on a case-by-case basis, as required through project-specific NEPA analysis or other environmental review.
- Leasable mineral resources would be considered unrecoverable in areas designated unavailable for leasing. They would also be considered unrecoverable in areas open to leasing but where surface use constraints prohibit development operations on areas larger than can be technically and economically developed from offsite locations. Leasable mineral resources within leased in-holdings would be considered recoverable.
- Oil and gas development potential is based on the following Wyoming State Office Reservoir Management Group (RMG) categories:
  - Very high potential for hydrocarbon development (Map 4-1) indicates areas where the average well density is anticipated to be more than 500 wells per township (36 square miles).
  - High potential for hydrocarbon development (Map 4-1) indicates areas where the average well density is anticipated to be more than 100 wells per township.

  - Moderate potential for hydrocarbon development (Map 4-1) indicates areas where the average well density is anticipated to be between 20 and 100 wells per township.
  - Low potential for hydrocarbon development (Map 4-1) indicates areas where the average well density is anticipated to be less than 20 wells per township.
  - Very low potential for hydrocarbon development (Map 4-1) indicates areas where the average well density is anticipated to be less than two wells per township.
  - No potential for hydrocarbon developments (Map 4-1) indicates areas where no wells are anticipated.
- Other than the depletion of hydrocarbon reserves through authorized fluid mineral leasing, development, and production operations, the resource management actions developed through this plan would not physically impact the subsurface oil and gas resources in the planning area.
- The primary impact on the leasable minerals program from the land use decisions in this plan would be a reduction in the availability of the hydrocarbon resources for extraction and consumer use. This would result in an increase in the cost to the producer and consumer.
- Directional drilling could be used to access hydrocarbon resources under areas constrained by surface use restrictions (e.g., 25% slopes, within 500 feet of riparian areas, NSO restrictions for elk feedgrounds, within a one-quarter mile CSU zone around greater sage-grouse leks) that necessitate relocating wells outside the drilling window established by the Wyoming Oil and Gas Conservation Commission (WOGCC).
- Directional drilling viability and offset distance varies with the target formation, the top depth of the target formation, and formation productivity (currently on the Pinedale Anticline, for instance, directional drilling is reaching offset distances of 2,200 to 2,500 feet).
- For the purposes of this document, resources more than one-half mile inside the boundary of an NSO area would be considered unavailable for hydrocarbon extraction.
- Directional drilling would potentially increase well development costs by approximately 10% to 15% for offset distances of up to 2,000 feet (Eustes 2004).
- Directional drilling can result in unrecoverable hydrocarbon resources in cases when the drill stem gets irretrievably stuck and the production casing cannot be set to the bottom of the production formation.
- No coal leasing or development is anticipated.
- Demand for salable minerals would occur over the next 20 years at increased levels.
- No development of other solid leasable minerals (trona, oil shale, or phosphate) is anticipated.

Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, reviews of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software, and the results were quantified where possible (refer to Table 2-32, Areas of Fluid Mineral Lease Conditional Requirements by Hydrocarbon Potential [Approximate Federal Subsurface Acres] for Conventional Oil and Gas, p. 2-169 and Table 2-33, Areas of Fluid Mineral Lease Conditional Requirements by Hydrocarbon Potential [Approximate Federal Subsurface Acres] for CBNG, p. 2-176). The oil and gas development potential (RFD) for Alternatives 1 through 4, as well as the unrestricted development potential (only standard lease stipulations would be required), were developed by RMG and are shown in Table 4-2. RMG correlated

the projected oil and gas recovery estimates for the unrestricted development base and for each alternative (Tables A10-4 and A10-5 in Appendix 10). RMG also developed the fluid mineral development potential, which reflects the number of wells anticipated to be developed in a township (36 square miles) during the planning period (e.g., in an area with high development potential, where between 100 and 500 wells would be anticipated for an average township over the planning period). (See the Assumptions above for the complete range of development potentials.) In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or are described in qualitative terms if appropriate.

Table 4-2. Total Number of Well Locations (Pads) by Alternative—Federal Minerals Only (RFD)

Alternative	Total Number of Single Well Pads (CBNG)	Total Number of Single Well Pads (non-CBNG)	Total Number of Multiple Well Pads (non-CBNG)	Total Number of Well Pads
Unrestricted Development[1]	518	4,800	369 pads (2,585 wells)	5,687 pads (7,903 wells)
Alternative 1	430	4,732	290 pads (2,030 wells)	5,452 pads (7,192 wells)
Alternative 2	504	5,110	310 pads (2,190 wells)	5,924 pads (7,804 wells)
Alternative 3	300	3,436	210 pads (1,473 wells)	3,946 pads (5,209 wells)
Alternative 4	465	4,671	285 pads (2,000 wells)	5,421 pads (7,136 wells)

[1] Only standard lease stipulations would be required
Source: BLM-Wyoming RMG, 2006.

Impacts Common to All Alternatives

Prescriptions and restrictions developed under each of the alternatives for surface resource management and protection would impact the rate of exploration, development, and extraction of leasable mineral resources. These prescriptions and restrictions would also increase the cost, to both the producer and the user of the end products, of exploring for, developing, and extracting those mineral resources.

Seasonal and surface use restrictions that cause increased well development costs, or that render oil and gas resources unavailable or unrecoverable, can also impact geophysical exploration. The primary impact would be increased costs to the operator through the use of more expensive but less surface-disturbing techniques, such as small, portable foot- or helicopter-transported drills, in areas where vehicle-based geophysical operations are prohibited. If an operator is deprived of the opportunity to collect geophysical data, development location decisions would be based on old or nonexistent information, and the chance of drilling unsuccessful wells would increase. This results in both increased expense to the operator and in nonproductive disturbances to the land and surface resources.

In addition to the prescriptions developed through this plan, there are additional in-place prescriptions, restrictions, and prohibitions imposed on leasable mineral development by existing oil and gas field development NEPA documents, including but not limited to the ROD for the Jonah Infill Project, the ROD for the Pinedale Anticline, and the ROD for the Big Piney/LaBarge Coordinated Activity Plan (CAP). The decisions in these documents are retained by reference in all alternatives of this RMP. The

impacts on leasable minerals development are disclosed in those guiding NEPA documents and are essentially the same as those described below.

All alternatives have NSO and CSU restrictions on a portion of lands available for mineral leasing, which preclude surface occupancy. Development of the mineral resources in these areas would require offsite methods such as directional drilling. The equipment and personnel for directional drilling increase development costs by 10% to 15%. Directional drilling also increases the risks of drilling problems (such as stuck casings) and diminished well production.

Of the 141 directional wells drilled by EnCana in the Jonah Field between 2002 and 2005, the drill stem/casing became stuck on 121 wells (86%). Of these, 39 became stuck at an average of 288 feet above the bottom of the hole and 82 became stuck at the targeted bottom-hole depth. The down-hole stuck casing problems and the attempted correctives increased the well development cost an average of about $250,000 over and above the cost of the directional wells drilled where no appreciable down-hole problems occurred. Of the 39 wells that became stuck above the targeted total depth, 33 were completed and put into production either without getting the hole drilled to total depth or without getting the production casing to the total productive formation depth. EnCana estimates the gas volume lost by the inability to produce these wells from their targeted depths to be approximately 360 million cubic feet (MMCF) per well or 11.95 billion cubic feet (BCF) for all 33 wells. This example captures one moment in time by one operator. Other operators may or may not have similar results or experiences.

Emission mitigation would be required under all alternatives to reduce impacts on air quality, visibility, and potentially climate change. The best available drill rig technologies would be used to lessen rig emissions. This would result in a reduction of air quality impacts from oil and gas development operations. However, implementing these requirements could result in greater operating costs and could make some resources less attractive to develop.

If future analysis determines that the mitigation has not been sufficiently effective to prevent emissions from oil and gas exploration and development from exceeding national or Wyoming ambient air quality standards, the development of additional wells could be in jeopardy.

Typical impacts from cultural resource management actions on oil and gas exploration and development would include increased well development costs associated with cultural resource inventories, relocation of projects (well pads, roads, pipelines) to avoid a cultural site, implementation of offsite drilling (directional drilling) techniques, and/or site excavation if avoidance is not possible. Discovery of previously undocumented cultural features during project construction would delay project implementation while the site is evaluated.

Forest management actions under all alternatives would have a negligible impact on mineral leasing or development.

Under all alternatives, lands and realty management actions would impact fluid mineral development by providing ROWs for access roads and power lines to well pads and for gas transportation pipelines from well pads. Federal regulations require that access roads, power lines, or pipelines crossing one lease to access another be permitted through a ROW grant. Without such grants, operators would not be able to legally access some well pads.

Oil and gas exploration and development often occur within grazing allotments. Oil and gas operators would have to abide by mitigations that would be specified in lease stipulations or in the conditions of approval (COA) for those operations. Mitigation measures within grazing allotments would increase the cost of oil and gas exploration and development. These measures would include providing for the upkeep

and repair of fences and gates; reclaiming surface disturbance areas with native grass and forb species to prevent erosion and replace lost forage; monitoring and treating weeds and other non-native, invasive plant species that occupy areas disturbed by oil and gas development and production; and taking measures to prevent loss or injury to livestock. Livestock mitigation would not be expected to substantially affect the technical or economic viability of recovering hydrocarbon resources. The spring and fall seasonal restriction on the Cora Stock Driveway (4,160 acres) prohibits the leaseholder from developing the leasable mineral resource during those seasons. The Cora Stock Driveway has a low to moderate development potential for conventional oil and gas and a very low potential for CBNG; therefore, the overall impact on mineral resource development would be low.

Fluid mineral (leasable) exploration, development, and production activities would occur under all alternatives. The mineral resources actually extracted would lead to an irreversible and irretrievable depletion of reserves. The ability to manage the volume of water produced during these activities would impact fluid mineral development. The disposal of drilling fluids, well completion (frac) fluids, and produced water must adhere to WDEQ and WOGCC regulations. Drilling and frac fluids would typically be evaporated in the on-location reserve pit and the remaining solids would be buried in place. Produced water would typically be transferred to a WDEQ-approved disposal pit or injection well. Reserve pit fluid could also be transferred to WDEQ-approved disposal facilities. The transfer and disposal of fluids at WDEQ-approved disposal sites would increase costs and could affect the viability of developing and producing fluid mineral resources. There would be a larger impact if there were insufficient disposal pit and injection well capacity to handle the volume of water that would be produced by the number of wells projected under each alternative.

Federal minerals overlaid by privately owned lands could be leased for mineral development in areas available for lease. If these areas were explored or developed, industrial activity could occur on the lands and could include road and well pad construction, operation of drilling rigs, and installation of pipelines.

Wildland fire management actions under all alternatives would have a minimal impact on the development and production of oil and gas resources. Fire management within the planning area would concentrate fire suppression in areas with high resource or human values, and as such would reduce the potential for catastrophic wildland fires in oil and gas fields. Fuel reduction management would also reduce the potential for catastrophic fires. In spite of concentrated fire suppression and fuel reduction projects, there would still be a potential for a wildland fire or an out-of-control prescribed fire to reach a well pad. Should this happen, on-location facilities could be damaged or destroyed. Stored hydrocarbon resources such as condensate would likely be consumed.

Management actions to protect wildlife and fish and their habitats would have moderate to high impacts on the development and production of leasable minerals (Tables 2-32 and 2-33). Seasonal restrictions would have the most serious impacts in terms of acres affected.

The restrictions would also delay fluid mineral product extraction and delivery to the consumer. In addition, activity during the seasons that are open to development and production is typically accelerated to compensate for the seasonal downtime, which creates the potential for overloading local service and emergency resources and also creates a greater potential for interactions with any wildlife species using the area during this period.

Currently, drilling time in the planning area varies depending on well depth, from a few days for shallow wells to between 55 and 70 days for wells up to 14,000 feet deep. In portions of the planning area, potential hydrocarbon-bearing zones extend to 20,000 feet or deeper. The drilling time to reach these depths could exceed 6 months. Where these zones overlap areas that have wildlife-related restrictions on winter activity, the drilling time required could exceed the window of opportunity for conducting

unrestricted drilling; hence, these seasonal restrictions would potentially preclude the exploration and development of valuable hydrocarbon resources. Where the deep zones overlap areas that have greater sage-grouse nesting and winter restrictions, the drilling window is reduced from 5 and a-half months to 3 and a-half months. To drill a deep well while having only a 3 and a-half-month drilling window would require that activity to extend over two or more drilling seasons, which would result in the operator being subjected to two or more sets of move-in and rig-up costs, as well as other inefficiencies.

In portions of the planning area, natural gas occurs in separate, vertically stacked, disconnected sandstone lenses (i.e., minireservoirs). Severe timing limitations (e.g., a 3 and a-half-month-long drilling window) limit the number of wells that could be drilled in a year and prolongs the total time needed to develop a field. In projects involving disconnected sandstone lens or minireservoir configurations, a well bore may contact some lenses and totally miss others. As the contacted lenses are produced, the pressure in these lens decreases. As new well bores are drilled, they will contact untapped lenses, but may also contact producing lenses that have reduced formation pressure. This could result in pressure differential problems, which could lead to stuck casings and lost well control. Drilling problems decrease development efficiency, increase drilling costs, and reduce the overall recovery efficiency for natural gas. This problem would be most acute in the Pinedale Anticline and Jonah Fields, as well as in other geologically similar areas. Although it would be difficult or impossible to estimate the volumes of potentially lost gas resources, they could be considerable. This problem would occur under any drilling scenario, short of drilling all the necessary wells at the same time, which is obviously not reasonable or practical, but the problem would be most prevalent in areas where the drilling window is 3 and a-half-months long.

Areas with existing, proposed, or candidate T&E plant and animal species and their habitats would be managed to keep the proposed and candidate species from becoming listed as T&E and to keep existing species populations and habitat from declining. Future species would be managed in the same way. New mineral leases and postlease actions on existing leases would be required to avoid degradation of the species and their habitat. Where species/habitat protection prohibits or restricts surface occupancy or disturbance, the development of leasable mineral resources in the restricted area would require the use of offsite development techniques such as directional drilling. Leasable mineral resources in areas beyond the technical or economic reach of offsite development methods would be considered unrecoverable.

Special Status Species inventories would be required for surface-disturbing projects in known or suspected Special Status Species habitat. The discovery of Special Status Species would potentially lead to a delay in the development and/or the relocation of well locations, access roads, pipelines, or ancillary facilities, as well as to the use of offsite development techniques. There are currently 930 acres of known sensitive plant habitat in the planning area. Across these habitat areas, the mineral development potential varies from very high to low for both CBNG and non-CBNG. Leaseholders/operators would be required to control weeds and other undesirable vegetation on areas disturbed by their mineral development actions. Weed control would add to the overall development costs but would not be expected to affect the overall economic viability of a well.

The Lake Mountain WSA (13,490 acres) and the Scab Creek WSA (7,710 acres) would be unavailable for fluid mineral leasing and development under all alternatives. Actions meeting the nonimpairment criteria would be considered. These WSA closures would render the underlying hydrocarbon resources unavailable for extraction and human use. According to the Pinedale Mineral Occurrence and Development Potential Report (2003), there is currently no potential for non-CBNG or CBNG hydrocarbon development in the Scab Creek WSA; therefore, this closure would not impact leasable minerals development. The western portion of the Lake Mountain WSA has a low potential for non-CBNG development, whereas the eastern portion has a moderate potential for non-CBNG development (including Madison Formation hydrogen sulfuric acid [H_2S]). The entire Lake Mountain WSA has a very

low potential for CBNG development. The Lake Mountain closure would potentially impact hydrocarbon production in the planning area. The Lake Mountain WSA contains eight existing leases or portions of leases held valid by production from wells located outside of the WSA's boundary. Six of the leases/portions of leases predate the passage of FLPMA in 1976 and therefore could sustain oil and gas exploration (including geophysical) and development under the Interim Management Procedures for WSAs. Development on the two post-FLPMA leases is precluded until a final wilderness determination is made. The unavailable for leasing designation would not preclude the holders of the six pre-FLPMA leases from developing those leases. The Lake Mountain WSA contains a 40-acre private in-holding and is partially bounded on the south by private surface ownership and on the west by state land. Mineral ownership on these parcels is either private or state. Should wells be developed on these private and state lands, there could be uncompensated drainage of federal mineral resources. Geophysical exploration would not be allowed on unleased lands in either WSA, unless it meets the nonimpairment criteria. This could limit an operator's ability to collect sound geophysical data on areas adjacent to the WSA.

Because of the low quality of the coal in the planning area and the thinness of the seams at or near the surface, no coal leasing or development is anticipated during the life of this plan. Therefore, no impacts on coal leasing or extraction are anticipated. Should it be determined in the future that coal resources in the planning area are suitable for leasing and extraction (mining), the impacts from the various surface disturbances would impact coal development in essentially the same way as they impact fluid mineral development under each of the alternatives. Because no coal leasing or development was assumed, no additional impact analysis for coal leasing or extraction was conducted.

Impacts Under Alternative 1, Continuation of Existing Management

This alternative would be the second least restrictive to oil and gas exploration and development activities. The 7,927 wells (federal minerals) projected under this alternative would potentially extract 19,104 BCF of natural gas and 157 million barrels of oil over the life of the plan, which is a 7% reduction in the projected number of wells and a 5% reduction in the projected gas and oil volume from the unrestricted estimates. Approximately 172,500 acres would be unavailable for fluid mineral leasing, exploration, development, or production. Existing leased in-holdings in this latter category would be available for exploration, development, and production as prescribed in the lease contract. Approximately 41,300 acres would be constrained by an NSO restriction. Under the NSO restriction, federal fluid minerals could be leased, but the leaseholder/operator would have to use offsite methods such as directional drilling to access the mineral resource. About 253,220 acres would be constrained by CSU restrictions. Under this designation, federal oil and gas minerals could be leased. Surface disturbance would be prohibited or restricted, but development could occur if the impact on the affected resource is mitigated. Approximately 1,026,780 acres would be available for leasing and development, but these activities would be constrained by TLSs, which limit the time of the year during which these activities can occur. About 187,540 acres would be available for fluid mineral leasing and development with standard lease stipulations.

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 1.

There would be minor impacts from cultural resource management actions on oil and gas exploration and development. NSO restrictions would be allowed on approximately 4,620 acres of selected communal big game kill sites (Trapper's Point), Oregon Trail inscription sites, rock shelters, and Native American burial locales and TCP sites (including 470 acres at the Boulder Lake Archeological District). Offsite drilling would be required to access oil and gas resources underlying these sites, which would incur the associated directional drilling impacts. Vehicle-based and shot-hole geophysical operations would be prohibited, but geophysical cable laying would be allowed. Based on Maps 4-1 and 4-2 (from the Pinedale Mineral

Occurrence and Development Potential Report, January 2003), most of these sites are within areas of low to moderate development potential. The site located in the Big Piney/LaBarge oil and gas field has moderate to high potential for natural gas and CBNG development. The Boulder Lake Archeological District has low to no potential for non-CBNG development and very low to no potential for CBNG development. Because of the generally low potential for development and the small size of these site areas, the impacts on fluid mineral exploration, development, and production from the management of these sites would be minimal.

Contributing segments of the Lander Trail and Sublette Cutoff Trail would be encumbered by a CSU stipulation that prohibits surface disturbance, including geophysical vehicle or shot-hole operations within one-quarter mile or the visual horizon, whichever is closer (geophysical cable laying by hand-crews on foot is allowed). The Sublette Cutoff has a low to moderate potential for both non-CBNG and CBNG development. The Lander Trail has a moderate potential for non-CBNG development in the LaBarge Platform area and on the flanks of the Pinedale Anticline, a high potential for non-CBNG development on the Pinedale Anticline, and a low potential for non-CBNG development elsewhere. The Lander Trail CBNG development potential varies from high in South Piney Creek Canyon, to moderate in Deer Hills, to low near Marbleton, and to very low elsewhere. To meet the one-quarter-mile setback and trail management criteria, operators would be required to consolidate multiple wells onto a single pad and to employ directional drilling, thus increasing development costs as previously described. Development of oil and gas resources underlying the rest of the Lander and Sublette Cutoff Trail system NSO area would require directional drilling and could potentially result in some fluid mineral resource being unrecoverable.

A 400-acre TCP funerary site would be unavailable for leasing and geophysical operations. The underlying fluid mineral resources would be considered unrecoverable. The development of federal wells on the south, west, or north sides of this site could result in unauthorized drainage of the underlying hydrocarbon. This loss would be somewhat mitigated because the product would be included in the gas volume legally extracted from the lease containing the wells. Consequently, the product would be accounted for and royalties collected. There would be loss of lease fees that would have been generated by auctioning the parcel for lease. The east side of the site is private surface and private minerals. The site area has a moderate potential for non-CBNG development and a very low potential for CBNG development. Drainage of federal hydrocarbon resources underlying the site through a private well would constitute an irretrievable loss of resource.

OHV management actions would impact the exploration for and development of leasable minerals, by restricting surface-disturbing activities on about one-third of the federal mineral acreage to a November 15 to April 30 (6 and a-half-month) development window, by instituting a year-round closure in some areas, and by precluding unauthorized human presence in other areas (Map 2-13). Approximately 13,620 acres (Scab Creek WSA, Rock Creek ACEC, and Holden Hill) would be closed year-round to OHV use, which would preclude oil and gas exploration (including geophysical) and development. The Scab Creek WSA has no potential for either CBNG or non-CBNG development. The western portion of the Lake Mountain WSA has a low development potential for both CBNG and non-CBNG; the eastern portion has a moderate development potential for non-CBNG and a low development potential for CBNG. The Holden Hill closure has a moderate development potential for non-CBNG and a low development potential for CBNG.

Approximately 577,850 acres would be closed to OHV use from November 15 to April 30. This corresponds with big game crucial winter range closures and precludes surface-disturbing activity, including oil and gas development, during this time. This would seasonally limit the extent of exploration (including geophysical operations) and development that could occur in these areas. Within the big game winter range OHV seasonal closure, the Bench Corral area and elk feedgrounds would not only be closed

to surface-disturbing activities, but would also be closed to unauthorized human presence from November 15 through April 30 annually. This would potentially impact production operations, such as pumper access, workover rig, and condensate/produced water hauling, as well as geophysical exploration in the closure area during the closure period. The closure would not restrict emergency access, nor would it prevent operations required to protect human and environmental safety. The leasable minerals development potential in the winter range OHV seasonal closure areas for non-CBNG varies from low to high and for CBNG from very low to high. The Bench Corral area and the Franz and North Piney elk feedgrounds have a very low potential for CBNG development and a moderate potential for non-CBNG development. The Fall Creek and Scab Creek elk feedgrounds have no potential for either CBNG or non-CBNG development. (Note: The elk feedgrounds are encumbered by an NSO restriction, for which impacts are discussed in Section 4.17—Wildlife and Fish Habitat.)

Approximately 247,250 acres would be open to OHV use year-round. OHV use on an additional 662,060 acres would be limited to existing roads and trails. OHV use that is open and limited to existing roads and trails would have no to minimal impact on leasable minerals development.

The impact of paleontological resource protections on leasable minerals exploration (including geophysical operations) and development would be minimal. If paleontological resources were discovered during an inventory, they would be managed according to BLM procedures. Avoidance of important paleontological resources would be accomplished in a manner similar to cultural resources, by such measures as relocation of access roads, drill pads, pipelines, and other ancillary facilities. Avoidance would possibly require delays in developing the resource and/or would result in directional drilling. Actions to close or restrict areas for fossil protection, or the development of RNAs or NNLs, would likely preclude or restrict leasable minerals development. Depending on the size of the protected area, or on the size of the RNA or NNL, the underlying hydrocarbon resources could be rendered technically or economically unrecoverable.

Vehicle-based geophysical operations could be prohibited in areas with known paleontological resources and in areas with a high potential to contain paleontological resources. Geophysical data source points would avoid paleontological sites. The data points would be either moved away from the site or skipped entirely. Depending on the size of the avoidance area and the geophysical data collection parameters, paleontological site avoidance could result in gaps in the subsurface geology data that are collected.

The one-quarter-mile no surface disturbance restriction around developed recreational sites would preclude leasable minerals development on about 2,060 acres (Tables 2-32 and 2-33). Extraction of the underlying hydrocarbon resources would require more expensive and higher risk offsite techniques such as directional drilling. The hydrocarbon development potential for designated campsites is as follows. The Warren Bridge (110 acres) and Upper Green River campgrounds (all sites located in the Upper Green River SRMA acreage) have a low potential for non-CBNG development and a very low potential for CBNG development. Boulder Lake/Boulder Lake Boat Ramp/Stokes Crossing (1,370 acres) has low to no potential for non-CBNG development and very low to no potential for CBNG development. The New Fork campground (470 acres) has a low potential for non-CBNG development and a very low potential for CBNG development. For both CBNG and non-CBNG development, the Huston Boat Access (450 acres) has a low potential; the Fear Boat Access (180 acres) has a moderate potential; and the Scab Creek campground (130 acres) has no potential. Recreation impacts on geophysical exploration would be minimal, because operations could be conducted using the existing roads and trails with the campgrounds.

Within the Boulder Lake SRMA (5,790 acres), a one-quarter-mile NSO restriction would be applied to protect the established recreational sites and campgrounds (see impacts above; also refer to Tables 2-32 and 2-33). The rest of the SRMA would be open to leasing with a CSU restriction. Geophysical operations would be considered on a case-by-case basis; consequently, impacts cannot be projected at this

time. Should the NSO and CSU restriction areas be wider than the technical/economic reach for directional drilling, some hydrocarbon resources may be rendered unrecoverable. Based on the oil and gas development potential for this area (i.e., low to none for non-CBNG production and very low to none for CBNG production) (Pinedale Mineral Occurrence and Development Potential Report, 2003), the NSO and CSU restrictions for the Boulder Lake SRMA would have minimal impacts on leasable minerals production for the planning area.

The portion of the Scab Creek SRMA outside the WSA (10,750 acres) and the Upper Green River SRMA (5,160 acres) would both be open to oil and gas leasing with CSU stipulations, which would potentially require the use of higher cost directional drilling techniques and procedures. Should the avoidance areas be wider than the technically feasible reach for directional drilling, some leasable mineral resources would be rendered unrecoverable. The portion of the Scab Creek SRMA within the WSA boundary would be closed to oil and gas leasing (see Impacts Common to All Alternatives, above). As with the Boulder Lake SRMA, the impact on hydrocarbon production in the planning area from the restrictions for the Scab Creek SRMA would be negligible because of the projected development potential (i.e., none for non-CBNG or CBNG development) (Tables 2-32 and 2-33). Potential impacts on non-CBNG development in the Upper Green River SRMA would be higher than in the Scab Creek SRMA because the northern portion of the SRMA has a moderate potential for non-CBNG development (Map 4-1). Impacts on geophysical operations would be the same as those under the Boulder Lake SRMA.

The CCC Ponds area (500 acres) would be open to oil and gas leasing with CSU stipulations within one-quarter mile of the ponds (Tables 2-32 and 2-33). Development potential, development criteria, and the impact on leasable minerals management, including geophysical operations, would be similar to that under the Boulder Lake SRMA.

Under this alternative, soils and watershed management actions, as prescribed by Appendix 2, would impact leasable minerals development and vehicle-based geophysical operations by restricting surface disturbance to slopes with less than 25% inclines, and by prohibiting disturbances within 500 feet of wetland/riparian and live water areas, including springs, seeps, and livestock water developments. These restrictions and prohibitions would cover 156,150 acres. Extraction of subsurface mineral resources from these areas would require more costly and higher risk offsite operations such as directional drilling. Where the size of those areas with restrictions related to steep slopes, wetland/riparian, and live water makes those areas' resources beyond the technical or economic reach of offsite methods, the unreachable mineral resource would be considered unrecoverable. The 25% slope incline and riparian restriction areas are located throughout the planning area and encompass the full range of potential for mineral development, from no potential along the Wind River Front MA to high potential in the Jonah and Pinedale Anticline Fields. Geophysical data collection in these areas would require nonvehicle-based operations such as heli-portable shot-hole drilling. This increases the exploration cost to the operator and the end product cost to the hydrocarbon consumer.

Under the management actions prescribed for access and transportation management, some existing roads could be closed. Closure of duplicative roads would have minimal or no impact on leasable minerals exploration, development, or production.

Approximately 13% of the federal surface and mineral estate in the planning area would be designated as VRM Class II. Because surface disturbance activities in VRM Class II areas can be visible but must not attract the attention of the casual observer, meeting this objective would require relocating certain projects, combining them in areas out of view, or otherwise mitigating them. Relocation would then require the use of directional drilling to reach the original target. If the relocation is to an area where the resources are beyond the technical and economic reach of directional drilling, some mineral resources could become unrecoverable.

About 37% of the federal surface and mineral estate in the planning area would be VRM Class III. Under this classification, the level of change in the landscape can be moderate. Projects can be visible, but still should not dominate the viewshed. Less impacting measures such as facility design, arrangement, and coloration may be sufficient to meet the VRM Class III objectives. Facility design that requires the retooling and manufacture of new components when standard components are available could increase the project cost borne by the leaseholder/operator. Extensive redesign could render some oil and gas wells uneconomic. Some project relocation could still be required. Relocation impacts would be the same as previously described.

The remaining 49% of the federal surface and mineral estate would be designated as VRM Class IV. Under this classification, the level of change and visibility can be high, but measures should still be taken to reduce the visibility. Centralized facilities, facility arrangements, and coloration should meet the VRM Class IV objectives. Project relocation warranting directional drilling would typically not be needed. The potential for fluid mineral development varies from low to high across the VRM Class II, III, and IV designated areas.

The development of roads, pipelines, well pads, and other leasable minerals facilities would be restricted and/or prohibited within 100-year flood plains (43,250 acres) and within 500 feet of open or live water, wetland/riparian areas, and livestock water sources such as springs, reservoirs, and water wells (156,150 acres) (Tables 2-32 and 2-33). These restrictions and/or prohibitions would potentially result in the relocation of these facilities. Where directional drilling is used to access hydrocarbon resources under wetland/riparian, live water, and livestock water sources, the cost of development would be the same as previously described. In addition, as previously described, hydrocarbon resources beyond directional drilling capabilities would be unrecoverable under current technology. Surface use would be restricted in the Soap Holes Basin (10,390 acres) to prevent increased salinity discharge to the Green River. Leaseholders would be required to design their construction equipment and facilities to prevent any discharge from their operations reaching the Green River. This could entail offsite development operations such as directional drilling. Some areas may not be reachable, in which case the fluid mineral resources could be unrecoverable. This restriction would not apply to state or private activities. Fluid mineral development on either of these ownerships that adjoin federal mineral estate could result in a noncompensated loss of federal mineral resources. The Soap Holes Basin has a low potential for CBNG development and low to moderate potential for non-CBNG development.

The application of seasonal restrictions (November 15 through April 30) on crucial winter range (636,390 acres) would prohibit lease development activities (drilling, well completion, pad construction) on encumbered leases for nearly one-half of each year. Surface-disturbing and other disruptive activities would also be prohibited in suitable nesting habitat (422,830 acres) within 2 miles of active greater sage-grouse leks from February 1 through July 31, in big game parturition areas (134,520 acres) from May 1 through June 30, and in raptor nesting habitat (22,390 acres) from February 1 though July 31. The short season for development severely limits the operator's/leaseholder's ability to enter into long-term contacts with drill rig contractors, and this results in less rig availability and increased development costs through multiple mobilization costs and higher costs to secure drilling and completion equipment and resources during the May through mid-November peak drilling season. Development potential on the seasonal habitats varies from no potential for CBNG and non-CBNG along the Wind River Front to high potential for CBNG in the South Piney/Fish Creek area and to high potential for non-CBNG on the Mesa and Riverside portions of the Pinedale Anticline. The Big Piney/LaBarge CAP area is identified as having a moderate potential for both CBNG and non-CBNG development (Compare Map 2-1 to Maps 4-1 and 4-2 to compare wildlife seasonal restrictions).

Hydrocarbon extraction in the elk feedground NSO areas (15,460 acres) would potentially require the use of directional drilling, which would increase the risk of drilling problems, well failure, and the total cost

of well development by approximately 10% to 15%. Hydrocarbon resources in areas beyond the technical and economic reach of directional drilling or those rendered unreachable by down-hole problems would become unrecoverable. Development potential varies from no potential for both CBNG and non-CBNG on the Scab Creek and Fall Creek elk feedgrounds, to moderate potential on the North Piney, Finnegan, and Bench Corral elk feedgrounds for non-CBNG, and to moderate potential on the Finnegan elk feedground for CBNG. Greater sage-grouse leks occur throughout the planning area; consequently, the fluid mineral development potential of these areas would vary broadly.

Activity between 8:00 p.m. and 8:00 a.m. would not be allowed within one-half mile of active leks during strutting season, March 1 through May 15 (Table 4-3). This action would preclude leasable minerals activity in these areas during this time period, but would not appreciably limit the availability of land for development of leasable minerals.

Table 4-3. Greater Sage-Grouse Lek Buffer Acreages (116 Total Leks)

Lek Buffer Size	Acres (BLM Land Only)
One-quarter mile	32,090
2 miles	520,720
3 miles	624,560

The greater sage-grouse protection restrictions would delay fluid mineral product extraction and delivery to the consumer. Phased development would potentially decrease efficiency and increase development costs to the operator through the costs incurred by multiple mobilizations, as well as higher costs incurred to secure drilling and completion equipment and resources during the limited drilling season. When areas with greater sage-grouse nesting restrictions overlap areas with big game crucial winter range restrictions, the oil and gas operator would potentially be restricted to a 3-and-a-half-month construction, drilling, and well completion season. This short drilling and development window in areas such as the Pinedale Anticline has led to accelerated operations, which results in congested traffic on primary access roads and a potential overload on local service and emergency resources. It also causes a yearly bust-and-boom cycle for the local communities as crews move in during the open development window then leave when the seasonal restrictions are invoked.

The portion of the Rock Creek ACEC (4,580 acres) within the Rock Creek watershed and the portion of the ACEC west of the watershed boundary fall completely within the Lake Mountain WSA (13,490 acres) and would not be available for leasing (Tables 2-32 and 2-33). See Impacts Common to All Alternatives for additional information.

The Beaver Creek ACEC (3,590 acres) would prohibit construction within 1,000 feet of streams and on slopes greater than 25% (Tables 2-32 and 2-33), which would require directional drilling to extract hydrocarbon resources. Should the avoidance areas be wider than the technical and economic reach for directional drilling, some hydrocarbon resources may be rendered unrecoverable. The Beaver Creek ACEC has a moderate potential for non-CBNG development and a high potential for CBNG development. Any unreachable resources would reduce the production potential for the planning area. The cost impacts of directional drilling would be as previously discussed. Vehicle-based geophysical operations would be restricted to existing roads and trails. To collect data in areas off existing roads and trails, the geophysical operator and leaseholder/operator would have to use more expensive heli-portable techniques.

The federal mineral estate within the Wind River Front leasing moratorium area (243,040 acres) would be unavailable for oil and gas leasing. Consequently, any underlying hydrocarbon resources would not be available for consumer use. Wells developed on private or state lands within or adjacent to the Wind River Front would potentially drain federal minerals, which would constitute an irretrievable loss. Based on the 2003 Pinedale Mineral Occurrence and Development Potential Report, the Wind River Front has low to moderate potential for non-CBNG production and very low to no potential for CBNG production.

Appendix 2 states that surface-disturbing activities may be prohibited within one-quarter mile of occupied dwellings. This would require conducting leasable minerals development activities from locales outside this restriction area. Offsite development would likely require methods such as directional drilling, provided such offsite methods are technically and economically feasible. An indirect impact would be that offsite methods typically have higher failure rates, drilling problem rates, and development costs than vertical onsite drilling. See Impacts Common to All Alternatives for additional information.

Table 4-4 and Table 4-5 show the acres available for leasing by development potential for conventional oil and gas and CBNG, respectively, under Alternative 1. See Maps 4-1 and 4-2 for conventional oil and gas and CBNG potentials and Map 2-1 for oil and gas leasing classification under Alternative 1.

Table 4-4. Lands Available for Conventional Oil and Gas Development (Alternative 1)

Development Potential	Subsurface Acres Available[1]
Very High	34,640
High	96,360
Moderate	485,040
Low	413,573
No Potential	0

[1] Acres available are a combination of lands open to leasing with standard lease terms, lands open to leasing with minor constraints, and lands open to leasing with major constraints. Lands closed to leasing are not included in this table.

Table 4-5. Lands Available for CBNG Development (Alternative 1)

Development Potential	Subsurface Acres Available[1]
High	19,180
Moderate	118,880
Low	136,696
Very Low	718,870
No Potential	6,390

[1] Acres available are a combination of lands open to leasing with standard lease terms and lands open to leasing with minor constraints.

Impacts Under Alternative 2

This alternative would be the least restrictive to oil and gas exploration and development activities, because a larger percentage of the planning area would be available for leasing without major restrictions. The 8,465 wells (federal minerals) projected under this alternative would potentially extract 20,052 BCF of natural gas and 157 million barrels of oil during the life of the plan, which is a 1% reduction in the projected number of wells and projected gas and oil volume from the unrestricted estimates.

Approximately 175,750 acres of federal mineral estate would be available for intensive fluid mineral leasing, exploration, development, and production; approximately 999,440 acres would be designated Traditional Leasing Areas and available for restricted fluid mineral leasing, exploration, development, and production; and 21,850 acres would be unavailable for leasing, exploration, development, and production. Existing leased in-holdings in this latter category would be available for exploration, development, and production, as prescribed in the lease contract.

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 2.

There would be minor impacts from cultural resource management actions on oil and gas leasing exploration and development. No surface occupancy would be allowed on approximately 4,080 acres of selected communal big game kill sites, Oregon Trail inscription sites, rock shelters, and Native American burial locales and TCP sites (including the Boulder Lake Archeological District). Vehicle-based and shot-hole geophysical operations would be prohibited, but geophysical cable laying would be allowed. Based on Maps 4-1 and 4-2, most of these sites are within areas of low to moderate development potential. Some of these sites are located in the Big Piney/LaBarge oil and gas field and have moderate to high potential for natural gas and CBNG development. The Boulder Lake Archeological District has low to no potential for non-CBNG development and very low to no potential for CBNG development. Because of the generally low potential for development and small size of these site areas, the impacts on fluid mineral exploration, development, and production from management of them would be minimal. Offsite drilling would be required to access oil and gas resources underlying these sites, which would incur the associated directional drilling impacts.

The impacts from management of the Lander Trail and the Sublette Cutoff would be the same as those identified under Alternative 1.

The impact of paleontological resource protection on leasable minerals exploration (including geophysical operations) and development would be minimal. If paleontological resources were discovered during an inventory, they would be managed according to BLM procedures. Avoidance of important paleontological resources would be performed in a manner similar to that used for cultural resources, such as by relocating access roads, drill pads, pipelines, and other ancillary facilities. This would possibly require delays in developing the resource and/or result in directional drilling. Impacts on geophysical operations would be the same as those described under Alternative 1.

Impacts on leasable minerals development associated with developed campgrounds and the Boulder Lake (5,790 acres), Scab Creek (18,460 acres), and Upper Green River (5,160 acres) SRMAs would be the same as those described under Alternative 1. CCC Pond management would not impact leasable minerals development.

This alternative would not contain a soils management restriction for slopes greater than 25%; consequently, there would be no corresponding impact on leasable minerals development.

The Rock Creek ACEC designation would not be retained. The portion of the ACEC that occurs inside the Lake Mountain WSA boundary would remain part of the WSA (see Impacts Common to All Alternatives for WSA impacts). The portion of the ACEC that extends outside of the Lake Mountain WSA would be available for oil and gas leasing and development. Mineral development on portions outside the WSA would not be impacted.

The Beaver Creek ACEC would not be retained. Mineral management would not be impacted.

The Trapper's Point ACEC (550 acres) would be unavailable for mineral leasing and development. Underlying mineral resources would be unavailable for production. Portions of that ACEC are bounded by private and state mineral ownerships. Fluid mineral development in either of these ownerships that adjoin the federal mineral estate could result in a noncompensated loss of federal mineral resources. The Trapper's Point ACEC has a low potential for CBNG development and low to moderate potential for non-CBNG development. There are no existing leases in the ACEC area. The ACEC adjoins parts of private or state mineral estates. Mineral extraction from these nonfederal areas could result in drainage of federal hydrocarbon resources, which would constitute an irretrievable loss of resources.

In the event that portions of any ACEC in the planning area would require reclassification to offset drainage or for other reasons, the converted area would be managed under the objectives and management actions established through a site-specific NEPA analysis.

VRM classifications (Map 2-20) would place fewer restrictions on mineral development in the planning area because approximately 91% of the land would be either VRM Class III (118,390 acres) or VRM Class IV (717,390 acres). There would be no VRM Class I areas and therefore no Class I impacts on mineral development. VRM Class II (87,150 acres) would account for 9% of the planning area (Map 2-20 and Table 2-29, p. 2-164). Although the size of the areas with specific VRM classifications are changed under this alternative, the impacts associated with management of VRM Class II, III, and IV areas would be the same as those identified under Alternative 1.

Under this alternative, there would be no specific prescribed restrictions to surface disturbance or occupancy within flood plains, wetland/riparian, open water, or livestock water areas; however, adherence to Executive Order (E.O.) 11988 for flood plain management and E.O. 11990 for wetlands management would still preclude surface disturbance in these areas. Consequently, the impacts and affected acreage identified under Alternative 1 would also apply under this alternative. The 500-foot buffer to wetland/riparian, open water, or livestock water sources would not be applied. Surface discharge of produced water that meets WDEQ's freshwater quality criteria and permitting requirements could be allowed; therefore, the impact of insufficient disposal facilities for produced water would potentially be alleviated.

Wildlife and fisheries management actions to protect wildlife would have minor impacts on the development and production of leasable minerals. There would be no restrictions on activities in big game crucial winter ranges or parturition areas, in greater sage-grouse winter concentration areas, or near active leks. Occupied and suitable habitats for Special Status Species as well as for listed, proposed, and candidate T&E species would be protected. More land would be available for the development of leasable minerals, and management actions would be the least restrictive under this alternative compared to the other alternatives. Drilling to deep gas formations would not be impacted by the length of the drilling season, nor would the impacts of a short drilling season occur in the Lance Formation (disconnected lenticular sand lens) development in the Pinedale Anticline and Jonah Fields.

Table 4-6 and Table 4-7 show the percentage reductions of lands available for conventional oil and gas and CBNG development, respectively, under Alternative 2.

Table 4-6. Percent Change of Acres Available for Conventional Oil and Gas Development Under Alternative 2

Development Potential	Acres Available[1] (Alternative 1)	Acres Available[1] (Alternative 2)	Percent Change (%)
Very High	34,640	34,760	<1
High	96,360	103,900	8
Moderate	485,040	500,860	3
Low	413,570	510,060	2
No Potential	0	41,160	NA

[1] Acres available are a combination of lands open to leasing with standard lease terms, lands open to leasing with minor constraints, and lands open to leasing with major constraints. Lands closed to leasing are not included in this table.

Table 4-7. Percent Change of Acres Available for CBNG Development Under Alternative 2

Development Potential	Acres Available[1] (Alternative 1)	Acres Available[1] (Alternative 2)	Percent Change (%)
High	19,180	19,190	<1
Moderate	118,880	119,280	<1
Low	136,696	167,570	23
Very Low	718,870	819,230	14
No Potential	6,390	63,580	895

[1] Acres available are a combination of lands open to leasing with standard lease terms, lands open to leasing with minor constraints, and lands open to leasing with major constraints. Lands closed to leasing are not included in this table.

Impacts Under Alternative 3

This alternative would be the most restrictive to the development of leasable minerals, primarily because a larger amount of the planning area would be unavailable for leasing and a greater array of leasable minerals development activities would be subject to NSO, CSU, and timing stipulations (Tables 2-32 and 2-33). These actions would potentially lead to the relocation and/or delay in the development of well locations, access roads, pipelines, or ancillary facilities. As established in the Impacts Common to All Alternatives, Impacts from Alternative 1, and Impacts from Alternative 2, fluid mineral resources underlying lands unavailable to leasing and without remnant existing leases would be unrecoverable. Development of resources underlying areas unavailable for leasing but with remnant existing leases would require substantial mitigation, or these resources would require offsite development actions such as directional drilling, and there would consequently be an increase in development costs. Leased hydrocarbon resources located beyond the technical or economic reach of directional drilling would be considered inaccessible and therefore unrecoverable.

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 3.

The 5,209 wells (federal minerals) projected under this alternative would potentially extract 16,730 BCF of natural gas and 130 million barrels of oil during the life of the plan, which is a 28% reduction in the projected number of wells and an 18% reduction in the projected gas and oil volume from the unrestricted

estimates. Approximately 67,210 acres would be available for intensive fluid mineral leasing, exploration, development, and production; approximately 420,780 acres would be designated Traditional Leasing Areas and would be available for restricted fluid mineral leasing, exploration, development, and production; and 723,200 acres would be unavailable for leasing, exploration, development, and production. Existing leased in-holdings in this latter category would be available for exploration, development, and production as prescribed in the lease contract.

Cultural resource management actions would require that approximately 4,080 acres of federal mineral estate within communal big game kill sites, Oregon Trail inscription sites, rock shelters, select rock alignments, rock art sites, and Native American burial locales and TCP sites, as well as within 1 mile of the Lander Trail and the Sublette Cutoff Trail (65,670 acres), would be unavailable for leasing and geophysical exploration. (Note: Geophysical exploration could legally be conducted on any existing lease within these areas.) These areas would also be encumbered by NSO restrictions. Because the designation as unavailable for leasing and geophysical exploration is a more stringent measure than an NSO restriction, the impacts on the fluid mineral resource would be based on the more stringent restriction. Accordingly, federal mineral resources (fluid) within the areas unavailable for leasing would be unrecoverable and consequently would not be available to contribute toward the national demand for fluid mineral products. Development potential for CBNG on these sites/areas varies from no potential for sites and trail segments along the Wind River Front to a very high potential for sites and trail segments in the South Piney Creek area on the Wyoming Range Front. Non-CBNG development potential varies from low along the Wind River Front to high along the crest of the Pinedale Anticline. The leasing availability would not apply to or affect existing, valid leases, but would apply when new leases are issued. The NSO restriction could impact postlease actions (APDs, ROWs, and geophysical Notices of Intent [NOIs]), unless imposition of the restriction would deprive the leaseholders of their legal right to develop any existing leases in the restriction area. Where the NSO restriction is applied, fluid mineral development would require offsite (directional drilling) techniques. Leasable mineral resources beyond the technical or economic reach of offsite methods would become unrecoverable. There would be a potential for an unrecoverable loss of federally owned hydrocarbon resources where unleased federal mineral estates adjoin private or state mineral estates.

The 6-mile-wide VRM Class II designation (169,570 acres) for the Lander Trail would potentially affect well pad, production facility, road, and pipeline placement within this corridor to meet the VRM Class II objectives. Where the terrain does not provide visual screening of mineral development facilities from the viewpoint of the trail, those facilities could be required to be located outside the VRM Class II buffer or in visually screened areas within the buffer. Fluid mineral resources beyond the reach of offsite development techniques would be unrecoverable. Impacts related to an unrecoverable loss of federal mineral resources because of drainage from nonfederal leaseholds would be the same as previously described.

Under this alternative, paleontological and natural history resource management prescriptions would result in the same impacts as under Alternative 1.

Recreation management strategies that set a one-half-mile NSO area around developed recreational sites would preclude leasable minerals development on approximately 2,760 acres (Tables 2-32 and 2-33). Extraction of underlying hydrocarbon resources would require more expensive and higher risk offsite techniques such as directional drilling. Leasable mineral resources beyond the technical or economic reach of offsite methods would become unrecoverable. The hydrocarbon development potential for developed recreation areas is as follows. Warren Bridge (110 acres) and Upper Green River campgrounds (all sites in Upper Green River SRMA acreage) have a low potential for non-CBNG development and a very low potential for CBNG development. Boulder Lake/Boulder Lake Boat Ramp/Stokes Crossing (1,370 acres) has low to no potential for non-CBNG development and very low to no potential for CBNG

development. New Fork campground (470 acres) has a low potential for non-CBNG development and a very low potential for CBNG development. For both CBNG and non-CBNG, Huston Boat Access (450 acres) has a low development potential, Fear Boat Access (180 acres) has a moderate development potential, and Scab Creek campground (130 acres) has no development potential.

The restriction prohibiting geophysical vehicle travel within one-quarter mile of developed sites would potentially cause geophysical operators to skip data collection in these areas, which would degrade the quality of the subsurface data both from the sites and from up to a mile radius around the sites. This restriction would not preclude nonvehicular geophysical-based methods.

The Green and New Fork River SRMA (118,550 acres) would be unavailable for mineral leasing. The impacts would be the same as previously described for areas unavailable for leasing. The CBNG development potential for the Green and New Fork River SRMA would vary from low on the New Fork River and the Upper Green River to moderate on the Green River portion located south of Big Piney. The non-CBNG development potential would be moderate to high for the New Fork River segments near the Pinedale Anticline and low to moderate for the Green River portion. Vehicle-based geophysical operations would be restricted to designated roads and trails. This could result in degraded subsurface data if large areas are skipped, it or would necessitate the use of more expensive data collection methods that do not require vehicles.

In the event that portions of an SRMA require reclassification to offset drainage or for other reasons, the converted area would be managed according to the objectives and management actions used for Traditional Leasing Areas, as described in Chapter 2. Impacts on mineral development would be the same as those described for Traditional Leasing Areas.

Existing leases within the SRMAs could be developed under the lease terms. Postlease actions could be encumbered by additional seasonal or surface use restrictions or could be subject to project relocation, depending on surface resource values, a site-specific NEPA analysis, and the management actions prescribed in the RMP, provided those prescriptions do not preclude leaseholders from legally developing their lease. The impact of seasonal restrictions (e.g., winter range, sage-grouse/raptor nesting) would be the same as under Alternative 1. Project relocation impacts would be the same as those described above for similar actions.

Soils management actions would be implemented to limit erosion. There would be special emphasis on sensitive/highly erosive soils throughout the planning area and especially in the Ross Butte, Milleson Draw, Blue Rim, Long Island Watershed, and Red Canyon areas. Surface disturbance would be restricted on all slopes greater than 25% (124,030 acres) and would be prohibited on sensitive soils with slopes having inclines greater than 8%. The impacts on leasable minerals development from the 25% slope restriction would be the same as those described in the soils and watershed impact discussion under Alternative 1. As with slopes greater than 25%, mineral development on sensitive soils with slopes greater than 8% would necessitate the use of offsite development techniques. Fluid mineral resources in areas beyond the technical and economic capabilities of the offsite methods would be considered unrecoverable. The Milleson Draw, Blue Rim, and Long Island Watershed areas have very low to low CBNG development potential and low to moderate non-CBNG development potential. Red Canyon has a very low rating for CBNG development potential and moderate for non-CBNG development potential. Geophysical operators would be restricted to nonvehicle-based methods on slopes greater than 25% and on slopes greater than 15% where sensitive soils occur.

With the exception of the Red Dugway Road closures, the OHV closures discussed in Section 4.12 (Transportation, Access, and Travel Management) correspond with areas unavailable for leasing. The OHV designation would create no greater impacts on mineral development than those already discussed

for lands unavailable for leasing. The Red Dugway closure would not impact leasable minerals development because the Red Dugway Road already has slides and slumps that preclude heavy truck traffic, and current leaseholders have therefore secured alternate access across private land.

Vegetation management would require that known Special Status Plant Species locations (930 acres) be closed to surface-disturbing activities (including geophysical exploration); surface disturbance would be prohibited on potential habitat for Special Status Plant Species; and noxious weed control would be limited to biological or mechanical methods. Other vegetation management would be the same as under Alternative 1. With the exception of impacts related to weed control and geophysical operations, the impacts from Special Status Plant Species protection and vegetation management actions would be the same as those described in Impacts Common to All Alternatives. Biological weed treatments are not as readily available and typically are not as fast acting as chemical treatments. Mechanical methods of weed control are time and labor intensive, which limits the achievable volume of treatment. The prohibition on the use of chemical treatment for noxious weed control would potentially decrease treatment effectiveness and increase control costs. Closing Special Status Plant Species habitats to geophysical vehicles could cause geophysical operators to skip data collection in these areas, which would degrade the quality of the subsurface data collected both from the sites and from up to a mile radius around the sites.

Under this alternative, VRM classifications (Map 2-22) would be the most restrictive to mineral development in the planning area because approximately 44% of the land would be categorized as VRM Class I (21,290 acres) and VRM Class II (393,260 acres). Approximately 56% of the land would be categorized as VRM Class III (225,830 acres) and VRM Class IV (282,300 acres). As discussed in the Alternative 1 impact section, VRM Class II management requires a high degree of screening to ensure that man-made intrusions do not attract the attention of the casual observer. Where this degree of screening cannot be achieved, the intrusion would potentially not be allowed and, in the case of leasable minerals, the hydrocarbon resource would not be recoverable. The expansion of VRM Class I and Class II areas would result in a 300% increase in acreage that would largely be unavailable for mineral development.

Much of the VRM Class II area would overlap the Wind River Front MA, where there is little or no development potential. However, the VRM Class II area would expand into known areas of hydrocarbon production on the Pinedale Anticline along the New Fork River and the Lander Trail, and it would also expand into known zones of oil and gas production along the Lander Trail in the Deer Hills and South Piney Creek Canyon area. The VRM Class II management requirements could impact postlease actions (APDs, ROWs, and geophysical NOIs), unless imposition of the restriction would deprive the leaseholders of their legal right to develop any existing leases in the restriction area. Where it is necessary to use offsite (directional drilling) techniques to meet the VRM Class II objectives, both product recovery cost and drilling risk would increase. Leasable mineral resources beyond the technical or economic reach of offsite methods would become unrecoverable. Substantial areas would potentially be beyond the economic or technical reach for directional drilling, and the underlying fluid mineral resources would be unrecoverable. Under this alternative, the VRM Class III and Class IV related impacts would be the same as under Alternative 1.

Water quality and watershed management actions would prescribe that no new permanent facilities would be allowed in flood plains, perennial or intermittent watercourses, or in wetland/riparian areas, which would lead to the relocation of oil and gas facilities outside these areas (Tables 2-32 and 2-33). The buffer zones protecting wetland/riparian area and flood plains would be expanded to one-quarter mile. This would result in an approximate 260% increase in the acreage affected by the restriction. Oil and gas reserves underlying areas beyond the viable reach of offsite development methods would be unrecoverable.

Oil and gas management actions would divide the planning area into three noncontiguous wildlife management areas: Intensively Developed Fields (78,270 acres), Traditional Leasing Areas (500,840 acres), and Unavailable Areas (641,820 acres). Collective management actions under each of the areas would impact leasable minerals development. The management prescriptions for the Intensively Developed Fields would have the least impact on mineral leasing and development, whereas the objectives and prescriptions for the Unavailable Areas would be the most constraining. Specific impacts will be addressed by management category. Only those wildlife management actions listed in Chapter 2 that actually impact mineral leasing or development are addressed below.

Intensively Developed Fields

Limiting vehicle use to existing roads and trails would not measurably impact mineral development.

Restricting field access on crucial big game winter range to two year-round routes would congest traffic, concentrate dust and vehicle emissions, increase safety concerns, increase the overall time required to drill wells and to complete the development of fields because of traffic delays, and increase the hazard to wildlife species crossing these concentrated access routes.

Given the availability of noise reduction equipment and the latitude provided to an operator to implement noise reduction restrictions, the impact on mineral development could be minimal. If, however, such equipment is not available and an operator cannot commence operations without it, field development delays would occur.

If minimizing impacts on big game during migration resulted in seasonal restrictions during the migration period, field development delays would occur and the overall period of development impact would be lengthened. Although there could be minor development delays, overall impacts would be minimal if the development could occur away from the areas with the most concentrated migration activity.

Impacts on mineral development from seasonal restrictions for greater sage-grouse nesting and brood rearing, big game parturition and crucial winter range, and raptor nesting protection could be avoided through project design and implementation criteria. Examples of these criteria are concentrating seasonal activity away from the more heavily used nesting, brood-rearing, parturition, and winter habitat areas; enhancing noise reduction; implementing strict traffic controls; stockpiling supplies at sites during noncrucial periods to reduce supply-related traffic; and enclosing the rig to control offsite lighting and noise. Some of these design features, such as enclosing the rig, come with their own impacts, such as possibly rendering a project uneconomical. In situations where the design features are not sufficient and the seasonal restrictions are invoked, the impacts would be the same as those identified under Alternative 1. As previously stated, the development potential on the seasonal habitats varies from no potential for CBNG and non-CBNG along the Wind River Front to high potential for CBNG in the South Piney/Fish Creek area and high potential for non-CBNG on the Mesa and Riverside portions of the Pinedale Anticline. The Big Piney/LaBarge CAP area is identified as having a moderate potential for both CBNG and non-CBNG development. The moderate potential designation means this area is expected to have a development rate of between 20 and 80 wells per township between 2001 and 2020. (Compare the wildlife seasonal restriction Map 2-3 to Maps 4-1 and 4-2.) The impacts from sensitive species management would be the same as those described in Impacts Common to All Alternatives.

The management actions under Wildlife Objective 5—to disallow exceptions to timing and distance stipulations—could result in drill hole failure and possible production loss if an operator were required to suspend drilling operations because of timing and/or distance restrictions at a point where the drill hole could be at risk, such as before setting the surface casing, between setting the surface casing and setting the intermediate casing (if intermediate casing is used), or between setting the intermediate casing and

setting the production casing (or between setting the surface casing and production casing if intermediate casing is not used). It would also prolong the overall time a rig would occupy the source habitat.

Condensate- and produced water-gathering systems are suitable for some fields or portions of fields, but not for all fields or all wells. The requirement to implement fluid (condensate and produced water) gathering systems involves much more than just installing extra pipelines to each well pad; it also involves central delivery points or collection manifolds, stabilization plants, condensate sale lines that run to processing terminals or refineries, and water disposal sites capable of handling the water volume. Collectively, these project components could cause some wells to become uneconomic. In addition, depending on pipe system pressure, some wells may need an on-location pump running constantly to pump the condensate or water into the pipe system. In these cases, pump monitoring and maintenance would increase traffic to the well pad.

Migratory bird exclusion devices such as netting on pits would increase the shading effect on the pit and could substantially increase the amount of time needed to evaporate the fluid, therefore lengthening the time the pit and well pad are not reclaimed. Snow loads on pit netting can collapse the net into the fluids, making it ineffective as a bird exclusion device.

Traditional Leasing Areas

The greater sage-grouse lek NSO restriction would expand to a 1-mile radius and would preclude human presence from March 1 through May 15 (Table 4-3, p. 4-60). Fluid mineral development would require offsite methods, and resources beyond the technical and economic capabilities of the offsite method would become unavailable for public use. Existing leases within the NSO area could be developed under the lease terms. Postlease actions could be encumbered by additional seasonal or surface use restrictions or could be subject to project relocation, depending on surface resource values, a site-specific NEPA analysis, and the management actions prescribed in the RMP, provided those prescriptions do not preclude leaseholders from legally developing their lease. Leks are scattered throughout the planning area, and the development potential is equally broad.

In addition, an NSO restriction would be applied to all suitable nesting habitat within 3 miles of active leks (Table 4-3, p. 4-60). This would directly impact fluid mineral development on 582,280 acres. Fluid mineral development would require offsite methods, and resources beyond the technical and economic capabilities of the offsite method would become unavailable for public use. If the entire 3-mile zone is suitable nesting habitat, this restriction would impact hydrocarbon recovery. Existing leases within the NSO area could be developed under the lease terms. The hydrocarbon development potential within 3 miles of the leks varies from low to high for both CBNG and non-CBNG development, with less than 1% in areas with very high hydrocarbon potential, and 6% in areas of high hydrocarbon potential. The remaining 93% of the 3-mile NSO restriction is within areas of moderate to low potential for hydrocarbon.

Surface disturbance and disruptive activities would be prohibited within 3 miles of active leks from March 15 through July 15. This would potentially prohibit well completion and well maintenance actions on existing wells within 3 miles of those active leks during the restriction period. This would prolong the time to fully develop a field, which in turn would prolong the period that development operations occupy wildlife habitats.

The impacts from prohibiting surface disturbance on all greater sage-grouse winter concentration habitat; limiting well pad development to one well pad per section in greater sage-grouse habitat; and allowing NSO on crucial big game winter range habitat within big game migration routes and bottlenecks, or within 1,000 feet of active raptor nests (1,400 feet for ferruginous hawks), would directly affect oil and

gas leasing and development. As stated previously, fluid mineral development in these NSO areas would require offsite methods, and resources beyond the technical and economic capabilities of the offsite method would become unavailable for public use. Existing leases within the NSO area could be developed under the lease terms. The impact of the one-pad-per-section restriction on oil and gas development could be lessened by implementing exceptions to meet WOGCC spacing requirements. The hydrocarbon development potential of these NSO areas varies from low to high for both CBNG and non-CBNG development.

The impacts associated with requiring noise reduction, placing a limitation on the number of year-round access routes allowed, not granting seasonal exceptions, and implementing bird exclusion devices for pits, would be the same as those described previously for Intensively Developed Fields.

The impacts of the big game parturition (May 1 through June 30) and the raptor seasonal restrictions (February 1 through July 31) would be the same as those under Alternative 1. The development potential in big game parturition habitat varies from very low to high for CBNG and is moderate for non-CBNG. Similar to greater sage-grouse leks, raptor nesting habitat occurs throughout the planning area; consequently, the development potentials of these raptor nesting habitat areas would be as diverse as the development potentials of lek areas.

The impacts from Special Status Species would the same as those described in Impacts Common to All Alternatives.

The impacts and development potential associated with white-tailed prairie dog management actions would be the same as those described later for the White-tailed Prairie Dog ACEC.

Requiring delays in surface-disturbing and other disruptive activities until wildlife activity is completed, where there are newly identified sensitive wildlife or aquatic species activities, would impact mineral development by prolonging the overall time required to develop oil and gas fields and therefore would prolong development activity on wildlife habitats.

Unavailable Areas

The federal mineral estate in this category (641,820 acres) would be indefinitely unavailable for mineral leasing. The impacts would be the same as those previously described for Unavailable Areas. Specifically, any underlying fluid mineral resources would be excluded from extraction and would not be available for public use or revenue generation, except with the existing leases, which encompass 325,290 acres. The Unavailable Areas are spread throughout the planning area, and their development potentials vary from no potential for CBNG and non-CBNG along the Wind River Front, to low potential for CBNG near Ross Butte, to moderate potential for non-CBNG in the Bench Corral and Ryegrass areas. The Unavailable Areas also contain or adjoin portions of private or state mineral estates. Mineral extraction from these nonfederal areas could result in drainage of federal hydrocarbon resources, which would constitute an irretrievable loss of resource.

Existing leases within the Unavailable Area could be developed under the lease terms. Postlease actions could be encumbered by additional seasonal or surface use restrictions or could be subject to project relocation, depending on surface resource values, a site-specific NEPA analysis, and the management actions prescribed in the RMP, provided those prescriptions do not preclude leaseholders from legally developing their lease. The impact of seasonal restrictions (e.g., winter range, sage-grouse/raptor nesting) would be the same as those described for the corresponding restrictions under Alternative 1. Project relocation impacts would be the same as those described above for similar actions.

The Alternative 3 sections of Tables 2-32 and 2-33 list a one-quarter-mile NSO zone around unincorporated municipalities and rural subdivisions (21,410 acres). These zones are scattered throughout the planning area. The impacts resulting from this NSO restriction would be the same as those described for developed recreational sites. Development potential with these zones varies from low to high for both CBNG and non-CBNG. Existing leases would be managed under lease terms and site-specific NEPA analysis for postlease actions (APDs, ROWs, and geophysical NOIs).

Approximately 21,200 acres within the Scab Creek and Lake Mountain WSAs would be closed to OHV use and to oil and gas leasing. Refer to the impact discussion in Impacts Common to All Alternatives.

The following three impacts and discussion apply to all of the ACECs and MAs:

- All of the ACECs or MAs either contain or adjoin portions of private or state mineral estates. Mineral extraction from these nonfederal areas could result in drainage of federal hydrocarbon resources. This would constitute an irretrievable loss of resource.
- All of the ACECs and MAs have areas that would be beyond the technical or economic capabilities of offsite development methods such as directional drilling, and would therefore have areas where the mineral resource would be unavailable for extraction and public use.
- In the event that portions of an ACEC or MA require reclassification to offset drainage or for other reasons, the converted area would be managed under the objectives and management actions for Traditional Leasing Areas as described in the Wildlife section of Alternative 3 in Chapter 2. Impacts on mineral development would be the same as those described for Traditional Leasing Areas.

Existing leases within an ACEC or MA could be developed under the lease terms. Postlease actions could be encumbered by additional seasonal or surface use restrictions or could be subject to project relocation, depending on surface resource values, a site-specific NEPA analysis, and the management actions prescribed in the RMP, provided those prescriptions do not preclude leaseholders from legally developing their lease. The impact of seasonal restrictions (e.g., winter range, sage-grouse/raptor nesting) would be the same as those described for corresponding restrictions under Alternative 1. Project relocation impacts would be the same as those described above for similar actions.

The Rock Creek ACEC and Deadline-Graphite elk winter range area (24,990 acres) would not be available for leasing or hydrocarbon extraction (Map 2-3). With the exception of eight leases that are held by production and that extend into the ACEC/Lake Mountain WSA, the fluid mineral resources in these areas would not be available for consumption. Only six of the leases (1,670 acres) predate the passage of FLPMA and could sustain some level of development activity. Geophysical exploration would be prohibited except on existing leases, where it would occur by nonvehicular methods. The potential for development and impacts would be the same as those described for the Scab Creek and Lake Mountain WSAs and Rock Creek ACEC in the discussion of Impacts Common to All Alternatives.

The Beaver Creek ACEC would be expanded to 10,160 acres and would be closed to oil and gas leasing (Tables 2-32 and 2-33). Existing leases would be allowed to expire and would not be reoffered; however, it is important to note that the entire ACEC is currently lease held from expiration by producing wells within the Lake Ridge Unit. Operations on future actions, such as APDs, would be precluded on slopes greater than 15%. The 15% slope restriction would increase the potential for relocation of well pads, and offsite development drilling techniques would have to be employed to extract the underlying hydrocarbon resources. This would also increase the potential that hydrocarbon resources would be beyond the current directional drilling capability and therefore would be unavailable for public use or revenue generation.

The hydrocarbon development potential for the Beaver Creek ACEC and the general impact on planning area production would be the same as under Alternative 1. Vehicle-based geophysical operations would be restricted to designated roads and trails. This could result in degraded subsurface data if large areas are skipped, or would necessitate the use of more expensive, nonvehicle-based data collection methods.

The Ross Butte ACEC (35,670 acres) would be closed to leasing, and existing leases would be allowed to expire (Tables 2-32 and 2-33). Surface disturbance associated with postlease actions (i.e., APDs) would not be allowed on slopes greater than 10%. Surface use and occupancy would not be allowed on erosive soils or areas with sensitive plant species habitat. Impacts would be similar to those described for the Beaver Creek ACEC. The hydrocarbon development potential for the Ross Butte ACEC is low to moderate for non-CBNG resources and very low to high for CBNG resources. The ACEC would impact the hydrocarbon production potential for the planning area.

The Wind River Front MA would be expanded to 358,400 acres and would include the New Fork Potholes ACEC (1,820 acres), the Trapper's Point ACEC (9,540 acres), the CCC Ponds ACEC (5,530 acres), the Upper Green River ACEC (12,270 acres), the East Fork River WSR (1,130 acres), the Green River WSR (7,100 acres), the Silver Creek WSR (860 acres), and the Scab Creek WSR (1,350 acres). The development potential for non-CBNG in the MA varies from low to no potential in the south and east to moderate potential in the north and west. The CBNG development potential is low to none (Tables 2-33). The federal mineral estate within the area would be unavailable for leasing. Existing leases would be allowed to expire. Postlease actions on existing leases prior to lease expiration would be constrained by CSU stipulations overall, and by NSO stipulations in the New Fork Potholes ACEC, unless the project at issue would specifically enhance wildlife, visual resource, recreation, water quality, or wilderness values. The leasing restriction would render the hydrocarbon resource underlying the unleased portion of the Wind River Front MA unavailable for extraction and thus unavailable for public use and revenue generation. The impact of the CSU and NSO restrictions would be the same as previously discussed. Vehicle-based geophysical operations would be prohibited in the WSRs, restricted to designated roads and trails in the ACECs, and limited to designated roads and trails in existing leases within the rest of the MA. These limitations could result in degraded subsurface data if large areas are skipped, or would necessitate the use of more expensive, nonvehicle-based data collection methods.

The White-tailed Prairie Dog ACEC would be open to oil and gas leasing and would be managed as an Intensively Developed Field in areas where the development meets the well density criteria. Otherwise, lands within the ACEC would be managed as Traditional Leasing Areas. Surface disturbance would be prohibited in towns or complexes larger than 12.5 acres. The surface disturbance restriction would potentially require fluid mineral development activities to be conducted by higher risk offsite methods (i.e., directional drilling). Depending on the size of the town/complex, hydrocarbon resources beyond the technical or economic distance of the offsite method would be unrecoverable. Vehicle-based geophysical operations would be restricted to designated roads and trails. This could result in degraded subsurface data if large areas are skipped, or would necessitate the use of more expensive, nonvehicle-based data collection methods. The fluid mineral development potential for CBNG ranges from very low in the Jonah Field area to moderate in the LaBarge area. The non-CBNG development potential varies from low in the Milleson Draw area to high in the Jonah Field area.

The Miller Mountain MA (66,440 acres) would be closed to leasing, and existing leases would be allowed to expire (Tables 2-32 and 2-33). No net gain in the miles of road would be allowed. Surface disturbance would not be allowed on slopes greater than 15%. The impacts from the slope restriction and from closing the area to leasing would be similar to those described for the Beaver Creek ACEC. New roads could only be developed upon reclamation of existing roads; this restriction would correlate directly with a limitation on the number of well pads/wells that could be developed in these areas. Hydrocarbon resources within existing leases could be developed by constructing pads adjacent to existing roads, directionally drilling

from existing pads, or directionally drilling from new pads constructed adjacent to existing roads. The impacts associated with directional drilling would the same as previously discussed. Hydrocarbon resources in areas beyond the technical or economic reach of directional drilling would be unrecoverable and unavailable for public use. The development potential would be very low for CBNG and low for non-CBNG.

Table 4-8 and Table 4-9 show the percentage of change of lands available for conventional oil and gas and CBNG development, respectively, under Alternative 3.

Table 4-8. Percent Change of Acres Available for Conventional Oil and Gas Development Under Alternative 3

Development Potential	Acres Available[1] (Alternative 1)	Acres Available[1] (Alternative 3)	Percent Change (%)
Very High	34,640	31,330	9
High	96,360	86,670	10
Moderate	485,040	248,470	49
Low	413,570	121,890	71
No Potential	0	0	0

[1] Acres available are a combination of lands open to leasing with standard lease terms, lands open to leasing with minor constraints, and lands open to leasing with major constraints. Lands closed to leasing are not included in this table.

Table 4-9. Percent Change of Acres Available for CBNG Development Under Alternative 3

Development Potential	Acres Available[1] (Alternative 1)	Acres Available[1] (Alternative 3)	Percent Change (%)
High	19,180	10,200	47
Moderate	118,880	82,160	31
Low	136,696	113,580	17
Very Low	718,870	280,750	61
No Potential	6,390	860	87

[1] Acres available are a combination of lands open to leasing with standard lease terms, lands open to leasing with minor constraints, and lands open to leasing with major constraints. Lands closed to leasing are not included in this table.

Impacts Under Alternative 4, Proposed RMP

A substantial part of the planning area (441,100 acres) would be unavailable for fluid mineral development (Tables 2-32 and 2-33). The affects of other management actions would be similar to those under Alternative 1. As established above in Impacts Common to All Alternatives, Impacts under Alternative 1, and Impacts under Alternative 2, fluid mineral resources underlying lands unavailable to leasing and without remnant existing leases would be unrecoverable. Resources underlying areas unavailable for leasing but with remnant existing leases would require substantial mitigation or offsite development actions such as directional drilling (as long as this does not infringe on lease rights), and these areas would experience increased development costs. Leased hydrocarbon resources located beyond the technical or economic reach of directional drilling would be considered inaccessible and therefore unrecoverable.

The impact discussion below is in addition to those impacts described in Impacts Common to All Alternatives.

The 7,136 wells (federal minerals) projected under this alternative would potentially extract 19,168 BCF of natural gas and 150 million barrels of oil during the life of the plan, which is an 8% reduction in the projected number of wells and a 5% reduction in the projected gas and oil volume from the unrestricted estimates. Approximately 175,040 acres in Intensively Developed Fields would be available for intensive fluid mineral leasing, exploration, development, and production; approximately 461,380 acres designated as Traditional Leasing Areas would be available for restricted fluid mineral leasing, exploration, development, and production; about 198,370 acres would be designated as NSO; and 439,470 acres would be designated as Unavailable Areas for leasing, exploration, development, and production. Existing leased in-holdings in NSO areas and Unavailable Areas would be available for exploration, development, and production, as granted by the lease contract.

Cultural resource management actions would impose an NSO restriction on approximately 4,430 acres of federal mineral estate within communal big game kill sites, Oregon Trail inscription sites, rock shelters, rock art sites, select rock alignments, and Native American burial locales and TCP sites. There would also be an NSO restriction applied to a one-quarter-mile strip on either side of the Lander Trail and to a 1-mile-wide strip on either side of the Sublette Cutoff Trail (23,000 total acres). The development potential would be the same as under Alternative 3. Development of the mineral resource in the NSO areas above would require offsite methods. Impacts would be the same as those described with the NSO and CSU restrictions in Impacts Common to All Alternatives.

The NSO restriction would apply to new leases offered in these areas. It would not directly apply to any existing lease within the NSO boundary, but could impact postlease actions (APDs, ROWs, and geophysical NOIs) unless imposition of the restriction would deprive the leaseholders of their legal right to develop any existing leases in the restriction area. Where the NSO restriction is applied, fluid mineral development would require offsite (directional drilling) techniques. Leasable mineral resources beyond the technical or economic reach of offsite methods would be considered unrecoverable. There would be a potential for the unrecoverable loss of federally owned hydrocarbon resources where unleased federal mineral estates adjoin private or state mineral estates. Geophysical exploration within Native American TCP areas and within one-quarter mile of rock art sites would be restricted to designated roads and trails or to the use of nonvehicular methods. (Note: Geophysical exploration could legally be conducted on any existing leases within these areas.) Vehicle-based geophysical operations would be restricted to designated roads and trails. This could result in degraded subsurface data if large areas are skipped or would necessitate the use of more expensive, nonvehicle-based data collection methods.

The proposed 6-mile-wide VRM Class II designation for contributing segments of the Lander Trail would potentially affect well pad, production facility, road, and pipeline placement within this corridor to meet the VRM Class II objectives. Where the terrain does not provide visual screening of mineral development facilities from the viewpoint of the trail, those facilities could be required to be located either entirely outside the VRM Class II buffer zone or in visually screened areas within the buffer. Fluid mineral resources beyond the reach of offsite development would have the same impact as described above. The impacts related to an unrecoverable loss of federal mineral resources because of drainage from nonfederal leaseholds would be the same as previously described. This would not apply to existing leases, but could apply to postlease actions.

The impact on leasable minerals development resulting from paleontology and natural history prescribed actions would be the same as under Alternative 3.

Under this alternative, management of developed recreational sites relative to leasable minerals development would be essentially the same as under Alternative 2; therefore, the impact would be the same. The Boulder Lake (5,790 acres) and Scab Creek (18,460) SRMAs would fall within the Wind River Front MA and would be unavailable for mineral leasing. Impacts for these SRMAs would be the same as under Alternative 3. The CCC Ponds area would be unavailable for mineral leasing; therefore, the impact would be the same as under Alternative 3.

The Upper Green River SRMA and the Green and New Fork River SRMA would be available for mineral leasing with an NSO restriction. The impacts of this NSO restriction on new leases or on the management of existing leases within a new NSO area would be the same as those described for similar actions in the preceding impact analysis (i.e., offsite development on new leases and potential offsite development on existing leases unless it precludes a leaseholder's/operator's grant right to explore, develop, and produce the fluid mineral resource).

Soils management would be essentially the same as under Alternative 3, except that surface disturbance operations could be conducted on sensitive soils with slopes greater than 8%. Under this alternative, the impacts on sensitive soils would be greater than under Alternative 3, because operations could be conducted on slopes between 8% and 15%. The 25% slope restriction for construction would be retained for nonsensitive soils.

The OHV closures discussed in the Transportation section correspond with areas unavailable for leasing. The OHV designation would create no greater impacts on mineral development than those already discussed for lands unavailable for leasing. The Red Dugway OHV limitation would not impact leasable minerals development because the Red Dugway Road already contains slides and slumps that preclude heavy truck traffic, and current leaseholders have therefore secured alternate access across private land.

Under this alternative, vegetation management relative to mineral management would be essentially the same as under Alternative 3. The only notable difference is that this alternative would allow chemicals to be used to treat noxious weeds. Except for the discussion specific to the preclusion of chemical treatments, the impact of vegetation management on mineral development would be the same as under Alternative 3. Allowing the use of chemical along with mechanical and biological methods provides leaseholders and operators with a more complete and effective weed treatment package.

Under this alternative, VRM classifications (Map 2-30) would be more restrictive than under Alternatives 1 and 2 but less restrictive than under Alternative 3. Approximately 28% of the planning area would be categorized as VRM Class I (21,290 acres) and Class II (239,520 acres), and the other 72% would be categorized as VRM Class III (419,410 acres) and Class IV (242,660 acres). As discussed under Alternative 1, VRM Class II management requires a high degree of screening to ensure that man-made intrusions do not attract the attention of the casual observer. Where this level of screening cannot be achieved, the intrusion would potentially not be allowed, and in the case of leasable minerals, the hydrocarbon resource would not be recovered.

The VRM Class I and II areas would be largely unavailable for mineral development. Much of the VRM Class II area overlaps the Unavailable Areas, which have little or no development potential. However, the VRM Class II area includes known areas of hydrocarbon production on the Pinedale Anticline along the New Fork River and the Lander Trail, and it also expands into known areas of oil and gas production along the Lander Trail in the Deer Hills and South Piney Creek Canyon area. The VRM Class II management requirements could impact postlease actions (APDs, ROWs, and geophysical NOIs), unless imposition of the restrictions would deprive the leaseholders of their legal right to develop any existing leases in the restriction area. Where meeting the Class II objective necessitates the use of offsite (directional drilling) techniques, both product recovery cost and drilling risk would increase. Leasable

mineral resources beyond the technical or economic reach of offsite methods would become unrecoverable. Substantial areas would potentially be beyond the economic or technical reach of directional drilling, and the underlying fluid mineral resources would be unrecoverable. The VRM Class III and Class IV related impacts would be the same as under Alternative 1.

Under this alternative, water quality and watershed management actions would basically be the same as under Alternative 3, and thus the impact on mineral development would be the same.

Wildlife and fisheries management actions divide the planning area into four noncontiguous wildlife management zones: Intensively Developed Fields (175,040 acres), Traditional Leasing Areas (461,380 acres), and Unavailable Areas (439,470 acres). Collective management actions under each of the zones would impact leasable minerals development. The management prescriptions for the Intensively Developed Fields would have the least impact on mineral leasing and development, whereas the objectives and prescriptions for the Unavailable Areas would be the most constraining. Specific impacts will be addressed by management category. Only those wildlife management actions listed in Chapter 2 that actually impact mineral leasing or development are addressed below.

Intensively Developed Fields

Permitted OHV activities would be allowed in Intensively Developed Fields; consequently, there would be no OHV impact on fluid mineral development in these areas.

Fluid mineral development would be required to minimize the direct, indirect, and cumulative impacts on greater sage-grouse, big game migration, and big game parturition habitats through project design and implementation of performance-based mitigation and stipulations. This would potentially impact fluid mineral development; however, the magnitude of the impact would depend on the design and implementation criteria and on any mitigation required at the implementation stage. Impacts could range from project relocation and offsite development, to seasonal timing limitations, to limiting facilities or beyond. These impacts could affect the economic or technical viability of the project.

The impact of the proposed NSO designations for elk feedgrounds and the potential for fluid mineral development would be the same as under Alternative 1. Impacts of the proposed NSO designation for raptors would be the same as described under Alternative 3. Impacts of the proposed seasonal restrictions would be the same as those under Alternative 1.

The impacts related to noise reduction would be the same as those described in the mineral development discussion under Alternative 3.

The impacts from sensitive species management would be the same as those described in Impacts Common to All Alternatives.

The impacts of required raptor surveys would be the same as the impacts of the required surveys for sensitive species described in Impacts Common to All Alternatives.

The impacts related to fluid gathering systems and migratory bird exclusion devices for pits would be the same as under Alternative 3.

Traditional Leasing Areas

The restriction limiting vehicular activities to existing roads and trails in greater sage-grouse habitats during the active lek, nesting/brood-rearing, and winter concentration periods, as well as in crucial big game winter ranges, would have minimal effect on fluid mineral development. Geophysical operations

would be restricted during the 5-month window where greater sage-grouse habitats occur. This would prolong the number of seasons needed to complete a development project and could deprive a leaseholder/operator of timely subsurface data.

The Upper Green River migration bottleneck (1,160 acres) would be available for fluid mineral leasing with an NSO stipulation. The impacts and existing lease management would be the same as those described for the 1-mile NSO restriction in the Traditional Leasing Areas under Alternative 3. The Upper Green River migration bottleneck has a very low potential for CBNG development and a moderate potential for non-CBNG development.

Fluid mineral development would be required to protect crucial big game winter range, migration, and parturition; greater sage-grouse nesting/brood rearing; sensitive species; sagebrush obligate; and raptor habitats, through project design and implementation of performance-based mitigation and stipulations. This requirement would potentially impact fluid mineral development; however, the magnitude of the impact would depend on the design and implementation criteria and on any mitigation required at the implementation stage. Impacts could range from project relocation and offsite development, to seasonal timing limitations, to limitations on facilities, to some fluid mineral resources becoming unavailable for extraction. These impacts could affect the economic or technical viability of some projects.

Surface-disturbing and other disruptive activities would be prohibited within 2 miles of active leks from March 15 through July 15. The impact would be the same as that described for greater sage-grouse nesting and brood rearing under Alternative 1.

The impacts associated with protecting large, contiguous patches of sagebrush with an NSO stipulation would be the same as those described for the 1-mile NSO restriction in the Traditional Leasing Areas under Alternative 3. This restriction would result in hydrocarbon resources becoming unavailable for public use.

The impacts of the proposed NSO designations on elk feedgrounds and the potential for fluid mineral development would be the same as under Alternative 1.

The impacts of big game parturition (May 1 through June 30) and raptor nesting seasonal restriction (February 1 through July 31), as well as the impacts of the crucial big game winter range seasonal restrictions, would be the same as under Alternative 1.

The impacts on Special Status Species would the same as those described in Impacts Common to All Alternatives.

The impacts related to noise reduction would be the same as those described for mineral development under Alternative 3.

The impacts from sensitive species management would be the same as those described in Impacts Common to All Alternatives.

The impacts of the NSO restriction within 1,000 feet of raptor nests (1,400 feet of ferruginous hawks) would be the same as those described above for the 1-mile greater sage-grouse lek NSO area under the Traditional Leasing Areas section in Alternative 3. Impacts of the seasonal restrictions for raptors would also be the same as described under the Traditional Leasing Areas section in Alternative 3.

The impacts on required raptor surveys would be the same as the impacts of the required surveys for sensitive species described in Impacts Common to All Alternatives.

The impacts related to fluid gathering systems and migratory bird exclusion devices for pits would be the same as under Alternative 3.

The impacts associated with white-tailed prairie dog management actions would be same as those described for the White-tailed Prairie Dog ACEC under Alternative 3.

The impacts of limiting surface disturbance in CRCT habitat between June 1 and August 15 could affect some creek crossings for roads and pipelines along the east front of the Wyoming Range, but this limitation is not anticipated to have a major impact on mineral development, because there are already a number of upgraded roads across the streams in this area. Pipeline installation could be completed by boring under the streams.

Tables 2-32 and 2-33 in the Alternative 4 section in Chapter 2 lists an NSO restriction for unincorporated municipalities and rural subdivisions (21,410 acres), which are scattered throughout the planning area. The impacts from this restriction would be the same as those described for developed recreational sites. The development potential with these sites varies from low to high for both CBNG and non-CBNG. Existing leases would be managed under lease terms and site-specific NEPA analysis for postlease actions (APDs, ROWs, and geophysical NOIs).

Appendix 3 states that surface-disturbing activities may be prohibited within one-quarter mile of occupied dwellings. This would require conducting leasable minerals development actions from locations outside of this restricted area. Offsite development would likely require methods such as directional drilling, providing the offsite method is technically and economically feasible. An indirect impact of this requirement would be that offsite methods typically have higher failure rates, drilling problem rates, and development costs than vertical onsite drilling (see Impacts Common to All Alternatives for additional information).

Unavailable Areas

The impact on leasable minerals development in the Unavailable Areas would be the same as under Alternative 3. However, there would be 206,690 fewer acres designated as Unavailable for leasing under Alternative 4, and consequently, the magnitude of the impact on leasable minerals would be commensurately lower under Alternative 4.

The following three impacts and discussion apply to all of the ACECs and MAs discussed below:

- All of the ACECs or MAs either contain or adjoin portions of private or state mineral estates. Mineral extraction from these nonfederal areas could result in drainage of federal hydrocarbon resources. This would constitute an irretrievable loss of resource.
- All of the ACECs and MAs have areas that would be beyond the technical or economic capabilities of offsite development methods such as directional drilling, and would therefore have areas where the mineral resource would be unavailable for extraction and public use.
- In the event that portions of an ACEC or MA require reclassification to offset drainage or for other reasons, the converted area would be managed under the objectives and management actions for the Traditional Leasing Areas, as described in the Wildlife section of Alternative 3 in Chapter 2. Impacts on mineral development would be the same as those described for Traditional Leasing Areas.

Existing leases with an ACEC or a MA could be developed under the lease terms. Postlease actions could be encumbered by additional seasonal or surface use restrictions or could be subject to project relocation,

depending on surface resource values, a site-specific NEPA analysis, and the management actions prescribed in the RMP, provided those prescriptions do not preclude leaseholders from legally developing their lease. The impact of seasonal restrictions (e.g., winter range, sage-grouse/raptor nesting) would be the same as described for corresponding restrictions under Alternative 1. Project relocation impacts would be the same as those described above for similar actions.

The Rock Creek ACEC (4,960 acres) would not be available for leasing or hydrocarbon extraction. With the exception of eight leases held by production and extending into the ACEC/Lake Mountain WSA, the fluid mineral resources would not be available for consumption. Only six of the leases predate the passage of FLPMA and could sustain some level of development activity. Geophysical exploration would be prohibited, except on existing leases and using only nonvehicular methods. The potential for development and impacts would be the same as those described for the Scab Creek and Lake Mountain WSAs and the Rock Creek ACEC in Impacts Common to All Alternatives. The Deadline-Graphite elk winter range area (20,970 acres) would not be managed as part of the Rock Creek ACEC (as it would under Alternative 3). The winter range would be managed as under Wildlife Objective 2. Impacts on minerals development would be the same as those described for Traditional Leasing Areas under Alternative 4.

The Beaver Creek ACEC (3,590 acres) would be open to oil and gas leasing (Tables 2-32 and 2-33) and would be managed essentially the same as under Alternative 1. One minor change would be restricting vehicular activity to *designated* roads and trails under this alternative, whereas under Alternative 1, vehicles would be restricted to *existing* roads and trails. The impacts on mineral development from Beaver Creek ACEC management would be the same as under Alternative 1. The difference between confining traffic to existing versus designated roads and trails would measurably alter the impacts. Fluid mineral development potential would be the same as previously described for the Beaver Creek ACEC.

Under this alternative, the impacts on mineral development of management objectives and actions for the Trapper's Point (4,160 acres) and New Fork Potholes ACECs would be the same as under Alternative 3. Under Alternative 3, Trapper's Point was a stand-alone ACEC, but it fell within the area encompassed by the Wind River Front MA and was included in its impact analysis. Under this alternative, mineral development potential for the Trapper's Point ACEC would be the same as under Alternative 2. The New Fork Potholes ACEC would have a very low CBNG development potential and low to moderate non-CBNG development potential. There are no existing leases in the Trapper's Point ACEC; however, there are two existing leases in the New Forks Potholes ACEC. Management of these leases would be the same as previously described for existing leases in areas with proposed NSO restrictions or unavailable for leasing designations.

The Ross Butte area (35,670 acres) would be designated as an MA under Alternative 4. The area would be available for mineral leasing with an NSO stipulation. The MAs managed under the Large Block NSO objectives and actions list the preceding wildlife discussion. Impacts on mineral development and management of existing leases would be the same as those listed in the Large Block NSO Areas impact discussion. The hydrocarbon development potential for the Ross Butte area is low to moderate for non-CBNG resources and very low to high for CBNG resources.

Under this alternative, the Wind River Front MA (201,240 acres) would include the East Fork River WSR (1,130 acres), the Silver Creek WSR (860 acres), and the Scab Creek WSR (1,350 acres). The MA, including the listed WSRs, would be unavailable for fluid mineral leasing. Impacts and management of existing leases would be the same as those described for the MA under Alternative 3. (Note: There are no existing leases in the WSRs.) The development potential for CBNG and non-CBNG in the MA varies from low to no potential (Tables 2-32 and 2-33).

The Green River WSR (7,100 acres) would be available for leasing with an NSO stipulation. The WSR would be closed to geophysical operations unless any impact from such operations could be adequately mitigated. The impacts on mineral development from the NSO designation would be the same as previously described for NSO areas. The WSR contains existing oil and gas leases. Management of these leases would be the same as previously described for existing leases in areas with proposed NSO designations or unavailable for leasing designations.

The CCC Ponds area is not designated as an ACEC or an MA under this alternative. The CCC Ponds area would fall within the Wind River Front MA and would be managed under the objectives and actions for that MA. The CCC Ponds area would also be managed under the Unavailable Areas designation in the Alternative 4 Wildlife section. Impacts on leasable minerals would be the same as those described for the Wind River Front MA and Unavailable Areas under Alternative 3. The CCC Ponds area has one existing lease, which would be managed the same as previously described for existing leases in areas with proposed NSO or unavailable for leasing designations.

The White-tailed Prairie Dog ACEC would not be retained under this alternative. White-tailed prairie dog habitat would be managed under Objective 4 in the Wildlife and Fish Habitat section of Chapter 2. Surface disturbance would be avoided in towns or complexes larger than 12.5 acres. The surface disturbance restriction would potentially require fluid mineral development activities to be conducted by higher risk offsite methods (i.e., directional drilling). Depending on the size of the town or complex, hydrocarbon resources beyond the technical or economic distance of the offsite method would be unrecoverable. Vehicle-based geophysical operations would be restricted to designated roads and trails. This could result in degraded subsurface data if large areas are skipped, or would necessitate the use of more expensive, nonvehicle-based data collection methods. The fluid mineral development potential ranges from very low for CBNG in the Jonah Field area to moderate for CBNG in the LaBarge area. The non-CBNG development potential varies from low in the Milleson Draw area to high in the Jonah Field area.

The Miller Mountain MA (66,440 acres) would be available for mineral leasing subject to mitigation (Tables 2-32 and 2-33). No net gain in the miles of road would be allowed. Surface disturbance would not be allowed on slopes steeper than 15%. The impacts of slope restrictions and of closing the area to leasing would be similar to those described for the Beaver Creek ACEC. New roads could only be developed as existing roads are reclaimed; this restriction would directly correlate to a limitation on the number of well pads/wells that could be developed in these areas. Hydrocarbon resources within existing leases could be developed by constructing pads adjacent to existing roads, directionally drilling from existing pads, and directionally drilling from new pads constructed adjacent to existing roads. Impacts associated with directional drilling would the same as previously discussed. Hydrocarbon resources in areas beyond the technical or economic reach of directional drilling would be unrecoverable and unavailable for public use. The development potential would be very low for CBNG and low for non-CBNG.

Table 4-10 and Table 4-11 show the percentage reduction of lands available for conventional oil and gas and CBNG development, respectively, under Alternative 4.

Table 4-10. Percent Change of Acres Available for Conventional Oil and Gas Development Under Alternative 4

Development Potential	Acres Available[1] (Alternative 1)	Acres Available[1] (Alternative 4)	Percent Change (%)
Very High	34,640	34,750	<1
High	96,360	102,960	7
Moderate	485,040	363,700	25
Low	413,570	277,880	33
No Potential	0	0	0

[1] Acres available are a combination of lands open to leasing with standard lease terms, lands open to leasing with minor constraints, and lands open to leasing with major constraints. Lands closed to leasing are not included in this table.

Table 4-11. Percent Change of Acres Available for CBNG Development Under Alternative 4

Development Potential	Acres Available[1] (Alternative 1)	Acres Available[1] (Alternative 4)	Percent Change (%)
High	19,180	19,190	<1
Moderate	118,880	106,270	11
Low	136,696	167,110	22
Very Low	718,870	482,160	33
No Potential	6,390	3,210	50

[1] Acres available are a combination of lands open to leasing with standard lease terms, lands open to leasing with minor constraints, and lands open to leasing with major constraints. Lands closed to leasing are not included in this table.

4.7.2 Locatable Minerals

Assumptions

The analysis is based on the following assumptions:

- The development potential for locatable minerals is low.
- The administration of locatable minerals and related surface-disturbing activities would involve BLM's cooperation with the WDEQ, as outlined in the current BLM/WDEQ Memorandum of Understanding (MOU) for locatable minerals. The current MOU, dated November 19, 2003, is entitled "Supplement to Memorandum of Understanding No. WY-19 between the USDI, BLM, and the WDEQ, Land Quality Division, for Management of Surface Mining and Exploration for Locatable Minerals on Public Lands."
- Unless a withdrawal exists, mining claimants have an inherent right to mine, which cannot be revoked by BLM.

Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, reviews of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

Impacts Common to All Alternatives

Impacts on locatable minerals resources are not anticipated as a result of implementing management actions for livestock grazing and wildland fires.

Air quality impacts on locatable minerals development would result from cooperation among BLM, WDEQ, and EPA to mitigate air quality impacts on a case-by-case basis. An example of possible mitigation would be dust control on roads used in mining operations.

The presence of cultural resources eligible for listing on the NRHP, as well as sites considered sensitive by Native Americans, could restrict some locatable minerals exploration or mining activities. The same types of impacts could result from locatable minerals activities occurring within the visual setting of cultural resources, in cases where the cultural resource's visual setting contributes to its NRHP eligibility.

Impacts from lands and realty management would be primarily related to the review and revocation of existing withdrawals that segregate against mineral location and/or to the development of new withdrawals that would prevent mineral location. New withdrawals could be for a variety of resources including cultural, T&E plants or animals, and/or recreation.

Exploration on mining claims would require that a notice be submitted to BLM for a cumulative surface disturbance of 5 acres or less and a plan of operations for exploration greater than 5 acres, as outlined in 43 CFR §3809. Mining operations, regardless of acreage, require a Plan of Operations. In designated SD/MAs (such as an ACEC), a Plan of Operations would be required for any surface-disturbing activities, regardless of acreage involved, in accordance with 43 CFR §3809. The requirement for a Plan of Operations with an ACEC could result in longer delays for projects than under a notice, even when the surface-disturbing activities are less than 5 acres in area. All operations under a Notice or Plan of Operations would have to follow the performance standards in 43 CFR §3809.420.

The discovery of significant paleontological resources could impact the timing or location of locatable minerals activities. Significant paleontological resources would include vertebrate fossils, as well as scientifically important invertebrate and plant fossils. In most cases, the main impact would be a delay in the development of locatable minerals while fossils are collected and recorded.

There would be vegetation-related impacts on locatable minerals development from Special Status Plant Species protection, which could restrict activities.

Locatable minerals mining activity within established VRM class areas would generally be required to conform to the objectives and characteristics of the VRM classification, especially in respect to the placement and design of facilities. For example, in VRM Class II areas, the level of change to the characteristic landscape should be low. In VRM Class II areas, activities may be visible but may not attract the attention of the casual observer. In VRM Class III areas, the level of change to the characteristic landscape should be moderate. The mining area and production facilities may attract attention but should not dominate the view of the casual observer. In VRM Class IV areas, the level of

change to the characteristic landscape can be high, with activities dominating the view and being the major focus of viewer attention.

Watershed impacts would involve the requirement that locatable minerals activity comply with E.O. 11988, Floodplain Management, and E.O. 11990, Protection of Wetlands, as well as with the WDEQ's water quality standards. Mining operations would be designed to avoid siltation and pollution of surface water and groundwater. Hazardous Spill Response Plans would be required.

Wildlife and fish management impacts on locatable minerals activities would involve mitigation for habitat or potential habitat containing listed, proposed, or candidate T&E species. Relocation or prohibition of certain development proposals could be required.

SD/MA impacts would result from the management plans written for all ACECs. SD/MA management prescriptions could cause modification or relocation of development proposals.

The Lake Mountain (13,490 acres) and Scab Creek (7,710 acres) WSAs would be managed under the Interim Management Policy and Guidelines for Lands Under Wilderness Review (USDI 1987b), and locatable minerals activity would be governed by the procedures in that policy. Discretionary uses within or adjacent to WSAs will be reviewed to ensure that these do not conflict with management and preservation of wilderness values. As a result, locatable minerals proposals near the WSAs could be restricted.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

The cultural resources program would require no surface disturbance within one-quarter mile or the visual horizon (whichever is closer) on contributing segments of historic trails. Also, three cultural sites would be protected by an NSO requirement. Locatable minerals exploration and mining activities may have to be modified or restricted to avoid impacting the trail and its setting.

Impacts from lands and realty management would primarily be from the pursuit of withdrawals in support of other resource management objectives. For example, certain cultural and recreational sites would be considered for withdrawal. Depending on the results of a study, there could also be a withdrawal pursued for the Rock Creek ACEC, covering about 5,270 acres. However, several withdrawals would also be revoked under Alternative 1. Phosphate, coal, and oil shale withdrawals would be removed, which would allow the location of mining claims in those areas, unless other withdrawals are present.

Impacts from the paleontology and natural history program would include possible designations to protect areas of unique natural history or particular natural interest such as NNLs, RNAs, and ACECs. One possible NNL would be the Pinedale Boulder Glacial area located on the east side of the planning area. The management prescriptions for these areas could impede development of locatable minerals mining activity.

Recreation management would require no surface disturbance within one-quarter mile of developed and semideveloped recreational sites unless the uses are compatible with recreation. Locatable minerals development could be restricted, depending on the type and magnitude of the activity.

Soils management would require mitigating measures to reduce soil erosion, as well as siltation and salinity inflow to the Green River Basin. Those measures could restrict exploration and development on mining claims.

Access management could allow more access to locatable areas by obtaining legal access to public land across private land. However, roads could be closed as well, thus reducing the ease of prospecting for locatable minerals.

Vegetation management (riparian) would restrict placement of facilities in 100-year flood plains and wetland/riparian areas, which could affect locatable minerals development plans.

VRM classifications would be 21,290 acres in Class I; 73,430 acres in Class II; 187,070 acres in Class III; and 641,140 acres in Class IV. Locatable minerals activities would be most restricted in VRM Class I areas and least restricted in VRM Class IV areas. Exploration and mining activities, and their associated facilities, would be subject to restrictions and/or redesign depending on the area involved and its VRM classification.

Watershed management could impose mitigating measures to reduce soil erosion, as well as siltation and salinity inflow to the Green River Basin. Those measures could restrict exploration and development on mining claims. No development would be allowed within 500 feet of riparian/wetlands and live water, which could affect proposed locatable minerals activities.

Wildlife and fish management would prohibit activity on and near elk feedgrounds, unless the activity is either temporary or compatible with elk habitat management. In certain areas, locatable minerals activity could be restricted by this mitigation. Seasonal wildlife restrictions and distance restrictions from various wildlife habitat areas would also complicate some locatable minerals activities.

There could be a possible withdrawal in the Rock Creek drainage area of the Rock Creek ACEC, which would prevent locatable minerals development in that area. There would also be a no surface disturbance requirement in this area. The Beaver Creek ACEC would contain activity restrictions on steep slopes and near streams, which could also affect any potential locatable minerals activity.

Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 2.

The impacts from soils and watershed management would be the same as under Alternative 1.

The cultural program would impact locatable minerals by prohibiting surface occupancy on certain cultural sites and prohibiting activity within one-quarter mile of certain historic trails. This could cause locatable minerals activities to be restricted in some areas. In terms of specific sites, this alternative would probably be less restrictive for locatable minerals than Alternative 1, because Alternative 1 would withdraw sites from the Mining Law.

The lands and realty program would not process the specific withdrawals mentioned under Alternative 1. The oil shale, phosphate, and coal withdrawals would remain, which would keep those areas closed to certain types of mining claims. Formal withdrawals for cultural sites, recreational sites, and the Rock Creek ACEC would not be pursued, making this alternative less restrictive for locatable minerals than Alternative 1. However, this alternative would be more restrictive on other withdrawals, because several large withdrawals would not be revoked.

Under this alternative, the paleontology and natural history program would not process designations to protect areas of unique natural history or particular natural interest such as NNLs, which would be less restrictive than under Alternative 1 and would have less of an impact on locatable minerals development.

Recreation management impacts would include a one-quarter-mile buffer zone of no surface disturbance around developed recreational sites and various restrictions in three SRMAs (Boulder Lake, Scab Creek, and Upper Green River). This would impact locatable minerals by limiting development around those sites and possibly modifying development proposals for those SRMAs. This would be less restrictive than Alternative 1, which would withdraw certain areas from the Mining Law.

Under this alternative, access management could allow more access to locatable areas by obtaining legal access to public land across private land. This would be less restrictive than under Alternative 1, because no roads would be closed.

Under this alternative, vegetation management would require weed control, which could add some costs to locatable minerals operations, and would therefore be slightly more restrictive than under Alternative 1. However, this alternative would not restrict placement of facilities in 100-year flood plains and wetland/riparian areas, which would make it less restrictive overall than Alternative 1.

Compared to Alternative 1, this alternative would have fewer VRM Class I and Class III areas, and more VRM Class II and Class IV areas. Specifically, this alternative would have 0 acres in Class I, versus 21,290 under Alternative 1; 87,150 acres in Class II, versus 73,430 acres under Alternative 1; 118,390 acres in Class III, versus 187,070 acres under Alternative 1; and 717,390 acres in Class IV, versus 641,140 acres under Alternative 1. The percentage increase in VRM Class II acreage (+16%) is offset by the percentage decrease in VRM Class I acreage (–100%), the percentage decrease in VRM Class III acreage (–36%), and the percentage increase in VRM Class IV acreage (+11%). Overall, this would allow larger changes in the visual landscape, which could allow for more locatable minerals development.

Wildlife and fish management would have temporal and areal restrictions on greater sage-grouse leks, nesting areas, and winter concentration areas, and elk feedgrounds would be closed. However, no seasonal restrictions would be applied on activities in big game parturition areas, crucial winter ranges, and migration routes and bottlenecks. This would allow more year-round locatable minerals activity and would be less restrictive than Alternative 1.

SD/MAs would impact locatable minerals development by restricting certain activities in particular areas. Under this alternative, impacts would include a new ACEC (Trapper’s Point—550 acres) and an area of 1,590 acres outside of the ACEC where activity would be prohibited. However, the Beaver Creek (3,590 acres) and Rock Creek (5,270 acres) ACECs would be dropped, and thus, based on acreage, this alternative would be less restrictive than Alternative 1.

Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 3.

Impacts from the paleontology and natural history program, soils management, and wildlife management would be the same as under Alternative 1.

Under this alternative, cultural resources management would write activity plans, prevent surface disturbance at various sites through the use of withdrawals, create a VRM Class II area within 3 miles of historic trails, and allow no surface disturbance within 1 mile of trails. These measures could affect

locatable minerals activities by restricting activity in certain areas and would be more restrictive than Alternative 2.

Under this alternative, lands and realty management would process withdrawals for 65,750 acres for various resources, which would prevent mining claim location in those areas. No withdrawals would be revoked; thus, this alternative would be more restrictive than Alternatives 1 or 2.

Under this alternative, recreation management would implement a no surface disturbance restriction in an area one-half mile from recreational sites and would add an additional SRMA (New Fork River). This could cause locatable minerals activities to be restricted in some areas, which would be more restrictive than under Alternative 2.

Under this alternative, access management, in addition to trying to obtain access across private land to public land, would also close some areas to motorized vehicles. This could hinder locatable minerals development and would be more restrictive than under Alternative 1.

Under this alternative, vegetation management would withdraw areas of Special Status Plant Species, including future discoveries, from locations of mining claims and would prohibit surface-disturbing activities that could affect the plants or their habitats. This could restrict locatable minerals mining projects and would be more restrictive than under Alternative 1.

Compared to Alternative 1, under this alternative VRM management would reduce Class IV areas by 56% (from 641,140 acres to 282,300 acres) and would increase Class II areas by 436% (from 73,430 acres to 393,260 acres) and Class III areas by 21% (from 187,070 acres to 225,830 acres). VRM Class I areas would remain the same (21,290 acres). This would result in more restrictions on locatable minerals development and would be much more restrictive than Alternatives 1 and 2.

Under this alternative, watershed management impacts would be more restrictive than under Alternatives 1 and 2, because this alternative would generally restrict disturbances on 100-year flood plains and within one-quarter mile of wetland/riparian areas and would specifically prohibit mineral exploration and mining within 500 feet of 100-year flood plains, wetland/riparian areas, and perennial streams. It would also restrict mining activity within 100 feet of the edge of the inner gorge of intermittent and large ephemeral drainages. These actions could restrict locatable minerals activity. This alternative would be more restrictive than Alternatives 1 and 2.

Wildlife and fish management impacts on locatable minerals would be highest under Alternative 3. The seasonal greater sage-grouse buffer would be extended from 2 miles to 3 miles, the acreage in winter range areas would increase, and parturition areas would cover deer and pronghorn as well as elk. Seasonal restrictions on big game migration areas would also be enforced. No exceptions would be granted under any of the restrictions mentioned above. Larger buffer areas would be in effect around greater sage-grouse leks, elk feedgrounds, and raptor nests. The net effect of these wildlife-related restrictions would be to allot less area to and allow less time for any possible locatable minerals development. This would be more restrictive than Alternatives 1 and 2.

SD/MAs would be the most numerous under this alternative. The Rock Creek and Beaver Creek ACECs would be retained. New ACECs would be designated in the Trapper’s Point, New Fork Potholes, Upper Green River, White-tailed Prairie Dog, Ross Butte, and CCC Ponds areas (a total of 65,340 acres). The Trapper’s Point ACEC would be larger under this alternative (9,540 acres). The Miller Mountain and Wind River Front MAs would be established (a total of 424,840 acres). Four river units would be managed as suitable for inclusion in the WSR system: East Fork River, Scab Creek, Silver Creek, and Upper Green River (a total of 10,440 acres). The following would be withdrawn from locatable minerals

activity: the New Fork Potholes, Trapper's Point, Upper Green River, and CCC Ponds ACECs; the Boulder Lake and Scab Creek SRMAs; the East Fork River WSR Unit; the Upper Green River big game migration bottleneck; the historic Sublette Cutoff Trail; and several sensitive cultural sites. In those areas that would not be withdrawn, management prescriptions would impact locatable minerals development as is seen, for example, in the Ross Butte's prescription: "to protect fragile soils and watersheds, sensitive plant species, and visual values in the Ross Butte area." Other SD/MAs would have their own prescriptions that could be restrictive to locatable minerals activity. This would be more restrictive than Alternatives 1 and 2.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4.

Impacts from the paleontology and natural history program, recreation management, and soils management would be the same as those identified for Alternative 1.

Under this alternative, in cultural resource management, impacts would result from buffer zones of no surface disturbance within one-quarter mile of the Lander Trail, which would be expanded along certain segments to buffer zones that would have restrictions on activity 1 mile from the trail. For contributing segments of the Lander Trail, a VRM Class II designation would be in place within 2 miles of the trail. Surface disturbance would be prohibited within 1 mile of the Sublette Cutoff. For some individual cultural sites, no surface disturbance would be allowed on or near the site. All of these restrictions would limit locatable minerals development in these areas. This would be more restrictive than Alternative 1.

In lands and realty management, 13,770 acres of new withdrawals from mining claim locations would be processed, including withdrawals for some cultural and recreational sites and for protection of wildlife habitat. Locatable minerals activities would not occur in those areas.

Recreation management would prevent substantial surface disturbance from locatable minerals development within one-quarter mile of developed recreational sites, which would cause any planned development to be relocated. This would be the same restriction as under Alternative 1.

Access management would close some areas to motorized vehicles and restrict access to designated roads in other areas. Approximately 2,500 acres between Silver Creek and Cottonwood Creek would be closed from November 15 to January 31. Other seasonal road closures would be possible. These closures would restrict possible locatable minerals activities in some areas and may result in relocation of those activities. This would be more restrictive than Alternative 1.

Vegetation management would withdraw both known and discovered locations of Special Status Plant Species from mining claim locations, which would preclude locatable minerals activity in those areas. This would be more restrictive than Alternative 1.

Compared to Alternative 1, under this alternative VRM management would keep the same acreage in Class I (21,290 acres); increase the acreage in Class II by 226% (from 73,430 acres to 239,520 acres) and in Class III by 124% (from 187,070 acres to 419,410 acres); and reduce Class IV acreage by 62% (from 641,140 acres to 242,660 acres). This would be more restrictive to locatable minerals activity than that under Alternative 1, because of the more stringent requirements to mitigate impacts on the visual setting under Classes II and III.

Watershed management would close 100-year flood plains and wetland/riparian areas to new permanent facilities. No locatable minerals mining activity would be allowed within 500 feet of 100-year flood plains, wetlands, and perennial streams, or within 100 feet of the edge of the inner gorge of intermittent and large ephemeral drainages. This would reduce the area available for locatable minerals development. The impacts under this alternative would be the same as under Alternative 3 but more restrictive than under Alternatives 1 and 2.

Wildlife management would affect locatable minerals activity by having seasonal closures for various species and by establishing minimum distances from wildlife activity such as raptor and greater sage-grouse nesting, as well as from greater sage-grouse breeding grounds. This alternative would designate a larger area as crucial winter range than under Alternative 1. In general, the restrictions under this alternative would be greater than those under Alternatives 1 and 2 but less than those under Alternative 3. In the case of locatable minerals, the restrictions would minimize the area available for exploration and mining. The time available for locatable minerals activities in different areas would also be constrained.

SD/MA management would create new ACECs at Trapper's Point and New Fork Potholes. Those areas, as well as the CCC Ponds SRMA, the East Fork River WSR Unit, and several sensitive cultural sites, would be withdrawn from mining claim location, thus eliminating locatable minerals activity. The Rock Creek and Beaver Creek ACECs would be retained, and the Miller Mountain, Ross Butte, and Wind River Front MAs would be established. Four rivers would be managed as suitable for the WSR system. In areas that would not be withdrawn, management prescriptions would impact locatable minerals development as is seen, for example, in the Ross Butte's prescription: "to protect fragile soils and watersheds, sensitive plant species, and visual values in the Ross Butte area." Other SD/MAs have their own prescriptions that may be restrictive to locatable minerals activity. This would be more restrictive than under Alternative 1.

4.7.3 Salable Minerals

Assumptions

The analysis is based on the following assumptions:

- Development of salable minerals (primarily aggregate and decorative stone) will be primarily driven by the pace of oil and gas development and of vacation home and recreational development.
- The early part of the planning period may have the greatest demand because of the initial construction of road infrastructure and the high rate of new housing construction.

Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, reviews of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or are described in qualitative terms if appropriate.

Impacts Common to All Alternatives

Impacts on the salable minerals resources are not anticipated as a result of implementing management actions for wildland fire and livestock grazing.

Air quality impacts on salable minerals development would consist of cooperation among BLM, WDEQ, and EPA to mitigate air quality impacts on a case-by-case basis. Examples of possible mitigation would be dust control on roads used in mining operations and WDEQ permitting of crushing/screening operations and asphalt plants.

The presence of cultural resources eligible for listing on the NRHP, as well as sites considered sensitive by Native Americans, could restrict and possibly prohibit some salable minerals exploration or mining activities. In some cases, relocation of the proposed activity could be necessary. The same types of impacts could result from salable minerals activities occurring within the visual setting of cultural resources, in cases where the cultural resource's visual setting contributes to its NRHP eligibility.

The discovery of significant paleontological resources could impact the timing and/or location of salable minerals activities. Significant paleontological resources would include vertebrate fossils, as well as scientifically important invertebrate and plant fossils. In most cases, the main impact would be a delay in the salable minerals development while fossils are collected and recorded.

There would be vegetation-related impacts on locatable minerals development from Special Status Plant Species protection, which could require relocation or prohibition of activities.

Salable minerals mining activity within established VRM class areas would generally be required to conform to the objectives and characteristics of the VRM classification, especially in respect to the placement and design of facilities. For example, in VRM Class II areas, the level of change to the characteristic landscape should be low. In VRM Class II areas, activity may be seen but should not attract the attention of the casual observer. In VRM Class III areas, the level of change to the characteristic landscape should be moderate. The mining area and production facilities may attract attention but should not dominate the view of the casual observer. In VRM Class IV areas, the level of change to the characteristic landscape could be high, with activities dominating the view and being the major focus of viewer attention.

Watershed impacts would involve the requirement that salable minerals activities comply with E.O. 11988, Floodplain Management, and E.O. 11990, Protection of Wetlands, as well as with the WDEQ's water quality standards. Mining operations would be designed to avoid siltation and pollution of surface water and groundwater. Hazardous Spill Response Plans would be required.

Wildlife and fish management impacts on salable minerals activities would involve mitigation for habitat or potential habitat containing listed, proposed, or candidate T&E species. Relocation and/or prohibition of certain development proposals could be required.

SD/MA impacts would result from the management plans written for all ACECs. SD/MA management prescriptions could cause modification or relocation of salable minerals development proposals.

The Lake Mountain (13,490 acres) and Scab Creek (7,710 acres) WSAs would be managed under the Interim Management Policy and Guidelines for Lands Under Wilderness Review (USDI 1987b), and salable minerals would be governed by the procedures in that policy, generally making the WSAs unavailable for salable minerals activities. Discretionary uses within or adjacent to WSAs will be reviewed to ensure that these do not create conflicts with management and preservation of wilderness

values. Salable minerals proposals near the WSAs could be prohibited or relocated because of this restriction.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

The cultural resources program would implement a no surface disturbance restriction within one-quarter mile or the visual horizon (whichever is closer) of contributing segments of historic trails. Three cultural sites would also be protected by an NSO requirement. Salable minerals exploration and mining activities may have to be modified or relocated to avoid impacting the trail and its setting as well as the three cultural sites.

The impacts from the paleontology and natural history program would include possible designations to protect areas of unique natural history or particular natural interest, such as NNLs, RNAs, or ACECs. One possible NNL would be the Pinedale Boulder Glacial area, located on the east side of the planning area. Depending on the management prescriptions for these areas, they could impede development of salable mining activity, particularly the removal of decorative boulders.

Recreation management would implement a no surface disturbance restriction within one-quarter mile of developed and semideveloped recreational sites, unless the uses are compatible with recreation. Salable minerals development could be restricted, depending on the type and magnitude of the activity.

Soils management would require mitigating measures to reduce soil erosion, as well as siltation and salinity inflow to the Green River Basin. Those measures could restrict exploration and development of salable minerals.

Access management could allow more access to salable areas by obtaining legal access to public land across private land. However, some roads could be closed, thus reducing access to some potential salable areas.

Vegetation management (riparian) would restrict placement of facilities in 100-year flood plains and wetland/riparian areas, which could affect salable minerals development plans.

VRM classification would have 21,290 acres in Class I; 73,430 acres in Class II; 187,070 acres in Class III; and 641,140 acres in Class IV. Salable minerals activities would be most restricted in VRM Class I and least restricted in VRM Class IV. Exploration, mining, and facilities would be subject to restrictions, redesign, or relocation, depending on the area involved and the VRM classification of that area. See Impacts Common to All Alternatives for more detail on allowable landscape changes.

Watershed management could impose mitigating measures to reduce soil erosion, as well as siltation and salinity inflow to the Green River Basin. Those measures could restrict exploration and development of salable minerals. Development within 500 feet of riparian/wetlands and live water would not be allowed, which could affect proposed salable minerals activities.

Wildlife and fish management would prohibit activity on and near elk feedgrounds, unless the activity is temporary or compatible with elk habitat management. Salable minerals activity could be restricted by this mitigation in certain areas. Seasonal wildlife restrictions and distance restrictions from various wildlife habitat areas would complicate and in some cases prohibit salable minerals activities. These restrictions could cause an operator to move to nearby state or private land having no such restrictions.

There would be a no surface disturbance requirement in the Rock Creek drainage area of the Rock Creek ACEC. The Beaver Creek ACEC would contain restrictions on activity on steep slopes and near streams, which could also affect any potential salable minerals activity.

Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 2.

The impacts from soils and watershed management would be the same as under Alternative 1.

Cultural program management would impact salable minerals by prohibiting surface occupancy on certain cultural sites and by prohibiting activity within one-quarter mile of certain historic trails. This could cause salable minerals activities in some areas to be prohibited or relocated. This would be more restrictive than under Alternative 1, because more sites would be protected under this alternative.

This alternative would place fewer restrictions on oil and gas development than Alternative 1, which would probably result in higher demand for mineral materials.

The paleontology and natural history program would not process designations to protect areas of unique natural history or particular natural interest, such as NNLs. This would be less restrictive than under Alternative 1 and would have less of an impact on salable minerals development.

Recreation impacts would include creating a one-quarter-mile zone of no surface disturbance around developed recreational sites and placing various restrictions on three SRMAs (Boulder Lake, Scab Creek, and Upper Green River). This would impact salable minerals by limiting development around sites and possibly by modifying development proposals in SRMAs. This would be less restrictive than under Alternative 1.

Under this alternative, access management could allow more access to salable areas by obtaining legal access to public land across private land. This would be less restrictive than under Alternative 1, because no roads would be closed.

Under this alternative, vegetation management would require weed control, which could add some costs to salable minerals operations and would be slightly more restrictive than under Alternative 1. However, this alternative would not restrict placement of facilities in 100-year flood plains and wetland/riparian areas, which would make it less restrictive overall than Alternative 1.

Compared to Alternative 1, VRM management under this alternative would reduce acreage in Class I areas (from 21,290 acres to 0 acres) and in Class III areas (from 187,070 acres to 118,390 acres) and would increase acreage in Class II areas (from 73,430 acres to 87,150 acres) and in Class IV areas (from 641,140 acres to 717,390 acres). The percentage increase for VRM Class II acreage (+16%) is offset by the decrease in VRM Class I acreage (-100%) and in VRM Class III acreage (-36%) and by the increase in VRM Class IV acreage (+11%). Overall, these changes in VRM classification would allow larger impacts on the landscape, which could allow more development of salable minerals.

Under this alternative, wildlife and fish management would have temporal and areal restrictions on greater sage-grouse leks, nesting areas, and winter concentration areas, and elk feedgrounds would be closed. However, no seasonal restrictions would be applied for activities in big game parturition areas, crucial winter ranges, and migration routes and bottlenecks. This would allow more year-round salable minerals activity and would be less restrictive than under Alternative 1.

SD/MAs would impact salable minerals development by prohibiting certain activities in particular areas. Under this alternative, impacts would include a new ACEC (Trapper's Point—550 acres) and an area of 1,590 acres outside the ACEC where activity would be prohibited. However, the Beaver Creek ACEC (3,590 acres) and Rock Creek ACEC (5,270 acres) would be dropped, making this alternative less restrictive than Alternative 1.

Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 3.

The impacts from the paleontology and natural history program, soils management, and wildlife management, would be the same as under Alternative 1.

Cultural resources management would write activity plans, prevent surface disturbance at various sites, create a VRM Class II area within 3 miles of historic trails, and allow no surface disturbance within 1 mile of trails. This could cause salable minerals activities in certain areas to be relocated or prohibited. This would be more restrictive than under Alternative 2.

Minerals management for oil and gas would involve the maximum restrictions, which would lower the number of wells and reduce the demand for aggregate.

Recreation management would implement a no surface disturbance restriction in a zone one-half mile around recreational sites and would also add an additional SRMA (Green and New Fork Rivers). This could cause salable minerals activities to be relocated or prohibited in some areas. This would be more restrictive than under Alternative 2.

Access management, in addition to trying to obtain access across private land to public land, would also close some areas to motorized vehicles. This could hinder salable minerals development and would be more restrictive than Alternative 1.

Vegetation management would prohibit surface-disturbing activities that could affect Special Status Plant Species (including future discoveries) or their habitats. This could restrict salable minerals mining projects and would be more restrictive than Alternative 1.

Compared to Alternative 1, under this alternative VRM management would reduce acreage in Class IV areas by 56% (from 641,140 acres to 282,300 acres) and would increase acreage in Class II areas by 436% (from 73,430 acres to 393,260 acres) and in Class III areas by 21% (from 187,070 acres to 225,830 acres). VRM Class I acreage would remain the same under both alternatives (21,290 acres). This would result in more restrictions on salable minerals development under this alternative, and this would be much more restrictive than under Alternatives 1 and 2.

Under this alternative, watershed impacts would be more restrictive than under Alternatives 1 and 2, because this alternative would generally restrict surface disturbance activities on 100-year flood plains and within one-quarter mile of wetland/riparian areas and would specifically prohibit salable minerals exploration and mining within 500 feet of 100-year flood plains, wetlands, or perennial streams. This alternative would also prohibit mining activity within 100 feet of the edge of the inner gorge of intermittent and large ephemeral drainages. Many of the areas restricted from salable mineral development are likely to contain, to some extent, salable minerals. These restrictions would put many of these minerals out of reach. These restrictions could inhibit or cause relocation of salable minerals activities and would be more restrictive than under Alternatives 1 and 2.

Wildlife and fish management impacts on salable minerals would be highest under this alternative. The seasonal greater sage-grouse buffer would be extended to 3 miles, the acreage in winter range areas would increase, and parturition areas would cover deer and pronghorn as well as elk. Seasonal restrictions on big game migration areas would also be enforced. Exceptions would not be granted under any of the restrictions mentioned above. Larger buffer areas would be in effect around sage-grouse leks, elk feedgrounds, and raptor nests. The net effect of the wildlife restrictions would allow a smaller area and less time for any possible salable minerals development. This would be more restrictive than under Alternatives 1 and 2.

SD/MAs would be most numerous under this alternative. The Rock Creek and Beaver Creek ACECs would be retained. New ACECs would be designated in the Trapper's Point, New Fork Potholes, Upper Green River, White-tailed Prairie Dog, Ross Butte, and CCC Ponds areas (65,340 acres). The Trapper's Point ACEC would be larger under this alternative (9,540 acres). The Miller Mountain and Wind River Front MAs would be established (424,840 acres). Four river units would be managed as suitable for inclusion in the WSR system: East Fork River, Scab Creek, Silver Creek, and the Upper Green River (10,440 acres). Management prescriptions would impact salable minerals development; as an example, Ross Butte's prescription is to "protect fragile soils and watersheds, sensitive plant species, and visual values in the Ross Butte area." Other SD/MAs would have their own prescriptions that would be restrictive to salable minerals activity. This would be more restrictive than under Alternatives 1 and 2.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4.

The impacts from the paleontology and natural history program, recreation management, and soils management would be the same as under Alternative 1.

In cultural resource management, impacts would result from buffer zones of no surface disturbance within one-quarter mile of the Lander Trail, which would be expanded in a certain area to a zone with restrictions on activity 1 mile from the trail. For contributing segments of the Lander Trail, a VRM Class II designation would be in place within 2 miles of the trail. Surface disturbance would be prohibited within 1 mile of the Sublette Cutoff. For some individual cultural sites, no surface disturbance would be allowed on or near the site. All of these restrictions would affect salable minerals development by either preventing it or causing it to be relocated. This would be more restrictive than under Alternative 1.

Recreation management would prevent substantial surface disturbance from salable minerals within one-quarter mile of developed recreational sites, which would cause any planned development to be relocated. This would be the same restriction as under Alternative 1.

Access management would close some areas to motorized vehicles and restrict access to designated roads in other areas. Approximately 2,500 acres between Silver Creek and Cottonwood Creek would be closed from November 15 to January 31. Other seasonal road closures would be possible. These closures would restrict possible salable minerals activities in some areas and could result in relocation of those activities. This would be more restrictive than under Alternative 1.

Vegetation management would protect or close known or discovered locations of Special Status Plant Species to mineral material sales. This would be more restrictive than under Alternative 1.

Compared to Alternative 1, under this alternative, VRM management would increase the acreage managed as Class II by 226% (from 73,430 acres to 239,520 acres) and as Class III by 124% (from

187,070 acres to 419,410 acres), and would reduce the acreage managed as Class IV by 62% (from 641,140 acres to 242,660 acres). This alternative would be more restrictive to salable minerals activity than Alternative 1, because of the more stringent requirements under VRM Class II and VRM Class III to mitigate impacts on the visual setting.

Watershed management would close 100-year flood plains and wetland/riparian areas to new permanent facilities. No salable minerals mining activity would be allowed within 500 feet of 100-year flood plains, wetlands, and perennial streams, and within 100 feet of the edge of the inner gorge of intermittent and large ephemeral drainages. Many of the areas restricted from salable mineral development are likely to contain some extent of salable minerals, especially sand and gravel. These restrictions would put many of these minerals out of reach. This would reduce the area available for salable minerals development, and the impact would be the same as under Alternative 3, which is more restrictive than under Alternatives 1 and 2.

Wildlife management would have seasonal closures for various species, as well as minimum distances from wildlife activity such as raptor and greater sage-grouse nesting, and also from sage-grouse breeding grounds. This alternative would designate a larger area as crucial winter range than under Alternative 1. In general, the restrictions under this alternative would be greater than those under Alternatives 1 and 2 but less than those under Alternative 3. In the case of salable minerals, the restrictions would minimize the area available for exploration and mining, which would require relocation of the activity. The time available in different areas for salable minerals activities would be constrained as well. Seasonal restrictions on BLM lands could cause an operator to move to nearby state and private lands that do not have such seasonal restrictions and could result in greater overall surface disturbance and loss of federal revenues.

SD/MA management would create new ACECs at Trapper's Point and New Fork Potholes. Rock Creek and Beaver Creek ACECs would be retained, and Miller Mountain, Ross Butte, and Wind River Front MAs would be established. Four rivers would be managed as suitable for the WSR system. Management prescriptions would impact salable minerals development: an example is the Ross Butte prescription to "protect fragile soils and watersheds, sensitive plant species, and visual values in the Ross Butte area." Other SD/MAs would have their own prescriptions that may be restrictive to salable minerals activity. Development could be prohibited or require relocation, which would be more restrictive than under Alternative 1.

4.8 PALEONTOLOGY AND NATURAL HISTORY

This section presents potential impacts on paleontological resources from management actions of other resource programs. Chapter 3 (Section 3.8) describes the existing condition of paleontological resources.

4.8.1 Assumptions

The analysis is based on the following assumptions:

- Vertebrate fossils will continue to be found throughout the Tertiary units exposed in the planning area. The Green River and Wasatch Formations are the most important geologic formations for paleontological resources, but nearly all the sedimentary formations are known to contain fossils.
- The number of paleontological resources that could be impacted by various actions is directly correlated with the degree, nature, and quantity of surface-disturbing activities within the planning area.
- Paleontological resources are most typically associated with bedrock exposures. Areas of deep soils, alluvium, or colluvium only rarely contain significant fossils. Therefore, the main areas of concern for impacts on paleontological resources are where fossil-bearing bedrock is at or near the surface, such as badlands, hill slopes, or areas with thin soils over bedrock.
- Surveys required prior to surface disturbance in areas known or suspected to contain significant paleontological resources would result in the identification and evaluation of previously undiscovered resources. In addition, continuing scientific research within the planning area will identify new paleontological resources. BLM would then manage these newly discovered resources accordingly.

4.8.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area; reviews of existing literature; and information provided by other agencies, institutions, and individuals. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

4.8.3 Impacts Common to All Alternatives

Paleontological resource management policy requires the assessment of paleontological resources prior to surface-disturbing activities. Any needed surveys or mitigation actions would be performed by a qualified paleontologist. This would serve to protect most paleontological resources from significant damage. A small benefit to paleontological resources would result from their identification, recordation, and collection, which would occur from applying mitigation measures to surface-disturbing activities that would be conducted under most of the resource programs.

Unmitigated surface-disturbing activities could damage or destroy paleontological resources that were unknown before that activity. Surveys performed prior to surface disturbance will not always locate all fossil material; therefore, surface disturbances in surveyed areas may still damage undiscovered paleontological resources. Subsurface paleontological resources cannot be identified prior to their

disturbance, but some geological features can indicate a higher likelihood of subsurface paleontological resource occurrence. Surface disturbances could expose fossils to discovery that would otherwise have been buried until exposed by natural erosion, thereby enhancing scientific knowledge.

Damage or destruction of unidentified paleontological resources is possible during any surface-disturbing activity. Impacts on unknown paleontological resources would often be greater than impacts on resources that had been previously identified (and thereby either avoided or subjected to mitigation measures), because recordation and evaluation of those unknown resources would not occur prior to any damage to them. These impacts would complicate mitigation procedures and result in a loss of scientific information. If paleontological resources that are discovered during disturbance activities should remain salvageable, further impacts could be mitigated through recovery of the fossil material and related data. Most surface-disturbing activities, including those that have mitigation measures applied, would preclude any future research.

Surface-disturbing activities are a component of several resource management and development actions. The aforementioned assessment and mitigation procedures would be applied in a similar manner to all surface-disturbing activities, but could vary in the level of mitigation on a case-by-case basis, depending primarily on the potential for impact on significant paleontological resources and the degree of planned disturbance. These procedures would not change under the various alternatives. Management of forest resources, minerals, recreation, OHVs, and fire and fuels, could all have a surface disturbance component.

Lands and realty management actions could impact paleontological resources by transferring public lands from federal jurisdiction and thereby removing federal protection measures and land use stipulations. However, before transferring public lands from federal jurisdiction, a paleontological assessment would be required, providing for adequate data recovery and documentation of significant paleontological resources. In addition, if surveys and evaluations identified significant fossil resources, the realty action could be adjusted to retain the associated parcels containing the resources. Given these conditions, the potential for such impacts would be minimal. Administrative actions that restrict scientific research, through restriction of either surface disturbance or access, would limit recovery of paleontological resources.

Physical damage or destruction to paleontological resources could result from trampling by grazing animals or from OHV activities if specific localities or fossils are impacted. Livestock tend to concentrate more than wildlife around water/mineral sources and also create wide, deep trails down hillsides to and from water sources, and therefore impacts from livestock would tend to be greater. This impact would be uncommon but would occur in some areas. Recreational OHVs tend to run straight upslope, sometimes repeatedly, leading to physical destruction and increased erosion. This could locally be a larger impact than trampling by grazing animals, but would still be localized in certain areas.

Soils management activities that reduce soil loss and mitigate soil erosion would maintain the soil cover that reduces degradation of paleontological resources within the bedrock/soil matrix. Restrictions on development projects with a potential to disturb the surface and increase erosion would reduce the degradation or destruction of paleontological resources. Implementation of intensive management activities to reduce erosion, whether naturally occurring or related to development activity, would reduce the exposure and degradation of paleontological resources.

The proliferation of unauthorized OHV trails would decrease vegetative cover and increase erosion, leading to potential exposure, damage, or destruction of paleontological resources. In addition, unauthorized OHV use off designated or existing roads and trails could directly damage paleontological resources at or near the surface. The significance of these impacts would depend on whether the surface

disturbance took place within an area with a high probability for paleontological resources or otherwise impact significant paleontological resources.

OHV use on designated or existing roads and trails would increase the potential for direct damage to or loss of significant paleontological resources where these routes pass through significant localities or areas with a high probability for paleontological resources. In addition, continued use in these areas would result in continued and additional erosion, increasing the potential for damaging paleontological resources.

The majority of recreation in the planning area would not require paleontological clearances and would not result in significant impacts on paleontological resources. While the recreational collecting of common nonvertebrate fossils is permissible, the uninformed and/or willful collection of significant and therefore protected paleontological resources could result in the damage to or complete removal of significant fossil resources from the public lands.

Increased access in areas known to contain a high probability for paleontological resources would improve the ability of authorized paleontologists to access the resources with the appropriate resources for research and recovery. Conversely, improved access would also increase the likelihood of unauthorized collection of paleontological resources.

Disturbance of paleontological resources within SD/MAs would be minimal because of increased development and occupancy restrictions and restrictions on surface-disturbing activities. Impacts from permitted surface-disturbing activities would not be anticipated because all activities would require inventories and appropriate mitigation.

Management actions for SRMAs that encourage recreation and development of facilities would impact paleontological resources directly through ground disturbing activities. Indirect impacts would result from the larger presence of human activity, which would increase the potential for vandalism. Direct impacts from ground disturbing actions would be mitigated by resource inventories, evaluations, and avoidance and data recovery procedures.

Damage to paleontological resources could occur as a direct result of surface disturbances caused by wildland fire suppression activities (e.g., construction of fire lines, bulldozing access roads, and general movement of heavy equipment) and indirect instances of increased erosion, although fire itself has nearly no effect. Because of the unplanned nature of wildland fires, the impacts on paleontological resources from wildland fire suppression activities would generally be unmitigated. Ground-disturbing activities during firefighting actions and postfire rehabilitation activities could damage or destroy known and unknown significant paleontological resources.

Fire management actions that minimize the potential for unplanned wildland fires or that lessen suppression activities would indirectly protect paleontological resources. Increased erosion from loss of vegetation following wildland fires could accelerate exposure and deterioration of paleontological resources. Identification of known localities and sensitive areas during fire planning efforts would allow for possible avoidance or modification of fire suppression activities, such as reducing the use of heavy equipment in paleontologically sensitive areas.

Disturbance of paleontological resources within SD/MAs would be minimal because of increased restrictions on development, surface occupancy, and surface-disturbing activities. Impacts from permitted surface-disturbing activities would not be anticipated because all activities would require assessment for paleontological resources and appropriate mitigation. Furthermore, most SD/MAs are not in areas of high paleontological resource potential.

4.8.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 1.

No restrictions are presently identified for the protection of cultural resources that may co-occur with paleontological resources. Although the possibility of such a situation is extremely low, the existing regulations would probably influence recovery of any significant paleontological resources.

Approximately 43,022 acres would be disturbed by oil, gas, and CBNG development throughout the planning area. Surface-disturbing activities associated with this development could damage or destroy paleontological resources that were not discovered and mitigated before surface disturbance occurred. These impacts could also occur as a result of locatable and salable minerals management activities.

Restrictions on surface-disturbing activities in VRM Class I and Class II areas (94,720 acres) would result in indirect protection of paleontological resources.

4.8.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 2.

The impacts from recreation and SRMA management actions would be the same as under Alternative 1.

Additional protections and restrictions for cultural resources would be implemented. There is a slight possibility that the sites or trails may correspond to paleontological localities, and this could have a slight impact on the retrieval of important fossils.

The impacts from lands and realty management would be similar to those under Alternative 1, except that the increase in ROW avoidance (201,420 acres) and exclusion areas (28,420 acres) would limit ROW placement, thereby reducing the likelihood of potentially disturbing or damaging currently unknown paleontological resources in these areas.

Impacts from minerals management would be greater than those under Alternative 1. Reduced restrictions on mineral development would result in increased foreseeable development. Nearly 46,739 acres of disturbance would occur throughout the planning area as a result of oil and gas and CBNG development. This would increase the potential for damage and destruction of previously unidentified paleontological resources. An increase in the number of roads related to mineral development would provide increased opportunities for access by OHVs, indirectly increasing the potential for disturbance of paleontological resources. Because only 11,256 acres of new roads would be required to accommodate increased mineral development, this impact would be minor.

Allowing establishment of ROWs without regard to common routes could increase the potential for disturbance of or damage to currently unknown paleontological resources.

Impacts from OHV use would be less than those under Alternative 1. A smaller area would be open to OHV use. OHV use in the 237,360-acre open area would be limited to existing roads and trails under this alternative, reducing the potential for damage, destruction, or looting of paleontological resources in this area. In addition, OHV use on approximately 18,970 acres would be limited to designated roads and trails.

This would further limit the impacts associated with OHV use by prohibiting travel in areas with a high probability for paleontological resources.

Impacts from VRM actions would be reduced compared to under Alternative 1. A larger area would be designated as VRM Class II (13,720 more acres than under Alternative 1). This would likely reduce surface-disturbing activities within these areas and subsequently increase the level of protection for paleontological resources.

Increased wildland fire use compared to that under Alternative 1 would result in increased surface disturbances caused by wildland fire suppression activities (e.g., construction of fire lines, bulldozing access roads, and general movement of heavy equipment). Although the likelihood for damage or destruction of paleontological resources from ground-disturbing activities would increase, the impacts from postfire effects and rehabilitation activities would decrease because of increased use of emergency stabilization and rehabilitation measures.

4.8.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 3.

The impacts resulting from access management would be the same as those under Alternative 1.

The impacts resulting from fires and fuels management would be the same as those identified under Alternative 2.

Additional protections and restrictions for cultural resources would be implemented, more than under Alternative 2. There is a slight possibility that the sites or trails may correspond to paleontological localities, and this may have a slight impact on the retrieval of important fossils.

The impacts from lands and realty management would be less than under Alternative 1. An increase in areas of ROW avoidance (555,210 acres) and exclusion (166,980 acres) would restrict or preclude ROW placement, reducing the likelihood that currently unknown paleontological resources in these areas would be disturbed and potentially damaged.

The impacts from minerals management would be less than those under Alternative 1. Increased land use restrictions would result in reduced foreseeable development. Approximately 31,139 acres of disturbance would occur throughout the planning area as a result of oil and gas and CBNG development. This would decrease the potential for damage and destruction of paleontological resources.

The impacts from OHV use would be least extensive under Alternative 3. Similar to Alternative 2, the 237,360-acre open area would be limited to existing roads and trails, thereby reducing the potential for exposure, damage, destruction, or looting of paleontological resources in this area. Areas limited to existing roads and trails would be increased to 751,920 acres, and areas limited to designated roads and trails would be increased to 140,610 acres. As compared to Alternative 1, these designations would decrease OHV-related impacts by limiting and prohibiting travel in areas with a high probability for paleontological resources.

The areas protected as VRM Class I and Class II (414,550 acres) would decrease the potential for unknown paleontological resources to be disturbed or damaged through surface-disturbing activities.

The increased number of SD/MAs and associated land use restrictions would reduce the potential for disturbance or destruction of paleontological resources during surface-disturbing and other disruptive activities.

4.8.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 4.

The impacts resulting from recreation, SD/MAs, and access management actions would be the same as under Alternative 1.

The impacts resulting from cultural resource and wildland fire management would be the same as under Alternative 2.

The impacts from lands and realty management would be less than under Alternative 1. An increase in areas of ROW avoidance (550,210 acres) and exclusion (41,500 acres) would restrict or preclude ROW placement, reducing the potential for disturbing and potentially damaging currently unknown paleontological resources in these areas.

The impacts from minerals management would be less than under Alternative 1. Increased land use restrictions would result in reduced foreseeable development. Approximately 42,180 acres of surface disturbance would occur throughout the planning area as a result of oil and gas and CBNG development. This would decrease the potential for damage and destruction of paleontological resources.

The impacts from OHV use would be similar to those under Alternative 3. All OHV Open areas would be eliminated, thereby reducing the potential for exposure, damage, destruction, or looting of paleontological resources. In addition, OHV use on over 139,000 acres would be limited to designated roads and trails. This would further limit the impacts associated with OHV use by prohibiting travel in areas with a high probability for paleontological resources.

The areas protected as VRM Class I and Class II (260,810 acres) would result in increased restrictions over a larger area, decreasing the potential for disturbing or damaging unknown paleontological resources through surface-disturbing activities.

4.9 RECREATION AND VISITOR SERVICES

This section describes potential impacts on recreational resources affected by other resource management activities and programs. Recreational resources available for public use are dependent largely on the physical setting and associated recreational opportunities.

Traditional recreational activities within the planning area include hunting, fishing, boating and floating, camping, hiking, rock climbing, horseback riding, learning about cultural and natural history, OHV use, rock hounding, photography, wildlife viewing, shed antler gathering, and social gatherings.

Chapter 3 (Section 3.9) describes existing conditions concerning recreational resources.

Section 4.12.2 of this chapter discusses OHV management and specific impacts on OHV use; however, based on the level of recreational OHV use in the planning area, this section has some references to OHV use.

4.9.1 Assumptions

The analysis is based on the following assumptions:

- Traditional recreational uses of planning area lands will continue, despite new recreational activities based on new technologies occurring in the area.
- The demand for fishing, floating, camping, OHV use, and new technology-based recreation is expected to increase. The number of hunters will fluctuate with the size of the herds and other indirect factors, but because of less interest by younger generations, the number of hunters will decrease.
- The incidence of resource damage and conflicts between OHV users and nonmotorized recreationists will increase as OHV use increases.
- Both new and traditional recreational uses will be accommodated where determined appropriate to support achievement of resource goals.
- Visitation throughout the planning area will continue to increase as resource availability and conditions allow. As the population of both neighboring states and the local area continues to grow, the need or search for less crowded or more remote recreational opportunities will continue to bring more people to the public lands in Wyoming.

4.9.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources and the planning area, reviews of existing literature, and information from other agencies. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

Impacts will be described in terms of the effect on the natural resource recreation settings and targeted outcomes as related to recreational activities, experiences, and benefits. Effects on recreation may also be expressed in terms of the quantity and quality of recreational opportunities, experiences, and benefits.

Quantity is expressed in terms of the availability of recreational opportunities, and quality is expressed in terms of improved or degraded recreational experiences and benefits.

4.9.3 Impacts Common to All Alternatives

Impacts on recreational resources are not anticipated as a result of implementing management actions for the paleontology and leasable minerals (other than fluid minerals).

Air quality affects user recreational benefits when the air visibility or quality appears diminished by human-caused or environmental factors. A perceived loss of air quality may prompt some users to be displaced to other areas, may cause user expectations about recreating in these areas to change, or may cause users to rationalize the importance of their pursuits with the causes of air quality issues.

Cultural resource management actions generally enhance recreational experiences and provide benefits by protecting resources and educating the public about cultural resources. Management actions for cultural resources could preclude the development of recreational facilities and opportunities in extremely localized areas, but this is expected to be minimal. Management actions involving interpretive programs, signage, markers, and other elements for historic trails, other historic sites, and important prehistoric sites would enhance recreational experiences, increase public awareness and stewardship, and reduce impacts on natural resources.

Forest management in the long term and short term would affect recreational activities, experiences, and benefits. Managing timber resources to favor the maintenance of forest health and to maintain cover for wildlife would maintain wildlife populations and the number of hunting days. The relative increase or decrease in the available forest cover, type, and condition would generate various effects on recreational resources. Forest management practices often create access where none existed or may change wildlife habitat to favor certain desired game species, thus increasing species population. Conversely, people may find modifications to the forest structure visually distracting and detrimental to their experience, and forest management would therefore be a detriment. Accomplishing landscape-level forest management objectives generally maintains and provides substantial recreational value. Timber harvest activities on a localized basis have a tendency to create a long-term shift in the recreational setting from Middle Country or Front Country settings to a Rural setting. Road closures implemented as part of timber harvest activities generally have not been effective because of closure violations. Ineffective road closures would most often result in increased hunting pressure and disruption of wildlife. People seeking a more primitive experience, one in which they encounter fewer roads, would be displaced to other areas. These changes would likely result in increases and changes in the types of recreational use occurring in the planning area. Prescribed forest management practices would likely contribute moderate to major recreational benefits.

Livestock grazing in and around campgrounds would create impacts on vegetation and could cause physical damage to facilities. The use of livestock fences could serve as obstacles to certain recreational activities. Livestock rub on public and private property such as signs and vehicles, and defecate in and around campsites, boat ramps, and other facilities. Allowing grazing on lakeshore and riparian areas could cause soil compaction and have impacts on riparian vegetation; this would be especially apparent in riparian areas where livestock remain for extended periods of the grazing season or where livestock are concentrated while grazing and loafing. These conditions decrease the benefits associated with an aesthetically pleasing and healthy environment and increase the public’s disregard for public property. The benefits attributed to the public’s perception of BLM grazing and recreational management practices would be affected. In localized areas, the impacts would be moderate. Some people enjoy seeing

livestock; grazing may contribute to an understanding of commodity production and agricultural practices.

Where existing and expanding fluid mineral development and associated ROWs, power lines, roads, and facilities change the recreational setting from a Front Country, Middle Country, or Rural setting to a predominately Urban setting, there would be long-term displacement of traditional recreation activities and a major loss of recreation benefits. Impacts on some recreation-based commercial business that requires a more primitive setting could be substantial. Diminished or relocated wildlife populations attributed to a loss of functional habitat or to other oil- and gas-related factors could impact wildlife-dependent recreational activities. Where quality recreational opportunities are diminished or foregone, there would be a major loss of personal, social, and economic benefits. However, potential onsite and offsite mitigation for wildlife habitat, if implemented, could reduce these impacts or enhance recreational values and associated benefits. Areas of intense fluid mineral development pose public health and safety risks, especially when industrial traffic and hazardous materials are present. Likewise, some recreational activities such as big game hunting within close proximity of fluid mineral facilities and activities may create hazards to industry employees and property. This potential risk-related impact may currently be low, but as development expands in the presence of continued public access, this impact may become a moderate risk. In addition, continued fluid mineral development would reduce the satisfaction associated with the hunting experience, because areas of high development are generally not satisfactory places to hunt.

The influx of fluid mineral development personnel and their families has increased the demand for the benefits derived from outdoor recreational activities. Increased use can impact BLM-managed facilities and natural resources when use exceeds capacity. In the long term, these impacts may be moderate to major. Conversely, additional intensive fluid mineral development would reduce the availability of open space and associated recreational resources. Indirect impacts would occur where fluid mineral activities create undesirable conditions. Displaced recreationists may move to adjacent undeveloped areas for their recreation. These new use areas could become more crowded, and social conditions may deteriorate. Opportunities to enjoy dispersed recreation would be diminished proportionately to the amount of area affected by fluid mineral development. Locatable and salable mineral development would create similar impacts, but for the planning area, the expected impacts from these kinds of development on recreational opportunities and the visitor experience should be minimal.

The development, use, and extraction of other resources in the planning area could cause substantial short-term and long-term impacts on recreational use. Impacts on the recreational setting would occur from intense development associated with construction of facilities and ROWs for pipelines, transmission lines, communication lines and towers, and mineral development. Land clearing, grading, construction, and drilling activities in project areas would also impact recreational use in the short term.

Recreational resource management actions would promote the public’s enjoyment of recreational activities in desired settings and would also produce major personal and economic benefits. Recreation management actions would reduce risks to public health and safety while decreasing impacts on soil, water, vegetation, wildlife, and cultural resources. Recreational activities would be impacted by both road closures and the development of roads associated with mineral development and other use activities. However, the development of roads and acquisition of legal access could enhance recreational activities by maintaining or increasing recreational access.

Soil management actions targeting the protection of soils and the reduction of unacceptable erosion levels could require seasonal restrictions or closures of roads and trails, which would displace recreationists and restrict recreational activities. Soils and watershed protection measures could restrict the development of future recreational facilities. Management actions associated with watershed areas could also influence

the design and use of recreational facilities and types of recreational activities. However, these impacts on recreation would be expected to be minimal. Management actions aimed at monitoring and protecting water quality would benefit recreational resources by maintaining the existing water quality in the planning area. The protection of riparian areas would also provide protection to recreational resources. Management of water quality in areas adjacent to the Green River and its tributaries, as well as in ponds located on BLM-administered lands, could restrict recreational activities.

Vegetative treatments would result in short- and long-term impacts on recreational experiences. Over the short term, recreationists might be displaced from treated or denuded areas to other more desirable areas until revegetation occurs. Area closures resulting from prescribed burns would temporarily prohibit recreational use. However, over the long term, vegetative treatments would result in improved vegetation cover and aesthetic qualities. Revegetation efforts would improve the visual quality of these areas over the long term, which would enhance recreational experiences.

Development activities, including the construction of recreational sites, would be prohibited in areas designated as VRM Class I, and would only be allowed in areas designated as VRM Class II where adequate mitigation was possible. Although these designations would reduce recreational opportunities related to developed sites, they would enhance recreational values related to solitude and natural environments. Substantial changes to the landscape would occur in areas designated as VRM Class III and Class IV. These changes would create short- and long-term visual impacts that would directly cause moderate to major impacts on the recreational setting. Outdoor recreationists generally avoid areas where the visual characteristics have been altered dramatically or appear unnatural. Typically, the area visually affected by surface-disturbing activities and associated features is considerably larger than the actual affected area. There could be major losses of recreational benefits as changes occur to existing and expected landscapes.

Water quality, if degraded by human or natural factors, would alter the level of use and enjoyment of recreational resources.

Fuels and fire management often creates temporary closures during wildland fire incidents, and prescribed burns may inhibit recreational uses of those areas involved. Management of vegetative resources through fire and prescribed burns could improve range conditions and wildlife habitat, which could benefit recreational activities, especially wildlife viewing and hunting.

Improvement of wildlife habitat through vegetation manipulation could increase wildlife populations, which would result in enhanced wildlife viewing opportunities and an increase in the number of allowed annual hunting days. Specifically, vegetation treatments in livestock grazing areas could improve wildlife habitat and increase wildlife populations.

Maintaining wilderness values like solitude, primitive and unconfined recreation, and naturalness would create recreational benefits for those seeking primitive or backcountry settings.

Special protections and enhancements in SD/MAs could increase visitation, particularly if their attributes are publicized. WSAs could serve as attractive locations for recreational users seeking primitive recreational opportunities and associated benefits, as would certain wildlife-related SD/MAs that would enhance or preserve benefits derived from hunting, fishing, and wildlife observation. SRMAs would be designated to protect unique recreational settings and experiences, which would provide substantial long-term personal, environmental, and economic recreational benefits.

4.9.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

BLM would pursue opportunities to acquire public access to certain areas to ensure continued availability of outdoor recreational opportunities and realized benefits. Consolidation of land ownership would be pursued in the applicable areas within the planning area to increase recreational opportunities for the public. Access acquisitions and land tenure adjustments would facilitate greater access to recreational areas and would reduce conflicts between recreationists and landowners within the planning area. These lands and realty actions, combined with the continued protection of existing recreational resources by the establishment of ROW avoidance areas and exclusion areas, could result in an increase in available recreational opportunities.

Surface disturbance caused by the construction of well pads and roads for mineral exploration and by the development of 7,192 proposed new wells would degrade the recreational setting and resources. The application of NSO stipulations on mineral leases within one-quarter mile of developed recreational sites would reduce direct impacts from fluid mineral development. Implementation of these stipulations would be essential to ensure public safety and protect the recreational sites and river-related resources. The application of NSO stipulations on mineral leases within the Upper Green River SRMA would maintain the river corridor's primary recreational values, but development on adjacent lands outside of the one-quarter mile zone, which are not subject to the NSO restrictions, would create direct and substantial impacts on the SRMA's setting and recreational values. A major loss of personal, environmental, and economic benefits could occur in the event fluid mineral developments were to occur in this SRMA.

OHV use would enhance recreational opportunities by facilitating dispersed use of recreational resources and access to recreational areas inaccessible to ordinary street vehicles. However, OHV use and its effects on air quality, noise levels, soils, vegetation, wildlife, and general aesthetics would diminish the recreational quality for other recreationists seeking solitude and natural settings for camping, hiking, and nonmotorized recreational activities. The pioneering of unauthorized roads and trails could degrade some recreational experiences. The Big Piney and Mount Airy OHV Open areas could be established pending activity plan development. The establishment of these areas designed to accommodate intense recreational OHV use would provide for a variety of OHV experiences while reducing excessive disturbance and road and trail proliferation. The creation of these managed OHV areas would reduce user conflicts elsewhere in the extensive recreation management area (ERMA) where motorized users share the same areas with users seeking a more primitive recreational experience. The Desert General Use area (237,360 acres) would be designated as open to generalized OHV use. Impacts on sensitive resources resulting from unregulated motorized vehicle use may prompt the closure of some areas to motorized activities. This action could create moderate impacts on OHV recreational opportunities and experiences.

The authorization of special recreation permits (SRP) and associated mitigation requirements for commercial, competitive, and group activities would create substantial economic and personal benefits. There could be moderate effects from conflicts such as crowding between private and commercial recreational service providers or others authorized by SRPs.

Management of the Boulder Lake (5,790 acres), Scab Creek (18,460 acres), and Upper Green River (5,160 acres) SRMAs would create major personal, environmental, and economic benefits. Recreational planning for these areas would reduce user conflicts and provide for the long-term enhancement of recreational values and benefits.

The protection and improvement of wildlife habitat and riparian areas would enhance recreational resources and could increase recreational visitations associated with fishing, hunting, and nonconsumptive wildlife uses. Wildlife, the most valuable recreational resource in the planning area, provides opportunities for hunting, fishing, and viewing. The protection of sensitive wildlife habitat and the application of leasing stipulations to protect wildlife would ensure the continued availability and production of wildlife-dependent recreational benefits. Although the protection of crucial big game winter ranges, elk feedground areas, and sage-grouse strutting grounds would enhance the recreational experience, recreational activities in these areas could be restricted. Restrictions on access to certain wildlife areas, such as crucial winter range, birthing areas, ACECs (Beaver Creek and Rock Creek), and SRMAs (Scab Creek), could inconvenience some users. In addition, some wildlife habitat protection measures may impact commercial wildlife watching, hunting, or tour service providers, by reducing opportunities to provide these services.

Motorized vehicle use in the Lake Mountain WSA would be limited to existing roads and trails. The recreation-related wilderness value of primitive and unconfined recreation attributed to the Lake Mountain WSA would be impacted by the use of motorized vehicles. Disturbance to soils and vegetation occurs when roads or trails are pioneered by all-terrain vehicles (ATV) and other vehicles used during hunting and other recreational activities. As ATV use for recreational activities is expected to increase, impacts on the area's naturalness and solitude as a primitive recreational setting would be diminished.

4.9.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts are anticipated under Alternative 2.

NSO and CSU restrictions surrounding the Lander and Sublette Cutoff Trails and other cultural sites protected by the NRHP would benefit recreational experiences by maintaining significant cultural landscapes.

A greater emphasis on the production of commercial forest products would result in a moderate reduction in recreational benefits. The construction of new logging roads could increase access to new areas and recreational opportunities. Although additional access provides more opportunities for motorized and mechanized types of recreation, it also greatly reduces the opportunity for more primitive recreational uses and further fragments the security cover for big game. This could impact hunting by facilitating access to remote areas and increasing the visibility of big game, making hunting easier in the short term. Over the long term, increasing the number of hunters combined with a lack of cover could decrease population levels and diminish benefits derived from wildlife resources.

The impacts from lands and realty management would be similar to those under Alternative 1, except that the priority to process energy-related ROWs in a timely manner may preclude the processing of land tenure adjustments selected to benefit public access or prime recreational resources. When compared to Alternative 1, the potential expansion of common ROW routes, including those issued for alternative energy development, could locally create slight to moderate impacts on dispersed recreational opportunities and experiences. Under this alternative, lands available for disposal by sale would be slightly less (5,000 acres versus 6,300 acres), thereby decreasing the potential to forfeit some lands with recreational values. Designation of ROW avoidance and exclusion areas would serve to limit surface-disturbing activities in these areas and thereby reduce visual intrusions and provide long-term protection of recreational and scenic values. The Lander and Sublette Cutoff Trails, SRMAs, ACECs, and VRM Class II areas would all be ROW avoidance areas. All cultural sites, WSAs, and VRM Class I and Class II areas would be ROW exclusion areas.

All developed recreational sites would be open to livestock grazing. This management action could increase long-term impacts on recreation, because grazing at recreational sites and campgrounds could cause physical damage to facilities and would be a nuisance to recreationists because of visual impacts and obstacles from denuded vegetation, defecation, and other related undesirable effects that result from grazing. The activation of suspended nonuse grazing AUMs (Table A20-1) and the allocation of 21,000 acres of unallocated forage, could contribute additional impacts on natural-appearing recreational settings and a reduction of benefits where the aforementioned conditions exist.

A greater amount of acreage would be available for oil and gas leasing and development. There would be increased surface disturbance from 7,804 proposed new wells. Wildlife habitat protection measures and restrictions for most wildlife game species would generally not apply within the Intensively Developed Fields. New leases would stipulate few wildlife habitat protection measures based on critical habitat timing limitations. In addition, in the advent of qualified fluid mineral discoveries within the Traditional Leasing Areas, these areas could become Intensively Developed Fields and would become subject to the same development scenario. This could likely cause alterations in wildlife habitat and a major reduction in public benefits derived from wildlife-dependent recreational activities. BMPs could reduce potential impacts on wildlife and the subsequent reduction in wildlife-dependent recreational benefits. Additional areas important to recreation would become available for fluid mineral leasing, and the potential for impacts on recreational settings and subsequent benefits could increase as these heretofore Unavailable Areas are leased and fully or partially developed. Stipulations prohibiting surface occupancy within one-quarter mile of developed recreational facilities and the Oregon Trail would tend to protect recreational values. Impacts on dispersed recreational opportunities for the ERMA would be greater from increased fluid mineral leasing and subsequent development.

Recreational settings and associated impacts for the Boulder Lake, Scab Creek (Front Country setting), and Green and New Fork River SRMAs would be different from those under Alternative 1. Management actions would promote expanded visitor amenities and advertise SRMA attractions to increase visitation to the area. These management actions could change the recreational setting from a Middle Country to a Rural setting, thereby impacting those benefits associated with the Middle Country setting while enhancing the public benefits typical of a Rural setting. Recreation management planning addressing the protection of desired recreational settings would not occur. The likelihood of impacts associated with user conflicts and resource damage could increase. Benefits could be diminished over the long term as user conflicts and resource damage increase. Issuing additional commercial SRPs to guided fishing service providers within the planning area could increase tourism and economic benefits. Likewise, certain segments of rivers may experience additional commercial use. Crowding at boat accesses and on popular river segments could increase. User conflicts could increase as the private and commercial river users compete for the same limited resources. The recreational benefits associated with a particular setting and associated experience could be impacted. In localized areas, this could mean a major reduction in recreational benefits.

There would be fewer restrictions to mitigate soil erosion. Fewer limitations on the placement of recreational facilities and public access could be expected.

The acquisition of legal access and the consolidation of public lands potentially beneficial for access and recreation would not be pursued. Recreational opportunities and experiences could be foregone. Seasonal OHV use closures designed to protect wildlife from harassment would not be implemented under this alternative, which could result in diminished wildlife and indirect impacts on recreational opportunities and benefits associated with hunting and wildlife observation. Under this alternative, the majority of the planning area would be managed to increase motorized recreational opportunities. This management action would increase resource damage and user conflicts between motorized and nonmotorized vehicle users, which would increase impacts and reduce recreational benefits for both user groups.

A decrease in the area designated as VRM Class II under this alternative could result in substantial alterations to the landscape, which would degrade the visual quality and recreational setting. Recreationists could avoid such altered landscapes and seek more natural-appearing areas to recreate. As the acreage of attractive landscapes diminishes, a major loss of recreational benefits could occur. Visual resource mitigation measures implemented to reduce the affects of surface-disturbing activities would lessen these visual impacts and promote a return of natural-appearing landscapes.

Discharge of produced water to streams or other nonisolated surface features could occur, if permitted by WDEQ. This action could degrade water quality and consequently the recreational setting and experience.

Some minimal impacts could occur from closing areas to recreational activities during fire activity and revegetation periods to reduce hazardous fuels and meet desired future condition (DFC) objectives. In addition, if emergency stabilization and rehabilitation efforts were implemented or if fencing or revegetation actions were used, recreational activities could be restricted in these areas. However, these short-term impacts would be minor and could serve to improve wildlife habitat and visual resources.

The protections afforded to wildlife and fisheries habitat would be reduced. This reduced protection could affect the population size and health of certain species, resulting in indirect, long-term impacts that would diminish hunting, fishing, and wildlife observation opportunities and benefits. In areas adjacent to elk feedgrounds, the elimination of elk feedgrounds would reduce hunting opportunities and user benefits.

Impacts would occur in the Trapper's Point ACEC (550 acres) because the area would be closed to oil and gas leasing and all surface-disturbing activities, except for those that enhance the wildlife-dependent recreational values associated with big game migration and habitat. Additional fences would not be constructed in the area except to enhance the viability of the big game migration. These actions would reduce user conflicts between mineral development and recreationists, and would improve and protect more primitive types of recreation. They would also improve hunting and wildlife observation activities, and would reduce obstructions caused by fencing. Prohibiting surface-disturbing activities would restrict the improvement of visitor services and roads at the Trapper's Point interpretive facilities, which could impact the user experience and resource conditions in the area. The Lake Mountain WSA would be impacted from the placement of livestock-related improvements within the Rock Creek area, and this action may affect the primitive and natural recreational setting identified with the Lake Mountain WSA.

4.9.6 Impacts Under Alternative 3

This alternative would provide the greatest protection for cultural resources from surface-disturbing activities and other activities potentially affecting the cultural property viewshed. These protective measures would tend to protect open space and other natural settings of particular value to recreationists. Some protective measures such as NSO restrictions could reduce recreational opportunities. Closing approximately 4,080 acres to motorized OHV use to protect cultural resources could reduce recreational OHV opportunities. Based on the acreage that would likely be included in these areas, this impact is expected to be minor. Impacts on recreational developments could occur as a result of the 3-mile VRM Class II designation surrounding the Lander and Sublette Cutoff Trails. These actions would limit or preclude development activities, but would help to maintain the cultural setting and characteristics. As priority cultural resources are inventoried, site-specific management actions could reduce some recreational opportunities by precluding use in these areas. Based on the acreage that would likely be included in these areas, this impact is expected to be minimal. Management actions involving public outreach and the development of cultural sites would be implemented, including public tours, education, and recreational opportunities. This would enhance recreational experiences, increase public awareness and stewardship, and reduce impacts on natural resources.

Impacts resulting from forest management would be similar to but less than those under Alternative 1 because the management actions under this alternative would restore forest function and improve wildlife habitat.

This alternative would provide the greatest long-term protection of recreational values primarily because of increased withdrawal areas. Proposed withdrawals under this alternative would total 65,750 acres, compared to 14,540 acres under Alternative 1, which would provide for the protection of recreational resources and other resources important to recreation, such as historic trails, SRMAs, cultural sites, open space, and wildlife habitat. In addition, fewer acres would be available for disposal consideration, and land exchanges and acquisition of nonfederal lands would be pursued for the enhancement of recreational opportunities. These management actions would provide for the consolidation of lands, which would facilitate recreational opportunities and related benefits over the long term. Land actions to acquire state and private lands in crucial wildlife habitats would be pursued, which would facilitate and enhance hunting and wildlife observation activities.

Designation of ROW avoidance and exclusion areas would limit surface-disturbing activities and thereby reduce visual intrusions and provide long-term protection of recreational and scenic values. The Lander and Sublette Cutoff Trails, SRMAs, ACECs, the Green River WSR Unit, and VRM Class II areas would all be ROW avoidance areas. All cultural sites, WSAs, VRM Class I areas, and the East Fork River, Scab Creek, and Silver Creek WSR Units would be ROW exclusion areas. Restrictions placed on communication tower heights and the consolidation of new communication development within existing sites would improve the visual quality and consequently improve the recreational experience in affected areas. Precluding wind energy development in raptor concentration areas, in areas designated as VRM Class I and Class II, in SD/MAs, within 3 miles of greater sage-grouse leks and winter concentration areas, and along the Lander and Sublette Cutoff Trails would maintain scenic values and therefore provide long-term benefits to recreationists.

Grazing systems and range improvements would be implemented to enhance wildlife, watershed, and riparian values. These management actions would improve the condition of these natural resources and consequently would enhance recreational values through improved water quality for water-based recreational activities and improved wildlife habitat for hunting and wildlife observation. The allocation of approximately 21,000 acres of unallocated forage to other resources such as recreation and wildlife could provide improved habitat and reduced impacts on riparian areas by livestock. This action could increase benefits attributed to the public's perception of BLM grazing and recreation management practices and contribute to protection of public property.

Surface disturbance would occur from 5,209 potential new wells. However, this alternative, unlike Alternative 2, would provide the greatest protection to recreation from conflicting mineral development activities, because less area would be available for leasing and a greater amount of area would be unavailable for leasing or subject to NSO stipulations. These management actions would result in long-term beneficial impacts on recreation by reducing potential user conflicts, while protecting valuable open space and ensuring long-term production of major social, personal, environmental, and economic benefits. Impacts from mineral leases that have been issued would also include stipulations to protect visual resources, wildlife, historic trails, SRMAs, and other resources with important recreational values. These stipulations would affect recreation by protecting resources, especially wildlife habitat and areas heavily used for recreation. However, a number of provisions developed to maximize fluid mineral development in leased areas could exempt these development actions from standard resource protection measures. There would be a major reduction of recreational benefits in areas of intense fluid mineral development. Under this alternative, the benefits and opportunities associated with dispersed recreation within the ERMA would be subject to the greatest protection. Impacts on recreation within the ERMA from fluid mineral development could be substantially less over the long term compared to the other alternatives.

Developed recreational sites would be managed with a one-half-mile NSO buffer. These management actions would help reduce user conflicts and maintain recreational opportunities. Management of the Boulder Lake, Scab Creek, and Green and New Fork Rivers SRMAs would serve to enhance recreational activities and values. Under this alternative, recreational settings and associated impacts for the Boulder Lake, Scab Creek (Front Country setting), and Green and New Fork River SRMAs would be different than those under Alternative 1. Management actions would result in reduced visitor amenities and reduced area visitation. These management actions could also change the recreational setting from Front Country to Middle Country, thereby impacting those benefits associated with a Front Country setting, while enhancing the recreational benefits typical of a Middle Country setting. Recreation management planning would occur; however, because visitor use under all alternatives is expected to increase, the benefits of such planning may be diminished over the long term as management actions are unable to adequately address user conflicts and resource damage. In addition, the Warren Bridge River accesses and the CCC Ponds recreation area would not be managed as part of an SRMA, and a recreation management plan would not be prepared. Management within these areas would be more directed at protecting wildlife as an ACEC and less as a unique recreational area. This action could diminish effective management of recreational resources.

There would be greater restrictions to mitigate soil erosion, which could further restrict the placement of recreational facilities and other recreation management actions.

Access to public lands would be actively pursued, which would impact recreation by maintaining existing access and providing additional access to recreational opportunities. Impacts resulting from OHV management would be similar to those under Alternative 1, except that fewer user conflicts would occur because areas most often used by recreationists for recreational activities would be limited to designated roads or trails or closed to OHV use. This management action would reduce user conflicts and provide protection to lands with important recreational resource values. Impacts would also occur from closing these areas to recreational OHV use, which is a popular recreational activity in the planning area; however, based on the small portion of the planning area that would be closed to OHV use, this would likely be a minor impact.

This alternative would provide the most protection to vegetation resources, which would in turn affect recreation. Recreational values and activities requiring a natural setting would be enhanced as a result of achieving management objectives that improve or protect desired plant communities. Recreational resources dependent on the maintenance of wildlife habitat, watershed resources, and biodiversity would be enhanced.

The designation of VRM Class II areas would increase in proportion to VRM Class IV compared to Alternative 1. Achieving the management objective to maintain or enhance an area’s scenic quality would result in long-term impacts on recreation by protecting the landscape’s visual values and recreational setting.

More protections would be afforded to watershed resources, which would enhance the recreational experience and setting.

Some minimal impacts could occur from closing areas to recreational activities during fire activity and revegetation periods to meet hazardous fuels reduction and DFC objectives. In addition, if the emergency stabilization and rehabilitation efforts were implemented, or if fencing or revegetation actions were used, recreational activities could be restricted in these areas; however, the impacts would be short term and could serve to improve visual quality over the long term.

This alternative would provide the most protection to wildlife and fish resources and to wildlife-related recreation primarily because the restrictions on surface-disturbing activities would be increased. Wildlife management actions would enhance benefits derived from wildlife-dependent recreational activities such as hunting, fishing, and wildlife observation. However, some wildlife habitat and protection restrictions could impact commercial guide and tour service providers by reducing opportunities for them to provide their services.

This alternative would provide the most protection to recreational values from management of SD/MAs. The protections that would be afforded to SD/MAs would also affect recreation primarily because a larger area within the SD/MAs would be subject to surface-disturbing activity restrictions, increased withdrawals, closures to fluid mineral leasing, closures to OHV use or limiting it to designated roads, and active pursuance of land tenure adjustments. These management actions would reduce user conflicts and enhance the recreational experience for those seeking less regulated types of recreation. The following areas would be designated: the New Fork Potholes (1,820 acres), Ross Butte (35,670 acres), Trapper's Point (9,540 acres), CCC Ponds (5,530 acres), Rock Creek (5,270 acres), Upper Green River (12,270 acres), and White-tailed Prairie Dog ACECs; the Miller Mountain MA (66,440 acres); and the expansion of the Beaver Creek ACEC (10,160 acres). Additional impacts would occur as a result of establishing the Wind River Front MA (358,400 acres). This action would close the area to fluid mineral leasing and development, thereby enhancing the area's unique recreational values. Further enhancement would also occur from closing the area to surface-disturbing activities, such as geophysical operations, commercial timber harvest, commercial mineral activities, and the application of vegetation treatments (except to enhance wildlife habitat or reduce fuels and fuel loading). The Lake Mountain WSA would be closed to motorized vehicles. The wilderness recreational value of primitive and unconfined recreation attributed to the Lake Mountain WSA would be enhanced. Maintaining the outstandingly remarkable values determined suitable for inclusion in the WSR system would enhance the recreational experience and benefits. The watercourses identified for management would be the East Fork River (1,130 acres), Scab Creek (1,350 acres), Silver Creek (860 acres), and Green River (7,100 acres) Units.

4.9.7 Impacts Under Alternative 4, Proposed RMP

The impacts from cultural resources management would be similar to those under Alternative 3. However, under this alternative, a somewhat smaller area would be protected by surface occupancy restrictions and by closures to fluid mineral leasing and OHV use.

The impacts from forest management actions would be the same as those under Alternative 3.

Recreational lands acquisitions could be less because of no net loss in private land restrictions. In addition, fewer acres would be available for withdrawal. This could cause a moderate reduction in recreation protection afforded by this lands management action.

Current grazing preferences would be maintained; therefore, the potential benefits to recreation would be slightly less where recreational use and grazing conflicts exist. Unallocated AUMs would not be allocated to recreation; therefore, the potential benefits associated with improvements to riparian areas would be somewhat less.

Increased surface disturbance would occur from 7,136 potential new wells. In comparison to Alternative 3, fewer acres would be administratively unavailable to fluid mineral leasing, and a larger proportion of Intensively Developed Fields could be exempted from TLSs. This may contribute to additional impacts on wildlife resources and a subsequent indirect loss of recreational benefits. However, recreational values,

especially those attributed to dispersed recreation throughout the ERMA, would remain better protected than under Alternatives 1 or 2.

Fewer acres would be administratively unavailable to fluid mineral leasing. However, some large portions of the planning area would be unavailable for leasing or leased with NSO stipulations, and this action would provide considerable protection from conflicting land use activities. In contrast to Alternative 3, this alternative would provide the greatest protection for the values and benefits afforded by the direct management of valuable recreational resources as SRMAs. Under this alternative, the impacts from recreation management for the SRMAs would be similar to those under Alternative 1, except that desired recreation settings would be managed to provide an array of public benefits for the Boulder, Green and New Fork Rivers, and CCC Pond SRMAs. The management actions would focus on maintaining the existing Front Country setting where visitor facilities are present. These provisions would provide adequate visitor amenities and services for existing and anticipated visitor use, thereby best preserving the area's unique recreational setting and ensuring the long-term production of major social, personal, environmental, and economic benefits.

The impacts from vegetation management would be the same as or minimally different from those under Alternative 3.

The impacts from VRM would provide an overall optimum balance of landscape visual values and the greatest benefits to recreational settings compared to Alternative 1. Achieving the management objective to maintain or enhance an area's scenic quality would result in long-term impacts on recreation by protecting the landscape's visual values and recreational setting.

The impacts resulting from the management of water quality and watersheds, wildland fire and fuels, wildlife and fish habitat, and SD/MAs would be the same as or minimally different from those under Alternative 3.

The impacts resulting from wildland fire and fuels management would be the same as or minimally different from those under Alternative 3,

The impacts resulting from wildlife and fish habitat management would be the same as or minimally different from those under Alternative 3.

The impacts resulting from management of SD/MAs would be the same as or minimally different from those under Alternative 3.

4.10 SOCIOECONOMICS

This section describes potential impacts of management actions on socioeconomics. Section 3.10 describes existing conditions concerning socioeconomics.

4.10.1 Assumptions

The analysis is based on the following assumptions:

- Economic benefits, in terms of labor earnings and employment, to the socioeconomic region of influence (ROI) would accrue from BLM-influenced activities such as oil and gas development, livestock grazing, and recreation.
- Employment and income would continue to be a driver of economic and population growth in the ROI.
- Housing supply and costs and community infrastructure and services will likely serve as constraints on population growth in the planning area vicinity.
- Tax revenues derived from activities on BLM lands would continue to have fiscal implications for communities within the ROI.
- Activities and resources available in and around the planning area would continue to be important to the quality of life of current and future residents.

The pace and timing of mineral development activities is dependent on a variety of factors outside the management decisions of BLM. These include national and international energy demand and prices, production factors within the planning area, and business strategies of operators. Because the pace of development in the planning area is unknown, a relatively constant rate of development is assumed for this analysis. Therefore, actual impacts could vary if the rate of development or production changes over the study period. Additional assumptions for the analysis are described in Appendix 26.

4.10.2 Methods of Analysis

The potential economic impacts of alternatives associated with the planning area were estimated using the IMPLAN (IMPLAN 1997) computer model. IMPLAN is a regional economic impact model that provides a mathematical accounting of the flow of dollars and commodities through a region's economy. The IMPLAN model provides estimates of how a given amount of a particular economic activity translates into jobs and income in a region.

All data used with the IMPLAN model were adjusted for inflation before calculations were performed. Once the calculations were complete, dollar values were converted to constant 2003 dollars for the 20-year study period (2001–2020) and discounted using a 7% real discount rate as recommended by the Office of Management and Budget (OMB 2003). OMB recommends using a real discount rate of 7% for constant-dollar benefit-cost analysis, which approximates the marginal pretax rate of return on an average investment in the private sector in recent years.

The IMPLAN model requires a series of inputs and assumptions specific to the study area, including the value of production resulting from land uses within the planning area under each alternative. BLM staff furnished information on current uses and how these uses might change under each alternative, which

provided a physical, quantitative measure of the inputs necessary for the economic impact analysis (e.g., the number of gas wells, AUMs, recreational visitor days). Table 4-12 summarizes the primary data and sources used to estimate physical inputs for the IMPLAN model.

Table 4-12. Primary Inputs for Socioeconomic Analysis

Use	Primary Data Inputs	Data Source
Oil and Gas Exploration and Development	1) Historical Production 2) Historical and Forecasted Prices 3) Development Cost Estimates 4) Reasonably Foreseeable Development Scenario	1) Wyoming State Geological Survey 2) U.S. Department of Energy 3) Interviews with Local Oil and Gas Companies 4) BLM
Grazing	1) Historical AUMs for Cattle and Sheep Within the Planning Area 2) Historical Cattle and Sheep Prices (1996–2001)	1) BLM 2) Wyoming Agriculture Statistics
Recreation	1) Estimated Recreational Visitors' Days per Recreational Activity 2) Estimated Recreational Expenditures per Activity	1) BLM Recreation Management Information System (RMIS) Database, Wyoming Game and Fish Department (WGFD) 2) WGFD, Wyoming Tourism Board, Colorado Off-Highway Vehicle Coalition

The estimated inputs and prices were used to evaluate the potential sales from uses within the planning area under each alternative. These data are the direct sales estimate that serves as the input into the IMPLAN model to obtain an estimate of total economic impact under each alternative (changes in direct, indirect, and induced income and employment).

Changes in employment and income cause other socioeconomic impacts such as changes in population, which can lead to other community impacts on housing, infrastructure, government services, and quality-of-life issues. The changes in employment and income have been used to qualitatively assess other impacts in the socioeconomic ROI.

Mineral production in the study area is the largest source of tax revenue for government entities within the study area. The analysis addressed any changes in tax revenues as a result of changes in oil and gas development within the planning area. The assessment of mineral tax revenues relied on production and assessed value estimates and effective tax rates provided by the Wyoming Department of Revenue, Mineral Tax Division.

In addition, an estimate of future oil and gas exploration and development was taken from the RFD scenario. Historic grazing use served as a basis for developing the grazing assumptions used under each alternative. Recreational use by alternative was estimated using data from the BLM Recreation Management Information System (RMIS) database and the Wyoming Game and Fish Department (WGFD). Additional methods for the analysis are described in Appendix 26.

4.10.3 Environmental Justice

E.O. 12898, Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations, requires identifying and addressing disproportionately high and adverse human health and environmental impacts of federal programs, policies, and activities on minority or low-income

populations. To evaluate potential environmental justice impacts, guidance obtained from other federal agencies was reviewed, including—

- E.O. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," February 11, 1994, *Federal Register* at 7630
- U.S. Environmental Protection Agency, "Interim Final Guidance for Incorporating Environmental Justice Concerns in EPA's Compliance Analysis, Office of Federal Activities," September 30, 1997
- Council on Environmental Quality, "Environmental Justice: Guidance Under the National Environmental Policy Act," Executive Office of the President, December 1997.

The following five-step method was used to evaluate potential environmental justice impacts associated with land management actions proposed by BLM:

- Step One: Identify potential minority or low-income populations within the ROI.
- Step Two: Identify a broad range of potential environmental and human health effects that could affect minority or low-income populations, including safety, traffic, air quality, noise, cultural resources, hazardous waste sites and hazardous materials transport, natural resources, land use, and socioeconomics.
- Step Three: Assess whether these potential impacts on minority and low-income populations would be high.
- Step Four: Conduct extended outreach to minority and low-income populations that would experience potential high effects.
- Step Five: Evaluate mitigation measures that would be used to minimize impacts on minority and low-income populations.

Relevant Census data for counties within the ROI, including Lincoln, Sublette, and Sweetwater counties, as well as for the State of Wyoming, were collected for this analysis. These data include—

- Total population
- Percentage of the population with minority status (e.g., Black or African American, Hispanic or Latino, Asian American, American Indian or Alaskan Native, Native Hawaiian and other Pacific Islander)
- Percentage of the population with low-income status, using annual statistical thresholds from the Bureau of the Census Current Population Reports
- Percentage of the population with minority status in the entire State of Wyoming
- Percentage of the population with low-income status in the entire State of Wyoming, using annual statistical thresholds from the Bureau of the Census Current Population Reports.

These data were then used to determine whether the populations residing within the counties in the ROI constitute an "environmental justice population" that meets any of the following criteria:

- At least one-half of the population is of minority status.

- At least one-half of the population is of low-income status.
- The percentage of population with minority status is at least 10 percentage points higher than for the entire State of Wyoming.
- The percentage of population with low-income status is at least 10 percentage points higher than for the entire State of Wyoming.

4.10.4 Impacts Common to All Alternatives

All alternatives would continue management activities on BLM-administered lands that would perpetuate already occurring trends in the area. For instance, continued development and operation of oil and gas wells within the planning area would require the purchase of goods and services from a variety of local and regional contractors and vendors. Expenditures associated with these activities, in addition to employee and contractor spending, would generate positive economic benefits in terms of employment and income. Other socioeconomic impacts that are already occurring and are likely to continue to occur (at various scales) under all alternatives include changes in employment and labor earnings; changes in crime and substance abuse; and changes in demand for housing and government services, such as schools, medical facilities, law enforcement. In addition, management actions could alter attitudes and opinions on the use of public lands.

Although current trends are expected to continue in the future for all alternatives, there will be some differences among alternatives regarding the relative rate of increase or decrease of those trends. Where possible, these differences among the alternatives are noted in Sections 4.10.6 through 4.10.9. Generally, these socioeconomic indicators are all expected to experience a similar direction or trend, and the increasing or decreasing trend is summarized in Table 4-13.

Table 4-13. Summary of Socioeconomic Impacts for All Alternatives

Socioeconomic Indicator	Impact for All Alternatives
Regional Employment	Employment is expected to increase under all alternatives driven by growth in gas activities. Nonresidential employment would continue to be considerable for drilling and completion activities (approximately 60% of the development labor force does not reside in the study area). If housing shortages are addressed, this may allow some temporary workers to move to the area permanently.
Personal Income	Real personal income is likely to increase under all alternatives driven by increasing labor earnings.
Labor Earnings	Labor earnings are expected to increase as oil and gas development and production increase.
Investment Income	Investment income in constant dollars is expected to decrease across the study area under all alternatives.
Median Household Income	Real median household income is expected to increase in the study area, with higher rates experienced in Sublette County.
Tax Revenues	Tax revenues are expected to increase under all alternatives, providing vital revenues to town and county governments for services and infrastructure.
Local Government Expenditures	Local town and county government expenditures and budgets are expected to increase as these communities struggle to provide housing, public services, and infrastructure to meet the booming population driven by gas development and extraction.

Socioeconomic Indicator	Impact for All Alternatives
Social and Community Services	These municipal and county services, including public service provisions such as education, road repair and construction, police and law enforcement, judicial facilities and services, medical services and facilities, emergency services, other social services, utility services (water, electricity, sewer, waste disposal), and often housing and land acquisition, are all expected to increase under all alternatives.
Population	Population is expected to increase under all alternatives.
Recreation and Tourism Visitation Levels	Recreation and tourism visitation are expected to decrease under all alternatives, most predominantly in Sublette County.
Community Stability and Connectedness	Community stability and connectiveness is expected to decrease, at least through the oil and gas development stage, as an increasing number of nonresidential temporary workers migrate to the area, bringing differing value systems and ways of life.
Oil and Gas Industry Mortality Rates	Oil and gas industry mortality rates are expected to increase along with development increases in the area.
Housing	Although there has been considerable building of housing in the area, there is still a housing shortage because of increasing population, which causes increases in the cost of housing in the area. These trends are expected to continue under all alternatives. These high housing costs and lack of availability make it difficult for both seasonal oil and gas and supporting sector workers (e.g., teachers, gas station attendants, waitresses) to move to the area.
Crime	The trend of increased incidences of crime would continue, especially in Sublette and Sweetwater Counties, with higher rates of increase in Sublette County. Crime impacts in Lincoln County are less certain.
Substances Abuse	Substance abuse is expected to increase, especially in Sublette County, where the bulk of gas development is occurring.
School Enrollment	School enrollment is expected to increase under all alternatives in Sweetwater and Sublette Counties, including seasonal demand for educational services as both the resident and transient population swells. Enrollment in Lincoln County is less certain.
Air Quality	Impacts on air quality and quality of life are expected to be exacerbated by increasing development and production in the area.
Viewsheds	Impacts on viewshed and natural scenery are expected to increase under all alternatives as development and production increases.
Traffic	With additional oil and gas development and production anticipated under all alternatives, it is likely that traffic, vehicle congestion, and road construction within Sublette and Sweetwater Counties would continue to increase, lowering the quality of life for those residents and groups who value remote and less congested lifestyles.
Boom and Bust Impacts	The boom cycle of the economy is currently occurring, and the bust cycle would eventually occur in the future.

Along with fish, wildlife, vegetation, and the physical environment, people are an integral part of ecosystems. Lifestyles, attitudes, beliefs, values, social structure, culture, and population characteristics affect and are affected by management actions such as those made by BLM within the planning area. In addition, both the planning area lands and BLM management of these lands have emotional meanings for many people. Management actions are expected to cause controversy within local communities. Long-term residents within the planning area have long-held opinions regarding the need to balance conservation of natural resources with the economic viability of resource-based industries. Graduate students from Rice University recently surveyed residents of Sublette County and determined that the majority of residents favored a balanced approach to gas development featuring a high degree of wildlife

and environmental protection. The authors found similar attitudes at a national level (Gelman and Lacouture, 2005).

The changing demographics of the west are consistent with the demographic information about the study area and indicate that retirees and perhaps amenity-focused, remote-working people have been moving to the study area—to Sublette County in particular (see Section 3.10.7). This area has also experienced increased tourism and recreation, at least during the summer months. These individuals and groups who value the area's natural beauty and visual resources are being and would continue to be affected by any oil and gas development that continues in the planning area. Recently, second home sales have been decreasing in the area with very little to no sales activity currently occurring (personal communication with realtors in Pinedale, April 15, 2007). Investment income has recently been decreasing across the study area (see Section 3.10.7), indicating that retirees and relocating professionals may either be leaving the area or have more recently stopped moving to the area. Presumably, these demographic changes would continue to occur within the study area regardless of the alternative chosen. These changes can create conflicts among people and stakeholder groups with diverging belief systems and values.

Wide-spread adverse impacts on tourism and recreational opportunities in the region could be possible as oil and gas development and production boom in the study area. Recreation and tourism employed 1,200 people in Summit and Lincoln Counties in 2005. Visitors spent more than $25 million recreating in the region that year (Bryant, 2007). Tourists are drawn to the region for diverse reasons, including hunting, fishing, hiking, OHV use, and wildlife viewing. With the increased industrialization of the area, it is likely that fewer tourists would recreate there. Additionally, the tourism industry would suffer due to lack of available hotel rooms for visitors as gas workers fill local hotels.

The Museum of the Mountain Man is a prominent tourist destination in Pinedale. The museum offers exhibits that illustrate early mountain man culture and the western fur trade. Attendance at the museum has declined from a high of 12,521 visitors in 1999 to 9,859 visitors in 2007, a 21% decrease over this 9-year time period. On average, this represents approximately 2% decrease in visitation per year. Several factors, including high gas prices and low hotel availability, have contributed to this decline. The Rendezvous Rodeo is another prominent tourist destination in Pinedale. Although statistics regarding attendance were unavailable, attendance has been increasing for the past decade. However, many of those in attendance in recent years have been local people because of the scarcity of hotel rooms in the region. Air quality concerns (see Quality of Life description in Section 4.10.6) are also contributing to declines in visitation to the area (personal communication with Town of Pinedale, April 29, 2008). These decreases in recreational and tourism visitation are expected to continue under all alternatives, most predominantly in Sublette County. Visitor impacts on Sweetwater and Lincoln Counties are less certain.

It is likely that under all alternatives, there would be increases in population and influxes of *newcomers* (both seasonal and residents). Many of the newcomers may bring with them value systems and mores different than those endemic to the region; a minority of newcomers may exhibit a lack of respect for the community. Anecdotal evidence suggests these trends are underway. Steven Smith, mayor of Pinedale noted that "the amount of litter on the side of the road is remarkable. People that have lived here a long time, I doubt anybody in this room has ever thrown anything out their car window, because we appreciate the natural environment and that's one of the reasons that we're here…This is the difference between people who live here because we want to and those that come here for employment," (personal communication, April 29, 2008).

Often, such trends can lead to an erosion of social integration and community satisfaction, at least during boom periods. Although some residents might not like the changes taking place in their communities as a result of this boom growth, most residents would, according to social research (Brown et al. 2005),

reconcile their feelings regarding the new and changing community context over time (see discussion below).

It is likely that the influx of newcomers would continue to strain the regional K-12 educational infrastructure. Recent trends suggest increased population is already having a direct impact on schools in the area. For example, in the Sublette County school district serving Pinedale and Bondurant, enrollment increased 208% between 2000 and 2006. Instructional staff increased 26% in this interval. During 2005 and 2006, 20% of students either entered or exited the school district, suggesting a sizable transient population. A growing percentage of students are non-native English speakers. Many of these impacts have been more muted in the school district serving Big Piney and Marbleton as historic decreases in enrollment have created a better ability to absorb increases in population (ERG, 2007). The SETG estimates that school enrollment will continue to increase at a considerable rate of 160% between 2005 and 2016, even under the low impact scenario. This equates to an additional 180 school attendees each year over the 11-year time period. Pinedale has recently increased its 5th and 6th grade facilities, and the town is considering building a new elementary school.

Sweetwater school enrollment has increased by 5% between 2003 and 2006. The elementary school has reached capacity and discussions are underway on building a new school. There are no clear enrollment trends in the districts serving Lincoln County (Wyoming Department of Education 2007) from the analysis undertaken in Section 3.10.7.

Until November 2006, regional school districts were extremely well funded. The districts retained 25% of excess special school district property tax revenues; 75% were returned to the state. An amendment to the state constitution in late 2006 mandated that all excess funding be returned to the state for redistribution (ERG 2007), making local school funding less certain. Under all alternatives, increases in oil and gas development and production would make it more difficult for the region to cope with the increasing and somewhat seasonal demand for educational services as the population swells.

Oil and gas industry mortality rates over the past few years have been rising and are currently 30.5 per 100,000 people, seven times the mortality rate of all occupations in the United States. Wyoming had the fourth highest number of oil and gas industry occupational fatalities and the highest average annual fatality rate (58.5 per 100,000) between 2003 and 2006. Researchers at the Centers for Disease Control and Prevention (CDC) have found a significant correlation between the number of drill rigs and the number of fatalities (CDC 2008). The authors suggest that this could be a result of several factors, including an increase in the proportion of inexperienced workers, longer working hours, and the use of all available rigs (including older equipment with fewer safeguards). Current petroleum prices suggest that increased oil and gas extraction activity will continue. Unless changes are made to increase worker safety, the high fatality rates are likely to continue. Under all alternatives, oil and gas industry fatality rates are expected to rise with increased development over the planning horizon.

Nonmarket Impacts

The values associated with BLM lands comprise two types. The first are market values that are normally estimated using a regional economic analysis such as IMPLAN. For example, oil and gas resources extracted from BLM minerals and lands are traded in the marketplace and sold to downstream processors and eventually to local distributors or utilities and the American public. The associated level of economic activity measured in terms of earnings, employment, and population is commonly estimated and reported in the impact section of NEPA documents. The second are nonmarket values for local people and society at large; these are other values provided by BLM lands that are nonmarket in nature, because they are not traded in the marketplace. In many cases, these values are actually larger than the market values, but are often overlooked because they are not always quantified. Examples of these nonmarket values include air

and water quality, open space, preservation of wildlife habitat, preservation and protection of threatened or endangered species, protection of cultural resource values, protection and preservation of wilderness areas, recreational values, aesthetic values, protection of lifestyles and community well-being, and others.

The argument against quantifying these nonmarket values is that they are more difficult to quantify, and the estimated value is more controversial than the market values produced by regional economic modeling. While this is true, many agencies, such as BLM, the United States Bureau of Reclamation, the National Park Service and the United States Fish and Wildlife Service (USFWS) have estimated and used these values in the past. In fact, a National Oceanic and Atmospheric Administration panel that included two Nobel Laureates recommended using the Contingent Valuation Methodology (CVM) for estimating passive use values. Moreover, there have been numerous published refereed journal articles written on the procedures used and the results derived in estimating these values. Even though they are more controversial than their market counterparts, these values have been estimated and reported in numerous studies in which nonmarket values were considered an important component to total value.

As mentioned previously, nonmarket values can be monetized, but the approaches are often complex, have the potential to be controversial, and require considerable resources to implement; therefore, it was determined that quantifying these values was beyond the scope of this RMP/EIS effort. However, it is recognized that the decreases in these nonmarket values will be likely and long lasting, but it is expected that the loss in nonmarket values would decrease as oil and gas fields evolve out of the development and into the production phase. Historically, as the productivity of these fields declines, they are sold off to marginal operations. The fields reach a point where they are no longer profitable, and the final reclamation may be left to the government.

With regard to the oil and gas boom on BLM lands in the Pinedale area, it is likely that under all alternatives many of the nonmarket values would decrease in value. For example, with the rapid pace of oil and gas development, there would be surface and subsurface disturbances that cause a loss of wildlife habitat, recreation opportunities, and open space. This level of development would degrade the air and water quality, increase substance abuse, increase crime, and reduce community cohesiveness among many other nonmarket impacts directly related to the boom. Because these nonmarket values will not be quantified, it is difficult to fully understand and report the tradeoffs inherent to the significant oil and gas development expected in this area. Nonetheless, from a subjective point of view, these nonmarket impacts are considerable and represent important impacts on the area.

Recreational and amenity values provided by public lands are both market and nonmarket in nature. Decreased visitation can be captured in the marketplace, through hotel and food and beverage spending. With decreasing viewsheds and increasing industrialization, fewer people would visit the region, decreasing spending within the area. Land use restrictions associated with natural gas development and urbanization would limit opportunities for OHV use, hunting, and hiking. These are all market impacts as recreation and tourism visitation decreases in the area. However, those that continue to visit and recreate in these areas would likely have a less enjoyable and therefore, less valuable, experience; this type of impact is not captured in the market. Short- and long-term habitat fragmentation and animal displacement associated with development activities could drive down the regional game population and limit opportunities for hunting and wildlife viewing. Declining watershed health associated with changing vegetation cover, nutrient loading, and erosion may adversely impact fisheries, thereby affecting the fishing experience. Increasing industrialization of the area would impact viewsheds and mountain vistas, decreasing the quality of the recreational experience.

In addition to recreational opportunities, the region’s water bodies offer hydrological services, including irrigation, waste transport, and municipal and industrial use. Surface water and regional aquifers provide drinking water to communities. Road construction and other development would increase runoff to

regional watersheds. Changing patterns of vegetation would increase runoff, potentially increasing nutrient loading and impacting water quality. Under each alternative, there would be a large number of additional water wells added over the life of the plan, primarily concentrated in areas in and around gas fields. This would put additional pressure on aquifers and increase the likelihood of contamination. Each phenomenon could adversely impact the surface and subsurface water throughout the region, which in turn could impact the quality of life.

Viewsheds would likely be adversely impacted by surface-disturbing activities that cause visual intrusions. Impacts would likely be greater in the southern portions of Sublette County where mineral development is more intense, and near state and private lands because of BLM's lack of authority on these lands. Impacts are already being felt by residents. "The viewshed is gone," stated one resident of Pinedale. "The rigs are right on top of the hill. I used to look out my back window across the mesa, I used to walk out my back door and hike down there, not anymore" (Brenner 2004).

The Division of Tourism indicates that the top five reasons people visit Wyoming include 1) mountains; 2) the opportunity to view wildlife not found at home; 3) wilderness; 4) lakes and rivers; and 5) the natural environment (Bryant 2007). Though the values are not monetized in this analysis, these attributes of Wyoming are valuable to visitors and residents. Other societal nonmarket values include bequest values (having the resources available for future generations), options for visitors to use the resource in the future, and existence values (i.e., knowing that the resources, amenities, or public land characteristics exist). It is possible that there would be considerable adverse impacts on these societal nonmarket values as gas development and production booms.

Some schools of thought posit that extractive industries are not beneficial for western economies, and that sustaining nonmarket values provided by public lands results in diverse and healthy local economies. For example, Duffy-Deno (1998) provides evidence that federal wilderness can be viewed as an amenity attracting people to an area, which can create an increase in tourism and visitation. Thomas Power (1992) obverses that since most western states in the 1990s experienced a decrease in employment such as mining, timber, and agriculture, traditional theory would indicate that their regional economies should be in decline. However, employment and income is flourishing in Colorado, Montana, Oregon, and Washington over this time period. He believes that the economies are transitioning from the Old West to the New West, where the quality of natural resources in these amenity-filled areas is drawing entrepreneurs, business owners, skilled workers, remotely working professionals, and retirees.

Ray Rasker offers additional insights into personal income and employment trends in western counties and states (Rasker et al. 2004). From 1970 to 2000 more than 80% of real growth in personal income has come from two sources: 1) personal income from employment in services and professional industries; and 2) nonlabor income, such as investment income and transfer payments. For states, he finds an inverse relationship between the degree of resource dependence on extractive industries and real growth in personal income. He concludes that counties in the west that are the most dependent on the relatively high-wage portion of services, the producers services (includes finance, insurance, real estate, management services, engineering, architecture, design), have much faster real growth in personal income than counties dependent on the transformative industries, which includes manufacturing (lumber, wood products, paper), agriculture, mining, oil and gas, and construction. The authors also studied the rate of growth in western counties statistically with a number of factors from 1970 to 2000 and found the keys to success in term of positive economic growth over time are—

- A high proportion of public lands
- A high proportion of protected public lands
- Amenities such as ski areas and food and beverage establishments
- An educated workforce

- Newcomers to a community
- Easy access to transportation infrastructure
- A high proportion of population employed in producer services.

According to the authors, counties that are far away from airports, transportation infrastructure, and metropolitan areas experienced negative growth or negative effects on growth. Other detrimental impacts on growth were low education rates and high dependence on transformative industries, such as mining and oil and gas.

Impacts of Boom-Bust-Recovery Cycles in the Local Economy

Evidence suggests that rapid, large-scale energy development can create a boom-bust-recovery cycle. Daniels (2006) indicated that a typical cycle consists of a rapid in-migration of skilled labor, which leads to population growth that quickly overwhelms a community's adaptive capacity to provide housing, public services, and municipal infrastructure. Local and regional governments may experience fiscal distress as they struggle to cope with increased demand for services. Often, production ad valorem tax receipts lag behind the funding needs for these infrastructure projects, which are typically driven by the labor-intensive gas development phase. Pinedale Anticline operators have indicated that approximately 60% of their drilling and completion labor force does not live within the study area (personal communication, June 16, 2006); these nonresidential, temporary workers would not contribute to other local tax revenues such as sales and use and property taxes needed to offset the government expenditures for infrastructure (e.g., roads), services (e.g., medical, schools, drug and counseling services), and utilities (e.g., water supply, sewer systems).

Research regarding energy boomtowns in the American West has documented the diverse social and economic impacts associated with boom-bust-recovery cycles. The balance of the literature suggests that large-scale energy development will have adverse impacts on rural communities, at least until the pace of development slows and population declines or stabilizes. Factors influencing the magnitude of these impacts include baseline community dynamics and the scale of energy development (e.g., Freudenburg, 1986; Brown et al., 2005; Gilmore, 1976).

During the boom stage, certain sectors of the economy gain from gas development activities. Others find it difficult to compete with rising average earnings, decreased motel and hotel availability for visitors, and other issues. Some of the local businesses that benefit are the ones directly supporting the gas drilling, including field services and support industries, wholesale trade, and other sectors that include developers, construction, real estate, lodging, and so forth. But it should be noted that other service sectors such as retail, food and beverage, and tourism-based businesses are finding it difficult to compete in an atmosphere of rising wages and scarce employee housing.

Pinedale is experiencing considerable boom growth characterized by housing subdivision proposals, planning meetings, and numerous socioeconomic and planning studies (ERG 2007). These types of activities can contribute to community anxiety and conflict over how to handle growth (Blevins et al. 2005). These boom-related impacts are expected to increase in the short term as the development phase continues. Newcomers are expected to continue moving to the area until the development phase is complete. Interviews with operating companies indicated that more than 60% of the workforce does not reside in the study area (personal communication with Pinedale Anticline Operators, June 16, 2006), which can negatively impact community cohesion and connectiveness. Often, these transient workers come to the area with differing value systems and ways of life, creating tension with residents. However, the initial cultural and economic shock felt by residents of the area would likely lessen as development continues (ERG 2007).

Typically, the bust phase is characterized by decreased economic activity, out-migration of residential and nonresidential employees, unemployment, and decreased inflation. The reduction in capital investment from drilling activities would decrease the downstream economic activity of other local businesses in the study area, including the food and beverage, lodging, health care, and construction industries. This could lead to increased unemployment, decreased economic output, reduced labor earnings and average earnings, housing and rental vacancies, and falling property values within the study area. Community infrastructure, such as schools, utilities, social services, and others may no longer be needed or not require operation at full capacity. In this environment, capital renewable and improvement projects on outdated and irrelevant community facilities could be expensive and controversial. Although development and population are expected to decrease after 2015, there would still be production and gas field activities occurring in the area (and production taxes accruing to the local area), which would partially mitigate this economic downturn as the region moves into the recovery phase. However, as production tapers off, government revenues from ad valorem taxes would decrease, likely causing budgetary shortfalls as investment project loans become due.

In addition, after the development phase, transient workers would return to their hometown communities unemployed. Unless there is demand for their services in other locations, it is likely that the loss of these relatively higher-paying jobs would also cause economic downturn conditions in the hometown communities of the transient workers.

Brown et al. (2005) explored the extent to which “time heals all wounds” in western energy boom towns. They studied the full spectrum of boom, bust, and recovery over 24 years in Delta, Utah, a rural community in which a 1.5 gigawatt power plant was constructed in 1979. The authors found that measures of community satisfaction were low as the date of construction approached and then declined sharply during the boom years. A recently conducted survey in Sublette County suggests this trend has already begun. When asked how an increased regional population would impact their quality of life, 57% of Pinedale residents indicated that it would decrease, while 28% said it would improve (McLeod et al. 1998). Popular press accounts suggest that residents of Pinedale are acutely aware that their city has achieved boomtown status in the national media and in the public imagination (Clarren 2007).

The largest increase in community satisfaction over Brown et al.’s 24-year study period occurred in the 9-year interval ending 1995, in which the community’s population was stable. Measures of community integration like friendship ties followed the same trend. The author proposed that community satisfaction recovered as population declined and the community reconciled itself to the new development and related activities. However, there are key differences between Brown’s exploration of Delta, Utah, and natural gas development in Sublette County and the study area. For example, due to the nature of natural gas development and production, a higher population would be sustained for a longer term in Sublette County than it was in Delta. Nonetheless, it is expected that the study area would follow the general boom-bust-recovery oscillation explored by Brown and experienced in energy towns across the west. As a sidelight, it should be noted that recent and historical boom-bust experiences may have created more resilient communities and counties. For example, a state law requires that 40% of tax revenue from natural gas extraction flows into a trust fund, and it is expected that this fund would contribute to the resilience of communities and counties in the recovery phase (Clarren 2007).

Both Sweetwater County and southern Sublette County have experienced energy booms and busts as early as the 1860s and as recently as the 1980s. Some residents welcome the boom times and the related level of general economic activity they generate, while others do not like the changes in their rural lifestyle. Because many of these communities have already experienced resource extraction boom-bust cycles, a Pinedale Anticline Working Group (PAWG) was established to serve as a local cross-sectional entity that would be involved in the planning process. In conjunction with the formation of PAWG, the community requested that a socioeconomic group be established along with the other resource groups to

report back to PAWG. A Socioeconomic Task Group (SETG) was formed to analyze the anticipated impacts of the oil and gas boom and develop suggestions and actions for monitoring and mitigating the affects. However, the expectation of some PAWG members was that they would be fully engaged in making recommendations affecting both the mitigation and monitoring plans associated with the oil and gas boom in the Pinedale area. It turned out their involvement was more limited than originally envisioned, and some members resigned. The PAWG has since been less involved in the process, and the SETG has for all practical purposes been disbanded.

Pinedale and the surrounding rural area may be more socially and culturally impacted than other communities in the southern portion of the study area from the in-migration of newcomers, This is because the area has lacked prior experience with the influx of activity associated with current nearby energy production, while Piney, Mableton, Rocks Springs, and other communities have been accustomed to the changes in population and culture associated with energy extraction from prior development (ERG 2007; Blevins et al. 2005; Wilkinson 2005).

Environmental Justice

Based on the results of the socioeconomic and environmental impact analysis conducted for this project, it can be concluded that those persons who reside in and around the planning area would endure some effects as a result of the continued management of the planning area. However, any identified socioeconomic or environmental impacts from continued BLM management of the planning area would be neither localized nor placed primarily on the identified minority and/or low-income populations. The identified minority and/or low-income populations in the study area, as described in Chapter 3, would not be disproportionately affected compared to the general population under any of the alternatives considered in the EIS. In addition, persons of all races and income levels were invited to contribute to the public participation process for the EIS, and comments or input into the process from minority or low-income persons were considered on an equal basis with those from all other persons. Therefore, implementation of any of the alternatives would be in compliance with E.O. 12898.

4.10.5 Summary of Oil and Gas IMPLAN Assumptions and Results of All Alternatives

Many of the economic impacts of the alternatives were estimated through the IMPLAN model based on assumptions made for the number of wells drilled and completed and the volume of production over the 20- year time frame, information which was provided by the BLM Reservoir Management Group as part of the RFD. Additional model assumptions and details are provided in Appendix 26. Table 4-14 and Table 4-15 summarize the well development and production volumes assumed under all alternatives.

Table 4-14. Well Development Projections by Alternative

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Completed Wells	P&A Wells[1]	Completed Wells	P&A Wells[1]	Completed Wells	P&A Wells[1]	Completed Wells	P&A Wells[1]
2001–2005	1,714	153	1714	153	1,714	153	1,714	153
2006	399	55	428	67	332	7	402	51
2007	407	56	436	68	340	7	410	52
2008	407	56	437	68	340	7	411	52
2009	444	61	472	74	356	7	445	56
2010	467	64	501	78	363	7	470	59

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Completed Wells	P&A Wells[1]	Completed Wells	P&A Wells[1]	Completed Wells	P&A Wells[1]	Completed Wells	P&A Wells[1]
2011	467	64	500	78	383	8	469	59
2012	467	64	500	78	388	8	469	59
2013	392	54	425	67	313	6	395	50
2014	261	36	295	46	203	4	264	33
2015	262	36	297	46	206	4	269	34
2016	292	40	327	51	219	4	288	36
2017	342	47	378	59	225	5	347	44
2018	327	45	343	54	172	3	315	40
2019	430	59	430	67	430	9	430	54
2020	345	47	345	54	345	7	345	44
Total	**7,421**	**936**	**7,826**	**1,110**	**6,328**	**246**	**7,443**	**876**
Total Well Projections	**8,439**		**9,051**		**6,456**		**8,383**	
Federal Wells	**7,192**		**7,804**		**5,209**		**7,136**	

[1]Wells that were drilled, plugged, and abandoned. Additional description regarding the variations in P&A wells under the alternatives is provided in Appendix 26.

Source: BLM Reservoir Management Group

Table 4-15. Estimated Production Volume by Alternative[1]

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Oil (Billions Barrels)	Gas (Billions Cubic Feet)	Oil (Billions Barrels)	Gas (Billions Cubic Feet)	Oil (Billions Barrels)	Gas (Billions Cubic Feet)	Oil (Billions Barrels)	Gas (Billions Cubic Feet)
2001	3.945	496	3.945	496	3.945	496	3.945	496
2002	4.468	573	4.468	573	4.468	573	4.468	573
2003	4.632	659	4.632	659	4.632	659	4.632	659
2004	4.737	734	4.737	734	4.737	734	4.737	734
2005	5.166	818	5.166	818	5.166	818	5.166	818
2006	6.741	844	6.901	863	6.325	794	6.723	842
2007	7.508	934	7.758	964	6.853	856	7.480	932
2008	8.085	1,005	8.422	1,046	7.238	903	8.079	1,005
2009	8.454	1,050	8.852	1,098	7.465	931	8.461	1,052
2010	8.722	1,082	9.169	1,137	7.617	950	8.737	1,086
2011	9.100	1,127	9.587	1,186	7.743	965	9.119	1,131
2012	9.409	1,163	9.937	1,228	7.864	980	9.432	1,169
2013	9.520	1,177	10.071	1,244	7.978	993	9.543	1,182
2014	9.774	1,207	10.361	1,279	8.196	1,019	9.798	1,213
2015	9.515	1,180	10.135	1,256	7.880	985	9.547	1,187
2016	8.603	1,080	9.252	1,160	7.044	893	8.634	1,087
2017	8.116	1,028	8.798	1,112	6.589	843	8.176	1,038
2018	7.833	998	8.540	1,085	6.302	813	7.902	1,009

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Oil (Billions Barrels)	Gas (Billions Cubic Feet)	Oil (Billions Barrels)	Gas (Billions Cubic Feet)	Oil (Billions Barrels)	Gas (Billions Cubic Feet)	Oil (Billions Barrels)	Gas (Billions Cubic Feet)
2019	7.822	999	8.551	1,089	6.123	794	7.889	1,010
2020	7.435	950	8.044	1,024	5.606	729	7.384	946
Total	**149.585**	**19,104**	**157.326**	**20,051**	**129.771**	**16,728**	**149.852**	**19,169**

[1] This is total production from federal, state, and other minerals.

Source: BLM Reservoir Management Group

The IMPLAN model generates results based on capital investments for drilling and completing wells and production revenues. The drilling and completion or development employment includes both resident and nonresident workers. According to operators, approximately 40% of drilling and completion workers reside in the study area, while the remaining 60% commute from outside the area (personal communication, Pinedale Anticline Operators, June 16, 2006). The employment figures summarized in Table 4-16 include both local and nonlocal employment. However, induced employment was reduced by 60% to account for the employment spending occurring outside of the study area. Tables 4-16 and 4-17 summarize the economic impact results for jobs and labor income under each alternative as a result of development (includes plugged and abandoned wells) and production from both federal and state and private wells, representing direct, indirect, and induced economic impacts.[1] IMPLAN estimates employment though annual figures; therefore, for the investments and activities within the planning area, there are a certain number of jobs supported by these activities each year. On average, the annual number of jobs that BLM oil and gas activities generate is provided in the last row of Table 4-16.

Table 4-16. Estimated Total Employment by Alternative[1]

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total
2001–2005	42,868 7,979	50,847	43,271 7,979	51,250	39,716 7,979	47,695	42,426 7,979	50,405
2006	9,979 2,066	12,045	10,805 2,113	12,918	7,693 1,943	9,636	9,951 2,061	12,012
2007	10,169 2,287	12,045	10,997 2,361	12,918	7,869 2,096	9,636	10,149 2,282	12,012
2008	10,169 2,261	12,430	11,022 2,562	13,584	7,869 2,211	10,080	10,173 2,461	12,634
2009	11,095 2,571	12,456	11,906 2,689	13,358	8,249 2,280	9,965	11,005 2,576	12,431

[1] Each industry that produces goods and services generates demands for other goods and services. When the oil and gas industries purchase services, such as construction, drilling contract, and stimulating, additional economic activity is generated. *Multipliers* describe these iterations (IMPLAN Manual, 2003). Multipliers can be described through the following definitions.

Direct effects are the changes in the industries to which a final demand change is made. In this case, there are direct impacts from extraction, support activities for oil and gas activities, and drilling activities.

Indirect effects are the changes in *inter-industry* purchases as they respond to the new demands of the directly affected industries. The direct change creates increases in economic activity for additional businesses that support these direct industries (e.g., construction, wholesale trade, geological services, trucking, power generation).

Induced effects are the increases in *household* income expenditures generated by labor earnings associated with the direct and indirect effects (e.g., food and beverage stores, motor vehicle dealers).

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total
2010	11,680 2,650	14,330	12,648 2,785	15,433	8,411 2,326	10,737	11,634 2,660	14,294
2011	11,680 2,760	12,430	12,623 2,905	13,584	8,875 2,363	10,080	11,609 2,770	12,634
2012	11,680 2,849	14,529	12,623 3,008	15,631	8,991 2,400	11,391	11,609 2,863	14,472
2013	9,804 2,883	13,666	10,729 3,047	14,595	7,253 2,432	10,529	9,777 2,895	13,581
2014	6,528 2,957	9,485	7,447 3,133	10,580	4,704 2,495	7,199	6,535 2,971	9,506
2015	6,545 2,890	14,330	7,490 3,076	15,433	4,773 2,412	10,737	6,659 2,907	14,294
2016	7,296 2,644	9,940	8,248 2,840	11,088	5,075 2,185	7,260	7,129 2,660	9,789
2017	8,546 2,515	14,440	9,535 2,721	15,528	5,207 2,061	11,238	8,582 2,539	14,379
2018	8,186 2,411	10,597	8,667 2,654	11,321	3,992 1,987	5,979	7,805 2,468	10,273
2019	10,755 2,443	14,529	10,856 2,664	15,631	9,964 1,940	11,391	10,644 2,470	14,472
2020	8,629 2,323	10,952	8,710 2,505	11,215	7,994 1,781	9,775	8,540 2,313	10,853
Average Jobs/ Year	**9,280 2,336**	**11,605**	**9,879 2,452**	**12,330**	**7,332 2,045**	**9,376**	**9,211 2,344**	**11,555**

[1] These employment estimates are based on total production from federal, state, and other minerals.

Table 4-17 summarizes the labor earnings IMPLAN results. These labor earnings represent both local and nonresidential earnings. It is assumed that 40% of the induced impact is incurred within the study area.

Table 4-17. Estimated Total Labor Earnings by Alternative (2005$, Thousands)

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total
2001-2005	$2,287,997 $445,702	$2,733,699	$2,309,495 $445,702	$2,755,197	$2,119,756 $445,702	$2,565,458	$2,264,410 $445,702	$2,710,112
2006	$532,620 $115,410	$648,030	$576,700 $118,016	$694,716	$410,595 $108,559	$519,154	$531,093 $115,135	$646,228
2007	$542,765 $127,759	$670,524	$586,940 $131,870	$718,810	$419,994 $117,065	$537,059	$541,662 $127,475	$669,137
2008	$542,765 $137,476	$680,241	$588,288 $143,091	$731,379	$419,994 $123,500	$543,494	$542,983 $137,471	$680,454
2009	$592,156 $143,638	$735,794	$635,448 $150,214	$785,662	$440,276 $127,332	$567,608	$587,373 $143,904	$731,277
2010	$623,392 $148,024	$771,416	$675,062 $155,552	$830,614	$448,933 $129,930	$578,863	$620,929 $148,557	$769,486
2011	$623,392 $154,194	$777,586	$673,715 $162,275	$835,990	$473,668 $131,987	$605,655	$619,608 $154,730	$774,338

Year	Alternative 1		Alternative 2		Alternative 3		Alternative 4	
	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total	Dev't/ Production	Total
2012	$623,392 $159,135	$782,527	$673,715 $168,031	$841,746	$479,851 $134,039	$613,890	$619,608 $159,934	$779,542
2013	$523,276 $161,049	$684,325	$572,658 $170,224	$742,882	$387,097 $135,826	$522,923	$521,845 $161,718	$683,563
2014	$348,406 $165,164	$513,570	$397,492 $175,019	$572,511	$251,056 $139,390	$390,446	$348,777 $165,963	$514,740
2015	$349,340 $161,434	$510,774	$399,782 $171,838	$571,620	$254,767 $134,702	$389,469	$355,383 $162,370	$517,753
2016	$389,387 $147,662	$537,049	$440,205 $158,610	$598,815	$270,844 $122,034	$392,878	$380,484 $148,597	$529,081
2017	$456,131 $140,489	$596,620	$508,924 $151,985	$660,909	$277,893 $115,149	$393,042	$458,034 $141,839	$599,873
2018	$436,909 $136,349	$573,258	$462,573 $148,256	$610,829	$213,089 $111,006	$324,095	$416,551 $137,837	$554,388
2019	$574,002 $136,470	$710,472	$579,395 $148,785	$728,180	$531,794 $108,384	$640,178	$568,084 $137,956	$706,040
2020	$460,536 $129,773	$590,309	$464,863 $139,907	$604,770	$426,672 $99,498	$526,170	$455,789 $129,209	$584,998
Total Labor Earnings (NPV 7%)	**$6,572,649 $1,288,844**	**$7,861,493**	**$6,961,577 $1,339,896**	**$8,301,473**	**$5,304,975 $1,159,782**	**$6,464,757**	**$6,526,397 $1,291,882**	**$7,818,279**

The types of business and industry sectors that are supported by the oil and gas economic activity are described in Table 4-18, as determined by the IMPLAN modeling effort.

Table 4-18. Types of Industries Supported by Oil and Gas Development and Production

	Direct	Indirect	Induced
Employment			
Development (Drilling and Completion)	Oil and Gas Drilling; Support Industries for Oil and Gas	Wholesale Trade; Construction; Management of Companies and Businesses; Real Estate; Legal Services; Independent Artists and Performers; Architecture and Engineering; Truck Transportation; Warehousing	State and Local Government Education and Non-Education; Food and Beverage Establishments; Medical and Dental Offices; Wholesale Trade; Real Estate; Hospitals

	Direct	Indirect	Induced
Production	Extraction	State and Local Education and Non-Education; Computer Programming Services; Management of Companies and Businesses; Support Industries for Oil and Gas; Services to Buildings and Dwellings; Legal Services; Social Assistance; Scientific Research; Maintenance and Repair of Highways	State and Local Government Education and Non-Education; Food Services; Medical and Dental Offices; Wholesale Trade; Real Estate; Hospitals; General Merchandise Stores
Labor Earnings			
Development (Drilling and Completion)	Oil and Gas Drilling; Support Industries for Oil and Gas	Wholesale Trade; Construction; Management of Companies and Business; Legal Services; Architecture and Engineering; Scientific Research and Development; Investment Services; Warehousing and Storage; Real Estate; Telecommunications	State and Local Government Education and Non-Education; Medical and Dental Offices; wholesale Trade; Food and Beverage Establishments; Hospitals; Insurance; Motor Vehicle Dealers; Real Estate
Production	Extraction	State and Local Education and Non-Education; Computer Programming Services; Management of Companies and Businesses ; Support Industries for Oil and Gas; Services to Buildings and Dwellings; Legal Services; Social Assistance; Scientific Research; Maintenance and Repair of Highways	State and Local Government Education and Non-Education; Food Services; Medical and Dental Offices; Wholesale Trade; Real Estate; Hospitals; General Merchandise Stores

Table 4-19 summarizes the breakdown of the IMPLAN employment and earnings estimates that lie within direct, indirect, and induced economic impacts, which were provided by the IMPLAN modeling effort. These percentages can be applied to the employment and labor earnings estimated above. For example, employment in the development phase under Alternative 4 is on average 9,211 jobs per year. Of these jobs, 51% or 4,698 are local to the study area, and of those 62% are in the drilling and support sectors. Indirect (22%) and induced (17%) impacts make up the remaining local jobs within the study area. However, development also contributes to jobs outside the study area (49% of all jobs). Of these total development jobs (within and outside the study area), 80% are drilling and support industry jobs, while the remaining 20% are indirect and induced employment industries noted in Table 4-18.

Table 4-19. Percentages of Employment and Labor Earnings by Type of Impact

	Direct	Indirect	Induced
Development (Drilling and Completion)			
Employment (51% is local)	80% of total 62% of local	11% of total 22% of local	9% of total 17% of local
Labor Earnings (46% is local)	90% of total 78% of local	6% of total 14% of local	4% of total 8% of local
Production			
Employment (100% is local)	33%	46%	21%
Labor Earnings (100% is local)	53%	38%	9%

Table 4-20 aggregates (or averages) the economic impacts among the alternatives for oil and gas development and production; the results were generated through the IMPLAN model.

Table 4-20. Summary of Oil and Gas Economic Impacts Under Each Alternative (2005$) for Federal, State, and Other Wells

Activity	Net Present Value (7% Discount Rate)[a]		Employment	
	Average Wells Drilled per Year/Total Value of Production	Total Labor Earnings[b]	Average Jobs Supported per Year	Average Earnings per Job
Alternative 1				
Oil and Gas Drilling and Completion	371	$6,572,649,168	9,280	$53,373
Oil and Gas Production	$51,857,359,602	$1,288,843,628	2,336	$55,858
Total Oil and Gas Activity		$7,861,492,966	11,616	$54,616
Alternative 2				
Oil and Gas Drilling and Completion	391	$6,961,576,780	9,879	$53,373
Oil and Gas Production	$53,911,486,540	$1,394,272,777	2,452	$55,858
Total Oil and Gas Activity		$8,355,849,557	12,331	$54,616
Alternative 3				
Oil and Gas Drilling and Completion	316	$5,304,974,868	7,332	$53,373
Oil and Gas Production	$46,664,511,232	$1,664,706,031	2,045	$55,858
Total Oil and Gas Activities		$6,969,680,717	9,377	$54,616

Activity	Net Present Value (7% Discount Rate)[a]		Employment	
	Average Wells Drilled per Year/Total Value of Production	Total Labor Earnings[b]	Average Jobs Supported per Year	Average Earnings per Job
Alternative 4				
Oil and Gas Drilling and Completion	372	$6,526,397,364	9,211	$53,373
Oil and Gas Production	$51,979,605,742	$1,344,309,978	2,344	$55,858
Total Oil and Gas Activities		$7,870,707,342	11,555	$54,616

[a] Total amount for the 20-year study period.
[b] This column shows the present value of the total labor earnings over the 20-year period. The net present value is estimated using a real discount rate of 7% as recommended by the Office of Management and Budget (OMB).

4.10.6 Impacts Under Alternative 1, Continuation of Existing Management

The current pace of gas development and production is expected to include a 183% increase in the number of wells between 2006 and 2020, from 2,979 wells in 2006 to 8,439 wells in 2020; 85% of those wells are assumed to be federal wells. Approximately 1,026,790 acres would be available for oil and gas leasing. In addition, the current permitted AUMs of 107,907 would be maintained. Transportation planning for the planning area would not be conducted, and the Desert General Use area would be open to OHV use without restrictions.

Impacts on Wyoming and U.S. Natural Gas Production

Natural gas production within the planning area provides energy for the nation. Wyoming and the United States consume approximately 107,363 and 21,653,000 MMCF per year, respectively. In 2006, Wyoming produced approximately 2,000,000 MMCF of natural gas, which was approximately 9% of all U.S. onshore and offshore production. The PFO in 2006 accounted for 40% of Wyoming's production and almost 4% of the nation's production of natural gas. The Federal Energy Regulatory Commission (FERC) provides an overview of the natural gas market in the west:

The western market is becoming a more prolific supplier and consumer of natural gas. Natural gas is the marginal fuel for dispatching power plants throughout most of the west. However, gas use is dependent on a complex set of factors: weather, storage inventory levels, pipeline capacity availability, hydroelectric resource availability, power-related imports, transmission line congestion, and other fossil-plant availabilities.

The western gas market is much more robust than it was 5 years ago because of massive, across-the-board investments in all phases of the natural gas supply chain (upstream wells, gathering and processing facilities, interstate pipeline expansions, market area storage, and distribution systems). Because of expanded drilling, natural gas production in the Rockie Mountains now equals about 8 billion cubic feed per day (Bcfd) or 15% of total U.S. domestic dry gas production. Imports from western Canada supply another 2 to 3 Bcfd of natural gas to the west. California accounts for the more than one-half of total regional gas use. Overall regional gas use is split somewhat comparably among the residential, industrial, and power sectors. Physical and financial gas-related products are traded actively at numerous market

locations in the west. Storage capacity limitations in the southwest can influence pipeline operating conditions, especially during peak periods (http://www.ferc.gov/market-oversight/mkt-gas/western.asp#mkt).

Production within the planning area would peak in 2014, with 1,207, 1,279, 1,019, and 1,213 billions of cubic feet of natural gas produced annually associated with Alternatives 1 through 4, respectively. If the U.S. production remains fairly steady over the next 10 years at 2006 levels (as has been demonstrated historically over the past 7 years), in 2014, Alternatives 1 through 4 would account for 4.9, 5.2, 4.2, and 4.9% of U.S. production, respectively. The difference between Alternative 1 and Alternative 2 represents a 0.3% difference in U.S. production in the year 2014, which could have implications for the price of natural gas.

Table 4-21. Natural Gas Consumption and Production Figures (Millions of Cubic Feet)

	2001	2002	2003	2004	2005	2006	2007	%Change 2001–2006/7
Wyoming NG Consumption	98,569	112,872	115,358	107,060	108,314	107,363	NA	9%
U.S. NG Consumption	22,238,624	23,007,017	22,276,502	22,388,975	22,010,596	21,653,086	23,057,969	4%
Wyoming NG Production (Total Withdrawals)[1]	1,634,987	1,747,476	1,836,115	1,929,040	2,003,826	2,111,766	NA	29%
U.S. NG Production (Total Withdrawals)[1]	24,500,779	23,941,279	24,118,978	23,969,678	23,456,822	23,507,471	24,536,309	0%
Pinedale Field Office Estimated Production (Alternative 1)	496,000	573,000	659,000	734,000	818,000	844,000	934,000	88%

[1]Production includes both onshore and offshore total withdrawals.
Source: Energy Information Agency.

Impacts on Regional Employment

Management actions under Alternative 1 would continue to influence employment in the regional economy during the study period. Under Alternative 1, activities within the planning area would continue to support more than 11,700 direct, indirect, and induced jobs on average per year during the planning period (Figure 4-2). Most of the employment is associated with oil and gas development and production activities. However, recreation activities and grazing operations would also generate employment within the study area. Eighty percent of the oil and gas employment is associated with the development stage. On average, Alternative 1 provides for 11,605 annual jobs generated through oil and gas activities, of which 61% are local jobs within the study area or 7,079 jobs (51% of development jobs are local, while all production jobs are considered local). A survey found that from 10% to 30% of the nonresidential oil and gas employees would consider relocation to Sublette County if housing were available and affordable (Jacquet 2007), which could have implications for future employment that would be local to the area.

It is expected that activities within the planning area would continue to support a significant percentage of the workforce of the three-county study area. This would be especially true for Sublette and Sweetwater counties, whose economies are more closely aligned with mineral production industries. Sweetwater County has experienced a steady decline in employment throughout much of the past decade because of declines in coal and trona production, as well as reductions in oil and gas development. However, recent trends have indicated that employment opportunities are again on the rise with the recent increase in oil and gas development throughout the region. Therefore, proposed development on BLM-administered lands would continue to be an important economic driver for southwest Wyoming.

Impacts on Regional Income

Land uses on BLM-administered lands would continue to be an important source of income for residents living near the planning area. Figure 4-3 summarizes potential impacts on total earnings. Under Alternative 1, activities within the planning area would generate approximately $7.9 billion, the present value (in 2005 dollars) in total labor earnings over the study period. This represents total economic impact, including direct, indirect, and induced earnings (and nonlocal labor earnings). On average, activities on BLM-administered lands are estimated to provide more than $395 million in earnings per year (in 2005 dollars) over the 20-year planning horizon. Earnings would be generated from continued oil and gas operations, downstream businesses that support this oil and gas economic activity, household spending, recreational and tourism activities, and grazing operations. The bulk of the labor earnings are provided by drilling and completion activities, representing more than 83% of the all labor earnings. Of these total oil and gas development and production labor earnings ($7.8 billion), approximately 55% or $4,312,262 is paid to workers residing within the study area.

Labor earnings are only one component of personal income; investment income and transfer payments are also important components. According to the analysis outlined in Section 3.10.7, transfer payments have grown steadily across the study area over the past 15 years, at an average annual increase of 2%. However, investment income in Sweetwater and Lincoln Counties has been decreasing since 2000, and Sublette County has experienced a decrease of 6% between 2004 and 2005. Over the past 5 years, investment income in Sublette County has remained constant. Increased earnings have been offsetting these decreases in investment income to increase personal income overall. Under Alternative 1, these trends are likely to continue, especially throughout the development phase. Oil and gas earnings are predicted to peak in years 2010 through 2012 and taper off, start to increase again in 2016, peak at a lower level in 2019, and decrease to 2005 levels in 2020. Therefore, personal income would continue to grow through 2012 and likely follow the trend of the oil and gas labor earnings projections. However, investment income would likely fall as the area becomes more industrialized and appeals to fewer retirees and second-home owners. As earnings cycle and eventually taper off after 2012 and then after 2019, personal income would likely follow as earnings cycle and investment income decline.

Real median household income, as analyzed in Section 3.10.7, is expected to increase until the gas development phase is over and remain constant or slightly taper off through the planning horizon. Sublette County's rate of increase would be much higher that those experienced in Sweetwater and Lincoln Counties, as shown by the historic trend. However, if the cost of living continues to increase substantially, these income gains may be offset by the inflationary tendencies; this is most likely to occur in Sweetwater and Lincoln Counties where the rate of growth in real household income is lower. Sublette County's household income would likely be reduced by the cost of living increases but would continue to rise through the oil an gas development phase.

Impacts on Tax Revenues

The analysis considered changes in potential mineral revenues under each alternative. The results summarized in Table 4-22 show the present value of total mineral revenues received as a result of gas production from 2000 through 2020, including federal mineral royalties, state severance taxes, and ad valorem taxes on production.

Table 4-22. Total Estimated Mineral Tax Royalties and Taxes from the Planning Area (2005$)

Alternative	Ad Valorem	Severance	Federal Royalties	Total Mineral Revenues
Alternative 1	$2,761,367,891	$2,832,656,411	$5,287,792,294	$10,881,816,597
Alternative 2	$2,870,748,704	$2,944,861,041	$5,497,333,510	$11,312,943,256
Alternative 3	$2,549,002,261	$2,549,002,261	$4,757,991,857	$9,791,846,490
Alternative 4	$2,767,877,412	$2,839,333,984	$5,300,208,255	$10,907,419,651

Total amount for 20-year study period.
This table summarizes the net present value of estimated mineral royalties and taxes by alternative. Royalties and taxes have been discounted using a real discount rate of 7% as recommended by OMB.
An average mill levy of 58.49 was applied to the value of production to determine the ad valorem tax revenues.
Ad valorem and severance taxes revenues are based on oil and gas sales, which is estimated to be 91.04% of the value of production (WY Consensus Revenue Estimating Group, 10/05/06).

Local governments would primarily benefit from changes in the ad valorem taxes collected by the counties on oil and gas production within the planning area. The ad valorem mill levy of 58.49 was applied to the value of production to determine the ad valorem receipts from oil and gas production within the study area. Approximately 20% of the ad valorem revenues accrue directly to the counties, while the remainder is funding for local schools and the State School Foundation (Wyoming Department of Revenue Annual Report 2006). Because most of the production is occurring in Sublette County, it would be the primary recipient of these tax receipts. Communities and towns within the county need to work with and request tax revenues for municipal projects and funding needs. In 2005, the ad valorem tax receipts accounted for approximately 95% of all Sublette County tax assessments, demonstrating the importance of this revenue source (ERG 2007). These production tax receipts paid to local governments often lag behind the funding needs spawned by the development boom, slightly delaying vital funding sources for needed infrastructure and government services. Figure 4-4 shows the estimated ad valorem taxes resulting each year from potential gas production in the planning area.

It should be noted that as a result of new recapture provisions for school funding in Wyoming, much of the ad valorem tax revenue going to county schools is in fact recaptured by the State School Foundation and is now allocated by the state, making local school funding less certain. Because of the high per-student assessed valuation in Sublette County, more than 50% of the school district's revenue was recaptured by the State School Foundation Program in 2004-2005. This figure is likely to increase in the future.

Local governments within the study area receive only a small percentage of federal royalties and severance taxes collected on production originating on public lands. The state severance tax applies to all mineral production in the state. This program is administered by the Wyoming Department of Revenue and is assessed on the current year's production. The state severance tax rate is currently 6% of the oil and gas marketable value. Of these severance assessments, only a small fraction is distributed to local governments, from 2% to 6% (ERG 2007). The remainder of the funds is distributed to the Permanent Mineral Trust Fund, the State General Fund, and the State Budget Reserve Account. The State of Wyoming also benefits from production on federal lands. Federal mineral production is assessed a 12.5% royalty on the value of production, of which the State of Wyoming receives approximately half. The remaining half is deposited into the U.S. Treasury.

Local governments also benefit from property and sales and use taxes paid by residents of the area. There are no income taxes in Wyoming. With increasing population, these revenues are expected to increase under this alternative. However, there are a considerable number (60%) of nonresidential gas employees

who live and likely spend most of their income outside the study area; these employees would not contribute property, sales, and use taxes to local governments.

Activities in the planning area under Alternative 1 would continue to generate tax revenues for local, state, and federal government entities. The majority of these tax revenues would be associated with natural gas operations, which are expected to generate approximately $10.9 billion in mineral tax revenues over the study period. Sublette County is likely to receive approximately $550 million over the 20-year time frame primarily from ad valorem tax receipts, while Lincoln County would also receive a portion of the ad valorem tax revenues. This tax revenue is vital to funding infrastructure, utility projects, community services, road maintenance, medical services, and many others within the study area. Grazing and recreational activities in the planning area would also generate tax revenues to government entities.

Impacts on Local Government Expenditures

County budgets have been increasing across the study area, as described in Section 3.10.5, likely a result of the population growth caused by increasing gas development and production activities. There are considerable costs to county governments for accommodating and meeting increasing infrastructure requirements associated with rapid growth and development. Utilities and service providers as well as municipalities are also faced with considerable infrastructure and capital investments expenditures. These municipal and county expenditures include public service provisions, such as education, road repair and construction, utilities (water, electricity, sewer, waste disposal), police and law enforcement, judicial facilities and services, medical services and facilities, emergency services, other social services, and often housing and land costs.

Overall, the county budgets have been increasing at various rates, 300%, 28% , 23% for Sublette, Lincoln, and Sweetwater Counties, respectively, over the past 5 years (see Section 3.10.5 for additional details). Many of these increased costs have been attributed to capital investments projects to meet the increasing population growth driven by gas development in the areas (ERG 2007). Higher government labor costs are also occurring as the governments compete with higher-paying gas industry jobs.

These impacts on local governments are expected to continue under this alternative. The building of new elementary and high schools is currently being discussed in Sweetwater and Sublette Counties. Pinedale recently finished building a new medical clinic. Road construction and improvement costs continue to increase as truck traffic and earthwork occur in the development of wells and the servicing of an increasing number of producing wells. Expenditures for the application of magnesium chloride to reduce dust impacts from traffic on dirt roads would continue to grow. Big Piney, Pinedale, and Mableton are all in the process of implementing or planning upgrades to sewer and water systems (ERG 2007). Steve Smith, Mayor of Pinedale, estimates that this cost would be approximately $25 million to $30 million for Pinedale within the next 5 years (personal communication, April 29, 2008). According to Marti Seipp, Sublette County waste disposal facilities currently cannot handle the increases in solid waste, and as a result, new solid waste facilities need to be considered (Seipp 2007). Requirements for more social and emergency services, police and law enforcement, medical and hospital services, judicial needs, child care services, educational infrastructure, and land acquisitions are expected to continue to grow under this alternative.

Impacts on Population

Any population change that could be associated with the implementation of alternatives would likely be linked to employment changes. Activities within the planning area would continue to support a significant percentage of the workforce in the study area. Activity within the planning area would continue to support a substantial percentage of the total jobs in the study area, and it also has been a contributing factor to

changes in population growth between 2001 and 2006. Most of this employment would be concentrated in the oil and gas industry. Given that housing availability in the study area is limited and many of the oil and gas development jobs are seasonal or temporary, the population growth impacts would be lessened. Management actions under Alternative 1 would continue to support economic development that would influence population trends over the study period.

The PAWG SETG has made predictions about population growth for Sublette County under a number of scenarios. Because housing availability is constrained within the county, the SETG believes the low-impact scenario is most likely, at least in the short term. Under Alternative 1, it is likely that Sublette County's population would increase steadily from approximately 6,926 in 2005 to 12,000 in 2015, a 73% increase over the 10-year period. After that time, the population would remain fairly constant or rise only slightly until 2030. Under Alternative 1, Sweetwater County would likely see a slight increase in its population; according to a school administrator and a law enforcement official, if housing is made available, there would be considerable in-migration to the county because there are many jobs available in both the tourism and the oil and gas industries (personal communication, Mike Dayton, October 15, 2006, and Sandy Vanvleet, October 18, 2006). Population rates have been stable in Lincoln County for the last few years; it is likely they would continue to remain stable under Alternative 1.

Impact on Housing

Although there is considerable housing development now occurring throughout the study area to meet the housing shortage, there does not appear to be any current excess housing capacity anywhere in the study area to absorb the predicted increases in population. Total rental units increased 288% in Sublette County, 57% in Sweetwater County, and 10% in Lincoln County in the 5 years ending in 2006. However, increased supply barely kept up with demand. In 2006, rental unit vacancy rates were just 1.9% across the study area. As a result of these market forces, housing costs have increased substantially. For example, apartment rental and housing costs in Sublette County increased 81% and 62% between 2000 and 2005, respectively. Sweetwater and Lincoln Counties have also experienced considerable increases, although not at as high a rate (41% and 47% over 5 years, respectively).

Population is predicted to increase by approximately 73% over 10 years, and approximately 37% over the next 5 years in Sublette County (SETG 2005). According to census estimates, the population in Sublette County increased by 17% between 2000 and 2005. The expected rate of increase in population is more than twice the historic population increase. In Sweetwater County, one official indicated that population rates would increase if housing were available (personal communication with Sheriff Mike Dayton, October 15, 2006).

A housing survey (SETG 2005) indicates that a considerable number of nonresident workers would consider relocation to Sublette County if housing were more available and affordable. Approximately 1,000 people are expected in Sublette County over the next 5 years. Using an average family size of 3.25 as an example, these figures would equate to a need for at least 300 new houses over this time frame. In Sublette County, housing construction has been steadily increasing since 2000 (Sublette County Assessors Office), with the most recent figures indicating that almost 160 homes were constructed in 2005, and 214 building permits were issued in 2006 (Sublette County Planning and Zoning Department). The housing supply of Sublette County has been struggling to keep up with new the demand. As a result, many regional businesses from ski resorts to gas stations to oil and gas companies must now supply housing to their employees to ensure retention.

Availability of affordable housing in Sublette County is lacking, as evidenced by the considerable increase in housing costs in the past 5 years, the increase in population, and the comparatively low wages earned by many residents of the county (ERG 2007). The SETG argues that the study area's lack of

affordable housing makes it difficult for those living in seasonal housing to move permanently to the area. This impacts the provision of town and county services because some workers (e.g., school teachers, county workers, waitresses, gas station attendants) may not be able to afford housing in the area.

All these trends are expected to increase under Alternative 1, with housing costs likely increasing at higher rates because of the increase in population expected in the future. Hotel and motel vacancy rates would remain low year-round (ERG 2007). Seasonal constraints on hotels would be more pronounced in the summer when both the tourism and drilling seasons peak. Progressively more public and private enterprises would likely be compelled to build and maintain housing to ensure employee retention. The high cost of living, combined with a large migrant worker population saturating the motels and rental housing, makes recruiting new employees difficult for the multitude of support services needed for a growing community (Jacquet 2007). These trends are expected to continue under this alternative.

Impacts on Community Stability and Connectiveness

The PAWG SETG has identified a number of social issues and impacts associated with the current level of oil and gas production in the area, which is expected to continue with the current management situation. The three prevalent social impacts that are occurring in the area from the relatively rapid gas industry development are categorized as follows: (1) impacts on community stability and connectiveness; (2) impacts on quality of life; and (3) impacts on social and community services. The SETG identified a number of critical social issues or community factors—housing, crime and drugs, education, emergency response and social services, and traffic—that could potentially have social impacts from the continued management of the planning area. These impacts are addressed in the following areas:

- Housing—addressed in the previous section
- Crime and Substance Abuse—addressed in both Quality of Life and Social and Community Services sections
- Education— addressed primarily in Section 4.10.4; mentioned in Social and Community Services
- Emergency Response—addressed in Social and Community Services
- Traffic—addressed in Quality of Life section.

The current management situation for gas industry development, which includes a 183% increase in wells over 16 years, would continue to affect community stability and connectiveness because of the high proportion of temporary or rotational residents residing in the study area who are associated with the gas industry. As a result, "community stability, sustainability, and connectiveness is seen to suffer as these temporary residents place strains on community services and culture but have little to no community ties or affiliation." (SETG 2006)

Newcomers are expected to continue moving to the area until the development phase is complete. There are many temporary or transient workers who come to the area with differing value systems and ways of life, creating tension with residents. The Mayor of Pinedale, Steve Smith, summarizes some of the residents' concerns with newcomers and temporary workers:

> *"This has always been a welcoming community, but there is a certain sense of resentment I think from the people that have chosen to live in Pinedale and the people that have come here for a job. All of us in this room moved to Pinedale because of what the community had to offer: clean air, clean water, good place to raise your kids, low crime. I didn't lock my door for 15 years in this community and I do now. So I think there's a*

> *resentment between those who came here because of what the community had to offer and those who are here simply for the paycheck."(Personal communication, April 29, 2008).*

Pinedale is experiencing considerable boom growth characterized by housing subdivision proposals, planning meetings, and numerous socioeconomic and planning studies (ERG 2007). These types of activities can contribute to community anxiety and conflict over how to handle growth (Blevins et al. 2005). All of these impacts are expected to continue under Alternative 1 throughout the development phase. However, the initial cultural and community shock felt by residents of the area would likely lessen as development continues (ERG 2007).

Impacts on Quality of Life

There are many values that can be indicators of quality of life. Obviously individuals and groups might not agree about which attributes are important to their individual quality of life. For example, one group of people might welcome new shopping areas in its community as an additional amenity, while another might view them only as visually unappealing and creating congestion and traffic. In 1996, one University of Wyoming survey (McLeod, Kruse, and Woirhaye 1998) asked Sublette County residents why they lived in the area. A number of values, including low population, overall lifestyle, scenery, and recreational opportunities were cited by the majority of residents. With the current management scenario, it is likely that the quality-of-life values derived from the low population of the study area would be affected by the area's population growth. Quality-of-life values derived from recreation and scenery would also be affected in the portions of the study area where there is considerable oil and gas development and extraction.

Overall, the continuation of the current management situation would cause dissatisfaction among individuals and groups that value remote and small-town western living. Some stakeholder groups, such as conservationists, motorized recreational groups, ranchers, sportsmen, younger residents, and wildlife protection groups, would likely perceive a decreased quality of life as a result of well drilling and field development industrialization of the area. In some cases, these groups might experience long-term impacts from a loss of open landscapes and solitude as a result of development activities in the planning area. Some residents might view increases in oil and gas development as negatively affecting their quality of life through various indicators such as increased traffic and congestion, higher crime rates, loss of open landscapes and viewscapes, and fewer opportunities (including less access to trails) for recreation. Others might be dissatisfied if portions of the planning area were not left in an undisturbed state. On the other hand, stakeholders such as some business interests, some long-term residents, and local and state government representatives, would welcome the economic growth and often support further development activities that might be tied to an increased standard of living (as an indicator of a better quality of life). It is expected that these conflicts would continue.

A common quality-of-life indicator is the level of crime and safety. The SETG has collected considerable data and statistics related to crime, arrests, and domestic violence activity. The crime statistics for Sublette County indicate that the recent rates of increase in crime and numbers of arrests have vastly outpaced the already robust rates of increase in population and that these increases in crimes and arrests are highly correlated with changes in drilling activity. For Sublette County, the report states—

> *"Changes in drilling activity have predicted 89.6 % of the changes in total reported index crimes during 1996–2004. The amount of drilling activity in Sublette County determines the population of temporary or rotational workers residing in the area, and it is likely this temporary workforce population plays a large role in driving changes in*

> *crime…The rates of increase in reported crime, arrests, and incidents far outpace the increase in population." (SETG 2006).*

It is also likely that the influx of newcomers would lead to an increased incidence of crime. Arrests in Sublette County increased 270% from 1995 to 2004. Regional law enforcement and police forces are taxed by these increases; the number of arrests per officer has more than doubled since 1995. Categories of crime that have increased include driving under the influence, outstanding warrants, simple assault, public drunkenness, and drug possession (Jacquet 2005). Sweetwater County is experiencing both increased crime and a proportional increase in population growth, so that the crime rate (number of incidences per population) has remained stable. Lincoln County's crime incidences and crime rate have been constant over the last 6 years.

With the increasing number of wells drilled in the area, (183% from 2006 to 2020), it is likely that under Alternative 1, the crime rate in Sublette County would continue to increase. It is likely that Sweetwater County would also be impacted by increasing crime incidences, but perhaps would experience a continued constant crime rate. However, increasing crime incidences would require more law enforcement personnel, police, criminal justice employees, and social services to address these changes. Given the historic trend for Lincoln County, the impact of crime under Alternative 1 on this county is less certain.

Substance abuse violations were up 209% for adult males and 400% for juvenile males during 2000 to 2006 in Sublette County (Jacquet 2007). Violations, however, may underestimate the extent of the regional drug problem. There is a consensus that crystal methamphetamine use is widespread among roughnecks in Wyoming. The highly addictive drug may be readily created using household ingredients. It is expected that drug use would continue to rise under Alternative 1 through the gas development phase.

Traffic and congestion are also often cited as quality-of-life indicators. According to the SETG (2006) report, both the amount of traffic and the number of accidents have increased appreciably in the past few years on three major highways within the study area. Anecdotal evidence in both Sublette and Sweetwater Counties indicates there is considerable traffic congestion (for example, truck traffic from oil and gas activities). The highway between Rock Springs and Pinedale is experiencing significant amounts of traffic. The Mayor of Pinedale, Steve Smith, states—

> *"The highway between Pinedale and Rock Springs used to be a kind of a nice scenic drive, and now it's nonstop truck traffic. In fact, the governor requested money to put 17 passing lanes between Pinedale and Rock Springs where there used not to be any. Secondly, the Highway Patrol used to have two highway patrolmen in Pinedale, and they were part of the Jackson Hole division. Now Pinedale has just received its own division with a lieutenant and eight patrolmen." (Personal communication, April 29, 2008).*

Children in Pinedale are currently being bused from the south side of Pine Street to the north side because of the dangers of traffic (Roy Allen, personal communication, October 2006). In addition, Sheriff Dayton of Sweetwater County suggests that Rock Springs has become so congested that there are lines at gas stations and overcrowding at restaurants at lunch hour (personal communication, October 2006). The Pinedale area is also experiencing significantly increased maintenance costs for some of its roads as a result of the heavy truck traffic. With the additional oil and gas development and production anticipated under this alternative, it is likely that traffic, vehicle congestion, and road construction within Sublette and Sweetwater Counties would continue to increase, lowering the quality of life for those residents and groups who value remote and quiet lifestyles.

There have been issues with air quality more recently as ozone data, collected at three monitoring sites in the area, recorded elevated ozone levels during 2005, 2006, and 2008 (see Table 3-5). The elevated ozone levels have been recorded during the winter months, primarily in February, which is atypical when compared to other areas of the country where ozone levels are elevated. The 8-hour ozone levels have ranged from 66 to 98 parts per billion (ppb). According to the EPA Air Quality Index guidance, levels from 85 to 104 ppb are unhealthy for sensitive groups, including children, the elderly, and people with respiratory problems, and these groups are advised to reduce outdoor activities. With ozone levels greater than 105 ppb, the general public should reduce outdoor activities.

Higher ozone levels in the area are obviously a human health issue because high ozone can cause inflammation and irritation of the respiratory tract, particularly during heavy physical activity. Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma. Ground-level ozone also can reduce lung function and inflame the linings of the lungs (WDEQ). During periods of higher ozone levels, sensitive groups should reduce the amount of time they spend outdoors. This is clearly a quality-of-life indicator for certain groups if they have reduced ability to spend time outdoors during these periods.

These recorded higher ozone levels also impact tourism. Steve Smith, mayor of Pinedale, states—

> *"Tourism's been such a big part of our history over the last 20, 30, 50 years. People start reading about the quality of our air diminishing and the ozone alerts and the health alerts and the elderly and the young and the asthmatic shouldn't be outside, that's going to make a huge impact on our tradition of tourism in the community." (Personal communication, April 29, 2008)*

One Pinedale town government official pointed out that a group from Texas has indicated that they do not want to come to Pinedale to recreate because the fresh mountain air is being compromised by pollution (personal communication, April 29, 2008). Under this alternative, impacts on air quality and quality of life are expected to continue along the trends experienced in recent years. As development and production increases over the planning horizon, the number of air quality exceedences could potentially increase.

Nonmarket values associated with BLM lands such as recreation (e.g., hunting, biking, hiking, and OHV use), viewsheds, wildlife habitat, water regulation, climate regulation, waste assimilation, hydrological function, and flood control (among many others) are expected to decrease under this alternative. Because the decreases in these values are often difficult to quantify, it is not easy to fully understand the tradeoffs inherent to significant oil and gas development. It could be that under Alternative 1, the societal nonmarket values could decrease more than the value of the oil and gas resource extracted (see Section 4.10.4 for an expanded discussion on Nonmarket Values).

Impacts on Other Social and Community Services

Activities within the planning area would continue to impact local government services in various ways (see Impact on Local Government Expenditures, above). As a result of increasing population driven by the gas development boom, the communities in the study area are coming under increasing pressure to provide infrastructure such as roads, water, and sewer lines to accommodate population growth within the study area. Social services such as education, emergency medical services, counseling services, childcare, and others are also needed to accommodate the increasing population.

The SETG (2006) found that there has been a considerable increase in the number of emergency medical service response runs, as well as in the demand for firefighter services and counselling services in the study area. The report states that although the increased oil and gas activity in the area has likely

contributed to the need for additional services, the increases could also stem from other factors such as increased tourism and population growth, as well as an aging population. Because many of these factors are assumed to continue with increased oil and gas activity in the planning area, it is likely that the need for emergency and social services would grow. Because housing is in such short supply, it has been difficult to fill vacant (and necessary) employment positions in social and community service organizations. This may cause a shortfall in these social and community services in the short term.

Crime, specifically in Sublette County, is increasing at a rapid rate (12% per year on average since 1999), and the increased crime rate has been shown to be highly correlated with the number of drill rigs in the area (SETG 2006). Crime rate increases put considerable strain on social (e.g., treatment and counselling) and emergency services, as well as other government services. Without additional housing availability, it would be difficult to increase the provision of these services, at least in the short term, unless housing is provided as a benefit. Both increasing crime and drug use in Sublette County would continue to place stresses on the medical and social facilities needed to address these issues. Pinedale has recently finished construction on a new medial clinic. The need for more of these types of community and county services are expected under this alternative. The incidence of crime would likely continue to increase in Sweetwater County under this alternative, which would also require additional social and medical services in the county. The crime impacts on Lincoln County under Alternative 1 are less certain.

School enrollment levels in much of Sweetwater and Sublette Counties have been increasing since 2003 (see Section 4.10.4 for additional details). As a result, school districts within the counties are accommodating this growing school-age population by constructing (or planning) new schools or by purchasing existing buildings to convert.

4.10.7 Impacts Under Alternative 2

Alternative 2 would provide for the most gas development and extraction, with a 204% increase in the number of wells between 2006 and 2020, of which 86% would be federal wells. Approximately 1,177,530 acres would be available for oil and gas leasing. Specific timing and distance mitigations would be applied for wildlife habitat protection only to the extent required by law (e.g., as with T&E species protection). In addition, the currently permitted AUMs would be increased from 107,907 to 157,308. No recreation area management plans (RAMP) would be completed, and no new SRMAs would be established under this alternative. The Desert General Use area would limit OHVs to existing roads and trails.

Impacts on Wyoming and U.S. Natural Gas Production

Natural gas production within the planning area provides energy for the nation. As discussed under Alternative 1 impacts, in 2006, Wyoming's natural gas production accounted for 40% of the nation's production and the PFO production accounted for almost 4% of the nation's production of natural gas. If the U.S. production level remains fairly steady over the next 10 years at 2006 levels, in 2014, Alternative 2 would account for 5.2% of U.S. production, which is 1% higher than under Alternative 3 (lowest production) and 0.3% higher than under Alternative 4 (Proposed RMP).

Table 4-23. Natural Gas Consumption and Production Figures (Millions of Cubic Feet)

	2001	2002	2003	2004	2005	2006	2007	%Change 2001–2006/7
Wyoming NG Production (Total Withdrawals)[1]	1,634,987	1,747,476	1,836,115	1,929,040	2,003,826	2,111,766	NA	29%
U.S. NG Production (Total Withdrawals)[1]	24,500,779	23,941,279	24,118,978	23,969,678	23,456,822	23,507,471	24,536,309	0%
Pinedale Field Office Estimated Production (Alternative 2)	496,000	573,000	659,000	734,000	818,000	863,000	964,000	94%

[1]Production includes both onshore and offshore total withdrawals.
Source: Energy Information Agency.

Impacts on Regional Employment

Under Alternative 2, activities within the planning area would be expected to increase employment by approximately 753 more people per year than under Alternative 1. Table 4-16 compares the economic impacts of oil and gas activities under each of the alternatives. Over the 20-year study period, total employment would be expected to average more than 12,500 jobs per year, including direct, indirect, and induced employment. An increase in oil and gas development activity would be expected to result in increased employment, although only 40% of gas drilling and completion employees are assumed to reside within the study area personal communication, Pinedale Anticline Operators, June 16, 2006). On average, Alternative 2 provides for 12,330 annual jobs generated through oil and gas activities, of which 61% are local direct, indirect, and induced jobs within the study area or 7,521 jobs (51% of total development jobs are local, while all production jobs are considered local). A survey found that from 10% to 30% of the nonresidential oil and gas employees would consider relocation to Sublette County if housing were available and affordable (Jacquet 2007), which could have implications for future employment that would be local to the area.

Employment associated with recreational activities would be expected to decline under this alternative (an approximately 7% reduction in recreation employment from that under Alternative 1) as a result of a reduction in recreational visitor days and increases in oil and gas activities. Employment associated with grazing operations would be expected to increase under this alternative (a 45% increase compared to that under Alternative 1) with its increased grazing opportunities. Figure 4-2 summarizes the employment impacts associated with each of the alternatives.

Impacts on Regional Income

Increased oil and gas drilling and production under Alternative 2 would be expected to increase total labor income in the study area over the 20-year time frame compared with that for Alternative 1. Under this alternative, the present value of regional labor income would be expected to be approximately $8.4 billion, a 6% increase from that under Alternative 1. However, a reduction in recreational visitor days would be expected to decrease income to businesses supporting these activities; the analysis predicts a 14% decrease in labor income for recreational income compared to that under Alternative 1. Labor earnings from BLM-administered activities would generate on average $418 million in labor earnings per year. Oil and gas activities consist of approximately $8.3 billion in labor earnings (99% of all labor earnings), of which 5% or $4.6 billion is paid to workers residing within the study area. Figure 4-3 summarizes the labor earnings under each of the alternatives. Grazing labor income is expected to increase under this alternative by approximately 45% compared to that under Alternative 1.

Labor earnings are only one component of personal income; investment income and transfer payments are also important components. According to the analysis outlined in Section 3.10.7, transfer payments have grown steadily across the study area over the past 15 years, at an average annual increase of 2%. However, investment income in Sweetwater and Lincoln Counties has been decreasing since 2000, and Sublette County has experienced a decrease of 6% between 2004 and 2005.

Increased earnings have been offsetting these decreases in investment income to increase personal income overall. Under Alternative 2, personal income trends are likely to follow those of gas labor earnings, especially throughout the development phase. Well development earnings are predicted to peak in 2010 and taper off in a cyclic pattern to 2005 levels in 2020. Therefore, personal income would continue to grow through 2010, driven by gas development labor earning increases. However, investment income would likely fall at a greater rate compared to that under Alternative 1 as the area becomes more industrialized and appeals to fewer retirees and second-home owners. As earnings fluctuate and taper off after 2019, personal income would likely follow as earning levels fluctuate and investment income falls.

Impacts on Tax Revenues

Tax revenues associated with activities in the planning area would be expected to increase under Alternative 2. Table 4-22, p. 4-135 compares the tax revenues associated with each of the alternatives. This increase would be mainly attributable to the increase in gas production expected under this alternative. The total present value of mineral tax revenues accruing to federal, state, and local governments would be expected to exceed $11 billion under this alternative, which represents a 4% increase from that under Alternative 1. The reduction in recreational activities would also be expected to negatively impact tax revenues. Figure 4-4 shows the estimated ad valorem taxes resulting each year from potential gas production in the planning area under all alternatives.

Most of the production is occurring in Sublette County, and therefore it would be the primary recipient of ad valorem tax receipts from this mineral production. Sublette County can expect to receive approximately 20% of ad valorem tax revenues, or $574 million over the 20-year time period, an increase of $24 million or 4% over that under Alternative 1. Lincoln County would also receive a portion of these ad valorem tax revenues. In 2005, the ad valorem tax receipts accounted for approximately 95% of all Sublette County tax assessments, demonstrating the importance of this revenue source (ERG 2007). These production tax receipts paid to local governments often lag behind the funding needs spawned by the development boom, slightly delaying vital funding sources for needed infrastructure and government services.

It should be noted that due to new recapture provisions for school funding in Wyoming, much of the ad

valorem tax revenue going to county schools is in fact recaptured by the State School Foundation and is now allocated by the state, making school funding less certain. As a result of the high per-student assessed valuation in Sublette County more than 50% of the school district's revenue was recaptured by the State School Foundation Program in 2004–2005. This figure is likely to increase in the future.

Local governments within the study area receive only a small percentage of federal royalties and severance taxes collected on production originating on public lands. The state severance tax applies to all mineral production in the state. Local governments also benefit from property and sales and use taxes paid by residents of the area. There are no income taxes in Wyoming. With increasing population, these revenues are expected to increase under this alternative. However, there are a considerable number (60%) of nonresidential gas employees that likely spend most of their income outside the study area; these employees would not contribute property and sales taxes to local governments, and the downstream induced spending does not contribute to the local study area economy.

Activities in the planning area under Alternative 2 would increase tax revenues for local, state, and federal government entities compared to that under Alternative 1. The majority of these tax revenues would be associated with natural gas operations, which are expected to generate approximately $11.3 billion in mineral tax revenues over the study period. Sublette County is likely to receive approximately $574 million over the 20-year time frame primarily from ad valorem tax receipts, while Lincoln County would also receive a portion of the ad valorem tax revenues. This tax revenue is vital to funding infrastructure, utility projects, community services, road maintenance, medical services, and many others within the study area.

Impacts on Local Government Expenditures

County budgets have been increasing across the study area, likely a result of the population growth caused by increasing gas development and production activities. There are considerable costs to local governments in accommodating and meeting increasing infrastructure requirements associated with rapid growth and development. Utilities and service providers as well as municipalities also face considerable infrastructure and capital investment expenditures. These municipal and county expenditures include public service provisions, such as education, road repair and construction, police and law enforcement, judicial facilities and services, medical services and facilities, child care services, emergency services, other social services, utilities (water, electricity, sewer, waste disposal), and often housing and land acquisition costs. All these fiscal impacts, as examined under Alternative 1, are expected to be exacerbated under Alternative 2, which has the highest amount of well development and production. Under this alternative, the county and local government expenditures are likely to be highest, compared with those under other alternatives, as the local governments plan for, absorb, and accommodate increased population and the associated infrastructure, utilities, and services.

Impacts on Population

Activities within the planning area under this alternative would be expected to increase employment on average by more that 700 jobs per year than under Alternative 1, of which 61% are jobs held by local residents. The increase in employment would mostly be tied to increased oil and gas development. Under these assumptions, it is likely that the population would increase at a higher rate under this alternative, as a result of additional gas and downstream supporting workers and their families moving to the study area to fill needed positions.

Although the temporary or seasonal nature of the employment would lessen the population impact, these employees would require housing during their stays, which would put further strains on the area's housing needs. In addition, a housing survey done by SETG (2006, http://sublette-se.org/survey.html)

found that a majority of the workers in the gas industry surveyed were thinking about relocating or planning on relocating to the Pinedale area. With 612 more wells proposed to be drilled under this alternative than under Alternative 1, there would be greater need for workers, which would increase the population and thus the need for housing. The PAWG SETG estimates conservatively that population will increase by 73% between 2006 and 2015, bringing an additional 5,074 people to Sublette County during the next 10 years. With higher employment pressures from this alternative, the future population levels would likely be realized, and possibly with greater rates of growth if more oil and gas employees can find available housing.

Impacts on Housing

All the housing trends (as described in Section 4.10.5) are expected to increase under Alternative 2 and would likely be exacerbated by the increased drilling and production associated with this alternative. Under this alternative, there would be additional demands for resident and nonresident employees associated with gas drilling and downstream economic activities, putting pressure on already strained housing shortages. Housing costs would likely be higher under this alternative relative to Alternative 1, because of the additional expected increases in population. Hotel and motel vacancy rates would remain low year-round as tourism and gas workers vie for available housing. It is possible that hotels and motels may be primarily occupied by gas field service employees and contractors; this phenomenon could adversely impact regional tourism. Seasonal constraints on hotels would likely be more pronounced in the summer when the tourism and gas drilling season are both at peak. The high cost of living, combined with a large migrant worker population saturating the motels and rental housing, would make recruiting new employees more difficult for the multitude of support services needed for a growing community (Jacquet 2007). It is possible that regional businesses would have more trouble under these alternative (relative to Alternative 1) retaining employees without providing housing or dramatically raising wages. The trend toward mobile housing units parked on the street could also be exacerbated. Public service employees without employee-provided housing may be forced to commute long distances, which could contribute to the difficulty in retaining employees.

Impacts on Community Stability and Connectiveness

Increasing the number of wells by 204% over the next 14 years would likely further affect community stability and connectiveness because of the high proportion of temporary or rotational residents associated with the oil and gas industry, who would be residing in the study area. As a result, "[C]ommunity stability, sustainability, and connectiveness is seen to suffer as these temporary residents place strains on community services and culture but have little to no community ties or affiliation." (SETG 2006) Under Alternative 2, it is expected that impacts on housing (both rentals and owned real estate) from population growth and the seasonal influx of workers would be affected by the increased oil and gas development in the planning area. Increasing the employment, population, and the number of nonresidential or rotational workers would likely have a greater impact on the amount of affordable housing, compared with the current management situation. As a result, it is likely that community connectiveness and stability would be further affected as well, at least in the short term.

Under Alternative 2, there would likely be an increase in population and continued influxes of newcomers (both seasonal and full-time residents). Often, this can lead to an erosion of social integration and community satisfaction, at least during the boom period. There are certainly social community changes occurring from the current and increasing gas development, but these changes are secondary to the existence and importance of what individuals and the communities perceive as social disruption. The potential for social disruption is highest under this alternative.

In addition, Pinedale is experiencing considerable boom growth characterized by housing subdivision proposals, planning meetings, and numerous socioeconomic and planning studies (ERG 2007). These types of activities can contribute to community anxiety and conflict over how to handle growth (Blevins et al. 2005). All of these impacts are expected to be exacerbated under Alternative 2 throughout the development phase. However, the initial cultural and community shock felt by residents of the area would likely lessen as development continues (ERG 2007).

Impacts on Quality of Life

The management of the planning area under this alternative would likely contribute to the highest rates of population growth within the study area compared to those from the other alternatives. Social impacts would also be highest under this alternative, as the study area attempts to accommodate the "industrialization" and to support more oil and gas operations. Communities across the study area would be impacted as they struggle with issues such as population growth; increasing crime and traffic; and increasing demands for housing, social services, police and law enforcement, educational facilities, medical facilities, governmental services, infrastructure, and so forth. These community stresses would be highest under this alternative.

Many of the communities in the northern part of the study area were also attracting owners of second homes and retirees, who might be less likely to support further development because it affects the natural characteristics of the area to which these individuals are attracted. These types of conflicts would be greatest under this alternative. Recent anecdotal evidence from realtors and BEA data indicates that both investment income and second home sales have recently declined in Sublette County.

Under Alternative 2, it is likely that residents who value low population and remote and quiet lifestyles would be affected by the increased growth in the study area. People who believe that recreation, scenery, and lifestyle are important to their quality of life might also be affected in those portions of the study area where there is considerable oil and gas development and extraction.

In general, however, residents of Sublette and Sweetwater Counties have been found to favor a balance between gas development and environmental preservation (see Section 3.10.9). Increased oil and gas development would be expected to have localized impacts on wildlife resources within the planning area. These impacts could be detrimental to certain groups, such as conservation, recreation (including hunting), and tourism-focused groups within the study area who value recreational and scenic/visual resources, which would also be expected to decline further under this alternative. This would also affect certain lifestyles within the study area.

Some stakeholder groups would view the increase in gas development as affecting their quality of life through increased traffic and congestion, higher crime rates, loss of open landscapes and viewscapes, and causing fewer opportunities and less access to trails for recreation. On the other hand, local business interests and some residents might support further development activities, as standards of living increase (as an indicator of better quality of life). Others may be incensed if areas within the planning area are industrialized and remain industrial for the foreseeable future. It is expected that these conflicts would be further exacerbated by the higher level of oil and gas development.

A common quality-of-life indicator is the level of crime and safety. Because the development under Alternative 2 is highest, it is likely that in Sublette County the increase in the rate of crime would be the greatest under this alternative, because there appears to be a considerable correlation between crime rate and drill rig activity (SETG 2006). It is likely the incidence of crime would increase in Sweetwater County, but this increase could be proportionate to the expected increase in population. Regardless, under this alternative, the incidence of crime would likely be the highest, requiring more law enforcement and

police and more criminal justice and social services employees to address the changes in crime. The impact on crime in Lincoln County is less certain.

Substance abuse violations have also been increasing between 2000 and 2006, and these figures may be underestimating the extent of the regional drug problem. There is a consensus that crystal methamphetamine use is widespread among roughnecks in Wyoming. It is likely that the increased natural gas development under Alternative 2 would exacerbate these trends.

According to the SETG (2006) report, both the amount of traffic and the number of accidents have increased appreciably in the past few years on three major highways within the study area. Anecdotal evidence in both Sublette and Sweetwater Counties indicates there is considerable traffic congestion (for example, truck traffic from oil and gas activities). The Pinedale area is also incurring significantly increased maintenance costs on some of its roads as a result of heavy truck traffic. With this alternative having the highest amount of oil and gas development and production within the study area, it is likely that traffic, vehicle congestion, and road construction within the study area would continue to increase, lowering the quality of life for those residents and groups who value rural lifestyles.

There have been issues with air quality more recently as ozone data collected at three monitoring sites in the area recorded elevated ozone levels during 2005, 2006, and 2008 (see Table 3-5). Higher ozone levels in the area are obviously a human health issue, because high ozone can cause inflammation and irritation of the respiratory tract, particularly during heavy physical activity. Breathing ozone can trigger a variety of health problems, including chest pain, coughing, throat irritation, and congestion. It can worsen bronchitis, emphysema, and asthma (WDEQ). During periods of higher ozone levels, sensitive groups should reduce the amount of time they spend outdoors.

Not only are these higher ozone levels a health concern, but they are also clearly a quality-of-life indicator for certain groups, if they have reduced ability to spend time outdoors during these periods. In addition, the recording of these higher ozone levels also impacts tourism as word spreads of decreased air quality in the area. Under this alternative, impacts on air quality and quality of life are expected to be exacerbated by the increased development and production experienced under this alternative. As development and production increases at a greater rate over the planning horizon, these air quality impacts are likely to be more severe under this alternative compared to those under Alternative 1.

Nonmarket values provided by BLM lands in the Pinedale planning area include recreation (e.g., hunting, biking, hiking, and ATV use), viewsheds, wildlife habitat, water regulation, climate regulation, waste assimilation, hydrological function, and flood control (among many others). It is likely that with the highest increases in oil and gas development (205% more wells) under this alternative, many of the nonmarket values associated with BLM lands would significantly decrease in value. For example, with more surface and subsurface disturbances associated with drilling wells, there may be erosion, area closures, or an introduction of pollutants into water supply aquifers, resulting in decreases in the values associated with water quality, wildlife habitat, recreational opportunities, scenery, and others. Because the decreases in these values are often difficult to quantify, it is not easy to fully understand the tradeoff inherent to significant oil and gas development. It is possible that under Alternative 2, which provides for the highest level of oil and gas activity, the societal nonmarket values would decrease significantly more than the value of the oil and gas resource extracted (see Section 4.10.4 for an expanded discussion on Nonmarket Values).

Impacts on Other Social and Community Services

Activities within the planning area could cause impacts on local government services in various ways. As discussed above, the activities within the planning area under this alternative are expected to support an

additional 700 people per year in the workforce in the years to come compared to Alternative 1. Because the greatest amount of oil and gas development is expected under this alternative, it is likely that the need for emergency, medical, fire fighting, counselling, law enforcement, child care, and other social services would also be greatest under this alternative. Without additional funding, greater gas development and operations would further strain the social infrastructure and the ability to provide services.

The crime rate, specifically in Sublette County, is increasing rapidly (12% per year on average since 1999), and the increase in crime has been shown to be highly correlated with the number of drill rigs in the area. With the highest amount of oil and gas development expected under Alternative 2, it is likely that crime incidences would continue to increase in Sublette and Sweetwater Counties. Crime increases put considerable strain on social (e.g., treatment and counselling) and emergency services, as well as on other government services. Drug use is also increasing, at least in part of the study area experiencing the most development. Without additional housing availability, it would be difficult to increase the delivery of services to address crime and drug use (i.e., police, social services), at least in the short term.

School enrollment levels in much of Sweetwater and Sublette Counties have been increasing since 2003 (see Section 4.10.4 for additional education impacts). As a result, school districts within the counties would need to accommodate the growing school-age population by constructing new schools or by purchasing existing buildings to convert. Many capital investment projects are underway or in the planning phase.

4.10.8 Impacts Under Alternative 3

Alternative 3 allows for the least amount of oil and gas development, which includes a 117% increase in the number of wells between 2006 and 2020, of which 81% would be federal wells. There would be approximately 487,360 acres available for oil and gas leasing. In addition, the planning area would be divided into three areas for management of oil and gas activity. Permitted use for livestock would be reduced from 107,907 AUMs to 84,000 AUMs. Transportation planning would be required in all areas to reduce road density. OHV use in the Desert General Use area would be limited to existing roads and trails.

Impacts on Wyoming and U.S. Natural Gas Production

Natural gas production within the planning area provides energy for the nation. As discussed under Alternative 1 impacts, in 2006, Wyoming's natural gas production accounted for 40% of the nation's production and the PFO production accounted for almost 4% of the nation's production of natural gas. If the U.S. production remains fairly steady over the next 10 years at 2006 levels, in 2014, Alternative 3 would account for 4.2% of U.S. production. Alternative 3 compared to Alternative 4 (Proposed RMP) is 0.7% lower in terms of a percentage of U.S. production, while compared to Alternative 2 (highest production), Alternative 3 is 1% lower as a percentage of U.S. production.

Table 4-24. Natural Gas Consumption and Production Figures (Millions of Cubic Feet)

	2001	2000	2003	2004	2005	2006	2007	%Change 2001–2006/7
Wyoming NG Production (Total Withdrawals)[1]	1,634,987	1,747,476	1,836,115	1,929,040	2,003,826	2,111,766	NA	29%

	2001	2000	2003	2004	2005	2006	2007	%Change 2001–2006/7
Pinedale Field Office Estimated Production (Alternative 3)	496,000	573,000	659,000	734,000	818,000	794,000	856,000	73%
U.S. NG Production (Total Withdrawals)[1]	24,500,779	23,941,279	24,118,978	23,969,678	23,456,822	23,507,471	24,536,309	0%

[1]Production includes both onshore and offshore total withdrawals.
Source: Energy Information Agency.

Impacts on Regional Employment

Under Alternative 3, management actions within the planning area would be expected to cause a reduction in growth in regional employment compared to that under Alternative 1. Over the 20-year study period, employment would be expected to average approximately 9,532 direct, indirect, and induced jobs per year, which are approximately 2,300 fewer jobs per year than are expected under Alternative 1. The analysis predicts that recreational employment would increase by 11 people annually under this alternative compared to that under Alternative 1. Figure 4-2 summarizes the employment impacts under the four alternatives.

Oil and gas employment comprises 98% of average annual employment from BLM activities within the study area. On average, oil and gas activities account for approximately 9,400 jobs annually, a decrease of 19% over those predicted under Alternative 1. Approximately 5,719 annual jobs are assumed to be held by people residing within the study area. Table 4-16 summarizes the oil and gas jobs estimated through the IMPLAN modeling efforts.

Impacts on Regional Income

Labor earnings under Alternative 3 would be expected to be $6.5 billion, which is 17% less than the labor income expected under Alternative 1 (at $7.9 billion). Labor earnings from BLM-administered activities would generate on average $325 million per year. Figure 4-3 summarizes the labor earnings for each of the alternatives. However, under this alternative, an increase in recreational visitor days compared to those under Alternative 1 would be expected to increase income to businesses and employees that support these activities. The analysis indicates that recreational income under Alternative 3 would increase by 10% compared to the recreational income under Alternative 1. Income associated with grazing would be expected to decline by approximately 21% compared with that under Alternative 1. Oil and gas activities contribute to 99 % of labor income generated by BLM activities or almost $6.5 billion, of which 55 % or $3.6 billion is paid to workers who reside within the study area.

Labor earnings are only one component of personal income; investment income and transfer payments are also important components. According to the analysis outlined in Section 3.10.7, transfer payments have grown steadily across the study area over the past 15 years, at an average annual increase of 2%. However, investment income in Sweetwater and Lincoln Counties has been decreasing since 2000, and Sublette County has experienced a decrease of 6% between 2004 and 2005. Over the past 5 years,

investment income in Sublette County has remained constant. Increased earnings have been offsetting these decreases in investment income to increase personal income overall.

Under Alternative 3, personal income trends are likely to continue following those of oil and gas labor earnings, especially throughout the development phase. Under this alternative, well development earnings are predicted to peak in 2012 and taper off in a cyclic pattern to 2005 levels in 2020. Therefore, personal income would continue to grow through 2012, driven by gas development labor earning increases. However, investment income would likely remain constant or fall as the area becomes more industrialized and appeals to fewer retirees and second-home owners. As earnings decrease after 2012, personal income would likely decrease driven by decreases in well development labor earnings and in investment income.

Impacts on Tax Revenues

Tax revenues associated with activities in the planning area would be expected to be less under Alternative 3 compared to those under Alternative 1 (Table 4-22, p. 4-135). These tax revenues are mainly attributable to the oil and gas production expected under this alternative. The total present value of mineral tax revenues would be expected to be approximately $9.8 billion under this alternative, a 10% decline compared to total revenues under Alternative 1. Impacts on tax revenues would also be expected with the increase in recreational activities relative to those under Alternative 1, although the impacts are expected to be small.

Local governments would primarily benefit from changes in the ad valorem taxes collected by the counties on oil and gas production within the planning area. Most of the production is occurring in Sublette County, and therefore, it would be the primary recipient of these tax receipts. In 2005, the ad valorem tax receipts accounted for approximately 95% of all Sublette County tax assessments, demonstrating the importance of this revenue source (ERG 2007). These production tax receipts paid to local governments often lag behind the funding needs spawned by the development boom, slightly delaying vital funding sources for needed infrastructure and government services. Figure 4-4 shows the estimated ad valorem taxes resulting each year from potential gas production in the planning area. It should be noted that as a result of new recapture provisions for school funding in Wyoming, much of the ad valorem tax revenue going to county schools is in fact recaptured by the State School Foundation and is now allocated by the state, making local education funding less certain for counties.

Local governments within the study area receive only a small percentage of federal royalties and severance taxes collected on production originating on public lands. However, local governments do benefit from property and sales and use taxes paid by residents of the area. There are no income taxes in Wyoming. With an increasing population, these revenues are expected to increase under this alternative. However, there are a considerable number (60%) of nonresidential gas employees who live elsewhere and likely spend most of their income outside the study area; these employees would not contribute property and sales taxes to local governments.

Activities in the planning area under Alternative 3 would continue to generate tax revenues for local, state, and federal government entities. The majority of these tax revenues would be associated with natural gas operations, which are expected to generate approximately $9.8 billion in mineral tax revenues over the study period. Sublette County is likely to directly receive approximately 20% of ad valorem tax receipts of $554 million over the 20-year time frame, while Lincoln County would also receive a portion of the ad valorem tax revenues. This tax revenue is vital to funding infrastructure, utility projects, community services, road maintenance, medical services, and many others within the study area. Grazing and recreational activities in the planning area would also generate tax revenues to government entities.

Impacts on Local Government Expenditures

County budgets have been increasing across the study area, likely a result of the population growth caused by increasing gas development and production activities (see Section 3.10.5). There are considerable costs to local governments in accommodating and meeting increasing infrastructure requirements associated with rapid growth and development. Utilities and service providers as well as municipalities are also faced with considerable infrastructure and capital investments expenditures. These municipal and county expenditures include public service provisions, such as education, road repair and construction, police and law enforcement, judicial facilities and services, medical services and facilities, emergency services, other social services, utilities (water, electricity, sewer, waste disposal), and often housing and land acquisition costs. All these impacts, as examined under Alternative 1, are expected to still occur under Alternative 3, but perhaps at a lower rate of increase than currently experienced, because this alternative has the least amount of well development and production. These county and local government expenditures would likely be lower under Alternative 3 relative to Alternative 1.

Impacts on Population

The decline in employment resulting from this alternative compared to Alternative 1 is approximately 2,300 workers per year. However, this analysis estimates that this alternative would still require approximately 8,000 employees per year, which would likely contribute to the continuation of recent population trends in the study area. The population would continue to increase in Sublette County, increase slightly in Sweetwater County, and remain stable in Lincoln County. It is likely that a considerable number of these workers, likely close to 60%, would be temporary or seasonal, which would lessen the population impact.

Impacts on Housing

Currently, housing continues to be characterized by low vacancy rates, which provide upward pressure on rents and housing costs. Under Alternative 3, it is likely that these trends would continue at least in the short term. As building continues, it is possible that housing supply would increase, potentially better meeting housing demand from tourism, gas company employees, and support services, perhaps in the long term. Under this alternative, housing costs and rents are likely to be lower relative to those under Alternative 1, although many of the trends as described in Section 4.10.6 would continue. Some regional employers would need to offer housing to employees to encourage retention, but this phenomenon would not be as pervasive or impacting to regional businesses. With less resident pressure on housing, it is possible that more nonresident workers could permanently relocate to Sublette County, depending on the housing costs of the area.

Impacts on Community Stability and Connectiveness

Increasing the number of wells by 117% over the next 14 years would likely have similar impacts on community stability and connectiveness to those under Alternative 1. However, because the proportion of temporary or rotational residents associated with the oil and gas industry who reside in the study area may be lower under this alternative than under the other alternatives, the communities in the area would experience less social disruption from this alternative's impacts compared with those impacts under the other alternatives. Under Alternative 3, the trends in the low availability of housing and the rising cost of housing would likely continue, at least in the near future. However, with the building of housing, the greatest potential in the future to mitigate the housing shortage could be under this alternative. The boom-bust cycle would still occur under this alternative, but the magnitudes of both the boom and bust levels would be lessened within the cycle. With fewer temporary residents and less pressures on housing

availability (compared to Alternative 1), it is possible that under Alternative 3, more gas employees could potentially move permanently to the area creating eventual ties with the existing communities.

Social community changes would certainly continue to occur from increased oil and gas activities under this alternative. Possibly, there could be impacts on social communities within the agricultural sector as these activities are reduced, restricted, and limited. Reducing opportunities to graze cattle on federal lands might affect the viability of ranching in the study area and lead to a further reduction in agricultural production and the ranching way of life.

Impacts on Quality of Life

Impacts on lifestyle are difficult to determine because people and groups have different ideas about which lifestyles are important. Management actions under this alternative could result in impacts on certain lifestyles. Although this alternative allows for considerable oil and gas development (increasing the number of wells by 117% between 2006 and 2020), it allows for the least amount of oil and gas activity. Certain population segments would prefer this alternative, because it would provide the greatest protection of wildlife resources, and therefore could provide more isolation and solitude than the other alternatives. Individuals such as retirees or amenity-driven residents who have moved to the area for its natural characteristics would likely perceive lifestyle and quality of life to be better under this alternative than under the other alternatives.

Allowing for a smaller increase in oil and gas development in the study area would be expected to affect some residents, such as conservation, recreation (including hunting), and tourism-focused groups, that value recreational and scenic/visual resources and want to maintain the diversity of the area's economy Some stakeholder groups, such as local business interests, oil and gas representatives, traditional extractive industry proponents, and perhaps local government representatives, who typically value economic growth, an increased standard of living, and a traditional western way of life, might perceive the smaller growth in oil and gas development and agricultural production under this alternative as decreasing their quality of life relative to that under Alternative 1. However, because this alternative still provides for a considerable increase in oil and gas development in the near future, it is possible these stakeholders might perceive a better balance with this alternative because it may better accommodate nonmarket values that can increase tourism and service sectors in the area, and it may decrease the magnitude of the eventual economic bust impacts on the communities and region.

A common quality-of-life indicator is the level of crime and safety. The SETG has collected considerable data and statistics related to crime, arrests, and domestic violence activity. The crime statistics for Sublette County indicate that recent increases in crime and arrests have grown at rates that vastly outpace the already growing population, and further, that crime and arrests have been shown to be highly correlated with drilling activity. Under this alternative, oil and gas development would still continue in the future, but at lower rates than under the other alternatives. Crime would therefore likely increase as the amount of oil and gas development continues in Sublette County. In Sublette County, the crime rate, which has been shown to correlate with drill rig activity, is therefore assumed to still grow but at a lower rate than it would under other alternatives that provide for more oil and gas drilling in the future.

Preliminary statistics on crime in Sweetwater County indicate that crime had been decreasing until 2004, and then the trend reversed and has been climbing. However, recently Sweetwater County is experiencing both increased crime and a proportional increase in its population, such that the crime rate has remained stable, which would require more law enforcement and police personnel in this area as well. Lincoln County has experienced low and stable incidences of crime. Under this alternative, it is less clear what would happen to the crime rates in Lincoln County.

Evidence suggests that substance use would increase under this alternative at least in Sublette County. Drug abuse violations were up 209 % for adult males and 400% for juvenile males in the interval between 2000 and 2006 in Sublette County (ERG 2007). Violations, however, may underestimate the extent of the regional drug problem (ERG 2007). It is likely that all natural gas development scenarios would exacerbate these trends. Alternative 3 has the least attendant gas development, so it is likely that this alternative would have the least attendant drug abuse.

Traffic and congestion is also often cited as a quality-of-life indicator. With the additional oil and gas development and production within the planning area, it is likely that traffic, vehicle congestion, and road construction within Sublette and Sweetwater Counties would continue to increase, though at a lower rate than under the other alternatives. This would still lower the quality of life for those residents and groups who value a rural and remote lifestyle.

There have been issues with air quality more recently as ozone data, collected at three monitoring sites in the area, recorded elevated ozone levels during 2005, 2006, and 2008 (see Table 3-5). Not only are these higher ozone levels a health concern, but they are also clearly a quality-of-life indicator for certain groups if they have reduced ability to spend time outdoors during these periods. The recorded higher ozone levels also impact tourism as word spreads of decreased air quality in the area. Under this alternative, impacts on air quality and quality of life are expected to be exacerbated by the increased development and production. As development and production increases, although at a lesser rate, over the planning horizon, these air quality impacts are likely to be less severe under this alternative compared to under the other alternatives.

Nonmarket values associated with BLM lands, such as recreation (e.g., hunting, biking, hiking, and ATV use), viewsheds, wildlife habitat, water regulation, climate regulation, waste assimilation, hydrological function, and flood control (among many others), are expected to decrease under this alternative, although these nonmarket impacts would be lesser than those experienced under the other alternatives. Because the decreases in these values are often difficult to quantify, it is not easy to fully understand the tradeoffs inherent to significant oil and gas development. It is difficult to know whether the increases in the value of oil and gas would offset the decreases in nonmarket values (see Section 4.10.4 for an expanded discussion on Nonmarket Values).

Impacts on Other Social and Community Services

Alternative 3 allows for the number of wells on the planning area to more than double by 2020. Therefore, this level of development is likely to still cause impacts on local government services in various ways. Alternative 3 provides for a smaller rate of growth in oil and gas development, allowing more recreation activities than those from Alternative 1. It is likely that under this alternative, the need for emergency and social services would grow, though perhaps at a more gradual rate. Because housing is in such short supply, it has been difficult to fill vacant and necessary employment positions in social and community service organizations. This may cause a shortfall in these social and community services in the short term, until the housing availability situation is addressed.

It is likely that the need for additional social and community services would continue and increase under this alternative. These services include emergency, medical, fire fighting, counselling, law enforcement and police, child care, and others. Greater gas development and operations would further strain the social infrastructure and the ability to provide services. For instance, changes in population and workforce would likely cause undue strain on infrastructure (e.g., roads, water, sewer and electric utilities, and schools).

Crime rates, specifically in Sublette County, are increasing rapidly (12% per year on average since 1999) and have been shown to be highly correlated with the number of drill rigs in the area. With increasing oil and gas development, it is expected that crime rates in Sublette County would continue to increase under Alternative 3, which would increase the number of wells drilled between 2006 and 2020 by 117%. Alternative 3 would likely have the least attendant crime given that this alternative has the least development. However, crime impacts would continue to strain social services (e.g., treatment and counselling services) and emergency services, as well as other government services. Without additional housing availability, it would be difficult to increase the provision of these services, at least in the short term.

School enrollment levels in much of Sweetwater and Sublette Counties have been increasing since 2003 (see additional educational impacts in Section 4.10.4). As a result, school districts within the counties would need to accommodate this growing school-age population by constructing new schools or by purchasing existing buildings to convert to schools, many of which are currently underway or in the planning stage.

4.10.9 Impacts Under Alternative 4, Proposed RMP

Under Alternative 4, the pace of gas development and production would be expected to be very similar to Alternative 1, which is the current management situation, with a 181% increase in the number of wells between 2006 and 2020, of which 85% would be federal wells. Approximately 1,024,880 acres would be available for oil and gas leasing. The planning area would be divided into three areas for the management of oil and gas leasing and development. In addition, the current permitted AUMs of 107,907 would be maintained. RAMPs would be developed to provide an array of outdoor recreation activities, settings, and experiences. OHV use in the Desert General Use area would be limited to existing trails and roads.

Impacts on Wyoming and U.S. Natural Gas Production

Natural gas production within the planning area provides energy for the nation. As discussed under Alternative 1 impacts, in 2006, Wyoming's natural gas production accounted for 40 % of the nation's production and the PFO production accounted for almost 4 % of the nation's production of natural gas. If the U.S. production remains fairly steady over the next 10 years at 2006 levels, in 2014, Alternative 4 would account for 4.9 % of U.S. production. The difference between Alternative 4 and Alternative 2 (highest production) represents a 0.3% decrease in U.S. production, while the difference between Alternatives 4 and 3 (lowest production) represents an increase of 0.7%, in the year 2014.

Table 4-25. Natural Gas Consumption and Production Figures (Millions of Cubic Feet)

	2001	2002	2003	2004	2005	2006	2007	%Change 2001–2006/7
Wyoming NG Production (Total Withdrawals)[1]	1,634,987	1,747,476	1,836,115	1,929,040	2,003,826	2,111,766	NA	29%
U.S. NG Production (Total Withdrawals)[1]	24,500,779	23,941,279	24,118,978	23,969,678	23,456,822	23,507,471	24,536,309	0%
Pinedale Field Office Estimated Production (Alternative 4)	496,000	573,000	659,000	734,000	818,000	842,000	932,000	88%

[1]Production includes both onshore and offshore total withdrawals.
Source: Energy Information Agency.

Impacts on Regional Employment

Management actions within the planning area under Alternative 4 would be similar to those under Alternative 1. The employment impacts are summarized in Figure 4-2 (see Table 4-16 for a comparison of the oil and gas impacts among the alternatives). Over the 20-year study period, employment would be expected to average more than 11,700 direct, indirect, and induced jobs per year, which would be slightly less than under Alternative 1. Slight declines in employment would be expected as slightly less oil and gas development would be permitted as compared to Alternative 1. Alternative 4 includes slight increases in recreational activities, which would be expected to have a small impact on employment relative to that under Alternative 1. Employment tied to grazing would not be expected to vary from Alternative 1. Oil and gas employment comprises almost 99% of the employment associated with BLM activities, or 11,555 jobs, of which 61% or 6,255 jobs are jobs held by local residents.

Impacts on Regional Income

Labor income under Alternative 4 would be expected to be slightly lower in the study area compared with that under Alternative 1. Under this alternative, labor earnings would be expected to exceed $7.8 billion, which represents a decrease of less than 1% from Alternative 1. On average, activities on BLM-administered lands are estimated to provide more than $390 million in earnings per year (in 2005 dollars). Regional labor income attributed to recreational activities and businesses would increase slightly under Alternative 4 from under Alternative 1, although no impacts from grazing would be expected to change relative to those under Alternative 1. Figure 4-3 summarizes potential impacts on total earnings.

Earnings would be generated from continued oil and gas operations, businesses that support recreational activities, and grazing operations. The bulk of the labor earnings are provided by drilling and completion activities, representing more than 83% of the labor earnings. However, these labor earnings encompass both local employment and nonresidential employment. As indicated previously, the nonlocal labor component is approximately 60% of the workforce for drilling and completion operations (personal communication with Pinedale Anticline Operators, June 15, 2006). Overall gas development and production labor earnings are approximately $4.3 billion and are paid to workers within the study area over the 20-year planning time frame.

Labor earnings are only one component of personal income; investment income and transfer payments are also important components. According to the analysis outlined in Section 3.10.6, transfer payments have grown steadily across the study area over the past 15 years, at an average annual increase of 2%. However, investment income in Sweetwater and Lincoln Counties has been decreasing since 2000, and Sublette County has experienced a decrease of 6 % between 2004 and 2005. Increased earnings have been offsetting these decreases in investment income to increase personal income overall. Under Alternative 4, these trends are likely to continue, especially throughout the development phase. Well development earnings are predicted to peak in 2010, cycle, and taper off to 2005 levels in 2020. Therefore, personal income would continue to follow the trends of the oil and gas labor earnings and peak in 2010. However, investment income would likely fall as the area becomes more industrialized and appeals to fewer retirees and second-home owners. As earnings fluctuate and decrease after 2012, personal income would likely follow, decreasing more significantly as both labor income and investment income fall.

Impacts on Local Government Expenditures

County budgets have been increasing across the study area, likely a result of the population growth caused by increasing gas development and production activities. There are considerable costs to local governments for accommodating and meeting increasing infrastructure requirements associated with rapid growth and development. Utilities and service providers as well as municipalities also face considerable infrastructure and capital investments expenditures. These municipal and county expenditures include public service provisions, such as education, road repair and construction, police and law enforcement, judicial facilities and services, medical services and facilities, emergency services, other social services, utilities (water, electricity, sewer, waste disposal), and often housing and land acquisition costs. All these impacts, as examined under Alternative 1, are expected to continue under Alternative 4 with similar amounts of well development and production. Under Alternative 4, these county and local government expenditures would continue to increase as infrastructure, community services, and other public service provisions are needed to meet the economic and population growth of the area.

Impacts on Tax Revenues

The total present value of mineral tax revenues would be expected to be slightly more than $10.9 billion under this alternative, a 0.2% increase from Alternative 1. No changes in impacts relative to those under Alternative 1 would be expected to occur on tax revenues as a result of changes in recreation or grazing. Figure 4-4 shows the estimated ad valorem taxes resulting each year from potential gas production in the planning area.

Local governments would primarily benefit from changes in the ad valorem taxes collected by the counties on oil and gas production within the planning area. Approximately 20% of the ad valorem revenues accrue directly to the counties, while the remainder is funding for local schools and the State School Foundation (Wyoming Department of Revenue Annual Report 2006). Because most of the production is occurring in Sublette County, it would be the primary recipient of these tax receipts. These production tax receipts paid to local governments often lag behind the funding needs spawned by the

development boom, slightly delaying vital funding sources for needed infrastructure and government services. It should be noted that as a result of new recapture provisions for school funding in Wyoming, much of the ad valorem tax revenue going to county schools is in fact recaptured by the State School Foundation and is now allocated by the state, making local school funding less certain.

Local governments within the study area receive only a small percentage of federal royalties and severance taxes collected on production originating on public lands. Local governments also benefit from property and sales and use taxes paid by residents of the area. There are no income taxes in Wyoming. With an increasing population, these revenues are expected to increase under this alternative. However, there are a considerable number (60%) of nonresidential gas employees who likely live and spend most of their income outside the study area; these employees would not contribute property and sales taxes to local governments.

Activities in the planning area under Alternative 4 would continue to generate tax revenues for local, state, and federal government entities. The majority of these tax revenues would be associated with natural gas operations, which are expected to generate approximately $10.9 billion in mineral tax revenues over the study period. Sublette County is likely to receive approximately $554 million over the 20-year time frame primarily from ad valorem tax receipts, while Lincoln County would also receive a portion of the ad valorem tax revenues. This tax revenue is vital for funding infrastructure, utility projects, community services, road maintenance, medical services, and many other services, within the study area.

Impacts on Population

Changes in regional employment under Alternative 4 would be similar to those characterized under Alternative 1. Management actions under Alternative 4 would continue to support economic development that would influence population trends over the study period. However, since housing availability is limited and many of the oil and gas development jobs are seasonal or temporary in nature, the population growth impacts would be less severe. The PAWG SETG has predicted population growth for Sublette County under a number of scenarios. Because housing availability is constrained within the county, the SETG believes the low-impact scenario is most likely, at least in the short term. Under Alternative 4, it is likely that the population would increase steadily from approximately 6,926 in 2005 to 12,000 in 2015, a 73% increase over the 10-year period. After that time, the population would remain fairly constant or rise only slightly until 2030.

Sweetwater County would likely see a slight increase in its population growth under Alternative 4; according to a school administrator and a law enforcement official, if housing is made available, there would be more in-migration to and population growth in the county, because there are many jobs available in both the tourism and oil and gas industries. Population impacts under Alternative 4 are less certain for Lincoln County.

Impacts on Housing

Under Alternative 3, the housing trends are expected to continue as described in Section 4.10.6, with low housing availability, rising housing costs, and difficulty retaining employees. Although there is considerable housing development now occurring throughout the study area to meet its housing shortage, there does not currently appear to be any excess housing capacity in the study area to absorb significant increases in population. Although the number of rental units is increasing across the study area, the vacancy rates are currently still 1.9% across all three counties, with rising housing costs.

Impacts on Community Stability and Connectiveness

Alternative 4 would include a 181% increase in the number of wells over the next 16 years; this would likely continue to affect community stability and connectiveness because of the high proportion of temporary or rotational residents associated with the oil and gas industry, who would reside in Sublette County. As a result, "[C]ommunity stability, sustainability, and connectiveness is seen to suffer as these temporary residents place strains on community services and culture but have little to no community ties or affiliation." (SETG 2006)

It is likely that under Alternative 4, there would be continued increases in population and influxes of newcomers (both seasonal and residents). Often, this can lead to an erosion of social integration and community satisfaction, at least during the boom periods. Although many residents might not like the changes taking place in their communities as a result of this boom growth, according to social research (Brown et al. 2005), most residents eventually would reconcile their feelings regarding the new and changing community context over time.

Impacts on Quality of Life

Overall, BLM management under Alternative 4 would cause dissatisfaction among many residents who value remote and rural lifestyles and individuals or groups that are being displaced by development activities. Some stakeholder groups, such as conservationists, recreational groups, wildlife protection groups, amenity-focused stakeholders, local tourism businesses, and others would likely perceive a decreased quality of life as a result of well drilling and field development and continuing industrialization of the area. In some cases, these groups might experience long-term impacts from a loss of open landscapes and viewscapes and solitude as a result of development and production in the planning area. However, others in the community, such as those supporting gas interests, some residents, and perhaps local and state government representatives, might support further development activities that they might feel increase the economic well-being of the area and overall standard of living. It is expected that these conflicts would continue under Alternative 4.

The crime statistics for Sublette County indicate that recent increases in crime and arrests have grown at rates that vastly outpace the already growing population, and that crimes and arrests have been shown to be highly correlated with drilling activity (ERG 2007). From this information and with the continued increase in the number of wells drilled (181% from 2006 to 2020) and operated in the study area under Alternative 4, it is reasonable to assume that the crime rate in Sublette County would continue to increase.

Preliminary statistics on crime in Sweetwater County indicate that crime had been decreasing until 2004, and then the trend reversed and has been climbing (see Section 3.10.6). However, the population of Sweetwater County has also been increasing, so that the crime rate has remained stable in this county. The crime rate in Lincoln County has been stable, and it is lower than the state average. However, both Sublette and Sweetwater Counties would be impacted by increasing crime, requiring more law enforcement personnel and police, criminal justice employees, and social services to address the changes in crime.

Substance abuse violations were up 209% for adult males and 400% for juvenile males in the interval between 2000 and 2006 in Sublette County (Jacquet 2007). Violations, however, may underestimate the extent of the regional drug problem. There is a consensus that crystal methamphetamine use is widespread among roughnecks in Wyoming. Alternative 4 would be characterized by less development than Alternative 2 and more development than Alternative 3. Therefore, it is likely that under Alternative 4, there would be more attendant drug use than Alternative 3 and less than Alternative 2. Drug abuse incidence is likely to increase at current rates.

Traffic and congestion is also often cited as a quality-of-life indicator. With the additional oil and gas development and production within the area under Alternative 4, it is likely that traffic, vehicle congestion, and road construction within the Sublette and Sweetwater Counties would continue to increase, lowering the quality of life for those residents and groups who value less traffic and congestion. It is less clear if traffic and congestion would increase in communities within Lincoln County.

There have been issues with air quality more recently as ozone data collected at three monitoring sites in the area recorded elevated ozone levels during 2005, 2006, and 2008 (see Table 3-5). Not only are these higher ozone levels a health concern, but they are also clearly a quality-of-life indicator for certain groups if they have reduced ability to spend time outdoors during these periods. The recorded higher ozone levels also impact tourism as word spreads of decreased air quality in the area. Under this alternative, impacts on air quality and quality of life are expected to be similar to those experienced under Alternative 1. As development and production increases over the planning horizon, these air quality impacts are likely to continue.

Nonmarket values associated with BLM lands, such as recreation (e.g., hunting, biking, hiking, and ATV use), viewsheds, wildlife habitat, water regulation, climate regulation, waste assimilation, hydrological function, and flood control (among many others), are expected to decrease under this alternative. Because the decreases in these values are often difficult to quantify, it is not easy to fully understand the tradeoffs inherent to significant oil and gas development. It could be the case that under Alternative 4, as could be under Alternative 1, the societal nonmarket values could decrease more than the value of the oil and gas resource extracted (see Section 4.10.4 for an expanded discussion on Nonmarket Values).

Impacts on Social and Community Services

Activities within the planning area would cause continued impacts on local government services in various ways. For instance, changes in demand for government services associated with projected population increases associated with drilling and production tied to the planning area would cause considerable strain on infrastructure (e.g., roads, utilities, and schools) and social services (e.g., medical and hospital facilities, counselling services, child care, and other municipal and county provisional services). As discussed above, the activities under Alternative 4 are expected to support a significant percentage of the workforce within the study area in the years to come.

Because all factors are assumed to continue with increased oil and gas activity in the planning area, it is likely that the need for emergency and social services would grow. Under this alternative, the incidence of crime and drug use is expected to increase in Sublette and Sweetwater Counties. This puts considerable strain on social (e.g., treatment and counselling services) and emergency services, as well as on other government services. Because housing is in such a short supply, it has been difficult to fill vacant and needed employment positions in social and community services organizations. This may cause a shortfall in these social and community services in the short term, until the housing availability situation is addressed.

School enrollment levels in much of Sweetwater and Sublette Counties have been increasing since 2003 (see additional discussion of education impacts in Section 4.10.4). As a result, school districts within the counties would need to accommodate this growing school-age population by constructing new schools or by purchasing existing buildings to convert to schools, many of which are currently in the planning or construction phases.

4.11 SOILS

This section presents potential impacts on soils from management actions for other resource programs. Existing conditions concerning soils are described in Chapter 3 (Section 3.11).

4.11.1 Assumptions

The analysis was based on the following assumptions:

- On undisturbed rangelands and forestlands, natural erosion rates are minimal.
- Erosion modeling for the planning area estimates that natural soil erosion averages 0.04 ton per acre per year on rangelands and 0.00 tons per acres per year on woodlands.
- For the purposes of this analysis, water erosion is the primary mechanism for loss of soil productivity.
- Erosion reduces soil productivity because topsoil, in which nutrients used by plants are most concentrated, is removed.
- Eroded soil can be deposited as sediment at any point downslope or can be transported to water bodies such as streams, rivers, lakes, and reservoirs.
- The amount of sediment from upland soil erosion that is transported to streams and other water bodies is dependent on distance, slope, soil texture, filtering capacity of upland and riparian vegetation, and storm intensity and duration.
- Vegetation removal and surface disturbance are the primary cause of accelerated soil erosion on the uplands.
- The removal of vegetation increases the erosive force of overland water flow, decreases soil strength, reduces infiltration, increases runoff, alters soil structure, and reduces protection of the surface from raindrop impact.
- Vegetation increases soil organic matter, aggregation of soil particles, and soil porosity, all of which increase soil resistance to erosion.
- Soil compaction, though a very real phenomenon, is not considered to be widespread within the planning area.
- Soil compaction is considered a localized impact common to activities such as livestock concentration areas, particularly during times when soils are wet, and high-traffic areas such as walking paths, hiking trails, or OHV areas.
- Soil compaction increases water runoff and thereby promotes sheet, rill, and gully erosion.
- Compacted soils are less accommodating to plant roots, and seed germination is difficult in such soils.
- Surface disturbance on unstable slopes could cause changes in moisture content and weight distribution, which could result in landslides, slumps, and mudflows.

- Soil productivity could be reduced by downwind and downslope deposition from eroded soils.
- Wind erosion can impact soil productivity in a similar manner as water erosion. Since no technologies similar to the Water Erosion Prediction Project (WEPP) exist to model wind erosion on rangelands, this analysis will be limited to impacts resulting from water erosion.
- Short-term erosion impacts depend on the length of time it takes for the disturbed area to become revegetated with a self-sustaining, perennial plant community. For the purposes of this analysis, it is assumed that this will be a 0- to 5-year time frame.
- Long-term erosion impacts are those impacts that continue after vegetation has become reestablished. They are due in part to changes in the vegetative community but to a greater extent to a surface area that remains void of vegetation, such as pads and roads.

4.11.2 Methods of Analysis

The WEPP soil erosion model was used to analyze impacts on the soil resource. WEPP is a data intensive-model. To facilitate this analysis, the Internet-based U.S. Forest Service (USFS) WEPP interfaces were used for erosion predictions using the "Disturbed WEPP" and "WEPP Road" modules.

Erosion rates are inherently difficult to predict. The rates of erosion predicted by WEPP are within +/– 50%. Despite this apparent lack of precision, erosion rates generated by WEPP are adequate for comparing and analyzing impacts of the alternatives on the soil resource.

Climatic parameters used by the WEPP model were developed using Pinedale, Wyoming, weather data.

Both the Disturbed WEPP and WEPP-Road modules are limited to four soil textures (clay loam, silt loam, sandy loam, and loam); a clay loam soil texture was used for all erosion predictions.

Disturbed WEPP has eight vegetative treatment options available: 20-year-old forest, 5-year-old forest, shrub-dominated rangeland, tall-grass prairie, short-grass prairie, low-severity fire, high-severity fire, and skid trail. By adjusting cover parameters, these vegetative treatment options can be applied to a wide variety of vegetative communities and land uses.

All WEPP erosion analyses were conducted using a 50-year simulation.

For the purposes of this analysis, the following parameters were used:

- Slopes used in Disturbed WEPP: Upper slope 0%–45%; lower slope 5%–45%
- Gradients used in WEPP-Road: Road gradient 4%; fill gradient 30%; buffer gradient 15%
- Slope lengths used in Disturbed WEPP: 300 feet
- Road length used in WEPP-Road: 200 feet
- Rock cover used in Disturbed WEPP: 10%.

4.11.3 Impacts Common to All Alternatives

The management of cultural and paleontological resources would have an indirect impact on the soil resource by restricting or limiting development. Cultural and paleontological investigations would have a minimal impact on the soil resource given the limited surface disturbance of such investigations and the fact that such excavations are usually conducted with hand tools.

The following nonenergy-related construction projects and facilities would be proposed. Figures are given in acres per year over the life of the document. In any one year, disturbance from any one source may be greater or less than the projected averages.

- Approximately 490 acres per year would be disturbed for the construction and improvement of roads and highways not related to oil and gas development. This would result in a short-term erosion rate of 3,018 tons per year. Following the reestablishment of vegetation, erosion rates would drop to 323 tons per year.
- An average of 5 acres per year would be disturbed by the installation of telephone and fiber-optic cable, resulting in 31 tons of soil erosion per year in the short term and 3 tons per year in the long term.
- Power lines would disturb 75 acres per year, resulting in 460 tons of soil erosion per year in the short term and 50 tons per year in the long term.
- Communication site construction would disturb an average of 3 acres per year, resulting in 18 tons of soil erosion per year in the short term and 2 tons per year in the long term.
- Other facilities would disturb 58 acres per year, resulting in 355 tons of soil erosion per year in the short term and 38 tons per year in the long term.

Livestock grazing would impact the soil resource. Livestock remove herbaceous vegetation that would otherwise be available to protect the soil surface from raindrop impact and overland flow. Natural or background erosion rates formulated by WEPP predict erosion to be 0.04 ton per acre per year. The cover values used in this prediction were based on in-the-field observations in vegetative communities similar to the planning area and took into account that these are grazed ecosystems.

In those areas where livestock congregate, particularly during wet soil conditions, there could be some soil compaction. Livestock trails often develop along fence lines and in the vicinity of water developments and have the potential to concentrate water flow and create gullies. Implementation of the Wyoming Standards for Rangeland Health (USDI, BLM 1997) would help ensure proper management of livestock and serve to minimize impacts on the soil resource.

Surface-disturbing activities associated with minerals activities such as the construction of well pads, roads, and pipelines expose soils to the erosive forces of water and wind in both the short and long term.

The vegetation management goal common to all alternatives is to maintain or enhance vegetation health, composition, and diversity and reclaim disturbed areas to desired plant communities (DPC), through noxious weed management and an emphasis on habitat for Special Status Species. These actions would indirectly benefit the soil resource by maintaining or improving vegetative cover.

VRM would have few if any impacts on the soil resource. There is limited potential that through the management of viewsheds there could be an indirect impact on soils by lessening the acres of surface disturbance.

Actions taken to minimize impacts on surface water and groundwater resources and recharge areas would directly benefit the soil resource. To meet water quality objectives, management of the soil resource in both the uplands and riparian areas is imperative. The emphasis in all alternatives to meet the Wyoming Standards for Rangeland Health would be on management actions at the watershed level, further benefiting the soil resource. The objective common to all alternatives is to control runoff from developed sites and maintain erosion rates at natural levels, which would further protect the soil resource.

Wildland fires would affect soil resources by exposing soils to water and wind erosion. Erosion rates could increase to 4.76 tons per acre per year in the short term. In certain vegetative communities, hot fires can create hydrophobic soil conditions (i.e., resistance to water infiltration), whereby runoff and erosion are increased. Provided that vegetative recovery is successful, the long-term effect of a fire and change in vegetation could reduce long-term erosion and benefit soil resources.

Fire suppression activities would have the potential to impact the soil resource. Fire lines constructed during suppression efforts could channelize surface runoff, causing gully erosion. When heavy equipment is used to construct fire lines, a wider area is cleared of vegetation, with the root masses often being removed as well. Fire suppression impacts could be mitigated if fire crews are used to construct erosion control structures such as water bars. Impacts could be further reduced through the implementation of BLM's Burned Area Stabilization protocols. Wildland fire would often stimulate the herbaceous component of the plant community, increasing cover in the long term with a subsequent reduction in the natural rate of erosion.

As with wildland fire, prescribed fire would have the potential to impact soil resources by removing stabilizing vegetation and exposing soils to accelerated wind and water erosion. Generally, these fires do not burn as hot and greater surface cover remains. Short-term erosion rates following prescribed fire are estimated to be 1.99 tons per acre per year. Prescribed fire usually stimulates the herbaceous component of the plant community, increasing cover in the long term with a subsequent reduction in the natural rate of erosion.

4.11.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 1.

The emphasis of this alternative to resolve conflicts between cultural resource and other uses and provide for appropriate levels of protection would indirectly impact the soil resource by restricting or limiting development. The goal to design cultural resource management actions that maintain the value of cultural resources and provide for scientific and educational uses of cultural resources could result in minimal surface disturbance from subsurface investigations.

This alternative would provide for approximately 4,000 acres of forest and woodlands to undergo various treatments such as thinning, hazardous fuels reduction, and commercial harvest activities. Given the limited size and extent of forest and woodland treatments, overall impacts on the soil resource would be minimal. Following harvest and treatment activities, groundcover would still be high since the understory would be largely undisturbed and limbs and other debris would cover much of the soil surface. Erosion rates following treatments or harvest activities would be only 0.02 ton per acre per year, resulting in approximately 80 tons of soil erosion. Erosion rates could be higher along skid trails and landings (0.22 ton per acre per year), and there could be some soil compaction associated with these facilities.

Under the current management, 6,400 acres would be eligible for disposal, with an additional 14,500 acres identified as suitable for consideration for disposal only by exchange. This alternative could potentially result in 20,900 acres being transferred out of federal ownership. Lands transferred out of federal ownership have the potential to impact the soil resource through uncontrolled surface-disturbing activities.

Surface-disturbing activities associated with minerals activities such as the construction of well pads, roads, and pipelines expose soils to the erosive forces of water and wind both in the short term and long term. With the projected initial disturbance of 21,599 acres for well pad development, short-term erosion rates would be 132,402 tons per year during the time it takes for the disturbed areas to become vegetated and stabilized. Once these sites become stabilized, erosion rates would drop to 64,212 tons per year. With the projection of 2,181 miles of new roads, short-term erosion would be 7,605 tons per year. Once the roads become stabilized, long-term erosion rates would be 2,044 tons per year. With the projection of 11,063 acres disturbed for pipeline construction, short-term erosion would be 67,816 tons per year. Once pipelines become stabilized, long-term erosion would be 841 tons per year.

Management actions would place an emphasis on three recreation management areas: Scab Creek, Upper Green River, and Boulder Lake, in addition to fishing and floating opportunities along the Green and New Fork Rivers. Management actions directed toward these recreational areas would indirectly impact the soil resource in two ways. First, large-scale surface-disturbing activities would not be allowed. Second, areas impacted from heavy-use areas, such as erosion along trails and access points, would be identified and mitigated or corrected.

Management actions would emphasize the reduction of soil erosion and sediment and salinity to the Green River Basin water system, relying on a case-by-case approach to management practices to reduce impacts on soils. This approach would continue to reduce impacts on the soil resource. By not mandating that impacts of erosion from past surface-disturbing activities be mitigated, these disturbed areas could continue to erode with subsequent onsite and offsite impacts.

Remaining open to unrestricted OHV use would be 247,250 acres. OHV use could have a significant impact on the soil resource. Conservative erosion estimates using WEPP predict that soil erosion could increase 10 times above the natural rate. In the unlikely event that the entire 247,250 acres were to be used as an OHV Open Area, erosion rates would average 610,708 tons per year. In addition to the predicted erosion impacts, there would be soil compaction along high-traffic routes and the potential for channelization of overland water flow with the resultant gully formation.

There would be no mandate to conduct vegetation treatments to meet DPC goals. Impacts on the soil resource such as improved vegetative cover would be limited to improvements resulting from noxious weed control and habitat protection for Special Status Species.

The wildlife management actions under Alternative 1 were developed before the current level of oil and gas activity. Wildlife management actions that benefit wildlife and wildlife habitat would have an indirect impact on the soil resource resulting from reduced or restricted surface-disturbing activities. Since the wildlife management actions under this alternative did not take into account the current pressures on wildlife and their habitats, this alternative would have the potential to impact the soil resource more through surface-disturbing activities.

One ACEC (Beaver Creek) and two SRMAs (Upper Green River and Boulder Lake), totaling 14,540 acres, would be withdrawn from mineral entry. This would have an indirect impact on the soil resource because these areas would not be subject to large-scale surface-disturbing activities.

4.11.5 Impacts Under Alternative 2

The objective of this alternative, to “protect the NRHP-eligible cultural sites and national historic trails,” would indirectly protect the soil resource though surface occupancy prohibitions and restrictions on surface-disturbing activities in the vicinity of significant cultural sites, such as historic trails, communal

big game kill sites, rock shelters, and Native American burial sites and TCPs. The limited number of management actions under this alternative could reduce the effectiveness of this alternative in protecting the soil resource.

This alternative would allow approximately 11,000 acres of forest and woodlands to undergo various treatments such as thinning, fuel reduction, or commercial harvest activities. Erosion rates following treatments or harvest activities would be 0.02 ton per acre per year, resulting in approximately 220 tons of soil erosion.

The emphasis placed on grazing under this alternative would cause impacts on the soil resource. A minimal decrease in vegetative cover from livestock grazing would result in a slight increase of runoff and erosion. If vegetation cover were reduced by 10%, erosion rates predicted by WEPP indicate that erosion would increase by only 0.01 ton per acre per year. In those areas where livestock congregate, particularly during wet soil conditions, there could be some additional soil compaction and runoff.

With the projected initial disturbance of 23,872 acres for well pad development, short-term erosion rates would be 146,335 tons per year during the time it takes for the disturbed areas to become vegetated and stabilized. Once these sites become stabilized, erosion rates would drop to 68,993 tons per year. With the projection of 2,370 miles of new roads, short-term erosion would be 8,624 tons per year. Long-term erosion rates from roads would be 2,221 tons per year. With the projection of 11,611 acres disturbed for pipeline construction, short-term erosion would be 71,175 tons per year. Once pipelines are revegetated, long-term erosion would be 882 tons per year.

This alternative would do the least to promote recreational opportunities in the planning area. The management objective to “manage recreational use to limit resource damage” would impact the soil resource when areas impacted from heavy use are identified, such as erosion along trails and access points, and responded to in such a manner as to mitigate or eliminate the damage. Only three SRMAs would be designated under this alternative, each of which would be open to limited oil and gas activity. The indirect impacts on the soil resource are common under Alternatives 3 and 4, whereby surface-disturbing activities would not occur in SRMAs and would not be realized under this alternative.

Under this alternative, up to 5,000 acres could be transferred out of federal ownership, with the resultant uncertainty of future land uses and impacts on the soil resource. DLEs would be allowed under this alternative; properly managed agricultural lands could benefit the soil resource by increasing vegetative groundcover, particularly for hay crops, and building soil fertility and soil structure. However, poor agricultural practices could lead to increased erosion, with onsite and offsite impacts. By allowing water disposal pits, there would be increased surface disturbance and the associated erosional impacts on soils. In addition, water disposal pits would increase the potential for catastrophic events, whereby large volumes of soils could be eroded from the landscape.

The objective to “mitigate impacts of erosion from past surface-disturbing activities” would have a direct impact on the soil resource, lowering erosion rates by as much as 10 times below current rates. In addition, the management objective to “ensure that all newly disturbed areas are successfully reclaimed” would directly impact the soil resource.

The designation of 20,640 acres for four OHV Open Areas would have direct impacts on the soil resource. Such a designation would lead to increased use by recreational riders. As a result, soil erosion rates would increase significantly, resulting in an average soil loss of 25,836 tons per year. These calculations probably underestimate the potential for erosion, because they do not include gully formation along trails and roads. The objective to mitigate erosion impacts along transportation corridors would result in an immediate benefit to the soil resource.

Impacts on the soil resource, such as improved vegetative cover, would be limited to improvements resulting from noxious weed control and habitat protection for Special Status Species.

The reduced emphasis placed on wildlife management under this alternative would also reduce the indirect impacts on the soil resource that normally result from wildlife management actions. Only to the extent that the objective to "maintain or enhance fish and wildlife habitat to the extent possible" would reduce surface-disturbing activities would there be any indirect impact on the soil resource.

The Trapper's Point ACEC would be the only SD/MA proposed under this alternative. This management action would represent an indirect impact on the soil resource. Under this alternative, there would be no acres withdrawn from mineral entry, therefore increasing the potential extent of surface disturbance with the subsequent erosional impacts.

4.11.6 Impacts Under Alternative 3

The management actions under this alternative would emphasize protection of cultural resources. Many areas would be unavailable for oil and gas leasing; 84,380 acres around the Lander Trail would be designated as a Class II VRM area; and land acquisitions and exchanges that benefit cultural resources would be pursued. These more protective actions would indirectly benefit the soil resource by limiting surface-disturbing activities over a much broader area than any of the other alternatives.

This alternative would provide for approximately 18,000 acres of forest and woodlands to undergo various treatments such as thinning, hazardous fuels reduction, and commercial harvest activities. Erosion rates following treatments or harvest activities would be 0.02 ton per acre per year, resulting in approximately 360 tons of soil erosion. Erosion rates could be higher along skid trails and landings (0.22 ton per acre per year), and there could be some soil compaction associated with these facilities. Long-term erosion rates would depend on the rates of vegetative and soil recovery.

By limiting the disposal of public lands to 790 acres, this alternative would greatly reduce the likelihood that changes in land ownership could result in uncontrolled surface-disturbing actions, with the resultant onsite and offsite impacts on the soil resource. By not allowing DLE, this alternative would not realize the potential for reducing erosion and improving soil fertility and structure through good agricultural practices; nor would the potential for increased soil erosion through poor agricultural practices be realized.

The reduction of AUMs under this alternative could reduce the impacts on the soil resource. There could be a minimal increase in vegetative cover because of the AUM reduction, resulting in a slight reduction in runoff and erosion. If vegetation cover were to increase by 10%, erosion rates predicted by WEPP indicate that erosion would decrease by only 0.01 ton per acre per year.

With the projected initial disturbance of 15,923 acres for well pad development, short-term erosion rates would be 97,608 tons per year during the time it takes for disturbed areas to become vegetated and stabilized. Once these sites become stabilized, erosion rates would drop to 49,193 tons per year. With the projection of 1,578 miles of new roads, short-term erosion would be 5,502 tons per year. Once they become stabilized, long-term erosion rates from roads would be 1,479 tons per year. With the projection of 7,719 acres disturbed for pipeline construction, short-term erosion would be 47,317 tons per year. Once pipelines become stabilized, long-term erosion would be 587 tons per year.

The emphasis placed on recreation management would indirectly impact the soil resource. The emphasis placed on completing RAMPs could reduce impacts on the soil resource though the implementation of

better recreation management. The management objective to "maintain and develop adequate recreational sites to meet public demand" could result in localized impacts on the soil resource, such as soil compaction along trails and access points; however, areas experiencing accelerated erosion could be readily identified and responded to. The three SRMAs identified under this alternative would not allow oil and gas activities resulting in indirect impact on the soil resource, because large-scale surface-disturbing activities would not occur.

This alternative would require that "natural" erosion rates be achieved. This action would result in little difference in reclamation success and would do little to reduce impacts on soils. By mandating that surface disturbance be prohibited on slopes greater than 8%, erosion rates on disturbed areas could be reduced by as much as 80%, in addition to the reduction of surface disturbance that would take place.

The objective to mitigate erosion impacts along transportation corridors would directly benefit the soil resource by reducing or eliminating runoff and erosion impacts along these corridors. By prohibiting OHV Open Areas, this alternative would benefit the soil resource in those areas currently being used by OHVs in an unrestricted manner. In the long term, these areas would revegetate and erosion rates would approach more natural levels.

Under this alternative, no areas would be designated as OHV Open Areas. Assuming that this would be strictly adhered to by the public, there would be no new impacts on the soil resource from expansion of OHV disturbance.

Some 200,000 acres would be proposed for treatment using prescribed fire, wildland fire, biological treatments, or a combination thereof. Such treatments would have the potential for short-term erosion impacts with erosion increasing to 1.99 tons per acre per year and an annual soil loss of 26,533 tons. Since vegetation treatments usually increase herbaceous cover, in the long term, erosion rates could be reduced below the predicted background erosion rate of 0.04 ton per acre per year.

Fire management actions under this alternative would have the potential to reduce suppression-related impacts on the soil resource, primarily through the management action to "conduct fire suppression activities in areas of known sensitive species habitat, fragile or erosive soils" in such a way as to avoid damage to these resources and would indirectly impact the soil resource by identifying such areas in advance and thus reduce or avoid impacts on the soil resource.

These wildlife and oil and gas management areas and subsequent management actions would limit the extent of oil and gas activity in the planning area, causing an indirect impact on the soil resource, whereby fewer acres would be disturbed through oil and gas exploration and development.

Under this alternative, 17 SD/MAs would be designated, covering 648,944 acres. This could significantly reduce the acres of surface disturbance primarily from oil and gas activity, which would have an indirect impact on the soil resource because soil erosion would be reduced.

4.11.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 4.

The impacts from livestock grazing would be similar to those under Alternative 1.

The impacts from cultural resources, lands and realty, OHV, and wildland fire management would be the same as under Alternative 3.

This alternative would provide for approximately 18,000 acres of forest and woodlands to undergo various treatments such as thinning, hazardous fuels reduction, and commercial harvest activities. Erosion rates following treatments or harvest activities would be 0.02 ton per acre per year, resulting in approximately 360 tons of soil erosion. Erosion rates could be higher along skid trails and landings (0.22 ton per acre per year), and there could be some soil compaction associated with these facilities.

With the projected initial disturbance of 21,853 acres for well pad development, short-term erosion rates would be 133,959 tons per year during the time it takes for the disturbed areas to become vegetated and stabilized. Once these sites become stabilized, erosion rates would drop to 63,997 tons per year. With the projection of 2,168 miles of new roads, short-term erosion would be 7,560 tons per year. Once the roads become stabilized, long-term erosion rates from roads would be 2,031 tons per year. With the projection of 10,027 acres disturbed for pipeline construction, short-term erosion would be 61,466 tons per year. Once pipelines become stabilized, estimated long-term erosion would be 762 tons per year.

The emphasis placed on recreation management would indirectly impact the soil resource. The emphasis placed on completing RAMPs could reduce impacts on the soil resource though the implementation of better recreational goals and objectives. The management objective to “maintain and develop adequate recreational sites to meet public demand” could result in localized impacts on the soil resource, such as soil compaction along trails and access points; however, areas experiencing accelerated erosion could be readily identified and responded to. Five SRMAs are identified under this alternative. All are open to oil and gas leasing but with NSO stipulations; the emphasis on SRMAs would benefit the soil resource because large-scale surface-disturbing activities would largely be eliminated.

The soil management actions under this alternative are the same as those under Alternatives 2 and 3—to “mitigate impacts of erosion from past surface-disturbing activities” and to “ensure that all newly disturbed areas are successfully reclaimed.” This alternative would require that natural erosion rates be achieved to the extent possible. This more realistic goal would result in similar long-term erosion rates as under the other alternatives. The 80% reduction in erosion from the 8% slope restriction under Alternative 3, along with the reduced acreage of surface disturbance, would not be realized under this alternative.

By prohibiting OHV Open areas, this alternative would benefit the soil resource in those areas currently being used by OHVs in an unrestricted manner. In the long term, these areas would revegetate and erosion rates would approach more natural levels.

The objective to mitigate erosion impacts along transportation corridors would be of immediate benefit the soil resource. Some 100,000 acres would be proposed for treatment using prescribed fire, wildland fire, biological treatments, or a combination thereof. Such treatments would have the potential for short-term erosion impacts, with erosion increasing to 1.99 tons per acre per year and an annual soil loss of 13,267 tons per year. Since vegetation treatments usually increase herbaceous cover, in the long term, erosion rates could be reduced below the predicted background erosion rate of 0.04 ton per acre per year.

The wildlife management actions in the Intensively Developed Fields, Traditional Leasing Areas, and Unavailable Areas would limit the extent of oil and gas activity in the planning area, though not to the same extent as under Alternative 3. Oil and gas activities would continue under Alternative 4 but at a more controlled pace. There still would be an indirect impact on the soil resource, whereby fewer acres would be disturbed through oil and gas exploration and development.

The emphasis on SRMAs and an ERMA would lead to a reduction in the acres of surface disturbance, with a subsequent reduction in soil erosion, thus representing an indirect impact on the soil resource.

4.12 TRANSPORTATION, ACCESS, AND TRAVEL MANAGEMENT

4.12.1 Transportation and Access

This section describes potential impacts on transportation and access from management actions for other resource programs. Transportation and access management includes management of ROWs for vehicular traffic and utility systems and access needs into isolated public land parcels. Existing conditions concerning transportation and access are described in Chapter 3 (Section 3.12).

The transportation and access program is a support program rather than an environmental component. The program responds to requests for authorization from other programs or outside entities. The following discussion of the effects on transportation and access focuses on the constraints and opportunities for ROW authorizations (e.g., pipelines and roads). Specifically, the analysis will determine whether the implementation of management actions for other resource programs influences or modifies the location, size, or design of a given transportation and access proposal or, in some cases, precludes the proposal from being approved. Such impacts would primarily occur from the implementation of management actions designed to protect natural resources and limit impacts on those resources from surface-disturbing activities. Therefore, the type and degree of limitations and restrictions placed on transportation and access proposals depends on the location of sensitive or high-value resources and the potential for environmental impacts on those resources.

Assumptions

The analysis was based on the following assumptions:

- ROW applications for energy-related transportation facilities (e.g., roads, pipelines) are anticipated to increase.
- Interest in community expansion and transportation needs is anticipated to increase during the planning period.
- The effects of designation and development of transportation and utility ROW corridors would be mitigated on a case-by-case basis.

Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, review of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

Impacts Common to All Alternatives

No impacts on the transportation and access program are anticipated as a result of implementing management actions for the following resources and resource uses: forest management, fire and fuels management, and livestock grazing.

Air quality management would affect how the transportation authorizations are stipulated to alleviate air quality impacts. As an example, stipulations may be placed on pipeline or road ROWs calling for dust

suppressants. The requirement to use dust suppressants may increase the construction costs. Formal consultation would be required for any project-related activity (dust suppression) that would cause a depletion of the Colorado River system.

Implementing protective measures for cultural and paleontological resources could require avoidance and other mitigation measures for transportation systems proposed near these resources. These measures could result in the relocation or redesign of the proposed transportation system. Because known cultural and paleontological resources occur throughout the planning area, and additional resources will likely be discovered in the future, impacts could be substantial and occur to varying degrees throughout the planning area.

Land tenure adjustments could serve to benefit the overall management of the transportation and access program. These actions would help to facilitate the location of transportation systems by providing for a more contiguous public land base and encouraging such developments near communities.

The minerals program would have a very large impact on the transportation and access program. Impacts would include roads required and transportation systems for natural gas and other produced liquids. In addition, areas that are closed to mineral leasing, have an NSO stipulation, or are otherwise identified as unsuitable for surface disturbance or occupancy would be managed as avoidance or exclusion areas for transportation. Minerals management actions, because they are so numerous in specific parts of the planning area, would potentially affect the location of subsequent transportation systems. Increased minerals actions would contribute to an increase in traffic, with a resultant increase in garbage and litter.

Recreation-related demands on public lands could increase the need for access. Overall, there would be minimal impacts on transportation and access from recreation management.

Implementing management actions for vegetation and soils could place land use restriction on some areas. Achieving high species diversity and the Standards for Rangeland Health (USDI, BLM 1997) for vegetation and preventing or minimizing soil erosion could result in the relocation or redesign of transportation systems. These potential impacts would be small scale and localized in sensitive vegetation and soils areas.

Managing the planning area to meet VRM objectives could affect the location and route of proposed transportation systems. Additional effort would be required to design projects to meet the objectives of the designated VRM class in an area in which a transportation system is proposed. Because transportation systems would generally be compatible with Class IV objectives, this classification would allow for increased opportunities for such authorizations. This is also true for VRM Class III objectives; however, some additional project planning could be necessary within VRM Class III areas to ensure that the landscape is partially retained. Any transportation systems proposed in VRM Class II would be subject to intensive mitigation and, in some cases, could be precluded.

Management of fish and wildlife habitat and Special Status Species would impact uses administered by the transportation and access program through the implementation of mitigation measures designed to protect species and wildlife habitat. Implementing species-specific conservation measures for BLM sensitive plant and animal species and prohibiting actions that adversely affect T&E species could result in the relocation of proposed transportation systems to avoid these habitat areas.

Potential impacts from all SD/MAs, whether existing or proposed, would usually be minimal and vary by management prescriptions associated with each designated SD/MA. Intensive management of SD/MAs would potentially affect the transportation and access program by altering locations. WSAs cause the

greatest restriction on transportation management actions, whereas the other SD/MAs place fewer restrictions on such actions.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 1.

Access across private lands would be pursued through a variety of methods as needed. Access closure, abandonment, and acquisition would be considered through activity planning and environmental analysis. This would increase the transportation and access workload in completing the necessary work for the actions and case files.

Impacts would result from the oil and gas RFD of 7,192 wells. This would impact transportation and access management by the demand for authorizations for oil and gas facilities, including pipelines and roads.

VRM classifications would affect the location of new transportation systems. Projects would be designed to meet the objectives of the established VRM class for the project area. Most transportation systems would be compatible with VRM Classes III (187,070 acres) and IV (641,140 acres). In VRM Class I (21,290 acres) and Class II (73,430 acres) areas, transportation actions would be limited and require mitigation to ensure that the project or surface disturbance did not attract the attention of the casual observer (Map 2-14).

Mitigation measures to protect wildlife resources, T&E species, and critical habitats would impact the transportation and access program. Seasonal closures would result in short-term impacts on transportation actions in sensitive areas such as the big game crucial winter range (501,620 acres) and greater sage-grouse lek buffer areas (392,880 acres). Year-round restrictions, including no surface-disturbing activities in areas such as sensitive aquatic and critical habitats, would restrict the location of transportation actions over the long term. Sensitive wildlife habitats such as prairie dog towns would be avoided to the extent possible, thereby limiting the placement of transportation systems and access. However, avoidance and exclusion areas would be considered on a case-by-case basis based on their level of sensitivity.

ACECs would be managed as transportation avoidance or exclusion areas.

Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 2.

Cultural resource management would prohibit transportation and access actions on communal big game kill sites, Oregon Trail inscription sites, rock shelters, and Native American burial locales and TCPs. Transportation actions would be prohibited or require special mitigation measures within one-quarter mile or the visual horizon (whichever is nearer) of the Lander and Sublette Cutoff Trails and also within one-quarter mile of contributing segments of these trails. This could result in the rerouting of transportation systems, thereby adding costs to proponents. Under Alternative 1, these restrictions would not occur, so this alternative would be more restrictive and have more impact on the transportation and access program.

Under this alternative, land tenure adjustments would be considered on a case-by-case basis, according to the criteria in Appendix 13. This action would increase the ability to exchange land, thereby increasing the potential for community and economic expansion. This might also increase the potential for sale or

exchange of isolated tracts of land, thereby facilitating management of the transportation and access program.

Impacts resulting from minerals management would be more extensive and would impact a larger portion of the planning area than under Alternative 1 because of fewer restrictions on use and increased development opportunities (RFD of 7,804 wells). This alternative would provide the most opportunity for mineral development and production, by allowing more open areas, which would increase transportation and access needs. This would impact the transportation and access program by increasing the demand.

Impacts resulting from the management of SD/MAs would be the same as those under Alternative 1, except that surface-disturbing activities would be prohibited in the Trapper's Point ACEC. All new transportation systems would need to be routed around the ACEC.

Impacts from VRM would be similar to those under Alternative 1, except that approximately 13,720 more acres would be designated as VRM Class II, which would increase the level of restrictions designed to protect visual resources and subsequently decrease opportunities for transportation authorizations.

Impacts resulting from wildlife and fisheries management would be more restrictive to the transportation program. For greater sage-grouse, big game, sensitive species, and raptors in Intensively Developed Fields, Traditional Leasing Areas, and Unavailable Areas, the restrictions placed on development would result in more impacts and restrictions to transportation and access. The placement of transportation systems and the construction windows could be affected by seasonal restrictions for NSO areas.

Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 3.

Cultural resource management, as under Alternative 2, would prohibit transportation and access actions on communal big game kill sites, Oregon Trail inscription sites, rock shelters, and Native American burial locales and TCPs. Transportation and access actions would be prohibited or would require special mitigation measures within 1 mile or the visual horizon (whichever is nearer) of the Lander and Sublette Cutoff Trails and also within 1 mile of contributing segments of these trails. This is an additional three-quarter mile and could result in the rerouting of transportation systems at additional costs to proponents. Under Alternative 1, these restrictions would not occur, and under Alternative 2 the restriction would be for one-quarter mile; thus, Alternative 3 would be more restrictive and have more impact on the transportation and access program.

Impacts from minerals management would be less extensive and would impact a smaller portion of the planning area than under Alternative 1, because of increased restrictions on use and decreased development opportunities. This alternative would provide the lowest opportunity for mineral development and production (RFD of 5,209 wells), thereby decreasing land use. This decrease would impact transportation and access management by lowering the demand for authorizations.

The increase of 371,970 acres for VRM Class II would increase the level of restrictions designed to protect visual resources and subsequently would decrease opportunities for transportation and access authorizations.

Impacts resulting from wildlife and fisheries management would be greater than under Alternative 1 because of an increased emphasis on habitat enhancement and protection and additional restrictions on surface-disturbing and other disruptive activities. For greater sage-grouse, big game, sensitive species,

and raptors in Intensively Developed Fields, Traditional Leasing Areas, and Unavailable Areas, the restrictions placed on development would result in more impacts and restrictions to transportation and access. The placement of transportation systems and the construction windows for building pipelines, roads, and so forth would be affected by NSO areas and seasonal restrictions. This would either decrease opportunities for authorizations or increase the stipulations placed on the authorizations, which could increase cost to the proponents.

SD/MAs under this alternative would restrict opportunities for development and associated transportation systems. There would be eight ACECs under this alternative. The emphasis of the ACECs would be to protect natural resources, which would place more restrictions on transportation. The Rock Creek ACEC would be a transportation exclusion area. In the Beaver Creek ACEC, all new roads and transportation would be required to follow existing ROW alignments. Trapper's Point and New Fork Potholes ACECs would be closed to all surface-disturbing activities except those activities that benefit natural resources. These areas would also be a transportation system exclusion area for all types of commercial activity. The Upper Green River ACEC would require the closure of the same amount of road that is built, with no net gain in miles of road. The White-tailed Prairie Dogs ACEC would have intensive management for surface-disturbing activities, more mitigation, and stipulations on all transportation systems. The Ross Butte ACEC would require new transportation systems to follow existing disturbance. The CCC Ponds ACEC would require that proposed projects be designed to maintain the integrity of big game migration routes. The East Fork River WSR Unit would be an exclusion area for transportation systems. The Green River WSR Unit would be an avoidance area for transportation systems. In other words, a transportation system could go through this ACEC but only with intensive management in the form of mitigation and stipulations placed on the authorization.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 4.

Cultural resource management would prohibit transportation and access actions on communal big game kill sites, Oregon Trail inscription sites, rock shelters, and Native American burial locales and TCPs, as it does under Alternatives 2 and 3. Transportation actions would be prohibited or require special mitigation measures within one-quarter mile or the visual horizon (whichever is nearer) of the Lander and Sublette Cutoff Trails and also within one-quarter mile of contributing segments of these trails, except for linear crossings. This could result in the rerouting of transportation systems and additional costs to proponents. Under Alternative 1, the restriction would not occur; under Alternative 2 the restriction would be for one-quarter mile; and under Alternative 3, the restriction would be for 3 miles. This alternative would be between Alternatives 2 and 3 for being restrictive and impacting on the transportation and access program.

Impacts from minerals management would be less extensive and would involve a smaller portion of the planning area than under Alternative 1 because of increased restrictions on use and decreased development opportunities. This alternative would provide slightly fewer opportunities for mineral development and production (RFD of 7,136 wells), thereby decreasing transportation needs. This decrease would impact lands and realty management by lowering the demand for transportation authorizations.

Impacts from VRM actions would be similar to those under Alternative 1, except that 166,090 more acres would be designated as VRM Class II, which would increase the level of restrictions designed to protect visual resources and subsequently decrease opportunities for transportation and access authorizations.

Impacts resulting from wildlife and fisheries management could be greater than under Alternative 1 because of an increased emphasis on habitat enhancement and protection and additional restrictions on surface-disturbing and other disruptive activities. For greater sage-grouse, big game, sensitive species, and raptors in Intensively Developed Fields, Traditional Leasing Areas, and Unavailable Areas, the restrictions placed on development would result in more impacts and restrictions to transportation and access. The placement of transportation systems and the construction windows for building pipelines, roads, and so forth could be affected by areas unavailable for leasing, NSO areas, and seasonal restrictions. This would either decrease opportunities for transportation and access authorizations or increase the stipulations placed on such authorizations, which could increase cost to the proponents.

SD/MAs under Alternative 4 would restrict opportunities for development and associated transportation systems. There would be an additional nine ACECs under this alternative. The emphasis of the ACECs is to protect natural resources, which would put more restrictions on transportation systems. The Rock Creek ACEC would be a transportation exclusion area. In the Beaver Creek ACEC, all new roads and transportation systems would be required to follow existing ROW alignments. The Trapper's Point and New Fork Potholes ACECs would be closed to all surface-disturbing activities except those that benefit the natural resources, which would make those ACECs transportation exclusion areas for all types of commercial activity. The Ross Butte ACEC would require new transportation systems to follow existing disturbance. The East Fork River WSR Unit would be an exclusion area for transportation. The Green River WSR Unit would be an avoidance area for transportation. In other words, a transportation system could go through this ACEC but only with intensive management in the form of mitigation and stipulations placed on the authorization.

4.12.2 Off-Highway Vehicle Management

This section describes impacts related to OHV management on public lands only. It does not apply to roads or transportation systems that are not under BLM jurisdiction, such as county roads owned and maintained by Sublette County.

Assumptions

The analysis was based on the following assumptions:

- Existing ROWs granted to other parties for access across the public lands are not affected by this RMP.
- OHV designations established by this RMP would not change the terms and conditions of use for an existing ROW.
- Lands would be open to motor vehicle access for emergency purposes such as search and rescue and fire fighting, regardless of the OHV designation.

Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of the area and its resources. Impacts are described using the best professional knowledge of the staff. Quantitative data are used where available. Impacts are often described using ranges of potential impact or in qualitative terms.

Impacts Common to All Alternatives

Potential impacts are complex in nature. The impacts that a given action produces depend on what is affected. For example, closing a given area to motor vehicles may be of great benefit to wildlife, to people who do not use motor vehicles to view or hunt wildlife, and to the visual character of the area. On the other hand, closing an area to motor vehicles excludes certain classes of people as well as certain kinds of activities.

Impacts from motor vehicle use typically occur when roads are constructed or when they are user-created by the passage of motor vehicles and by the activities that are facilitated by motor vehicle use. When roads are created, there is a corresponding loss of vegetation and removal or erosion of soil. Excessive or inappropriate road establishment can damage or degrade wildlife habitat, damage or destroy cultural resources, change the visual character of the landscape, change or degrade the kind of recreational experience provided by a given area, or even displace values and activities entirely. For example, excessive motor vehicle activity in crucial wildlife habitat can disturb wildlife and degrade the habitat to the point that it is abandoned.

Lands in the "closed to all motor vehicle use" category would receive no impacts from motor vehicle use. Motorized activities would be excluded from such areas, making them unavailable to people who choose to access the public lands only by motor vehicle or those who are unable to travel by means other than motor vehicles.

Wildlife would benefit from OHV closures because elimination of motor vehicles would decrease the amount of disturbance they would be subject to, particularly at critical times of the year (e.g., elk calving). Hunters would have to travel by foot or horseback. This would either enhance the hunting experience or detract from it, depending on the desires and attitudes of the affected hunters. Under a closed designation, the visual quality of the land would be enhanced because it would retain a more natural appearance.

Lands in the "limited" categories would be subject to a variety of impacts, depending on the terms and conditions of the designation. For "limited to existing roads and trails," motor vehicle access would be available on the entire existing road and trail network, plus any new roads authorized. This category normally provides excellent access to the public lands. However, it often encourages the proliferation of additional roads, because it is so difficult to determine what, exactly, are "existing roads and trails."

For "limited to designated roads and trails," lands would be subject to a higher degree of protection than under the "existing" category. Motor vehicle use would be limited to a specific road and trail network established through collaboration with users, other agencies, and the general public. Unauthorized road proliferation would be curtailed, thus extending protection to wildlife habitat, livestock grazing uses, and visual resources.

Impacts Under Alternative 1, Continuation of Existing Management

Under this alternative, about 26% of the public lands in the planning area would be open to all motor vehicle use (Map 2-13). They would be subject to uncontrolled OHV use, road proliferation, associated damage to vegetation and soils, and degradation of the visual appearance of the landscape. This would affect the southeastern quarter of the planning area, the northern portion of the Mesa, and a small parcel just east of Big Piney. Although this might be of benefit to OHV enthusiasts, it would generally be detrimental to most other values and uses of the public lands except mineral development.

Lands in the "open" category would be subject to OHV use any time and anywhere. This has a high potential to significantly increase the number of user-created roads and trails above the number

appropriate for a given mix of resource uses. There would also be a high potential for damage to soils and vegetation. An excessive number of roads with accompanying damage to soils and vegetation would adversely affect wildlife habitat, degrade the productivity of the land for livestock grazing, and have an adverse visual impact. Open lands would be subject to abusive motor vehicle use.

With the exception of the WSAs, the remainder of the planning area would be limited to existing roads and trails. This would allow unauthorized road proliferation and associated impacts on soils, vegetation, and the visual quality of the landscape. This slow process would have minimal short-term effects, but in the long term, areas of interest to hunters and OHV enthusiasts could be changed to the point that roads and their visual appearance would be a dominant feature.

The impact from access management would be minimal, both in the short term and long term. Access acquisition would occur infrequently because of a limited budget and lack of willing sellers. Easements would only be acquired when there is agreement between the buyer (BLM) and the seller. Generally, the public benefits from increased or improved legal access to the public lands. Private landowners who grant easements to the public lands across their property would benefit by being paid for doing so.

Impacts Under Alternative 2

Under this alternative the vast majority of the planning area would be limited to existing roads and trails, with less than 1% of the public lands open, approximately 2% limited to designated roads and trails, and less than 1% closed to OHV use (Map 2-21). This would extend OHV management to the majority of the planning area but would use the least effective form of management to do so.

Lands in the “open” category would be subject to OHV use any time and anywhere. This has a high potential to significantly increase the number of user-created roads and trails above the number appropriate for a given mix of resource uses. There would also be a high potential for damage to soils and vegetation. An excessive number of roads with accompanying damage to soils and vegetation would adversely affect wildlife habitat, degrade the productivity of the land for livestock grazing, and have an adverse visual impact. Open lands would be subject to abusive motor vehicle use.

While somewhat effective, the “limited to existing roads and trails” designation is not as effective as “limited to designated roads and trails.” Under the “existing” category, it is difficult for users (and managers) to determine the authorized existing road network. Accordingly, road proliferation would continue to occur where a specific identified network of roads and trails has not been identified. The impacts would include unauthorized roads and trails, damage to vegetation and soils, decreased visual quality of the landscape, potential degradation of wildlife habitat, damage to riparian areas, and at the extreme, decreased quality of activities such as recreation. These impacts are usually minimal in the short term but could become considerable in the long term.

For the areas where OHV travel would be limited to designated roads and trails, management of motor vehicle access would be effective. Impacts would include preventing the proliferation of roads and trails and protecting the natural appearance of the landscape, wildlife habitat, and cultural resources. The benefits would be realized in the short term and in the long term as well.

Areas closed to OHV use would benefit from the absence of motor vehicle use. This designation would add to the effectiveness of the Wilderness Interim Management Policy (IMP) for the Scab Creek WSA.

Overall, by decreasing the acreage in the “open” category, this alternative would more effectively manage OHV use than under Alternative 1.

The impact from access management would be minimal, both in the short term and long term. Access acquisition occurs infrequently because of a limited budget and lack of willing sellers. Easements are only acquired when there is agreement between the buyer (BLM) and the seller. Generally, easements increase or improve legal access to the public lands. Private landowners are paid for granting easements across their property to the public lands.

Travel management planning would enable land managers to assess the transportation needs of the planning area. By identifying needs, BLM would be better able to respond to the needs of the public for access to the public lands and would be better prepared to designate a transportation system that meets those needs. These impacts of transportation planning would be long term in nature.

Impacts Under Alternative 3

This alternative would eliminate all open areas and increase the closed areas to include the Lake Mountain WSA, Red Dugway/Fish Creek area, cultural resource sites, and the East Fork River WSR unit (Map 2-27). The acreage in the "limited to designated roads and trails" category would be significantly increased and the acreage in the "limited to existing roads and trails" category would be decreased (Map 2-27). A notable component of the OHV designations under this alternative is the category for seasonal limitation on OHV access to the public lands, whereby 55% of the planning area would have some form of seasonal OHV limitation to protect public land and resource values.

Wildlife habitat would be protected, and the visual quality of the areas in the "closed," "limited to designated roads and trails," and seasonal limitation areas would benefit from limited OHV activity. Cultural resources would benefit. The specific impacts would be less road proliferation and associated vegetation and soil damage. Fewer roads often mean higher quality wildlife habitat and less harassment of wildlife during critical times of the year. In terms of recreation, fewer roads often mean trading quantity of access for a higher quality of recreational experience.

The overall impact of this alternative would be to extend a higher degree of protection to the public lands in terms of motor vehicle use than under any of the other alternatives.

The impacts from access management and travel management would be similar to those under Alternative 2.

Impacts Under Alternative 4, Proposed RMP

This alternative is similar to Alternative 3 in that it proposes the elimination of all open areas and significant seasonal limitations on OHV use, and it would place about 13% of the planning area in the "limited to designated roads and trails" category (Map 2-35). As a result, the impacts would be similar to those under Alternative 3.

OHV closures would protect the Lake Mountain WSA, the Pinedale Pathway, selected rock alignment sites, and the East Fork River WSR Unit from all potential motor vehicle impacts (road extension, damage to soils and vegetation). Motorized activities would be excluded from these areas, making them unavailable to people who choose to access the public lands only by motor vehicle or those who are unable to travel by means other than motor vehicles.

Limiting motor vehicle use to designated roads and trails at the Boulder Lake, Scab Creek, CCC Ponds, and Upper Green River SRMAs; the East Fork River/Irish Canyon area; Miller Mountain and Ross Butte; selected cultural resource sites; the Muddy Creek/Badlands area; the Wyoming Range Front area; the Hoback area; and the Green River WSR Unit would protect them from potential motor vehicle impacts.

The impacts would include protection of wildlife habitat (fewer roads means less disturbance), protection of cultural resources, protection of visual resources, and preservation of the existing character of recreational activities and experiences.

Seasonal limitations, which overlay other OHV designations, add an additional dimension of protection, primarily to wildlife habitat. The impact would be to reduce disturbance to wildlife during sensitive times of the year (normally in winter and during calving, lambing, and so forth). A secondary impact would be that it would provide a better resource for human use and enjoyment.

Except for Alternative 3, this alternative would have the least acreage in the combined “Open”/“limited to existing roads and trails” category, making it more protective of resource values such as wildlife habitat, cultural resources, and visual resources than any of the other alternatives.

The impacts from access management and travel management would be similar to those under Alternative 2.

4.13 VEGETATION

This section describes potential impacts on vegetation from management actions for other resource programs. This section discusses vegetation in general, Special Status Plants Species, and vegetation communities. FLPMA and the Wyoming Standards for Rangeland Health (USDI, BLM 1997) direct BLM to manage vegetation resources toward the maintenance or restoration of the physical function and biological health of vegetative ecosystems. Objectives are to maintain and improve the condition and trend in plant communities that provide wildlife habitat, recreation, forage, scientific, scenic, ecological, and water and soil conservation benefits for consumptive and nonconsumptive uses.

4.13.1 Assumptions

Assumptions can be made concerning the condition of the flora resource, vegetation, and forage responses to different stimuli and the level of activity within the planning area. The analysis is based on the following assumptions:

- Environmental impacts associated with the management alternatives are caused by land use activities within the planning area. Impacts on vegetation resources are generally the result of activities that remove and disturb soil and vegetation.
- Although reductions could be seen in some areas, the livestock type and stocking rate would remain relatively stable over the planning period.
- Current trends in plant succession and vegetation health would continue.
- Some existing plant communities likely would not be reestablished to pre-disturbance structure and density for more than 20 years.
- Short-term vegetation impacts depend on the length of time it takes for a disturbed area to become revegetated, generally a 1- to 5-year time frame.
- Grassland and shrubland communities would be maintained with a mix of species composition, cover, and age classes.
- Noncommercial woodland communities would increase in age and cover with reduced composition and cover of understory species.
- Where assessments for healthy rangeland standards have been conducted, riparian plant communities are functioning properly or are in the process of achieving PFC.
- As more monitoring and survey data become available, it is possible that additional populations of existing Special Status Plant Species may be found.
- Reclamation of Special Status Plant Species is difficult, and little success has been accomplished to date and is envisioned in the future.
- Management of listed, proposed, and candidate T&E plant species is subject to the Endangered Species Act of 1973 (ESA).

4.13.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, review of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

4.13.3 Impacts Common to All Alternatives

No impacts on vegetation management are anticipated as a result of implementing management actions for air quality.

Management of cultural resources would have minor and short-term effects on vegetation resources. Management actions would generally focus on the avoidance and protection of cultural sites, which in turn would decrease surface-disturbing activities on or near such sites. This could result in the adjustment of a project location or design, but impacts on vegetation could still occur. Data recovery excavations would cause minor surface disturbance and vegetation removal. These areas are generally small (less than 1 acre), and vegetation disturbance would usually be localized and temporary. Investigation and mitigation of cultural resources sites would often include surface disturbance and off-road travel. If Special Status Plants Species or plant communities were found in these areas, they would not be disturbed to minimize the effects on them.

Forest management actions that would impact vegetation include tree thinning, timber harvesting, and other practices used to improve forest health. The impacts of thinning on vegetation would include increased vigor of the remaining trees and a more open tree canopy, which increases herbaceous plant cover. Fuel reduction would also reduce the frequency and intensity of wildland fires. Harvesting of commercial forestlands would increase herbaceous vegetation in the short term. Roads and skid trails would have both short-term and long-term impacts on vegetation cover, depending on the scale of the timber harvest and whether the roads and skid trails are needed for future harvesting. The impacts of these actions on vegetation would result in fewer trees but would lower fire potential because harvested areas could serve as buffer areas for wildland fires.

Forestry actions within the planning area, including small timber sales, firewood gathering, and other permitted activities related to forest products, could result in the introduction and spread of noxious and invasive weeds. Vehicles, equipment, animals, and people could transport weed seed to activity sites.

Lands and realty management actions would generally result in surface disturbance, which would increase the susceptibility to weed invasion or inadvertently spread existing weed patches. Lands proposed for exchange or acquisition sometimes have weed populations that would need to be considered in the initial screening process. The installation of utility systems and other facilities in the planning area would result in short-term vegetation disturbance until the area has been reclaimed. Native grasses and forbs would dominate reclaimed sites initially. Shrubs would return over a longer period of time. Long-term impacts would mostly be associated with the installation of access routes. Increased erosion and decreased vegetation cover would occur from soil compaction and the channelization of surface runoff in ruts and road ditches. Areas below mid-slope roads would become drier, reducing plant productivity and potentially changing species composition.

Construction of utility systems and other facilities would cause short-term vegetation disturbance. Requirements for survey, avoidance, and protection of sensitive plants would reduce disturbance to

Special Status Plant Species and plant communities. As proposed ROWs are surveyed before realty actions, new locations of Special Status Plant Species and communities could be discovered, increasing knowledge of these plant species.

Vegetation would be restored through reclamation within the first 5 years after construction, resulting in no long-term surface disturbance impact, except for access roads that may never be reclaimed. Reclamation would return some level of herbaceous and woody vegetation to the disturbed areas following construction, but would not achieve pre-disturbance vegetation composition, density, or production for many years.

Implementation of the Wyoming Standards for Rangeland Health as the minimum acceptable conditions for public rangelands would increase the health and diversity of vegetation communities. Impacts on vegetation resulting from livestock grazing management on BLM-administered lands would include the removal of forage by livestock, which could alter the amount, condition, plant community composition, and vigor of vegetation in grazed areas. Grazing during the growing season or summer months could result in reduced vigor of desired species and a change in species composition. Concentration areas, including locations of supplemental minerals and water, could result in soil disturbance, vegetation removal, and altered plant community composition. Livestock grazing could be used as a tool to manipulate and improve plant community composition. Livestock management activities include travel via OHVs and horses and the use of livestock trailers. Over time, these activities could alter the cover and composition of vegetation in areas of repeated use, especially during periods of saturated soils.

Riparian areas are more susceptible to grazing impacts during the hot season (July and early August). Livestock are naturally attracted to areas with water and thermal cover. Many grazing management strategies, such as rotation, deferment, rest from use, and the manipulation of season of use and grazing intensity, would be implemented to manage vegetation composition, cover, and vigor to maintain or achieve PFC in riparian areas or achieve DPC on upland plant communities. The implementation of riparian pastures and exclosures would increase the density, age class, and cover of desirable riparian plants, including willow, cottonwood, and herbaceous wetland/riparian plants, within the exclosures.

Range improvements such as water developments, fences, exclosures, and vegetation treatments would result in disturbances to vegetation, including loss of vegetation cover and changes in plant composition and vigor adjacent to each project. Some impacts, such as vegetation removal for reservoir construction or changes in grazing use adjacent to improvements, would remain for the life of the project. Vegetation removal for fence construction would be short-term. Improved grazing management achieved through range improvements could provide periods of rest for plant growth and seed production to maintain plant vigor.

Livestock grazing could maintain or create habitat for sensitive plants by reducing vegetation competition. However, livestock grazing could potentially reduce the occurrence of some species through trampling, consumption, and general site degradation.

Livestock would contribute to the introduction and spread of undesirable plant species, including noxious weeds. Weed seeds could be transported by livestock. Areas where animals concentrate and disturb the soil would be particularly vulnerable to infestations of weeds. Range improvements that disturb the soil surface would provide locations for weeds to become established. Overgrazing of native vegetation in areas where BMPs have not yet been implemented could increase the susceptibility of an area to weed infestation. However, grazing plans that promote healthy ecosystem function would create conditions more resistant to the spread of weeds.

Mineral resource development impacts on vegetation resources would include long- and short-term impacts, small and localized removal of vegetative surface cover, and major disturbances covering several hundred acres. Mineral development would fracture vegetation communities, change plant community structure and diversity, and alter vegetation landscapes. Long-term impacts would mostly be associated with permanent structures and construction of roads. Increased erosion and decreased vegetation cover would potentially occur from soil compaction and the channelization of surface runoff in ruts and road ditches. Areas below mid-slope roads would become drier, which would reduce plant productivity and potentially change species composition. Effects from minerals management could be reduced by COAs on APDs within these areas, which would be based on site-specific analysis and would establish specific, necessary mitigation measures not covered by lease stipulations for resource and environmental protection. The severity of effects would be dependent on the amount of activity and the success of reclamation efforts for disturbed areas.

Reclamation of mineral resource development activity could offset impacts on vegetation resources by changing the species composition and increasing total perennial grass and forb cover in reclaimed areas. Within the first 5 years after construction, approximately 50% of disturbed vegetation would undergo reclamation. Initial reclamation would not achieve pre-disturbance vegetation composition, density, or production. The presence of rare or T&E species would often be identified as a result of baseline studies conducted in connection with new mineral development. Plant surveys would be conducted in potential habitat locations for all project types, which would identify wildlife habitats and aid in developing vegetation maps and baseline data. In addition, reclamation activities would provide opportunities for experimentation and refinement of revegetation techniques and processes that ultimately help mitigate all types of surface-disturbing activities. Native grasses and forbs would dominate reclaimed sites initially. Shrubs would return over a longer period of time. If reclamation is unsuccessful, changes in grazing management or AUM reductions could be necessary.

Paleontological excavation and research activities would cause short-term, small, and localized impacts on vegetation by disturbing and removing soil.

Recreational activities would result in localized impacts, such as vegetation disturbance, trampling, and removal as a result of camping and off-road travel activities. Recreational activities that require a permit would not be authorized in known locations of Special Status Plant Species if there were a potential to adversely impact the plants. Activities that do not require a permit, such as camping outside of designated campgrounds, could cause minor impacts on sensitive plants and their habitats. Visitor use and access would be promoted in SRMAs, resulting in increased vegetation disturbance.

Management actions aimed at maintaining or improving soil conditions and minimizing soil erosion would also maintain or improve the condition of vegetation.

OHV use would result in localized impacts on vegetation, such as reduction of vegetation cover and density and community composition changes. The generation of dust from vehicular travel on roads next to Special Status Species could affect plant photosynthesis and population survival because of the small number of individual plants in some areas. Reclamation would replace abandoned roads with herbaceous and shrubby vegetation and the impacts stated above would no longer occur.

VRM Class I and II designations would minimally impact the timing and extent of vegetation treatments such as prescribed burns. VRM classifications would also prohibit or limit some surface-disturbing activities and thereby protect vegetation.

Effective watershed management would result in healthy and diverse plant communities. Restricting surface disturbance around wetland/riparian areas, perennial surface waters, identified flood plains, and

ephemeral channels would reduce soil erosion, vegetation removal, and the potential for invasive weed establishment and spread. Conformance with water quality standards and watershed guidelines during construction of projects would assist in achieving the desired plant and litter cover objectives.

The use of livestock exclosures to protect seeps and springs would preclude grazing by livestock but not necessarily by other grazing animals in these areas. Developed water sources on uplands would be used to improve distribution of livestock in wetland/riparian areas. This would help to improve species composition, vigor, and cover in wetland/riparian habitat.

Maintenance of healthy soil conditions would enhance the viability, vigor, and abundance of Special Status Plant Species and plant communities.

Impacts from vegetation treatments would include short-term losses of vegetation and changes in plant community structure. In the long term, treatments would be designed to improve the health and vigor of surviving vegetation, increase vegetation diversity, modify vegetation types (e.g., a change from shrubs to herbaceous vegetation), and modify age class and structure. The different types of vegetation treatments would include prescribed burning and cultural, mechanical, biological, and chemical treatment.

Special Status Plant Species communities could be adversely impacted by the spread and proliferation of weeds because of their limited size and distribution. Weed management would help to control weed populations and thereby improve the health of native plant communities. Vegetation treatments such as prescribed burning and mechanical treatments would increase the potential for the establishment of invasive weeds because of increased soil surface exposure. These impacts could potentially be avoided by using chemical or biological treatments. Prescribed burns generally occur in the cooler seasons (April through June and September through November) to avoid burning the root crowns of herbaceous plants. Following fire treatment, native herbaceous plants generally return with increased vigor.

The increase in oil and gas development activities, OHV use, and recreational activities would increase fire ignition sources. Increased fire frequency would result in a greater loss of vegetation cover over the short term, but could improve species composition and cover over the long term. Prescribed fire would generally have a long-term effect on vegetation by increasing the age and species diversity of plant communities, increasing plant vigor, and enhancing nutrient cycling.

Wildland fires result in a short-term loss of vegetation, change the composition of a plant community, and inhibit plant succession. The vegetation response to wildland fire would be dependent on the size, location, intensity, season, timing, amount of precipitation, preexisting plant community type and condition, and abundance of weeds in the area. Wildland fires could burn with enough heat to kill soil organisms and root systems, resulting in diminished plant recruitment and growth rates, particularly for fire-sensitive species.

Although wildland fires would have short-term localized impacts on vegetation, the long-term effect of fire would generally be increased vegetation production and diversity (i.e., diverse species, cover, and age class). Wildland fires would also cause a long-term decrease in fire-sensitive shrubs and trees; a short-term increase in annual weeds, grass, and forb species; and a long-term increase in fire-resistant or fire-dependent grasses, forbs, shrubs, and trees. Vegetative cover would be reduced during the first two growing seasons but would likely improve in the third year following a prescribed burn. Fire-sensitive shrubs and trees would eventually reestablish on burned sites. In lodgepole pine forests, wildland fire would remove duff and litter on the forest floor, allowing serotinous cone disarticulation and seeds to make contact with the soil and germinate.

Surface disturbance associated with fire line construction, the use of heavy equipment, and other fire suppression activity would damage or destroy vegetation and accelerate natural soil erosion. Fire suppression would be concentrated in areas containing high resource and/or human values, where the benefits of fire suppression would outweigh the impacts.

Wildland fires would affect Special Status Plants and plant communities by temporarily removing vegetation, changing plant community composition, inhibiting plant succession, and removing woody vegetation and plant litter. If Special Status Plants are dependent on a specific seral stage or associative plants, a wildland fire could upset the ecological balance that supports a sensitive plant's habitat or plant community. Yet wildland fire could also enhance the habitat for Special Status Plants and serve as a catalyst for their reestablishment and proliferation.

Wildland fires create an opportunity for the establishment or spread of invasive and noxious weeds by removing vegetation and increasing weed susceptibility. Most weeds respond rapidly after fire, and can out-compete native species. In areas where weeds occur or are in close proximity, wildland fire increases the likelihood of weed expansion. Firefighters and their equipment may also introduce or spread weeds. Some mechanical control activities disturb the soil surface and remove vegetation, creating an opportunity for the establishment or spread of weeds. Most of the vegetative communities within the planning area are adapted to mixed or high-severity fire (partial to total overstory removal). These types of fire regimes have short-term effects (loss) on the organic material in the soil and the potential for increased erosion and water flow until herbaceous cover is re-established.

Prescribed fire would result in many of the impacts on vegetation described above. Prescribed fires would be planned, contained, and generally occur in the cooler seasons of the year (spring and fall). Prescribed fires usually burn at lower temperatures, enabling more rapid recovery of the surviving, fire-tolerant plant species. The change in ground surface temperature could damage vegetation root structure, but usually would not destroy the root crown of fire-tolerant perennial grasses, enabling them to flourish after the fire has removed competing shrubs.

The wildlife impact on vegetation would be dependent on population levels, the distribution of those animals, and the ability of those animals to move. Key areas, including crucial winter ranges for mule deer and pronghorn where shrubs are heavily used, could exhibit vegetation shifts from sagebrush, bitterbrush, and mountain mahogany to conifers, grasses, forbs, and annuals, and in some cases, bare ground. Extensive browsing of desirable shrubs in riparian habitats could impact the density, height, and vigor of such species as willows, aspen, water birch, cottonwood, dogwood, and currant. Prairie dogs could affect the density and type of herbaceous vegetation around their towns. Beaver activity could lower the density of willows, aspen, and other streamside vegetation, although the ponds that beavers create often raise the water table, allowing for more extensive areas of water-dependent shrubs and herbaceous plants. The distribution, population, and grazing intensity of wildlife could change or delay vegetation treatments, and vegetation recovery following a treatment could be slowed if heavy wildlife utilization occurs.

Management actions associated with SD/MAs would preclude most impacts on vegetation in those areas. For example, management of WSAs would preclude surface-disturbing activities in these areas; and land use restrictions in ACECs would limit the extent of surface disturbance. However, the designation of SD/MAs would increase popularity and actual use in these areas, resulting in increased potential for vegetation disturbance and removal and weed proliferation.

Management actions designed to prevent accidental spills of hazardous materials would impact vegetation by providing protection of riparian and upland areas. Because hazardous materials (e.g., oil, oil and gas byproducts, pesticides, cleaning solvents) are being produced and transported within the planning area,

the threat of accidents or spills exists. No impacts on vegetation would result unless a spill or accident occurs. If a spill occurs, mitigation and cleanup would rarely succeed in recovering a riparian or upland area to its original condition over the short term; thus, long-term impacts would result.

4.13.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

Timber management under this alternative would provide for 37,729 acres of forest and woodland areas to be available for production of forest products. Forests and woodlands managed for intensive management (Category 1) and harvesting of wood products would include 1,644 acres. Intensively managed forest would experience increases in roads and soil disturbance. These forests would have an open canopy and more herbaceous vegetation and may be more fire resistant. Forests and woodlands managed for production of wood products with emphasis on improving wildlife habitat and watershed stability and recreation (Category 2) would occur on 36,085 acres. These areas would be impacted to a lesser degree by timber harvesting and management activities. Approximately 2,382 acres of forest would be under restrictive forest management (Categories 3 and 4). These areas would have minimal forest management activities and could include more advanced seral stages. They could also be more susceptible to wildland fire.

Noncommercial forestlands would be managed primarily to sustain forest health objectives and for the benefit of other resource values such as wildlife, watershed, fisheries, and healthy plant communities. Management practices would include removing encroaching conifers from shrub and aspen stands, thinning diseased and insect-infested trees, and reducing fuel loads. These practices would result in increased vegetation diversity, altered successional status, increased plant vigor, increased available water for herbaceous vegetation, and improved watershed health.

Pipeline construction would disturb an average of 553 acres per year or a total of 11,063 acres. This vegetation loss would be temporary, as reclamation would return herbaceous vegetation to the disturbance areas following construction. Disturbed areas would be reclaimed with native plant species, but reclaimed areas would not have the same level of vegetative cover or species diversity as before disturbance. Many plant communities, such as shrub- and tree-dominated vegetation types, would not reach pre-disturbance conditions for 10 to 50 years following reclamation.

The RFD for oil and gas development under this alternative would be 7,192 federal wells. Drill pad construction would create an initial disturbance of approximately 1,080 acres per year or a total of 21,599 acres. More than 50% of this disturbance would be reclaimed within 4 years, leaving a long-term surface disturbance impact of 17,372 acres. Similar impacts would occur for other leasable, locatable, and salable minerals, although on a smaller scale.

Impacts from minerals management to Special Status Plant Species would be negligible because of required mitigation measures. As proposed developments are reviewed prior to permitting, new locations of Special Status Plant Species and communities might be found, increasing knowledge of these plant species.

Construction and improvement of roads and highways (104 miles per year) would disturb 528 acres per year or a total of 10,567 acres. Approximately 98% of these roads would be included in the estimated acreage of disturbance for oil and gas development.

Where surface and vegetation disturbance is limited by SD/MA management actions, impacts on Special Status Plant Species and plant communities would be reduced. This would include the Rock Creek ACEC and Beaver Creek ACEC. The Rock Creek ACEC and the Deadline-Graphite elk winter range area (approximately 25,640 total acres) would be closed to oil and gas leasing, which would help to protect vegetation resources in these areas.

Achieving the objective of protecting the Rock Creek drainage within the Rock Creek ACEC, ensuring quality aquatic habitat for the CRCT, and providing crucial winter range for a portion of the Piney elk herd would ensure that plant vigor and cover was sufficient to meet and maintain DPC and PFC status.

Achieving the objective to ensure quality aquatic habitat for the sensitive CRCT in the Beaver Creek ACEC and to protect elk calving habitat would ensure that plant vigor and cover was sufficient to meet and maintain DPC and PFC status. Restricting clear-cutting within 1,000 feet of Beaver Creek would increase the age of the timber stand and alter the structure in this area.

4.13.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 2.

Increased timber harvest would increase associated impacts on vegetation compared to those under Alternative 1. Timber management under Alternative 2 would provide for 35,120 acres of forest and woodland areas for production of forest products or harvest. Intensively managing forested areas would result in increased roads and soil disturbance. These forests would have an open canopy and more herbaceous vegetation and could be more fire resistant. The 12,346 forested acres within WSAs would be indirectly managed to restore the forest landscape. Impacts of these actions would alter the current fire regime in the area and most likely stabilize the seral stage at mid-seral.

Precommercial thinning in areas that have been previously treated would prevent these areas from becoming densely populated with small understory trees. This would also lower the probability of destructive, uncontrolled wildland fires.

Impacts on vegetation from lands and realty management would include the loss of 5,000 acres of native plant communities from the disposal and loss of an unknown number of acres owing to DLE. Loss of an unknown amount of riparian/wetland areas would directly impact the diversity of habitats provided by these highly productive vegetative areas.

Impacts on vegetation from livestock grazing would include increased utilization, increased trampling, and removal of vegetation. Activating suspended nonuse AUMs (Table A20-1) would increase forage consumption compared to Alternative 1 and would create additional stress to herbaceous forage, which would affect vigor and plant community composition in some areas. Additional range improvements such as reservoirs, troughs, and fences would increase disturbance and loss of vegetation in those areas because of increased use.

Removing existing exclosures and limiting new exclosures would impact vegetation resources that were formerly protected from grazing. Exclosures often protect riparian areas where livestock and wildlife concentrate, and where other management actions have failed to protect the vegetation. Lower plant diversity, production, and vigor could result from this action.

Additional disturbances from increased oil and gas development would increase impacts on vegetation by disturbing and destroying more vegetation compared to Alternative 1. Pipeline construction would disturb an average of 581 acres per year or a total of 11,611 acres.

The RFD for oil and gas development would total 7,804 federal wells under this alternative, an increase of 612 wells over Alternative 1. Drill pad construction would create an initial disturbance of approximately 1,193 acres per year, or a total of 23,872 acres. Long-term surface disturbance of 18,689 acres would result in long-term vegetation losses in these areas.

Impacts from minerals management to Special Status Plant Species would be negligible because of required mitigation measures. As proposed developments are reviewed prior to permitting, new locations of Special Status Plant Species and communities might be found, increasing knowledge of these plant species.

Reducing OHV Open areas by 226,610 acres and increasing the amount of area in which OHV use is limited to existing roads and trails would reduce the level of vegetation disturbance compared to the level under Alternative 1.

Under this alternative, additional development of recreational facilities would have minimal direct impacts on vegetation. However, indirect impacts (vegetation trampling and removal and soil compaction) would increase as a result of increased public use of these areas.

Impacts resulting from transportation and access management would be greater than those under Alternative 1. Fewer restrictions and more opportunity for access would result from increased development and an expanded road network within the planning area. This could increase the level of vegetation disturbance and removal throughout the planning area.

Construction and improvement of roads and highways (114 miles per year) would disturb 574 acres per year or a total of approximately 11,481 acres. Approximately 98% of these roads would be included in the estimated acreage of disturbance for oil and gas development.

Increased vegetation treatments under this alternative would increase the level of vegetation disturbance. This would increase the proportion of early- and mid-seral plant communities to late-seral plant communities, resulting in vigorous, diverse, and productive plant communities. Prescribed fire treatments would reintroduce fire into fire-dependent plant communities on a landscape scale, from which they have been long absent.

Management of aspen stands for early-seral conditions would increase total aspen cover and total vegetation diversity and understory production in aspen stands (Kay 1997).

Allowing new permanent facilities within flood plain and wetland/riparian areas would impact vegetation in these areas by permanently removing vegetation and possibly contributing hazardous runoff and materials. The additional water discharged from oil and gas production would result in additional activities to mitigate the impacts of this water. Increases in soil salinity would change riparian vegetation composition from salt-intolerant species to salt-tolerant species.

Increased fire suppression efforts would decrease the extent of mid-summer and hot fires over the short term. However, additional fire suppression efforts under this alternative would allow natural succession and fuel accumulation to shift some plant communities into late-seral shrub- and conifer-dominated communities. Continuation of this trend would result in a potential increase in the size and intensity of wildland fires. Increased suppression activity would also increase soil disturbance and potentially increase

susceptibility to weed invasion and proliferation. However, the smaller number of acres burned during the hot season would limit opportunities for weed invasion.

Additional rehabilitation and restoration efforts would mitigate losses from wildland fires in areas where commodity values are high. This would return native vegetation to these areas more quickly than would naturally occur.

Prescribed fire would likely reduce some fuel loading; however, prescribed fire would more commonly be used to assist vegetation communities in reaching DPC to meet forage and other commodity resource objectives. This would lower the seral stage and reduce shrub density, where commodity benefits could be best realized. Aspen colonies would be managed for early-seral stages, which would increase herbaceous production and diversity in these areas.

Impacts on vegetation from SD/MA management would be less than those under Alternative 1. Additional withdrawals in the CCC Ponds SRMA would impact vegetation management by possibly restricting vegetation treatments and range improvements in these areas. This area would also receive protection from surface-disturbing activities.

The Deadline-Graphite elk winter range area would be open to oil and gas leasing subject to seasonal wildlife restrictions, which would impact vegetation not impacted under Alternatives 1, 3, and 4.

The Trapper's Point ACEC would be closed to oil and gas leasing and closed to all surface-disturbing activities except those enhancing the viability of big game migration and the operations of the Green River Drift to interpret or enhance understanding of the site. This would ensure that vegetation was not disturbed or removed by surface-disturbing activities.

4.13.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 3.

Impacts resulting from forest management would be less than those under Alternative 2. Fewer acres would be available for timber harvest, resulting in fewer impacts. Managing forests for a disturbance-based seral state would create a more diverse forest age class structure and as a result, woody vegetation, fuel loadings, insect infestations, and catastrophic wildland fires would decrease. The lower timber harvest proposed under this alternative would also reduce the ability for weeds to establish in disturbed areas.

Impacts from lands and realty management would be less than under Alternative 1. Increased withdrawals (a total of 65,750 acres) would reduce impacts associated with locatable minerals development. In addition, riparian/wetland and aquatic resources would not be suitable for sale, but could be exchanged for lands of equal or greater monetary and ecologically functional value. This action would likely maintain federal jurisdiction and related protection measures for many areas containing aquatic vegetation. Impacts also include the loss of 790 acres of native plant communities owing to disposal, which would result in a much lower effect on the native species composition compared to that under Alternative 2.

Impacts from livestock grazing activities would be minimized under this alternative. Livestock improvements would be designed to support vegetation objectives and minimize impacts on vegetation.

Grazing would be discontinued on several allotments on select oil and gas fields, which would eliminate impacts on vegetation from livestock grazing on these allotments.

The decreased oil and gas development proposed under Alternative 3 would result in reduced vegetation disturbance and a lower potential for weed invasion compared to that under Alternatives 1 and 2. Prohibiting geophysical vehicle-based activities in the Aspen Ridge Rock Alignment Site, Ross Butte, rock art sites, Wind River Front MA, and within the Long Island Watershed where slopes are greater than 10% would reduce disturbance in these areas.

Impacts from minerals management to Special Status Plant Species would not occur because of required mitigation measures and no surface disturbance requirements.

Pipeline construction would disturb an average of 386 acres per year or a total of 7,719 acres over the 20-year planning period.

The RFD for oil and gas development would total 5,209 federal wells under this alternative, approximately 1,983 fewer wells than under Alternative 1. Drill pad construction would create an initial disturbance of approximately 796 acres per year or a total of 15,923 acres. Long-term surface disturbance of 13,325 acres would result in long-term vegetation losses in these areas.

Eliminating the OHV Open areas and increasing the amount of area, by more than 140,600 acres, in which OHV use is limited to designated roads and trails would greatly reduce the level of vegetation disturbance compared to Alternative 1.

More restrictions and fewer opportunities for access would result from decreased development and a limited road network within the planning area. However, impact intensity resulting from transportation and access management would be similar to that under Alternative 1.

Construction and improvement of roads and highways (76 miles per year) would disturb 382 acres per year or a total of 7,646 acres. Approximately 98% of these roads would be included in the estimated acreage of disturbance for oil and gas development.

Impacts from vegetation management would be less than those under Alternative 1. Plant communities would be managed to meet wildlife habitat, watershed, recreational, and biodiversity values and objectives. Upland communities would be managed to maximize diversity and community health. This would result in riparian vegetation that consists of mid- to late-seral-stage communities with a mixture of herbaceous and multi-aged woody species. Other effects would include increased vegetation production, increased diversity, and a more stable riparian plant growth medium.

Vegetation treatments would be designed to reestablish the natural role of fire in the ecosystem. This would result in lower-seral plant communities with less woody species. Additional use of exclosures would decrease grazing impacts where the exclosures were constructed.

Impacts resulting from fire and fuels management would be less than under Alternative 1. The restoration of fire to its natural role in the ecosystem would be emphasized under Alternative 3, which would alter plant community age structure from predominantly late- to early- and mid-seral and create more diverse plant communities. Wildland fire would be used to maintain and improve fire-dependent plant communities. This alternative would require less fire line construction and other surface disturbance, which would reduce disturbance and removal of vegetation and limit areas where weed invasions could occur.

Only prescribed fire would be used as a vegetation manipulation tool to improve vegetation composition, age class, and diversity. Mechanical, biological, and wildland fire control techniques could be employed to reduce hazardous fuels and manage fire fuels. This would limit the timing, size, location, and scope of these treatments, which would result in much less vegetation manipulation treatment occurring in the planning area.

Wildlife and fisheries objectives would be addressed during reclamation activities, which would influence the plant seed mix selection used in reclaimed areas. Impacts on vegetation from surface-disturbing activities would not occur within certain wildlife buffers, which would help to retain a native vegetation composition. Managing important waterfowl areas for preferred waterfowl habitat would benefit vegetation. Protecting unique pothole wildlife habitat used by numerous species, such as the trumpeter swan, would enhance vegetation resources in this area.

Generally, this alternative would be more restrictive of resource exploitation within SD/MAs than the other alternatives. This would protect vegetation from disturbance associated with roads, oil and gas activity, locatable minerals activity, logging, and OHV use.

Oil and gas leasing would not be allowed in the Rock Creek ACEC within the Rock Creek Watershed boundary, Miller Mountain MA, Wind River Front MA, Boulder Lake SRMA, Upper Green River SRMA, CCC Ponds SRMA, or Green and New Fork Rivers SRMA. Timber harvesting would not be allowed in the Beaver Creek ACEC, Miller Mountain MA, or Wind River Front MA. These actions would limit vegetation disturbance in these areas, which would reduce the degree of plant community composition changes and the loss of vegetation cover.

4.13.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4.

Impacts resulting from OHV and fire and fuels management on vegetation management would be similar to those under Alternative 3.

Impacts resulting from forest management would be less than those under Alternative 1. The equivalent number of acres could be treated, but less forest product would be harvested, primarily because of the emphasis on removing small diameter trees and concentrating on forest health issues. Woodlands would also be treated under this alternative, compared to Alternative 1 in which none were considered. This emphasis on forest health and restoration should improve wildlife habitat and resistance and resilience to wildland fire. Managing forests for a disturbance-based seral state would create a more diverse forest age class structure. The lower timber harvest proposed under this alternative would also reduce the ability for weeds to establish themselves in disturbed areas.

Impacts from lands and realty management actions would be less than under Alternative 1. Disturbance and removal of vegetation resources would be reduced because less development (i.e., ROWs) would occur. Impacts also include the loss of 790 acres of native plant communities, with the corresponding impacts similar to those under Alternative 3.

Implementation of this alternative would ensure that impacts on vegetation from overutilization by livestock were minimized. Total AUMs would be maintained at 107,907. Livestock improvements such as water developments, fences, and exclosures would be designed to support vegetation objectives and minimize impacts on vegetation.

Oil and gas development under this alternative would result in long- and short-term impacts on vegetation resources. Prohibiting vehicle-based geophysical activities in the Aspen Ridge Rock Alignment Site, Ross Butte, rock art sites, Wind River Front MA, and within the Long Island Watershed where slopes are greater than 10% would reduce disturbance in these areas where vegetation disturbance causes soil instability.

Impacts from minerals management to Special Status Plant Species would not occur because of required mitigation measures and no surface disturbance requirements.

Initial pipeline construction would disturb an average of 501 acres per year or a total of 10,027 acres.

The RFD for oil and gas development would total 7,136 federal wells under this alternative, approximately 56 fewer wells than under Alternative 1. Drill pad construction would create an initial disturbance of approximately 1,093 acres per year or a total of 21,853 acres. Long-term surface disturbance of 17,330 acres would create long-term vegetation losses in these areas.

Construction and improvement of roads and highways (105 miles per year) would disturb 523 acres per year or a total of 10,506 acres. Approximately 98% of these roads would be included in the estimated acreage of disturbance for oil and gas development.

Plant communities would be managed to meet wildlife habitat, livestock management, watershed, and recreational and biodiversity values and objectives. Upland vegetation communities would be managed to maximize diversity and community health. This would result in riparian vegetation communities that consist of mid- to late-seral-stage communities with a mixture of herbaceous and multi-aged woody species. In short, this alternative would increase plant and age diversity in most vegetation types. Other benefits would include increased vegetation production and aesthetic plant values.

Vegetation treatments would be designed to reestablish the natural role of fire in the ecosystem. This would increase the mosaic pattern of vegetation and cause higher seral communities to be more dispersed among low- and mid-seral communities. Additional use of exclosures would decrease grazing impacts where the exclosures were constructed.

Prescribed fire; wildland fire; and chemical, biological, and mechanical vegetation methods would be used to manipulate vegetation, providing land managers the tools they need to maintain PFC. Vegetation treatments would be designed to mimic the natural role of wildland fires in the ecosystem, while maintaining multiple uses of the land and preventing weed establishment in treated areas. Treated areas would be rested from grazing for a minimum of two full growing seasons after treatment, which would ensure the proper recovery time for plants following a fire.

Any areas with Special Status Plant Species would be managed with emphasis on those plants and the plant communities that support them. This could alter vegetation manipulation treatments in these areas if they were to interfere with the Special Status Plant Species or communities.

Wildlife and fisheries objectives would be addressed during reclamation activities, which would influence the plant seed mix selection used in reclaimed areas. Impacts on vegetation from surface-disturbing activities would not occur within certain wildlife buffers, which would help to retain native vegetation composition. Managing important waterfowl areas for preferred waterfowl habitat would help to maintain and protect vegetation.

The effects of wildlife and fisheries management would be less than those under Alternative 1. Riparian areas that support habitat for sensitive fish and CRCT would be managed for a seral stage appropriate for

the maximum benefit to the species. In addition, under Alternative 4 all riparian areas would be managed to meet or exceed PFC. This would usually increase the vegetation age structure of the riparian area and increase vegetation types that provide shading to stream banks. Increased emphasis on maintaining and improving habitats for sensitive species would possibly limit vegetation manipulation treatments in these areas.

Management of most SD/MAs would be similar to that proposed under Alternative 1, except that the entire Rock Creek ACEC and the Deadline-Graphite elk winter range area (approximately 25,330 total acres) and the East Fork River WSR Unit would be closed to oil and gas leasing and geophysical exploration. The CCC Ponds SRMA and the Green River Unit would also be closed to oil and gas leasing. These SD/MA management actions would reduce surface disturbance and serve to maintain and protect vegetation resources within these areas. Management of the New Fork Potholes ACEC**,** Scab Creek SRMA, and Boulder Lake SRMA would be similar to that under Alternative 3.

The Miller Mountain Management Area would put limitations on general surface disturbance and travel, which would limit development of range improvements in this area and protect vegetation from disturbance associated with vehicle use.

4.14 VISUAL RESOURCES

This section presents potential impacts on visual resources from management actions for other resource programs. Existing conditions concerning VRM are described in Chapter 3 (Section 3.14).

4.14.1 Assumptions

The analysis was based on the following assumptions:

- VRM objectives would be achieved.
- Procedures would be established for VRM, including completing contrast ratings and developing mitigation measures as appropriate for projects.
- VRM objectives provide for varying degrees of change (impact) to the visual quality of the landscape. For example, VRM Class IV provides for management activities that require major modifications (e.g., visual impacts) of the existing character of the landscape. These modifications may create substantial impacts and may be the major focus of viewer attention.

4.14.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of the area and its resources. Often, quantitative data are not available for visual resource impact assessment, in which case best professional judgment is used. Impacts are often described using ranges of potential impact or in qualitative terms.

4.14.3 Impacts Common to All Alternatives

Management actions would have effects on visual resources in VRM Class II areas if the action caused impacts that exceeded the allowable level.

There would be no impact on the visual quality of the landscape in Class I and II areas. The objective for Class I allows virtually no change to the visual character of the landscape. In Class II areas, projects may be seen but may not create sufficient impact (i.e., contrast with the surrounding landscape) to attract the attention of the casual observer. However, ongoing resource use and development in Class III and IV areas would have the potential to impact visual resources. This is particularly true in areas that are, at the present time, largely natural in appearance. Activities that have the greatest potential to affect the visual quality of the landscape are oil and gas development or other activities that require substantial road building, clearing of vegetation, or other activities that introduce noticeable visual contrast to the landscape. Degradation of visual qualities would primarily occur from surface-disturbing activities, such as those associated with construction of ROWs (e.g., pipelines, transmission lines, communication lines) and oil and gas facilities (e.g., well pads, reserve pits, roads). The development of permanent structures would result in long-term degradation of scenic quality and in some cases could become the dominant feature on the landscape. The degree of impact would depend on the amount of development projected to occur and the effectiveness of mitigation measures (e.g., siting, painting, and screening). Other activities, such as vegetation manipulation (e.g., prescribed fire) and OHV use, would affect scenic quality by removing soil and vegetation and creating temporary, short-term intrusions on the landscape.

Project development would impact all landscape character elements: form, line, color, and texture.

- **Form**—By introducing forms such as clearings in the vegetation or structures that contrast with natural forms of the landscape
- **Line**—By introducing lines such as roads or ROWs that contrast with natural lines
- **Color**—By causing change in color such as exposing soil or introducing structures having a color that contrasts with the natural colors in the landscape
- **Texture**—By changing the texture of the land or structures; for example, by placing a smooth structure such as a storage tank or building against a coarse background of sagebrush or juniper vegetation.

Even though resource development activities may meet VRM Class III and IV objectives, the fact that projects are seen and attract attention (Class III) or may dominate the view of the casual observer means they would impact visual resources (the scenic quality or character of the landscape). For Class III and IV areas that currently have ongoing development activities, additional development would add to the cumulative impacts from development in those areas. In other words, more surface disturbance or structures would add to the cumulative impact of resource development on the visual quality of the landscape.

Oil and gas development would be augmented by large numbers of lights, because drilling rigs operate at all hours of the day and night. The ability to substantially shield the nighttime sky from the ambient light created by fluid mineral drilling operations is somewhat limited by operational safety requirements. Night lighting in the immediate area of gas field development, and potentially in large areas surrounding the gas field, would significantly reducing the nighttime viewing experiences of individuals. Lights on the valley floor could make night viewing of the sky difficult from all areas of the planning area and even from the surrounding mountain ranges.

Protection of scenic quality and landscape character would primarily occur from the implementation of management actions designed to protect natural resources. Management of soil, water, vegetation, and fish and wildlife habitat would generally limit the amount of surface-disturbing activities and associated vegetation removal.

Sale of public lands would remove all VRM designations and accompanying objectives for protection of their scenic values.

Actions designed to prevent surface disturbance (such as CSU, NSO, and prohibiting surface disturbance) and disturbance to wildlife and Special Status Species would indirectly limit the level of change to characteristic landscapes, which would help meet VRM objectives of retaining or preserving the existing character of the landscape. This would increase the potential for landscapes in VRM Class II areas to retain or preserve their existing visual character.

4.14.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1. This alternative places nearly 90% of the planning area in the combined VRM Classes III and IV, which provide for varying degrees of visual impact from resource development activities. It

would allow visual impacts that would change the character of the landscape and would dominate the view of the casual observer (Class IV) on 70% of the total public land surface area of the planning area.

The majority of the planning area would be available for oil and gas leasing, so impacts from accompanying development would be widespread throughout the area.

Designating 247,250 acres open to OHV use and 662,060 acres limited to existing roads and trails would cause visual impacts through road proliferation and vegetation loss. Designating 13,620 acres "closed to OHV use" would provide protection from visual impacts owing to OHV use.

The visual quality of WSAs would be protected. Under this alternative, they are managed under both the Wilderness IMP and the VRM Class I objective, which would protect them until Congress provides alternate direction for their management.

ROWs associated with oil and gas development or roads would create linear features across the landscape. Range improvement projects, especially fences, consist of noticeable structures that could change characteristic landscapes, but the level of change would be low.

4.14.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 2. This alternative places 91% of the planning area in VRM Classes III and IV, which provide for varying degrees of visual impact from resource development activities.

This alternative would provide for the greatest degree of visual impact of any of the alternatives. Relative to Alternative 1, the acreage in Class IV would be increased, Class I protection for the Lake Mountain and Scab Creek WSAs would be eliminated, the acreage in Class II would be slightly increased, and the acreage in Class III would be decreased. This alternative would allow visual impacts that would change the character of the landscape and dominate the view of the casual observer (Class IV) on 70% of the total public land surface area of the planning area.

Impacts would result from surface disturbance and construction of structures, primarily (but not exclusively) from the oil and gas industry. Vegetative manipulation, range improvement projects, and communication facilities would also impact visual resources. Impacts on form, line, color, and texture would occur.

Designating 20,640 acres open to OHV use and 874,870 acres limited to existing roads and trails would cause visual impacts through road proliferation and vegetation loss. On the other hand, designating 8,400 acres closed to OHV use and 18,970 acres limited to designated roads and trails would protect them from OHV-related visual impacts. This alternative has significantly fewer acres in the "open" category than those under Alternative 1 and would cause considerably less visual impact as a result.

The visual quality of WSAs would be protected, because they are managed under the Wilderness IMP to protect them until Congress provides alternate direction for their management.

4.14.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 3. This alternative would place 58% of the planning area in Classes III and IV and the remaining 42% in Classes I and II (40% of the planning area would be in Class II).

This alternative would provide the greatest degree of protection of visual resources, and particularly more protection than Alternatives 1 and 2. Relative to Alternative 1, the acreage in Class II would be substantially increased, the Class I protection for the Lake Mountain and Scab Creek WSAs would be maintained, the acreage in Class III would be increased, and the acreage in Class IV would be dramatically decreased.

By affording a greater degree of protection to visual resources, the impacts would be decreased. As indicated above, 40% of the planning area would be in Class II versus 8% under Alternative 1.

Under this alternative, 751,920 acres would be limited to existing roads and trails. Visual impacts through road proliferation and vegetation loss would occur as a result. On the other hand, 30,350 acres would be closed to OHV use and 140,610 acres would be limited to designated roads and trails. This action would extend protection from visual impacts on those areas. This alternative has no acreage in the "open" category and would cause considerably less visual impact as a result.

4.14.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4. This alternative would place 70% of the planning area in Classes III and IV and the remaining 30% in Classes I and II (28% of the planning area would be in Class II).

This alternative would provide less protection of visual resources than Alternative 3 but much more than Alternatives 1 or 2. Relative to Alternative 1, the acreage in Class II would be substantially increased, Class I protection for the Lake Mountain and Scab Creek WSAs would be maintained, the acreage in Class III would be substantially increased, and the acreage in Class IV would be dramatically decreased.

By affording a greater degree of protection to visual resources, the impacts would be decreased. Under this alternative, 30% of the planning area would be in Classes I and II versus 10% under Alternative 1. Class IV areas would cover 27% of the planning area, versus 69% under Alternative 1 and 78% under Alternative 2.

Designating 754,480 acres limited to existing roads and trails would cause visual impacts through road proliferation and vegetation loss. On the other hand, 26,320 acres closed to OHV use and 139,000 acres limited to designated roads and trails would be protected from visual impacts. This alternative would eliminate OHV Open areas and would cause considerably less visual impact as a result. OHV-created disturbance generally is less noticeable than existing roads and other disturbances. The exception is in localized areas where extensive user-created routes are more noticeable and potentially visually impairing.

4.15 WATERSHED AND WATER QUALITY (SURFACE WATER AND GROUNDWATER)

This section deals with the interactions of water and the earth's surface and subsurface. It covers potential changes to water quality and land quality resulting from the land/water interactions and how actions taken to make use of or protect other resources may affect water quality and watershed health.

4.15.1 Assumptions

The analysis was based on the following assumptions:

- The State of Wyoming has primacy with regard to water quality and quantity. BLM manages the public lands within the analysis area. The management of these lands can affect the quality and timing of flows of the waters through them. Because the state must comply with federal laws, compliance with state laws includes compliance with federal rules and regulations, including the Clean Water Act, Colorado River Salinity Compact, Safe Drinking Water Act, and others. Therefore, it is assumed that any discharged water would meet water quality standards at the point of discharge.
- Actions that provide protection for the soil and vegetation resources will generally mitigate impacts on the water resource as well.
- As populations expand in the area, disturbances created by OHVs will most likely continue to expand.
- Water flows down gradient. The faster water flows, the more and bigger the material it can carry.
- Management actions for soil resources will help minimize soil erosion and sediment, salt, and nutrient loading to water bodies.
- Degradation of stream channel and land health conditions can be quite rapid. Recovery is often a much slower process. It is generally more efficient to prevent degradation in the first place rather than to recover a degraded system.
- As mineral development continues to expand, there will be an increase in produced water volumes that will decrease as the rate of development decreases and the aquifers are drained.
- Grazing management plans will be correctly followed and rangeland improvements properly maintained.
- The more rapid the speed of overland flow the greater the potential for water quality degradation. Keeping water on the land longer and allowing for greater volumes of infiltration decreases the potential for water quality degradation.

4.15.2 Methods of Analysis

Analysis of impacts on water resources is based on achieving the watershed objectives of managing surface use and groundwater resources to maintain or improve water quality according to the classes, uses, and standards enumerated in the State of Wyoming Water Quality Rules and Regulations, and to

maintain the land health in compliance with the Wyoming Standards for Rangeland Health. This includes maintaining wetland/riparian areas at PFC or better.

The Wyoming Standards for Rangeland Health contains the minimum qualitative standards for watershed health. The minimum standard for riparian areas may also be described as PFC, as described in Technical References 1737-15, A Users Guide to Assessing Proper Functioning Condition and Supporting Science for Lotic Areas, and 1737-16, A Users Guide to Assessing Proper Functioning Condition and Supporting Science for Lentic Areas.

State of Wyoming water quality standards will be used as minimal standards for discharge criteria and aquatic habitat determination.

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, review of existing literature, and information provided by other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

4.15.3 Impacts Common to All Alternatives

There is a close correlation between the soil, vegetation, and water resources. Removal of vegetation generally increases the rate at which water flows off the land. Substantial disturbance to soil, including compaction of soil or changes in vegetative cover that result in decreased surface coverage, root depth, or root density, would increase water runoff; alter timing and duration of runoff; reduce infiltration capacity; lower soil productivity; and accelerate erosion, sedimentation, and the addition of nutrients and sediment loads to stream channels, thereby degrading water quality, channel structure, and overall watershed health.

Increases in resource development and population will cause subsequent increases in surface disturbance related to construction of roads, well pads, and pipelines; OHV use; recreation; and other activities. These changes will in turn affect established land uses such as grazing and existing transportation and recreational patterns, shifting, concentrating, or eliminating their related disturbances.

As the amount of surface disturbance increases, the ability of a watershed to buffer high flows, filter water and sediment, and provide habitat decreases. Areas such as the gas fields and open areas near residential or recreational areas would experience greater surface disturbance than others located further from population centers. The extent to which these changes would be reflected in water quality is unknown and is dependent on several factors, including the type of and distance between disturbances; distance to the nearest water course; the interactions of the disturbances; the repetition of disturbing activities; the nature and type of the soil, slopes, and vegetative community; and others.

There would potentially be an increase in the number of additional water and mineral production wells added over the life of the plan, primarily in concentrated areas in and around gas fields. By virtue of more water well bores into the fresh water bearing zones, there would be an inherent increase in the change of exposure to aquifer contamination and aquifer mixing. As the number of new and active wells decreases and the number of properly abandoned wells increases, the total risk may level out and slowly diminish. Failure to properly maintain and abandon wells would increase the potential for groundwater contamination.

Hazardous materials use and storage would most likely increase with population and resource development, increasing the potential for chemical contamination for both surface water and groundwater as the result of a chemical spill.

Roads affect the movement of water, changing the drainage system by acting both as dams and as a superimposed set of ephemeral channels, redirecting water from natural drainage patterns. Proper road construction and maintenance can help to reduce this effect, but the alteration of the land surface required to create roads changes the way watersheds react to flow events.

Undisturbed or fully reclaimed areas and unaltered water flows will have little or no deleterious effects on land or water conditions. Areas of disturbed soil, decreased vegetative vigor, and altered water flows may affect watershed health.

Groundwater could be affected by multiple factors, including industrial, domestic, or agricultural activities, through withdrawal, injection, or mixing of material from different geologic layers or the surface. Withdrawal of groundwater could affect local groundwater flow patterns and create changes in quality and quantity of the remaining groundwater. The complexity of the geology in the area also increases the potential for mixing between aquifers along the annulus of a well or wells when one or more aquifers in an area are drawn upon. If aquifers are interconnected, withdrawal from or contamination of one well could affect others in the area. The following best management practices in this RMP, State of Wyoming rules and regulations, and actions set out on a field- and/or site-specific basis would help to reduce the likelihood of negative impacts.

Chemical spills on the surface would have the potential to penetrate into the soil and groundwater.

Particulate matter and chemical constituents such as nitrogen and sulfur oxides are produced year-round but go through complex reactions that concentrate them in initial meltwater from the snow pack. This can result in an initial flush of lower pH runoff in the early spring. Soils in the lower elevations of the planning area are primarily derived from marine deposits and tend to have a higher pH and a higher buffering capacity than the granitic soils associated with the surrounding mountains. This means that the alterations in water quality resulting from atmospheric depositions have a lower potential to create a negative effect in the lower elevations than in the mountainous regions. Given that the State of Wyoming has primacy in both air and water quality, BLM will work with the state to address both air and water issues.

Cultural management actions would focus on the protection or preservation of cultural sites, which would improve water resources by limiting or excluding surface-disturbing activities on or near such sites. Data recovery excavations could affect watershed resources via surface disturbances and vegetation removal in the short term. Indirect effects could occur when avoidance of cultural sites directs activities to other areas, possibly concentrating uses and increasing impacts on local watersheds.

Forestry practices that increase snow accumulation and alter forest floor composition could change the duration and timing of stream flow, which could potentially affect water quality and quantity. This could improve the overall watershed yield, but could also cause undesirable alterations to stream channels and riparian areas, such as downcutting, widening, or other types of channel degradation. Forest removal could also affect the nutrient balance in a watershed by increasing nitrates, carbon, and phosphorus to streams following deforestation. The addition of these nutrients can cause eutrophication of waters. This would be a minor impact.

Designation of avoidance areas near wetland/riparian areas and other water bodies and specific limitations on surface-disturbing activities would serve to maintain vegetative cover and reduce runoff and nutrient and sediment loading.

Lands and realty actions such as ROWs could affect water quality and watersheds. Installation of utility systems and other facilities would cause short-term soil erosion and sediment loading to nearby streams and rivers until the disturbed area was successfully reclaimed. Long-term effects would be associated with well pads and access routes to utility and transportation facilities. Increased channelization of surface runoff would occur in ruts, road ditches, and areas of compacted soil.

Lands removed from BLM management through disposal could affect the water and watershed resources on adjacent public lands if the management of the vegetation, soil, and subsurface resources changes.

Livestock grazing has the potential to impact water quality and watershed resources. Grazing could lead to soil compaction, stream bank instability, and a loss of vegetation, causing increased potential for erosion, sedimentation, and higher loads of salt and nutrients such as nitrate and phosphate in streams. Livestock water developments and range improvements could distribute livestock over a large landscape but could create concentrated use in local areas. Over the long term, these improvements would potentially enhance water quality by improving the stability and resiliency of wetland/riparian areas and protecting streamside vegetation.

Gravel pits and other excavated mineral sites would most likely be relatively small in size and easily isolated hydrologically. As with other disturbances, shape, orientation, and position relative to water bodies and channels are determining factors.

Mineral development and associated surface disturbances would impact water resources. Potential impacts include stream sedimentation, soil contamination, salt and nutrient loading, groundwater contamination, and augmented water flows. Much of the oil and gas development would occur in concentrated areas such as the Pinedale Anticline and the Jonah Field. Other areas of concentrated development would most likely occur over the life of this plan. Concentrated development would result in changes to the nature of overland flows within the development area, which will need to be addressed over the life of the fields and their associated roads and well pads on an individual field basis. As multiple fields develop, the interactions of their runoffs may also need to be considered.

Wells would have the potential to affect groundwater quality and quantity through withdrawal, injection, or communication along the path of the well. Proper well sanitation, drilling, and completion methods could reduce these impacts but would not entirely eliminate them.

Year-round drilling could affect watershed health and water quality, primarily through runoff and during the times that soils are saturated with liquid water (e.g., mud). Roads and well pads, although mostly protected by a gravel surface, are more vulnerable to disturbance and rutting when the soils are saturated with liquid water than when the soils are dry or frozen. Minor spills and accumulations that occur during the times of frozen soils could contribute to early spring pulses of pollutants.

APD requirements would help minimize but not completely eliminate impacts from increased development. Although the potential for CBNG is low, dewatering of coalbeds or other geological formations could affect both quantity and quality of groundwater, because large areas would be potentially dewatered and the produced water would be either reinjected or otherwise managed.

Coal gasification is an emerging technology that has a potential to create disruptions to surface water and groundwater quality and quantity. Surface water would be affected by the amount of surface disturbance.

Groundwater would be affected by the changes to the aquifers. The exact nature of these potential effects would depend on the location of the project and the nature of the native groundwater. At the time of writing this document, no coal gasification projects are planned for the PFO, and the potential for such projects has not been established.

Activities associated with water quality protection and clean up of undesirable events, such as those associated with the hydrocarbon monitoring and clean up in water wells in the Pinedale Anticline Project Area (PAPA), would have a positive effect on water quality.

In areas of concentrated mineral development, there could be some changes in management in response to the level of development. Additional water sources could be developed from commercial water wells, which could help in livestock distribution. Grazing patterns could be altered, resulting in changes in impacts on watersheds and water quality.

Compaction of soils, channelization of overland flows, and loss of vegetation from OHV activity would increase erosion, reduce revegetation rates, and decrease stream bank stability, thereby causing increased sedimentation and salt and nutrient loading of streams. OHV use during periods of high soil moisture, such as early winter and spring, would accelerate erosion and vegetation damage.

Recreational activities that occur in proximity to water sources would impact watershed resources and water quality to a greater extent than those located farther from surface waters.

Activities undertaken to preserve and improve the soil resource would have an effect on water resources. As soil surveys are completed in the area, vegetation and watershed projects could be completed with greater accuracy.

Long-term effects of transportation and access systems on water quality and watersheds would most likely be associated with energy and mineral development and transport. Additional disturbance would also be associated with recreation. Increased erosion and sedimentation would occur from soil compaction, removal of vegetative cover, and channelization of surface runoff in ruts and road ditches. In addition, road-surfacing and dust suppressant chemicals used near riparian/wetland areas could contaminate water sources. Proper road maintenance and design would help to reduce the overall impact of the designated transportation system.

Closing the Scab Creek WSA (7,710 acres) (Map 2-16) would limit soil erosion and sedimentation of surface waters in these areas.

Improving vegetative cover in riparian areas and uplands could impact water quality and watersheds by reducing sedimentation of streams. Vegetation removal could result in increased stream flow energies and increased sediment erosion and transport and reduced water quality. Over the long term, with successful recovery, vegetative production could increase over pretreatment production levels, which would decrease erosion potential and help to protect and improve water quality.

Management of riparian areas to achieve PFC as a minimum condition would impact water quality and watersheds by helping to stabilize stream banks, reduce erosion and sediment yield, promote vegetative cover, and enhance water quality. Watershed assessments, monitoring efforts, and implementation of mitigation measures would improve watersheds with sensitive baseline conditions and have a long-term impact on the resource.

VRM classifications that restrict surface-disturbing activities would indirectly protect water resources.

Fires would increase sediment loading into streams immediately after burning; however, this would diminish in the short term provided there is sufficient vegetative recovery. Both wildland fires and prescribed fires could have long-term localized impacts on water quality and quantity. Prescribed burns would be designed to diversify plant community composition and age structure, thereby promoting more vigorous vegetation growth. These plant community changes would improve soil stabilization and decrease erosion, resulting in decreased sediment loading to nearby streams and water sources. Changes in vegetation communities resulting from fuel management activities could also improve long-term water quality by increasing the effectiveness of the soil sponge. Restrictions placed on grazing and other land-disturbing activities until there has been sufficient vegetative recovery after treatment would reduce soil loss and related water quality problems.

Fire retardants and surfactants contain chemicals that could degrade surface water quality. Careful use and application of these chemicals would reduce the likelihood of such events.

Emergency stabilization and rehabilitation efforts would provide protection to water resources by controlling soil erosion and thereby reducing sediment loading.

Management actions for wildlife and fisheries would, for the most part, protect riparian areas, improve vegetative cover, and reduce surface disturbance. Actions to improve wildlife habitat generally involve the protection of water sources and the promotion of diverse plant communities that are better able to slow and filter overland flow, reduce erosive forces, and improve water quality. This would impact water resources by restricting surface disturbance and reducing the potential for accelerated soil erosion. Impacts could occur where wildlife populations concentrate near water sources, potentially increasing erosion and sediment loads.

SD/MAs would affect water quality and watershed health to the extent that they affect surface disturbance.

4.15.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 1.

Approximately 24,223 acres of forestland and 13,506 acres of woodland would be managed for forest products. The potential for short-term sediment loading to streams and rivers above acceptable levels would be increased by such activities.

Use and placement of mineral supplements encourages concentrated animal activities that would cause soil compaction and create an area that is denuded of vegetation and saturated with salt. Keeping mineral supplements a minimum of 500 feet from the outer edge of wetlands or water bodies and in locations that encourage effective use of forage resources would encourage more widespread livestock distribution, which could, in turn, reduce impacts within the riparian areas.

The proposed withdrawal of 14,540 acres from locatable minerals entry would reduce the potential for accelerated erosion and sediment loading in these areas. However, as no substantial development of locatable minerals is foreseen (see Section 4.7.2 Locatable Minerals), the likelihood of this impact is low.

Mineral development and associated surface disturbances would impact water resources. Potential impacts include stream sedimentation, soil contamination, salt and nutrient loading, groundwater

contamination, and augmented water flows. Pipeline construction would disturb an average of 553 acres per year or approximately 11,063 acres over the 20-year planning period. Four years after construction, vegetation would be restored through reclamation and would have no long-term surface disturbance impact.

The RFD scenario for oil and gas development is listed in Appendix 10. The 7,192 wells with 43,022 acres of initial disturbance and 17,372 acres of long-term disturbance on public lands is the second-highest level of surface disturbance of all the alternatives. Given that oil and gas development is a major source of disturbance, and that there is a high correlation between surface disturbance and potential watershed health and water quality issues, this alternative also has the second-highest potential for concerns regarding watershed health and water quality.

Alternative 1 has the greatest potential OHV-related impacts. Approximately 247,250 acres, including the Desert General Use area, would remain designated as open OHV area. The potentially high level of unrestricted traffic in these areas could cause soil compaction and vegetation removal, increasing erosion and related impacts on water quality.

Surface discharge of produced water could impact surface water quality with augmented flows that could accelerate erosion in stream channels that are not adjusted to the timing and volumes created by the greater energies and volumes. This could result in additions of salt and sediment from eroded soils that would not be detected at the initial discharge point. Discharging to larger perennial channels that have the capacity to accept the increased flows without degrading the channel could help reduce the volume of salt and sediment introduced through erosion but would not eliminate it entirely.

Closing the Rock Creek ACEC (5,270 acres) to OHV use (Map 2-13) would limit soil erosion and sedimentation of surface waters in these areas.

4.15.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 2.

This alternative would result in the greatest impacts on water resources from mineral development and livestock grazing. The amount of surface disturbance would be greater than under all other alternatives. There would be a higher potential for groundwater contamination because of the greater number of wells.

This alternative would provide greater protection to forest resources than Alternative 1. Approximately 21,960 acres of forestland and 13,160 acres of woodland would be actively managed, and 12,346 acres of forestland and woodland within WSAs would be indirectly managed to restore the forest landscape to a more historical stocking level and would not be managed for forest products. The change in management emphasis would reduce surface-disturbing activities associated with the production of forest products and subsequent sediment loading to streams and rivers.

Impacts resulting from livestock grazing management, soils management, SD/MA management, water quality and watershed management, and wildlife and fish management would be greater than under other alternatives. Having no minimal distance for placing mineral supplements from the edge of riparian areas or water bodies could create areas of concentrated grazing impacts that could destabilize channel banks, degrade water quality, and decrease watershed health.

The RFD scenario for oil and gas development is listed in Appendix 10. The 7,804 wells with 46,739 acres of initial disturbance on public lands and 18,689 acres of long-term disturbance is the highest level of surface disturbance of all the alternatives. Given that oil and gas is a major source of disturbance and that there is a high correlation between surface disturbance and potential watershed health and water quality issues, this alternative also has the highest potential for concerns regarding watershed health and water quality.

Surface discharge of produced waters would be considered if WDEQ approval was obtained, and it could be demonstrated that the augmented flows would not cause significant environmental damage, as defined by the Wyoming Standards for Rangeland Health. Surface discharge activities would require additional monitoring of the functioning condition and water quality of the receiving water body.

Installation of utility systems and transportation facilities would cause short-term soil erosion and sediment loading to nearby streams and rivers until the disturbed area was reclaimed. Long-term effects would be associated with well pads and access routes to utility and transportation facilities. Increased channelization of surface runoff would occur in ruts, road ditches, and areas of compacted soil.

Designation of 20,640 acres as open to OHV use would create areas of concentrated impacts on vegetative and soil resources. This, in turn, would create local impacts on surface water resources. If properly managed, the presence of OHV Open areas could help control impacts over the larger planning area if they reduce recreational OHV activity outside of the designated areas. Water resources within the OHV Open areas would need to be intensively managed and impacts on them mitigated.

At 540 acres, Alternative 2 has the smallest area of seasonal restrictions for OHV use, but it does have 3,110 acres of special restrictions and 18,970 acres of designated roads and trails restrictions. This could create a different distribution of OHV-related impacts when compared to the other alternatives that have different designations.

Impacts from vegetation management would be similar but slightly greater than those under Alternative 1. Less land would be designated as avoidance areas for surface-disturbing activities, resulting in increased potential for soil erosion and sedimentation of surface water sources.

4.15.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 3.

This alternative would provide the greatest protection to water resources of all the alternatives. Management actions, such as closing the Rock Creek ACEC to livestock grazing, would emphasize the enhancement and protection of watershed and riparian resources.

Impacts on water quality and watersheds from soils and vegetation management would be similar to those under Alternative 1.

Impacts resulting from fire and fuels management and forest management would be the same as those under Alternative 2.

Lands and realty management actions under this alternative would provide the greatest level of protection to soil and vegetation resources, which would reduce soil erosion and sedimentation of water resources. Under this alternative, 65,750 acres would be withdrawn from locatable minerals entry, instead of 14,540 acres as under Alternative 1. Approximately 51,210 more acres would be protected from surface-

disturbing activities associated with locatable minerals activities, which would reduce the potential for sediment loading to nearby streams and rivers. However, as no substantial development of locatable minerals is foreseen (see Section 4.7.2 Locatable Minerals assumptions), the likelihood of this impact is low.

The RFD scenario for oil and gas development is listed in Appendix 10. The 5,209 wells with 31,139 acres of initial disturbance and 13,325 acres of long-term disturbance would be the lowest level of surface disturbance of all the alternatives. Given that oil and gas is a major source of disturbance, and that there is a high correlation between surface disturbance and potential watershed health and water quality issues, this alternative also has the lowest potential for concerns regarding watershed health and water quality.

Closing the Rock Creek ACEC (5,270 acres) and the Scab Creek (1,350 acres) and Silver Creek (860 acres) WSR Units to OHV use (Map 2-27) would limit soil erosion and sedimentation of surface waters in these areas.

Having no open OHV areas and restricting OHV use to existing roads and trails would reduce surface disturbance and the associated impacts on water and vegetative resources.

At 518,860 acres, this alternative has the largest area of seasonal restrictions for OHV use. It also has 1,010 acres of special restrictions and 140,610 acres of designated roads and trails restrictions, which could help provide protection from OHV-related disturbance to the soil, vegetation, and water resources.

No produced waters would be discharged into surface drainages. This would reduce the potential for channel incision, sediment transport, and water quality degradation associated with channel adjustments of that from Alternative 2.

Designations of WSR would have no direct effect on water quality but could provide additional protection from surface disturbance.

4.15.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 4. Overall impacts under this alternative would be between those under Alternatives 2 and 3.

Impacts resulting from forest management would be similar to those under Alternative 2.

Impacts from OHV management would be similar to those under Alternative 3.

The total numbers of AUMs under this alternative are similar to those under Alternative 1. Livestock grazing has the potential to impact water quality and watershed resources. Heavy utilization of forage in riparian areas or uplands can lead to a loss of vegetation, soil compaction, and bank instability, causing increased erosion, sedimentation, and higher loads of salt and nutrients such as nitrate and phosphate in streams.

Impacts from placement of mineral supplements a minimum of 500 feet from wetlands and water bodies would be similar to Alternative 1.

Under this alternative, 13,770 acres would be withdrawn from locatable minerals entry, instead of 14,540 acres as under Alternative 1. Approximately 770 fewer acres would be protected from surface-disturbing activities associated with locatable minerals activities, which would increase the potential for sediment

loading to nearby streams and rivers. However, as no substantial development of locatable minerals is foreseen (see Assumptions in Section 4.7.2, Locatable Minerals), the likelihood of this impact is low.

The RFD scenario for oil and gas development is listed in Appendix 10. The 7,136 wells, with 42,180 acres of initial disturbance and 17,330 acres of long-term disturbance, involves slightly less surface disturbance than under Alternative 1. Given that oil and gas is a major source of disturbance and that there is a high correlation between surface disturbance and potential watershed health and water quality issues, Alternative 4 also has slightly less potential for concerns regarding watershed health and water quality than Alternative 1.

No produced waters would be discharged into surface drainages. This would reduce the potential for channel incision, sediment transport, and water quality degradation associated with channel adjustments from that of Alternative 2.

Closing the Rock Creek ACEC (4,960 acres) and the Scab Creek (1,350 acres) and Silver Creek (860 acres) WSR Units to OHV use (Map 2-35) would limit soil erosion and sedimentation of surface waters in these areas.

At 518,860 acres, Alternative 4 has the same extent of seasonal restrictions for OHV use as Alternative 3. It also has 7,230acres of special restrictions and 139,000 acres of designated roads and trails restrictions, which could help provide protection from OHV-related disturbance to the soil, vegetation, and water resources.

Impacts resulting from vegetation management actions would be the same as those under Alternative 1. Improving vegetative cover in riparian areas and uplands could impact water quality and watersheds by reducing sedimentation of streams. Vegetation removal could result in increased stream flow that forces stream channels to readjust their width and depth to accommodate the larger flows. Over the long term, with successful recovery, vegetative production could increase over pretreatment production levels, which would decrease erosion potential and help to protect and improve water quality.

4.16 WILDLAND FIRE AND FUELS

This section presents potential impacts on fire and fuels management from management actions for other resource programs. Existing conditions concerning fire and fuels management are described in Chapter 3 (Section 3.16).

4.16.1 Assumptions

The analysis was based on the following assumptions:

- A direct relationship exists between density of human use within the planning area and the frequency of human-caused fires.
- A direct relationship exists between fuel loads (standing and nonstanding vegetation) and potential fire size and intensity.
- Proper application of prescribed fire (as well as mechanical, chemical, and biological treatments) can reduce the fire hazards presented by an accumulation of fuel. The application of prescribed fire and the effects of prescribed fire on resource values will be considered in this section.
- There is an average of approximately two fires per year: one human-caused fire and one from natural ignition (lightning). Half of natural ignitions are in forested areas and half in sagebrush/grass areas.
- Approximately 35% of years have no fire occurrence.
- About 70% of all fires burn less than 2 acres; 15% burn between 3 and 100 acres; and 15% burn 100 acres or more.
- Historically, there has been one prescribed fire every 2 years for 870 acres.
- Fuel treatments would continue within the range of current projections.
- WUI funding will be more stable than non-WUI funding.
- A long-term stewardship contract with the Rocky Mountain Elk Foundation is being developed. This will be a 10-year-long project overlapping with forestry.
- National direction will continue to focus on cost containment for large fire activities and emphasize appropriate management response (AMR).
- Fire management budgets will be cyclical, with a 5-year downturn that began in 2006.

4.16.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, review of existing literature, and information from other agencies. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate. Risk assessment and mitigation

strategies (RAMS) have been used in the planning area to quantify risk ratings for WUI areas and catastrophic fire potential for wildland fuels.

4.16.3 Impacts Common to All Alternatives

Impacts on fire management are not anticipated as a result of implementing management actions for the following resources and resource uses: lands and realty, paleontology and natural history, and transportation and access management.

The potential for wildland fires within the planning area to seriously damage sensitive resource values is considered to be low in areas proposed for WFURB as well as in areas considered for appropriate management response.

Management of cultural resources could affect fire management by placing restrictions on wildland fire suppression activities. Protections afforded to cultural resources and surrounding areas (e.g., identified historical trails, buildings, cultural sites) include fire suppression related limitations and restrictions, which could affect the ability of firefighters to protect these sites and surrounding areas during wildland fire suppression activities.

Timber harvest would affect the fuel profile and subsequent fire behavior. The primary stand attributes that influence crown fire initiation and spread are surface fuel loading, crown base height, and canopy bulk density. At a minimum, timber harvests planned under this alternative would affect canopy bulk density, which in turn affects canopy fire spread. After a timber harvest, a fire may still transition into the crown of an individual tree; however, the reduced crown bulk density may inhibit the movement of the fire through the canopy. Slash that is left onsite from harvesting and fuel reduction projects could increase surface fire intensity; however, if slash were treated by piling, lopping, and burning, the effect could be partially mitigated. Forest health initiatives that favor aspen and reduce conifer encroachment on aspen would aid in fire suppression efforts and reduce the potential for crown fires.

Forest health objectives would reduce the amount of dead and downed forest fuels attributed to insects, disease, and overgrowth, which could reduce the frequency and intensity of fire. Forest management actions to reduce conifer encroachment could also reduce the frequency and intensity of fire and facilitate fire suppression efforts.

Livestock grazing would affect fire management through the reduction of fine fuels, which would reduce the capacity for wildland fire to spread. Decreasing the probability of fire spread through reduction of fine fuels by livestock grazing would provide more time for the accumulation of larger fuel sources (e.g., shrub vegetation) between fires.

Mineral resource development would increase management requirements for fire suppression. Impacts of fluid mineral resource development on fire management could include the introduction of additional ignition sources, barriers, or impediments to fire areas, and increased fire risk potential as a result of increased access for recreational and other public land users. These impacts would generally be the same for leasable, locatable, and salable minerals.

Mineral resource development activity can also affect fire management by providing increased overall accessibility to remote areas and the presence of emergency equipment and manpower in remote areas. The presence of minerals personnel can also increase the likelihood that fires can be spotted and potentially controlled quickly.

Recreational activities such as camping and backpacking have the potential to increase fire frequency by directly increasing the number of ignition sources (e.g., campfires and catalytic converters). When conditions warrant, fire prohibitions (not allowing open campfires) would reduce the likelihood of accidental human-caused wildland fires. Public service announcements and newspaper articles in conjunction with posting the prohibitions at recreational sites would help the public understand and comply with fire regulations.

OHV use could directly impact fire management. Catalytic converters on vehicles could start fires when in contact with dry vegetation. OHV use frequently occurs in remote areas accessed by unimproved vehicle trails, potentially causing wildland fires in areas not readily accessible to conventional fire equipment.

The primary benefit that would be derived from fire suppression designations is increased efficiency of fire suppression activities. However, large, damaging fires can occur. The potential effects on sensitive resource values from such an occurrence have been considered in the Western Zone Fire Management Plan (2004). Some of the values to be considered are cultural resources, crucial big game winter range, high-priority watersheds, fragile soils, oil and gas fields, air quality, and high-value scenic areas.

Fuel reduction projects, especially in WUI areas, would impact fire suppression activities. Removal of fuels helps slow the spread of fire, enabling firefighters to more easily keep fires under control and contained.

Wildlife management actions would impact the use of fuels management. Some impacts may be through restrictions aimed at protecting and enhancing wildlife habitat, such as seasonality, treatment size, or treatment type. Another effect could be the use of prescribed fire to enhance wildlife habitat, which would alter vegetation and fuel loading to decrease the risk of catastrophic wildland fire in the area treated.

WSA IMP would limit the use of motorized fire suppression equipment. Fire suppression in the WSAs would be more difficult. Fires in the WSAs could grow to the extent that they are difficult to contain at the WSA boundary.

4.16.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

Forest management under this alternative is divided into four categories, ranging from intensive commercial management to no management, depending on the area identified. Forest health is not identified, nor are any fuel reduction goals. The lack of these elements could affect fire management by increasing fuel loadings and the intensity of wildland fire.

Fire management under this alternative would allow for prescribed fire for multiple objectives as well as managing natural ignitions as WFURB. Suppression actions would be undertaken under an “appropriate suppression response” emphasizing values at risk.

WSA IMP would limit the use of fire suppression equipment to hand tools to reduce surface disturbance. Vehicle access would also be limited by OHV restrictions. This would increase the risk of large, uncontrolled wildland fires, the risk to firefighters, and fire suppression costs.

As a result of vegetation management actions, healthy, diverse vegetation communities promoting mosaic vegetation patterns could slow the spread of fires and reduce their size and intensity. Management actions aimed at reducing the spread of invasive species under Alternative 1 would aid fire suppression activities and fuel reduction, because invasive species can increase the frequency and severity of fires.

4.16.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts are anticipated under Alternative 2.

Increased total surface disturbance and distribution of oil and gas development would affect the fire management program by increasing the amount and distribution of industrial interface in the WUI. Protecting this infrastructure would require a more intensive mechanical and chemical fuels treatment program. It would also reduce the options available in the AMR for the firefighters and reduce the amount of acreage that would be available for prescribed fire.

Forest management would also impact fire management. Forest and woodland stands not identified as old growth would be available for commercial use. The commercial use of these stands would not necessarily increase their resilience to wildland fire, potentially increasing the risk for catastrophic wildland fire.

Additional or increased OHV use, in conjunction with additional recreational facilities, would increase the potential for wildland fire by increasing the number of ignition sources.

Fire management under this alternative would allow for prescribed fire for multiple objectives. Suppression actions would be undertaken under an “appropriate suppression response” emphasizing values at risk.

4.16.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 3.

The oil and gas impacts on fire management would be decreased under this alternative. The acreages under this alternative would reduce the amount of fuels treatments necessary to protect the oil and gas infrastructure and would allow potentially larger landscape-scale prescribed fire treatments. It would also decrease the constraints in the AMR that higher levels of oil and gas would impose.

Impacts from the forestry program would affect fire management. The emphasis on managing all forests and woodlands to bring them to pre-suppression composition, structure, and function would in the long term decrease the potential for catastrophic fire and increase the options for fire management under the AMR. Emphasis on restoring aspen stands to their historic range of variability would create natural fuel breaks on the landscape, further increasing the resilience of the vegetation to wildland fire. Aggressively managing for forest health would also make the forested stands more resilient and resistant to wildland fire, creating more opportunities for the use of WFURB.

Impacts from livestock grazing management would affect fire management. The establishment of reserve common allotments would facilitate prescribed burns in areas by creating more flexibility within the permittee’s grazing system, allowing for rest before or after a prescribed fire to meet the objectives of the treatment.

Subjecting fire suppression vehicles to OHV restrictions would severely hamper firefighting efforts. Dozer lines could not be constructed. Trucks could not drive crosscountry to spray water. Fire suppression activities would be limited to hand lines, spraying water from roads, and air drops. Larger fires would likely result.

4.16.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4.

Oil and gas development would impact fire management. The proposed disturbance would be the same as under Alternative 1.

Impacts from OHV management and vegetation management would be the same as those under Alternative 3.

Impacts resulting from forest management would be the same as those under Alternative 2.

4.17 WILDLIFE AND FISH HABITAT

This section presents potential impacts on wildlife and fisheries from management actions for other resource programs. Existing conditions concerning wildlife and fisheries are described in Chapter 3.

Wildlife populations fluctuate, sometimes widely, in response to natural factors such as cycles in the abundance of prey base or extremes in seasonal weather (e.g., severe winters). It is often difficult to discern whether impacts on wildlife result from any specific management action or from population changes caused by natural factors. Changes to or stressors (e.g., increased human presence and noise) on habitat components such as vegetation, water, soil, or air are most likely to cause direct and indirect effects on wildlife and fish.

4.17.1 Assumptions

The analysis is based on the following assumptions:

- The quality and quantity of winter ranges are generally considered to be the limiting factors on big game populations in the planning area. The ability of these areas to support wintering populations is a major factor in determining yearlong population levels.
- Significant modifications to habitat suitability can impact the survivability and viability of populations (e.g., higher winter mortality, reduced reproductive success).
- Crucial winter ranges, transitional ranges, and parturition areas are critically important wildlife habitat.
- Fish and wildlife populations would continue to be managed by WGFD. BLM would continue to manage wildlife habitat. Big game habitat would be managed in coordination with WGFD herd objectives and the Strategic Habitat Plan.
- Natural variability in wildlife health, population levels, and habitat conditions would continue. Periods of mild or severe weather as well as outbreaks of wildlife disease or insects/diseases that impact habitat (e.g., mountain pine beetle, blister rust, mistletoe, and bleeding rust) could impact wildlife population levels.
- The WGFD may adjust herd objectives in response to these periodic fluctuations in population levels. Occasional changes in movement patterns or habitat preference may occur in response to habitat changes or levels of human disturbance.
- USFWS may designate additional wildlife species as T&E as additional data are collected and evaluated. These species would be managed in accordance with the Endangered Species Act and as directed by decisions in the alternatives.
- BLM is responsible for impacts occurring from public land management activities and would coordinate fish and wildlife habitat management activities on public lands with the WGFD. BLM is not restricted from making any reasonable decision within the framework of multiple use management and applicable laws as a result of this coordination.
- Management of streams toward their potential natural condition would generally improve habitats for both native and introduced coldwater fishes, such as trout and sculpin.

- Consideration of aquatic habitat conditions when conducting BLM assessments, such as PFC and the Standards for Rangeland Health (USDI, BLM 1997), would help to identify areas for stream habitat management and watershed management efforts.
- The health of fisheries within the planning area is directly related to the overall health and functional capabilities of riparian/wetland resources, which in turn reflect watershed health.
- Any activities that affect the ecological condition of the watershed and its vegetative cover would directly or indirectly affect the aquatic environment. The degree of impact attributed to any one disturbance or series of disturbances is influenced by location within the watershed, time and degree of disturbance, existing vegetation, and hydrologic condition.
- As riparian systems adjust in response to the removal of vegetation or changes in hydrologic conditions, the availability of habitats required to fulfill the life history requirements of fish populations is likely to be affected.
- Supporting industrial linear infrastructure such as roads and pipeline corridors is likely under all alternatives.

4.17.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources and appropriate data within the planning area, review of existing literature, and professional judgment of experts within and outside BLM. Spatial data analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

4.17.3 Impacts Common to All Alternatives

As acreages of surface disturbance and human activity levels increase, the quality and quantity of wildlife habitats likely will be reduced. Habitat fragmentation occurs when a contiguous habitat is intersected, divided, or segmented by disturbing activities. Fragmentation causes a reduction in usable ranges and the isolation of smaller, less mobile species; a loss of genetic integrity within species or populations; and an increase in abundance of habitat generalists that are characteristic of disturbed environments (i.e., competitors, predators, and parasites) (Harris 1984). Displaced wildlife tend to use lower quality habitats or compete with existing herds and livestock for forage and use private lands to a greater extent. Density dependency thresholds of suitable habitats for these species could be met, which ultimately could decrease herd size and genetic variability and increase disease frequency.

Working with the state to maintain Wyoming State air quality standards would aid in reducing or limiting acidification of waters within the planning area.

Authorized excavation of cultural sites and cultural inventories would cause localized, short-term disruption to wildlife's use of the excavation site. If the excavation would occur in sensitive or endangered species habitat, or if cultural sites were found at proposed locations of wildlife habitat enhancement projects, the projects would be re-evaluated, subject to site-specific adjustments, and potentially redesigned.

Impacts resulting from forest management activities and associated infrastructure would include habitat loss, fragmentation, avoidance or displacement of animals from management areas, noise disturbance, and increased vehicle traffic (MDFWP 1985).

Forest management practices would change the seral stage of the affected stands. Many forest management practices are designed to alter or set back the seral stage of the forest community. Harvest of late-seral or climax forest stands would change the structure and species makeup of timber stands to favor early-seral species and address morbidity in stands, disease, and risk of large fires. These activities could potentially increase species diversity and richness, depending on different wildlife species' habitat requirements. This would affect all wildlife species dependent on those forest seral stages. Properly mitigated commercial timber harvests could improve big game habitat in the long term. Timber management activities would improve big game habitat by improving forest age class diversity and distribution, edge effect, and forage community diversity.

Potential short-term impacts on elk from forest management include loss of security and calving cover and displacement of elk to other portions of the habitat. Displacement of elk has been detected as far as 4 miles from the area of summer logging activity. Long-term impacts on security cover in the areas would also be caused by timber harvest. Timber harvest practices could lead to increased human presence, wildlife harassment, and increased hunting success in elk habitats.

Timber management activities could have impacts on Canada lynx by removing forest cover for foraging and denning habitat needed for lynx and prey. Snowshoe hares may reach their highest densities in young, dense coniferous or coniferous-deciduous forests, or mature forests with a dense understory of shrubs, aspen, and/or conifers. Lynx natal dens generally occur in areas with large quantities of coarse woody debris, such as blowdown and root wads, which typically occur in mature forests or in regenerating stands. Timber harvest would result in an increase in roads, facilitating snowmobile and other human uses in the winter and thereby increasing access into lynx habitat (LCAS 2000). Maintenance of old growth forest (especially in the mixed conifer/spruce fir and aspen/spruce fir) stands is critical in maintaining the historic snowshoe hare population levels and therefore the continued presence of Canada lynx in the planning area.

In all timber management activities, the practice of leaving dead and dying trees, trees with heart rot, and other standing unmerchantable timber would meet the ecological needs of numerous species, including woodpeckers, owls, and many neotropical bird migrants.

Access roads for logging operations could affect aquatic habitats by concentrating stream flow, increasing erosion rates, and fragmenting habitats. Increased spring runoff could increase erosion. Removal of forest understory vegetative cover could alter aquatic habitats by changing the time to peak discharge following precipitation events and increasing sediment transport from upland sources to the stream channel. This also impacts a forage component required for many forest-dwelling species.

Impacts on wildlife and fisheries from lands and realty management would be dependent on the placement of ROWs and the location of realty actions in relation to critical wildlife habitat, and on the success of reclamation and mitigation on disturbed lands. The impacts on wildlife and fish habitat would vary with the specific type and location of the requested ROW. Some actions such as construction of pipelines, buried fiber-optic lines, and other subsurface actions likely would have short-term impact, because proper reclamation should restore some level of habitat function in these areas that could be used by wildlife. Because of the long time frames required for disturbed sites to return to predisturbance vegetation cover or the redisturbance of a ROW corridor, some impacts would be long term. Aboveground ROW actions, such as communication sites and power lines, would have long-term

impacts. These types of permanent structures are particularly hazardous to avian wildlife because of the potential for collision or electrocution.

Habitat loss, degradation, fragmentation, and species displacement from approved linear features (e.g., power lines, roads, pipelines) and other permitted facilities would occur. Linear ROW features could fragment habitat and disturb vegetation; increase erosion; and degrade the quality of riparian areas, watersheds, and habitats if features cannot be avoided or mitigated. Impacts from buried pipeline construction could last for 30–40 years or more, depending on the time required for full reclamation of pre-disturbance vegetation, including sagebrush. The length of time of wildlife displacement would depend on the timeliness and effectiveness of reclamation efforts. Impacts from ROW-approved actions such as power lines, communication sites, and wind turbines, would include increased injury and death to bats, raptors, and other migratory birds as a result of collisions.

Reclamation on many pipeline corridors is difficult when uncontrolled livestock grazing and repeated disturbance occurs. When these situations are encountered, disturbances from pipelines would result in long-term impacts on wildlife habitats. Forage loss and increased human activity from roads and linear features could result in reduced wildlife health (when wildlife is displaced into a lower quality habitat), modifications in population distribution or numbers, possible habitat abandonment, or increased competition with generalist species.

Fisheries are directly affected by the condition of riparian areas. Surface-disturbing activities, such as ROWs for linear actions (e.g., pipelines, roads, and utilities) and construction of well pads and other facilities, could adversely affect watershed resources, riparian areas, and fisheries. Road construction near streams could adversely impact fish habitats by altering the hydrology and the associated riparian zone, causing erosion, loss of aquatic and riparian vegetation, and increased sedimentation. RMP stipulations and other site-specific mitigation measures to address timing and extent of surface-disturbing activities in or near riparian areas and streams would reduce these impacts.

Sedimentation of streams from linear stream crossings and increased sedimentation from disturbed land would impact fisheries by reducing habitat complexity. Sedimentation reduces fish spawning potential and results in a lower diversity of prey organisms. Increased turbidity also results from increased sediment input, which decreases light penetration, inhibits instream plant growth and visual predation by fish, and could increase water temperature. The increase in nutrient loads associated with increased sediment inputs would increase plant production above natural levels, which would degrade habitat and decrease oxygen levels. In addition, disturbance of the stream bank caused by linear crossings could create bank instability and thereby alter stream flow and destroy pool-riffle formations necessary for fish survival. Proper design of linear crossings and BMPs would minimize these impacts.

The impacts from livestock grazing on fish and wildlife habitat would include competition for forage and water and habitat use and alteration. Livestock driveways impact wildlife habitats because of reduced vegetation and compaction of soils. Stock driveways tend to concentrate high levels of livestock use that can cause significant degradation (e.g., near-complete removal of vegetation, soil compaction). These areas no longer provide forage or shelter but could be used as wildlife movement corridors. Late-season grazing can remove residual vegetation that would be necessary on big game winter ranges and provide important nesting cover for greater sage-grouse in the following spring. Livestock grazing can also enhance forage and brood-rearing conditions for wildlife species. Regrowth areas previously used by cattle could be favored because of the resultant increase in forage palatability.

Placement of water development projects for livestock in certain areas could lead to a redistribution of livestock on crucial winter ranges not previously used by livestock. This could lead to increased competition between livestock and big game for forage on crucial winter ranges. Water developments that

are maintained throughout the year can be beneficial to wildlife where other water sources are limited. Properly distributed water developments can be used to facilitate rotational or other livestock grazing systems to improve rangeland health and also provide better forage for wildlife. Well-designed water developments (reservoirs) and associated riparian vegetation create nesting, feeding, and brood-rearing habitat for waterfowl, greater sage-grouse, and other migratory birds. The development of water sources in dry regions would allow wildlife use to expand into habitats that previously were used only seasonally. Dispersion of wildlife to access water sources reduces potential impacts from predators; however, livestock use around water sources could also alter vegetative diversity found in these mesic areas, potentially reducing habitat quality for a wide variety of wildlife species, including sage-grouse.

Proper grazing practices in a sagebrush/bunchgrass plant community would provide proper understory cover for nesting and brood rearing to persist. Overgrazing could change the bunchgrass community to a less desirable rhizomatous grass community that does not provide sufficient understory for nesting cover and brood rearing. There are many complexities to this issue, including management history, grazing intensity, the amount of rest, rotation strategies, and the type of livestock involved (Kuipers 2004). Sage-grouse nesting and early brood-rearing periods are the most vulnerable to livestock grazing influences (Beck and Mitchell 2000), primarily due to requirements for tall and abundant understories of residual grasses, new grasses, forbs, and litter within sagebrush habitats (Gregg et al. 1994; Heath et al. 1997 and 1998; Holloran 1999; Lyon 2000; Kuipers 2004).

Livestock grazing management could adversely impact stream processes and fish habitats, including the loss of stabilizing riparian vegetation, which can lead to stream instability and an associated loss of habitat complexity; the loss of shading vegetation, which can lead to elevated stream temperatures, increased sediment delivery, and loss of stream channel complexity provided by fluvial processes and woody debris. The degree of adverse impact, if any, would depend on livestock grazing timing and intensity, site characteristics, and species habitat requirements (Armour et al. 1991; White 1996; Rinne 1999). Early spring and late summer are periods when livestock are most apt to utilize shrubs, thereby reducing their availability to wildlife. Browsing of shrubs could reduce their competitive ability against grasses, which could increase abundance and vigor of the herbaceous understory.

Livestock grazing in the fall or early spring would remove the residual herbaceous understory, reducing its vertical structure, which reduces the visual security for upland nesting birds. This could lead to increased predation and lower nesting success. Removal of residual cover could also hasten spring green-up of the herbaceous understory, providing quality forage for wildlife coming out of stressful winter conditions.

Livestock range improvements designed to alter grazing distribution and use of pastures, such as fences and water developments, would affect wildlife. Big game species use mineral supplements placed for livestock use. Placement of mineral supplements in sage-grouse strutting areas could degrade sage-grouse nesting habitat. However, livestock fences create travel barriers, create stress, and could lead to decreased reproduction success (especially when constructed in big game migration corridors) as well as death from entanglement.

Because of the large amount of oil and gas reserves and existing leases in the planning area, loss of important habitat could occur throughout the planning area, depending on the economic feasibility of development and fluctuations in market price. Although 43 CFR 3161.2 directs BLM to ensure that “all operations are conducted in a manner which protects other natural resources and the environmental quality,” it also contains many scenarios in which operators may continue to conduct activities without requesting exceptions. Many studies have shown that these actions involving increased human presence has negatively affected wildlife populations such as mule deer and sage grouse.

The primary impacts on wildlife species (especially big game) from minerals development within the planning area are the reduction in usable wildlife habitat and disruption of migration corridors that link crucial habitats (winter range) and parturition areas. Reductions would be particularly severe in areas with continuous surface disturbance. As discussed by Bartmann et al. (1992), crowding may have a density-dependent impact of reducing animal survival and damaging resources.

The impacts of human activity, including those related to minerals development and recreation, on big game crucial winter range include loss of habitat and forage occurring from surface-disturbing activities at any time of the year, and displacement and physiological stress as a result of human presence and activity during the winter. Human disturbance of big game, whether from harassment or by accident, results in increased energy costs to the alerted animal (Bromley 1985). The disturbed big game animal incurs a physiological cost either through excitement (preparation for exertion) or locomotion. A fleeing or displaced animal incurs additional costs through loss of food intake and potential displacement to poorer (lower) quality habitat. If the disturbance becomes chronic or continuous, these costs can result in reduced animal fitness and reproductive potential (Geist 1978). Phillips and Alldredge (2000) and Shively et al. (2005) demonstrated a 30% reduction in elk calf recruitment resulting from an activity as benign as simulated recreational hiking imposed during the calving season.

Large seismic projects, particularly the use of thumper trucks, negatively impact sagebrush habitats, because they provide trails for increased predator access; fragment sage-grouse habitats; crush live sagebrush and understory grass and forb species; and may potentially disrupt breeding and nesting activities.

As fields such as Jonah Field are developed to a 5-acre and 10-acre spacing, the habitat functionality would primarily be suitable only for generalist species that can still function in habitat that is highly fragmented and has a high level of human presence and noise. As reclamation and habitat succession change the habitat type, the species with more specific micro-habitat requirements could reinhabit these areas over time if populations were able to be maintained within dispersal distances for that species, and assuming that human-caused disturbances have ceased. In the Anticline Field, the assumption is that the 120-acre (from vertical wells) to 160-acre (from multi-well pads) spacing would maintain a greater expanse of habitat integrity because of the increased use of multi-well pads. Human presence and noise could still cause some species to abandon these areas because of their specific habitat requirements and intolerance of disturbance (e.g., sage-grouse).

As densities of wells, roads, and facilities increase, habitats within and near well fields become progressively less effective until most animals no longer use these areas. Although vegetation and other natural features may remain physically unaltered, wildlife make proportionately less use of areas near oil and gas facilities. Animals that remain within the affected zones are subjected to increased physiological stress. This avoidance and stress response impairs habitat function by reducing the capability of wildlife to use the habitat effectively. In addition, physical or psychological barriers lead to fragmentation of habitats, further limiting the availability of effective habitat. An area of intensive activity or construction becomes a barrier when animals cannot or will not cross it to access otherwise suitable habitat. These impacts are especially problematic when they occur within limiting habitat components such as crucial winter ranges and reproductive habitats (WGFD 2004a).

In all other oil and gas developments (Appendix 10), the assumption is that there would be between 40- and 60-acre spacing between well bores. Many of these areas such as the Big Piney/LaBarge oil and gas fields have been drilling for more than 50 years, and some of their spacing is much smaller than 40 acres (because the CAP Environmental Assessment [EA] does not have a well spacing requirement). The Big Piney mule deer herd has likely experienced a level of disturbance that has caused it to move away from development but not completely abandon its winter range, similar to the findings of Sawyer (2006).

However, there is no scientific information that supports that the mule deer herd would maintain its occupancy in these areas if oil and gas activities increase over time. The elk herds in the Wyoming Range have not experienced a high level of drilling activity or presence in their crucial winter range. Past research has shown that elk were displaced out of the high-quality winter ranges during drilling and construction activities and did not return until those activities were completed. Continued development in these areas could lead to not only native winter range abandonment in the Wyoming Range but also a loss of high-quality forage until reclamation has successfully returned these ranges to elk habitat.

Forage loss and increased human activity from surface disturbance and other disruptive activities would result in reduced wildlife species diversity, modifications in population distribution or numbers, or possible habitat abandonment. Reclaimed areas would be more vulnerable to invasion of noxious weeds and would not initially provide the same level of habitat function, forage, or cover that the original area provided. Population reductions in the planning area could also be manifested in other areas, particularly where big game herd areas include lands both within and outside the planning area. Winter range, transitional range, and migration route impacts could impact populations on the forest, the Little Colorado Desert, and as far away as Grand Teton National Park.

In 2004, the WGFD initiated a statewide monitoring protocol for key big game habitat ranges. Eleven transects have been monitored in various shrub habitats and three in true mountain mahogany habitats. Analysis of the past 2 years of data sets indicates that these shrub communities have very few young plants and are being browsed heavily. These plants are not healthy and vigorous, which limits their productivity and may be the result of several contiguous years of drought (Scribner 2006).

Annual precipitation plays an important role in plant vigor and nutrient loading for big game species. A deficiency in vegetation nutrients significantly impacts body condition during female ungulate gestation and lactation. Lomas and Bender (2007) determined fawn survival increased roughly 1.3 times and 8.8 times in New Mexico for each 1 centimeter (cm) increase in annual and summer precipitation, respectively. In addition, each percent of increased body fat in does increased fawn survival by 20 times. However, increased precipitation alone allows only small increases in population growth. For large increases, vegetation enhancements are required to increase female body condition and fawn nutrition to sufficiently produce high population increases (Lomas and Bender 2007).

Increasing forage amount will not likely improve energy balance in deer, unless those increases are accompanied by changes in the availability or nutritional value of forage. Small improvements in the condition of animals at the beginning of winter, or enhancements in forage quality that provide deer greater energy intake during winter, are likely to pay large dividends in reducing winter mortality (Hobbs 1989). Habitat improvements must be accompanied by interseeding and balanced with an appropriate grazing regime to maintain forage quality, especially in areas that may be of lesser value than the historic ranges.

Mule deer exhibit a stress response to disturbances associated with noise and activity up to 0.29 mile from the source (Freddy et. al. 1986). It is estimated that well development would reduce habitat effectiveness for mule deer within 170 acres surrounding each well pad.

The Sublette Mule Deer Study was conducted between 1998 and 2003 by West Inc.; its goal was to determine whether natural gas development affected habitat selection patterns and ultimately the distribution of wintering mule deer in western Wyoming. Following 1 year of development, 17% of the study area classified as high use before development had changed to medium-low or low use, and by year 3 of development, 40% of the study area classified as low use before development had changed to medium-high or high use areas.

Further, research conducted by Sawyer et al. (2006) suggests winter habitat selection and distribution patterns of mule deer were affected by well pad development. Changes in habitat selection by mule deer appeared to be immediate (i.e., year 1 of development), and through 3 years of development, no evidence was found that suggested mule deer acclimated or habituated to well pads. Rather, mule deer had a progressively higher probability of using areas farther away from well pads as development progressed; however, this occurred only up to a certain distance. These results reflect the ability of mule deer to avoid localized disturbances and habitat perturbations without completely abandoning their home ranges (Sawyer et al. 2006). These results were collected during the Questar winter drilling as well as the Anschutz, Shell, and Ultra winter drilling programs to indicate the effects of drilling during the crucial wintering periods. Thus far in the study, the results indicate that mule deer use patterns are changing not only because of changes in timing restrictions for surface-disturbing and human disruptive activities, but are a culmination of habitat fragmentation, year-round human disruptive activities, and placement of development.

Natural gas development on the Mesa has displaced mule deer to less suitable habitats. Within 3 years, the highest probability of mule deer use was 3.7 kilometers (km) away from well pads. The research suggests that winter habitat selection and distribution patterns of mule deer are affected by well pad development and that changes in habitat selection appear to be rapid. Mule deer progressively used areas farther from well pads as development progressed, but only moved a defined distance, suggesting home ranges would not be completely abandoned (Sawyer et al. 2006). Further, Sawyer et al. suggest that reducing the level of human activity during the production and development phases as well as limiting public access and developing road management strategies would reduce disturbances to wintering mule deer.

Disturbance may contribute to reduced reproductive rates due to reduced feeding, feeding in poor quality habitats, or feeding on rough forage (Gillin and Irwin 1985). Research conducted by Gillin and Irwin (1985) in the Bridger-Teton National Forest found seismic activity caused displacement of elk within home ranges by an average of three-quarters of a mile and into dense (greater than 70% canopy) forests with reduced forage. Displacement was observed to be rapid on spring range when calves were less than 1 month of age. Oil and gas exploration and field development in the Riley Ridge Project area was found to change elk distribution after drilling one well; after three wells were drilled, elk abandoned 6,000 acres of winter range. After drilling ceased, elk returned to the area. Further drilling activities in elk calving areas also caused elk to temporarily abandon the Lake Ridge calving area. Elk abandoned the Snider Basin calving area in 1984 and returned a year later when drilling activity left the basin. Elk have until now been able to find suitable, undisturbed habitats away from human activity; however, continued development could lead to abandonment of their historic ranges (in the last native winter foraging area on the Wyoming Range) (Johnson 1985). A study conducted by Hayden-Wing Associates (1990) found a similar response in the Graphite Hollow/Rock Creek Winter Range where elk moved 0.5 to 2.4 miles away from a well site.

Sawyer et al. (2007) indicate that the effectiveness of elk habitat in forested regions declines when road densities exceed 0.62 km/km^2 (1 mile/mile^2). Behavioral response to traffic is influenced by topography and forest canopy adjacent to roads, and in some cases, road closures have been shown to decrease elk movements and increase survival.

WGFD estimates that 170 acres surrounding each well pad is the minimum area in which impacts on pronghorn would occur (WGFD 2004a). The greater mobility and adaptability of this species to human activity and disturbed areas likely would prevent long-term population impacts. However, it is feasible that pronghorn behavior or populations could be altered at some level of development.

The acreage of wildlife habitat disturbance coupled with the level of fragmentation and human presence and noise during critical life stages determine whether wildlife would be able to remain in an oil and gas field. Research has shown that sage-grouse will tolerate one well per section within 3 miles of a lek (Holloran 2005). In addition, timing restrictions on construction and drilling during the breeding season do not prevent impacts of infrastructure (e.g., avoidance, collisions, raptor predation) at other times of the year, during the production phase (which may last a decade or more), or in other seasonal habitats that may be crucial for population persistence (e.g., winter) (Walker et al. 2006).

Greater sage-grouse populations in Sublette County and across the west have been declining over the last half of the century due to such factors as habitat degradation, fragmentation, and loss (Holloran 2005). As oil and gas development has increased in Wyoming, so has the concern over how this type of development might affect greater sage-grouse populations. Impacts of fluid mineral development on greater sage-grouse populations in developed fields would include habitat loss from well, road, pipeline, and transmission line construction; displacement from increased human activity and associated noise; increased illegal harvest; and mortality associated with evaporation ponds and increased exposure to predation (Braun 1986; Schroeder et al. 2004). Greater sage-grouse are dependent on sagebrush habitats year-round. Habitat loss and degradation, as well as loss of population connectivity have been identified as important factors contributing to the rangewide decline of greater sage-grouse populations (Braun 1998; Wisdom et al. 2002). Therefore, any activities that result in the loss or degradation of sagebrush habitats that are important to this species should be closely evaluated for their impacts on sage-grouse. It is likely that sage-grouse populations in the planning area would continue to decline at an unknown rate.

As more generations of greater sage-grouse yearlings become displaced to areas outside of the natural gas development, “refugia” habitats would become important as a reservoir population to reestablish a reclaimed natural gas field. However, if there are not adequate buffers between fields or a lengthening of the time frame between development of additional gas fields surrounding the one currently under construction (Holloran 2005; Braun et al. 2002), there may not be adequate reservoir populations available for reestablishment. Sage-grouse could repopulate an area following energy development, but there is little evidence suggesting grouse populations would attain predevelopment levels (Connelly 1999).

Other studies conducted on greater sage-grouse indicate that noise could adversely affect the communication abilities of strutting males (LaGory et al. 2001; Dantzker et al. 1999). Continuous noise emissions from industrial facilities such as compressor stations located close to active greater sage-grouse leks would interfere with sage-grouse strutting behavior (Holloran 2005). This would reduce the reproductive success of the greater sage-grouse using leks close to noise sources. All sagebrush-obligate species are affected by habitat alterations resulting in sagebrush (*Artemesia* spp.) removal and reduction of shrub patch size (Holloran 2005).

Well densities exceeding one well per 699 acres are likely to lead to declines in male sage-grouse lek attendance (Holloran 2005; Holloran and Anderson 2005; Holloran et al. 2005; Doherty et al. in press; Kaiser 2006; Lyon and Anderson 2003; Walker et al. in press). Overall declines in male lek attendance approached 100% when the distance from leks to drilling rigs, producing wells, and main haul roads decreased, in conjunction with an increase in the number of wells within 5 km and the total length of main haul roads within 3 km (attributed to traffic volume and vehicle activity during the strutting period) of the lek (Holloran 2005). In the Powder River Basin in Buffalo, Wyoming, research on the effects of CBNG production on sage-grouse populations conducted by Walker et al. (2006) indicated that from 2001 to 2005, the number of males observed on leks in CBNG fields declined more rapidly than on leks outside of CBNG fields. Of leks active in 1997 or later, only 38% of 26 leks in 26 CBNG fields remained active by 2004–2005, compared to 84% of 250 leks outside CBNG fields. By 2005, leks in CBNG fields had 46% fewer males per active lek than those outside of CBNG fields. Finally, active leks in energy-developed

areas are experiencing a lack of yearling male recruitment. Assuming a yearly male mortality of 50%, a lek could become inactive in 4–6 years if yearling sage-grouse recruitment does not occur (Kaiser 2006). Sage-grouse are closely tied to sagebrush habitats throughout their annual cycle, and variation in the amount of sagebrush habitat available for foraging and nesting is likely to influence the size of breeding populations and persistence of leks (Walker et al. 2006). Walker et al. (2006) found that maintaining extensive stands of sagebrush habitat over large areas (6.4 km or more) around leks is required for sage-grouse breeding populations to persist. Walker et al. (in press) have determined that current lease stipulations that prohibit development within 0.4 km of sage-grouse leks on federal lands are inadequate to ensure lek persistence and may result in impacts to breeding populations over larger areas. Seasonal restrictions on drilling and construction do not address impacts caused by loss of sagebrush and incursion of infrastructure that can affect populations over long periods of time.

In addition, female sage-grouse are known to have a high fidelity to their natal nesting habitat; it could be 5–9 years before the nesting population response to a gas field development is realized (Holloran 2005). Yearling female sage-grouse displaced from their natal habitat have been found to have a lower nest initiation rate than those that remained, perhaps because of unfamiliarity with the habitat (Kaiser 2006). Over time, female sage-grouse chose nest sites farther from active drilling rigs and producing gas wells, suggesting a long-term avoidance of active natural gas developments (Holloran 2005).

Inglefinger (2001) found that for lands within 328 feet (100 meters [m]) of a road or well pad, the density of sagebrush obligate birds drops by 50 % regardless of the amount of activity on the road.

Mineral development would likely deplete water from the Colorado River system. Water depletion can affect fisheries locally and downstream from the planning area. Though not calculated in this land use planning document for each alternative (amounts will be handled through site-specific environmental documents by project and proponent), depletions may affect, and are likely to adversely affect, Colorado River sensitive species.

The direct impacts on recharge of surface water resources from groundwater sources because of CBNG development are variable, depending on the connectivity of surface water resources to the target groundwater aquifer. Reduction of recharge to streams and wetlands that might be of importance to aquatic populations could occur if the groundwater and surface water resources were connected. Based on the depth of targeted coal formations (1,200 to 5,500 feet) and high pressures in most reservoirs, it is unlikely that a connection to surface waters would exist.

Surface-disturbing activities associated with well pad construction would increase sediment delivery to stream and standing water systems, which could interfere with fish life stages. Clean gravels are required by most salmonid fish species for successful spawning. Increased sediment delivery can embed these gravels and render spawning efforts unsuccessful. In addition, habitat fragmentation has been shown to interfere with the metapopulation dynamics of many fish populations. When extirpations occur because of localized environmental variation, restrictions on fish passage eliminate the possibility of the area being recolonized from a neighboring population.

Evaporation ponds built for produced water from producing natural gas wells contain waters that are highly alkaline and contain very high concentrations of salt. Waterfowl and shorebirds become attracted to these ponds and over time become encrusted; this can cause death from excess salts in the body from preening; birds can drown from the excess weight, or they can suffer from cold stress resulting from the loss of insulation from their feathers (USFWS 2006). Making these areas less attractive to birds would mitigate this situation.

The potential for locatable minerals production in the planning area is low. However, if locatable minerals were developed, impacts would include displacement of wildlife from developed areas, avoidance of a larger area around the development because of human presence and noise, and possible offsite impacts, including erosion and sedimentation of streams.

Salable minerals extraction would result in short-term, direct impacts on wildlife and associated habitat. Impacts would include displacement and disturbance of animals, removal of vegetation, and loss of habitat. The level of impacts would be dependent on the size of the salable minerals area and the importance of the altered habitat to wildlife. Many sand and gravel areas are associated with riverine and alluvial plains; their development would impact these areas. The vegetative communities normally associated with these areas would be significantly impacted by the extraction of salable minerals. Cottonwood communities normally associated with these minerals would be impacted by potentially lowering the water table, resulting in loss of these communities. Aeries for nesting birds such as great blue herons, bald eagles, and habitat for numerous waterfowl and neotropical migrants that rely on many of these communities would be lost. Many big game species rely on these areas during the winter to provide cover from the elements.

The extraction of salable minerals would also potentially alter water tables and possibly impact stream channels if development were to take place close to adjacent riparian areas. This would lead to increased sediment loading and siltation, impacting fish populations and their prey base.

Management actions for paleontological resources likely would provide varying degrees of habitat protection by minimizing vegetation loss and erosion and by restricting surface-disturbing activities. Wildlife disturbances could occur if public interpretation facilities generate increased human presence during sensitive seasonal periods (e.g., breeding, nesting, or migration); however, it is not likely that substantial human presence would occur during the winter period.

Recreational activities that result in increased human presence would have localized impacts on wildlife and fish species. These activities would include hiking, biking, camping, boating, fishing, hunting, and sightseeing. Although many recreational activities are nonconsumptive, they can have an impact on wildlife and fish and their habitats. Increased human presence could result in habitat or water quality degradation or wildlife disturbance (e.g., dispersal or avoidance). If recreational activities were conducted on noncrucial habitats or during seasons when sensitive wildlife species are not present and in compliance with recreation management actions, impacts likely would be minimal. During seasonally sensitive periods (e.g., winter, parturition, breeding, nesting, and early brood rearing), recreational activities could significantly alter animal behavior and result in increased winter mortality or lowered reproductive success.

The installation of recreational facilities, particularly in new areas, could disturb habitat during construction, permanently alter the habitat, or lead to increased human presence that could disturb wildlife. Animal avoidance of developed areas would be similar to that seen for any other type of development in wildlife habitat.

In addition to the stressors from BLM-permitted activities on game animals (big game, small game, furbearers, and game birds), these animals are hunted seasonally. Pursuit of game animals during hunting seasons may provide additional short-term stressors. Hunting seasons vary from weeks to months depending on the game species and are designed to harvest animals to maintain established population objectives and/or maintain populations at or below sustainable habitat thresholds (carrying capacity).

In general, OHV management decisions that result in increased human presence would have a moderate, localized impact on wildlife and fisheries. Impacts would include increased displacement of wildlife,

increased stress during critical time periods, and degradation of habitats. OHV use can alter the seasonal use patterns of many wildlife species. The use of snow vehicles on winter range could lead to excessive wildlife disturbance, causing additional stress, more rapid depletion of fat (energy) reserves, and in extreme cases, death. New roads created from the extensive use of OHVs could result in access to areas that normally do not contain human presence; habitat degradation through vegetation loss; access for predator species, creating competition for species such as Canada lynx; and soil compaction, causing accelerated erosion or preventing water infiltration.

Use of transportation and access routes has the potential to fragment wildlife habitats and degrade vegetation communities by increasing erosion and stream sedimentation. Vehicle-wildlife collisions could increase in areas of high wildlife use and high human activity.

Road closures and subsequent reclamation would benefit fish and wildlife by improving habitat and water quality. Closure and reclamation of unnecessary roads could reduce fragmentation and restore habitat integrity while reducing the potential for wildlife disturbance.

Management actions to prevent the reoccurrence and spread of invasive and noxious weeds would maintain the native vegetative species that provide wildlife forage and habitat. Certain species of noxious weeds are poisonous and potentially fatal to some wildlife species.

Water impoundments change the hydrologic characteristics of the watershed and impact fish habitats by altering water temperatures and the timing and volume of flow, minimizing the effects of flushing flows and altering sediment transport within the system. In addition, impoundments constructed on streams containing populations of fish, invertebrates, or amphibians could limit movement between required habitats. Reservoirs with habitat sufficient to support salmonid populations would increase habitats available for potential trout fisheries. In addition, small reservoirs (including beaver dams) can improve stream flow, especially later in the season, by increasing water storage in the soil profile and releasing it gradually.

In general, water depletions occur when water is removed from flowing rivers and streams, or when water is pumped from groundwater aquifers that recharge (are directly connected with) rivers and streams. Groundwater and surface water interaction typically occurs in shallow aquifers; increased depths reduce the likelihood of impacts from groundwater pumping.

Fencing of springs and seeps to protect water sources would help to maintain flow conditions supportive of fish populations. The use or implementation of grazing BMPs would help to maintain or restore habitat conditions for a variety of fishes. Rangeland and vegetation monitoring and grazing management decisions would help to ensure that livestock grazing does not significantly impact wildlife habitats.

The health of fisheries within the planning area is directly related to the overall health and functional capabilities of riparian resources, which in turn are a reflection of watershed health. Any activities that affect the ecological condition of the watershed and its vegetative cover would directly affect the aquatic environment. Any substantial disturbance to soils or changes in vegetative cover would have an effect on watershed health and water quality and would therefore have an effect on associated fisheries. The degree of impact attributed to any one disturbance or series of disturbances would be influenced by location within the watershed, time and degree of disturbance, existing vegetation, and precipitation. Water quality and watershed management actions designed to achieve PFC in riparian areas would improve fish habitat in areas not currently at PFC.

Surface disturbances near streams and watercourses would result in accelerated erosion and runoff, increasing stream flow and sediment and nutrient loads to local channels. Sedimentation of a given

channel could impact fisheries by reducing habitat complexity, resulting in a lower diversity of prey organisms. Increased turbidity would also result from increased sediment input, decreasing light penetration and inhibiting visual predation by fish. Surface disturbance near streams that results in substantial removal of riparian vegetation could increase current velocity, putting additional strain on fish and reducing nutrient cycling. In addition to increased sediment input, stream bank disturbance could impact fisheries by creating bank instability, which could alter flow and destroy pool-riffle formations necessary for fish survival. Increased nutrient loading of streams could also impact fisheries by increasing primary production above natural levels, which would degrade habitat and decrease oxygen levels. Since any impact on natural water resources is also an impact on fisheries, impacts on fisheries can be inferred from Section 4.15, which discusses impacts on riparian areas and water quality. Four endangered species outside of Wyoming are affected adversely by water depletions within the planning area due to changes in water quantity, timing, and flow. See the biological assessment that meets the requirements for ESA Section 7 consultation.

Wildlife species have adapted to survive the pattern of fire frequency, season, size, severity, and uniformity that characterized their habitat in pre-settlement times. Historically, low-intensity fires created mosaics resulting in more variability in vegetation seral stage, species composition, vertical stratification, and improved herbaceous understory. If the fire frequency or severity increases or decreases from pre-settlement patterns, habitat for many species would decline. Animal-fire studies have shown a reorganization of animal communities in response to fire, with increases in some species and decreases in others (Smith 2000). In areas where fire exclusion has changed species composition and fuel arrays over large areas, subsequent fires without prior fuel modification are unlikely to restore pre-settlement vegetation and habitat. In the last 10,000 years, fire in North American ecosystems has not operated in isolation from other disturbances or has occurred independent of human influence (Smith 2000).

Over the past several decades, human intervention in fire suppression has led to unnatural fuel-loading conditions that could allow wildfires to burn with greater intensity. These unnatural fuel loading conditions have occurred primarily in the sagebrush/grass ecosystems, the transition areas between the sagebrush/grass and limber pine/ juniper woodlands and some xeric Douglas fir sites. The long return interval stand replacement regimes found in the lodgepole pine and spruce-fir forests within the planning areas have been affected to a much lesser extent. Using fire as a habitat management tool in a sage-steppe ecosystem may have effects if improperly used such as by converting desirable shrub and perennial grass stands to annual grasses or maintaining annual grass communities.

Prescribed fire and wildland fire could have both short-term and long-term effects on wildlife. In the short term, animals would be displaced from habitats, small game and ground-nesting birds could be killed, and vegetation and forage would be removed. Any fire would cause some loss of less mobile wildlife that may not be able to avoid the fire path. Surface disturbance associated with fire line construction, the use of heavy equipment, and other fire suppression activity could damage or destroy vegetation and habitat.

Fire would generally improve habitat conditions for most species over the long term. Fire would reduce dense understory that has mixed values for various species of wildlife. If a fire consumes great volumes of plant material in a forest, the ash may serve as an important fertilizer (USDA 2004). In vegetative climax communities, fire would return the vegetative community to an earlier stage of succession, increasing forage and cover for a greater diversity of wildlife. Fire can result in removal of excess dead and dying trees, reducing hiding cover for prey species, potential thermal cover in the winter months, and lynx denning and rearing habitat. However, in the long term, fire would increase denning habitat by increasing horizontal cover with log and limb fall. Additional aspen growth after a fire would be available for instream uses by beavers, which would generally improve habitat conditions for a variety of fish and wildlife species. The extent of effects on wildlife that result from fire depends on the extent of change in habitat structure and species composition caused by the fire. Stand replacement fires typically alter the

animal community more dramatically than understory fires (Smith 2000); however, at the species-specific level, such as the Canada lynx, understory fires may have greater impacts because their primary prey species (the snowshoe hare) depends on the understory shrub structure.

Prescribed burns would usually be conducted during the spring or fall. These fires would generally be "cooler" than summer wildland fires and typically would not severely sterilize soils or the nutrients found in the ash of fire. Prescribed fire could increase the nutrient content of shrubs. A slight and short-lived increase in protein in grasses could also occur (Jourdannais and Bedunah 1990).

Big sagebrush is completely killed when burned (USDA 2004). Prescribed fire intensity could be sufficiently high to kill seeds in the upper part of the surface litter, or in the inflorescence. Those seeds on or under the mineral soil surface may survive (USDA 2004), reducing the reestablishment of sagebrush seedlings postfire. Removal of large tracts of sagebrush in sage-grouse nesting habitats has resulted in major declines in sage-grouse breeding populations (Connelly et al. 1999). Studies of the effects of burning mountain big sagebrush have shown that the canopy cover had not recovered to provide appropriate nesting habitat for sage-grouse 14 years after burning (Connelly 1999). In addition, the biological soil crusts that are important in binding the soil, increasing soil moisture infiltration and retention, and nitrogen fixation (Rosentreter 2003) in a sage community may be compromised by a high-intensity fire.

An increase in wildland and prescribed fire frequency, coupled with drought, has contributed to the decline of the quality and quantity of sage-grouse nesting and brood-rearing habitats, as well as overall population declines (Slater 2003). This has created long-term impacts on sage-grouse populations where sagebrush recovery occurs between 15 and 40 years, depending on the species of sagebrush (Slater 2003). If fire return intervals occur between 100 and 200 years in arid mountain big sagebrush/western needlegrass communities (Brown 2000), the role of fire as a sagebrush habitat management tool may be questioned. Areas that have been burned could be unable to consistently produce forbs, and have been found to have a reduction in the number and diversity of insect species that are the main dietary components for sage-grouse broods (Connelly et al. 1999). Slater (2000) found sage-grouse use for loafing and feeding in prescribed and wildland burned habitats occurred primarily in areas 60 m from the burned/unburned edge. The burn areas did not contain greatly improved brood-rearing habitat; however, females were able to find select areas to take their young. Where suitable greater sage-grouse nesting or winter concentration habitats are adversely impacted, the length of time to return these areas to a suitable state would be extensive.

Numerous residential and neotropical migrant bird species would be directly impacted by loss of habitat from wildland fires. The duration of habitat loss would depend on the types of vegetation removed and the fire severity.

Vegetative treatments in some upland areas could increase water yields and affect fish habitats. These effects are likely to be highly variable depending on local hydrologic characteristics and fish community interactions and are generally short term. Increased inputs of carbon to sterile aquatic habitats (aquatic habitats associated with acidic soil types) that result from fires could cause localized impacts on fish populations, spawning beds, and aquatic habitats. An increase in carbon could create higher nutrient loads for micro-invertebrates; however, these increases show short-term benefits (2–5 years) until the carbon loading subsides.

Habitats used by greater sage-grouse have been widely altered by land management practices, resulting in vegetation manipulations during the last 150 years (Braun 1987; Connelly and Braun 1997; Schroeder et al. 1999, 2004; Rowland et al. 2004). By 1974, about 10% to 12% of the 40 million hectares of sagebrush steppe habitats in North America had been treated to provide forage for livestock (Rowland et al. 2004).

Overall, more than 80% of sagebrush steppe habitats have been altered in some way by human activities (Rowland et al. 2004).

The management of wetland/riparian areas to improve their PFC rating would improve habitat conditions for various fish and wildlife species. Because the PFC assessment methodology does not incorporate the habitat requirements of fish and wildlife, additional management would be necessary to ensure that habitats provide conditions suitable to meet the life history requirements of various fish and wildlife species.

Chemical and mechanical fire management equipment would potentially result in habitat degradation through the creation of roads for fire control equipment. Use of chemicals and other fire suppression measures would potentially degrade vegetation and water quality, altering the type of forage available and the quality of water available for wildlife in the area. The duration of the impacts would vary depending on the type of methods employed and the habitat type being treated.

Fire suppression agents contain chemicals that can be detrimental and poisonous to macro-invertebrates that are a necessary food source for numerous fish and wildlife species. Some of these fire suppression chemicals are also directly poisonous to some fish and wildlife species.

There has been research documenting the benefits of vegetation manipulation for big game species; however, there has been no documentation on the effects or the need of such manipulations in the planning area to improve sage-grouse nesting habitat.

Wildlife management would prevent or reduce impacts on wildlife species and habitat resulting from surface-disturbing and other disruptive activities through the implementation of mitigation and BMPs, such as timing stipulations and designation of spatial buffers. These stipulations would provide some mitigation for loss of habitat function or habitat value for wildlife or fish species, including Special Status Species.

Human disturbance near raptor nest sites could result in the abandonment of the nest; high nestling mortality from overheating, chilling, or desiccation when young are left unattended; premature fledging; and ejection of eggs or young from the nest. Raptors that successfully nest during a disturbance may abandon the nesting territory the following year. Responses of nesting raptors to human disturbance typically are determined by the type, duration, magnitude, noise level, and timing of activity relative to nesting phenology. Although some level of habituation to disturbance could occur, repeated flushing of adult raptors increases energy expenditure during foraging and decreases energy ingestion, depleting energy reserves and resulting in premature mortality during harsh conditions. Evidence suggests that some falcons, ospreys, and owls are generally more tolerant of human-induced disturbance and human environments; golden eagles, turkey vultures, northern harriers, Cooper’s hawks, northern goshawks, and sharp-shinned hawks appear much less tolerant; and buteos exhibit a wide range of acceptance levels; however, some speculate that ferruginous hawks should be considered the raptor most sensitive to human disturbance. Raptors are less tolerant of disturbance when populations of prey species are at low levels (Romin and Muck 2002).

Careful placement of future water injection wells is essential for the continued protection of sensitive habitats and future wildlife population expansion. Injection facilities have continued human presence and truck traffic.

Protection of habitats for Special Status Species ensures that suitable habitat would be available for dispersal areas, territory shifting, and recruitment. In addition, the protection of species and habitat during sensitive life cycles is essential to species survival and could prevent future ESA listing. Avoidance is the

only known effective mitigation strategy for sensitive species such as the white-tailed prairie dog and the pygmy rabbit. If there are known occurrences of these species and their habitats cannot be avoided, pygmy rabbits and white-tailed prairie dogs could leave their burrow systems and be displaced into existing territories or be killed by surface-disturbing activities. Pygmy rabbits have small home ranges, and habitat isolation can be detrimental to maintaining viable populations and genetic integrity. Most of the known occurrences of the white-tailed prairie dog occur within the Jonah and Anticline Fields. The impacts of intense development have not been studied to date, and the planning area could face extirpation of the white-tailed prairie dog if mitigation efforts fail. Populations of pygmy rabbits are being found in many different areas throughout the planning area. There could be more mitigation opportunities for the pygmy rabbit when survey efforts delineate the full extent of their range.

Winter big game habitat is more sensitive to logging, road construction, and vegetative change than other seasonal habitats. Since winter habitats are considered the “limiting factor” to these big game populations, significant modifications to habitat suitability can impact species survivability and viability (e.g., higher winter mortality, reduced reproductive success), ultimately leading to reductions in population size. This impact would be intensified in areas where winter range habitat is in unsuitable condition.

Big game migration routes have been used for hundreds or thousands of years. Development of all types could narrow or interrupt important corridors. Wildlife could be prevented from accessing crucial habitat, with herds displaced to less desirable locations or locations unwanted by the public, or out-competed by other species.

The management actions afforded to SD/MAs would generally result in impacts on wildlife. Protections aimed at conserving vegetation and limiting surface-disturbing activities would benefit wildlife by preventing surface-disturbing and other disruptive activities in sensitive habitats. Further analysis is provided in the discussions for each SD/MA.

The WSAs would benefit wildlife and fish species and their habitats by restricting surface-disturbing and other disruptive activities and preserving wilderness characteristics. Loss or alteration of high-value wildlife habitat would be minimized in the WSAs.

Any offsite mitigation actions must be carefully analyzed, with baseline vegetative information collected before the project is designed, to facilitate the use of proper management techniques for the circumstances of the location and the species that use the habitat. Projects not taking these issues under consideration may create long-term population instabilities.

4.17.4 Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 1.

The identification and preservation of cultural properties would indirectly affect wildlife and fish by restricting surface disturbance and helping maintain the integrity of habitat in the area. Authorized excavation of cultural sites would have local impacts on wildlife and their habitats through displacement of animals and disruption of wildlife use of the site (particularly for species with small home ranges and specific habitat requirements). These impacts would be of unknown duration. Cultural site excavations could increase erosion or stream sedimentation, potentially impacting fish spawning. However, the extremely localized nature of cultural excavations would minimize the likelihood and magnitude of these impacts.

The forest management unit's objectives were designed to minimize impacts on elk and CRCT. Forest management actions could impact feeding, breeding, and sheltering of raptors and other forest-dependent species. Habitat fragmentation and degradation, increased human presence, and habitat access by competitor species that normally cannot use these areas could all be impacts on these species, depending on whether the action is a harvest or thinning, where the access roads are constructed, the type of equipment used, and the rate of habitat rehabilitation.

Land tenure adjustment actions could impact wildlife and fisheries, depending on the future use of the habitat. Even uses that maintain open spaces could have an impact if the habitat is altered. Approximately 6,400 acres were identified as suitable for future consideration for disposal, and another 14,500 acres were identified as suitable for consideration for disposal only by exchange (Appendix 14).

Disposing of all acres that meet the FLPMA disposal criteria could fragment sensitive habitats. Exchanging parcels rather than using other disposal methods could ensure that sensitive habitats remain secure, prevent further fragmentation, and address management gaps caused by isolated private landholdings. Disposing of or exchanging parcels containing riparian/wetland and aquatic resources could reduce available habitat for migratory songbirds (including the yellow-billed cuckoo) and sensitive fish, as well as crucial moose winter range and sage-grouse brood-rearing areas. An exchange could be beneficial if the habitat acquired is high quality and contains a great wildlife and fish diversity.

Land acquisitions could increase the overall quantity or quality of wildlife habitat within the planning area. Land exchanges to acquire state and private lands in crucial habitats in important and predominantly federal MAs likely would result in long-term habitat sustainability.

Routing linear ROWs (e.g., pipelines, power lines, roads) where impacts would be least disturbing would help to minimize fragmentation of sensitive habitats. However, habitat fragmentation would still occur as more ROWs are located and developed or as an existing ROW corridor is expanded. Restricting communication tower heights and requiring towers to be nonguyed would reduce impacts on migratory birds, including collisions during periods of low visibility.

Allowing wind energy development throughout the planning area would create collision hazards for bats, multiple avian species, and greater sage-grouse. Large wind energy fields also involve surface disturbance, which could permanently change the habitat structure of the wildlife inhabitants.

Designing livestock grazing systems to limit forage competition between livestock and wildlife for forbs, shrubs, and other desirable plants would aid in wildlife survival at critical times of the year. It would be particularly critical in the spring, when enhanced nutrition is essential following the demands on body reserves during the winter, to maintain residual grass cover for sage-grouse nests, or to maintain greater forb diversity for juveniles (e.g., sage-grouse chicks).

Maintaining livestock grazing AUMs in areas of intense industrial activity could result in lower sage-grouse nesting success and increased big game forage competition. Many of these industrialized areas correspond to sensitive wildlife habitats (e.g., big game crucial winter range and migration routes, greater sage-grouse nesting and winter concentration areas). Without an appropriate reduction in AUMs, the combination of industrial development and livestock grazing could severely impact the suitability of these areas for wildlife. Where wildlife are being displaced from important habitats by human activity and industrial development, the additional impact of competition with livestock for forage could be detrimental to the local wildlife population.

Allocating forage increases realized from management prescriptions and range improvement practices to wildlife and livestock could potentially benefit wildlife species by increasing the amount of forage

available. Forage increases achieved through vegetation treatment practices would be temporary, because the vegetative community is successional. Active management of vegetation treatments would improve grazing conditions, potentially decreasing competition for forage between big game and livestock. Any increases in AUMs allocated to livestock (increasing permitted use) would have the potential to increase forage competition with wildlife.

Water projects developed on crucial winter ranges could lead to a redistribution of livestock on those ranges, which could result in the loss of sufficient forage to maintain wildlife during the winter. Loss of forage could cause wildlife redistribution, particularly big game, to areas that might be occupied by other big game herds, to areas containing a lower quality habitat, or to private lands. Because native winter habitats can only support a limited wildlife population, this could result in increased winter mortality and reduced species viability. Restricting placement of mineral supplements within 500 feet of live water or wetland/riparian areas would minimize soil compaction and subsequent runoff near surface waters.

Approximately 1,026,780 acres would be available for oil and gas leasing and development. Timing and distance mitigation would be applied to protect sage-grouse, raptors, and big game and their habitats; however, there is no current scientific evidence that proves these actions are enough to maintain these species in their current habitat ranges.

It is estimated that a total of 7,192 wells (5,162 vertical wells and 2,030 directional wells) (5,452 pads) would be developed under Alternative 1. The acres disturbed (43,022 acres of initial surface disturbance; 17,372 acres of long-term disturbance) would take place in some important habitats, such as crucial big game winter range and sage-grouse habitats. For some species (e.g., sage-grouse), the impacts of long-term and short-term surface disturbance are the same if the level of human presence is maintained. In addition, habitat fragmentation would be greater in areas that have a higher proportion of vertical wells.

Discharge of continuous flows of water into drainages not adapted to continued flows would lead to stream channel geomorphic adjustments, including downcutting, widening, and straightening, which would reduce the diversity of habitats required by fish life stages (i.e., juvenile rearing habitats, spawning habitats, and refuge habitats).

The impacts on fisheries from surface discharge of produced waters would be variable and depend on both the quantity and quality of the discharged waters. Discharge of produced water resulting from natural gas extraction from coal reservoirs to surface water features would affect fisheries by altering local hydrologic conditions of receiving water bodies. If the discharged water were of lesser quality than receiving water bodies, fish could be affected either directly (e.g., through increased water temperatures) or through the processes of bioaccumulation of metals and salts. Fish adapted to highly turbid rivers would be impacted by the discharge of clearer waters. In addition, decreasing the intermittence of flows would favor introduced fish over native fish that have evolved in the presence of a highly variable environment.

The NSO designation in the Rock Creek watershed area would prevent disturbance to sensitive habitats and destruction of vegetation associated with minerals development and reduce the potential for increased erosion, sedimentation of surface water, and human-caused wildlife disturbances. Pursuing a withdrawal would help further prevent these impacts from occurring. Prohibiting forest management activities within the drainage area would eliminate habitat disturbance associated with forest management (e.g., loss of wildlife habitats, including fragmentation) and prevent excess erosion and sedimentation in the drainage area.

Seasonal limitations on geophysical activities would be beneficial for wildlife during the critical life stages of the limitation; however, depending on the type of equipment being used, geophysical

exploration could result in fragmented and degraded habitat for those species after the exploration is completed.

If coal lease applications were approved, the appropriate mitigation measures would be developed. The extent of wildlife and fish impacts could be extensive, depending on the extent and location of the coal development. Activities could cause wildlife avoidance and habitat destruction within the footprint of the development. Development of other leasable minerals (e.g., geothermal steam, coal, sodium, oil shale, phosphate) would have the same impacts as traditional oil and gas development on wildlife. Depending on the scale and location of the disturbance to critical wildlife habitats, the effects could be more immediate.

Withdrawals of NRHP-eligible sites from mineral location would indirectly help to preserve wildlife habitats in the vicinity of the sites.

OHV use restrictions would limit the potential for the proliferation of unauthorized trails and related habitat degradation and wildlife disturbance. OHV Open areas would be provided for recreational use; these include the Big Piney, Mount Airy, and Desert General Use areas (247,250 total acres). All of these areas have a sensitive wildlife component during a particular season of use, which includes big game migration and winter foraging and greater sage-grouse and raptor nesting. OHV use in these open areas would alter wildlife use patterns and reduce avian nesting success and cause nest abandonment.

Limiting OHV use to existing roads and trails (662,060 acres) and closing areas to OHV use (13,620 acres) would help to protect wildlife from human-caused disturbances or to sustain habitat integrity and water quality by preventing vegetation loss or soil erosion and compaction. Restricting and closing OHV use in crucial big game winter ranges and the elk feedgrounds would increase fitness and decrease displacement to areas of lower quality habitats. Avian and sage-grouse nesting success could be higher than in areas of high OHV use, and fitness could also be higher because of reduced stress of displacement.

Impacts on wildlife and fisheries could result from management of the Boulder Lake, Scab Creek, and Upper Green River SRMAs. The installation of facilities could directly disturb wildlife, permanently alter the habitat, or lead to increased human presence that possibly results in wildlife abandonment of those areas.

Management actions under Alternative 1 could include reductions in livestock numbers, adjustments in grazing distribution patterns, fencing, herding, livestock conversions, and so forth. Alternative 1 prioritizes riparian management objectives and does not discuss any other habitat types.

Avoiding surface-disturbing and other disruptive activities in identified 100-year flood plains; areas within 500 feet of perennial waters, springs, wells, and wetlands; and areas 100 feet from the inner gorge of ephemeral drainages would help to maintain the functionality of aquatic ecosystems for various fish and amphibian species.

Implementation of the East Front Aquatic and Upper Green River Habitat Management Plans (HMP) would contribute to the increase of these populations and could provide for further insight into BMPs for these species.

Gray wolves have been known to forage from elk feedground to feedground within the planning area throughout the winter. Feedground elk no longer have the ability to move to lower elevations and disperse during the winter. There has also been no evidence of gray wolves limiting the elk herd populations by unnecessary killing. Ungulates are the primary food source of gray wolves, and gray wolves within the Greater Yellowstone area primarily feed on elk. The kill rate is one every 14 days (Carbyn 1983).

Maintaining the elk feedgrounds under this alternative would continue the pattern of elk use and elk-predator relations that currently exist in the planning area. Elk would continue to gather on the feedgrounds and spend much of the winter in close association. In addition to brucellosis, which is currently present in the herds, other diseases such as bovine tuberculosis and chronic wasting disease could spread more rapidly through the population if they are introduced to the area.

The feedgrounds would continue to provide winter sustenance for elk, preventing elk from using or destroying private haystacks and fences and from mingling with livestock on winter feed lines.

The Rock Creek ACEC (proposed) and the Deadline-Graphite elk winter range would provide elk winter range outside of the area currently subject to oil and gas exploration, in addition to habitat for a pure strain of CRCT.

Limiting vehicle use in the Beaver Creek ACEC would protect sensitive vegetation, riparian areas, water quality, and wildlife and fish habitats. This restriction would prevent the pioneering of new access routes that could result in habitat degradation and wildlife disturbances. Management actions associated with VRM Class III designation would limit intensive development or surface disturbance. Limiting development on slopes greater than 25% and within 1,000 feet of streams would help to reduce erosion, degradation of water quality, and destruction of habitat and nesting sites. Timber management activities would have the potential to damage vegetation and cause excessive erosion and sedimentation of surface water. Wildlife habitats would be altered, and the potential exists for increased wildlife disturbances that could cause dispersal or avoidance (both temporarily and permanently). Reducing the potential for road proliferation would alleviate fragmentation impacts on wildlife. Limiting stream crossings to lower elevations and gentler slopes and prohibiting creek diversions unless they benefit the CRCT would reduce the potential for adverse impact on fish habitats.

4.17.5 Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 2.

The impacts of locatable and salable minerals would be the same as under Alternative 1.

Alternative 2 would include fewer restrictions to protect cultural resources, which could indirectly increase the level of impact on wildlife and fish habitat from surface-disturbing activities. Actions prohibiting surface-disturbing activities and occupancy would indirectly benefit wildlife habitats that overlap sensitive cultural sites. However, because of the discrete areas that are typically associated with cultural sites, this would mainly benefit species with small home ranges or whose habitat requirements cover smaller areas (e.g., pygmy rabbits); areas outside of the buffers are not offered these measures, resulting in habitat fragmentation and displacement.

The actions proposed under Alternative 2 would remove more forested habitat per year than those proposed under Alternative 1. In some areas this approach could be beneficial for the overall health of a stand. Forest management actions involving conifer-encroached aspen stands would result in the rejuvenation of decadent aspen stands and providing cover and forage resources for wildlife. Multiseral stages of aspen and associated understory provide multiple benefits to many wildlife species. In addition, maintaining forest health is beneficial to streams and fisheries. However, forest management actions could lead to loss of important lynx habitats in a particular Lynx Analysis Unit (LAU).

Land tenure adjustments proposed under this alternative would have various effects on wildlife and fisheries. Approximately 5,000 acres of BLM-administered public lands would be available for consideration for disposal (Appendix 14); this would allow fewer acres for disposal than under Alternative 1. Whereas Alternative 1 emphasizes that exchange for these lands is preferred, this is not proposed under Alternative 2; nor is the acquisition of lands in big game migratory pathways or other important wildlife habitats. Alternative 2 focuses on responding to the community needs of expansion and development. Many of the big game migratory pathways are being bottlenecked because of housing/community and mineral/industrial development in migration corridors. Further disposal of these lands would either exacerbate the existing issues (displacing mule deer and pronghorn farther onto private land) or cause abandonment of these historic pathways. Disposal of lands in riparian zones and crucial habitats could impact wildlife and fish species and their habitat by disrupting migration routes and limiting the availability of high-quality crucial winter range, calving and fawning, and brooding and nesting areas.

This alternative provides more opportunity for energy-related ROWs; Alternative 1 designated only two corridors. There is no designation of ROW exclusion areas under Alternative 2; in fact, there is more of an opportunity for an exception to this exclusion under this alternative, resulting in an increase in the level of related disturbance to wildlife and fish habitats.

Alternative energy developments would be permitted throughout the planning area. New developments could permanently discourage specialist wildlife species from reinhabiting those areas. For example, wind energy developments could cause adverse impacts on wildlife from collisions and habitat fragmentation and degradation.

Produced water disposal pits and discharge flow of produced water into existing drainages could create more hazards to wildlife and fish. Produced water from producing natural gas wells can be highly alkaline and contain very high concentrations of salt (USFWS 2006). Waterfowl then accumulate high concentrations of salt in their feathers, causing them to drown from the excess weight, or they ingest it, accumulating the salt in their tissues. This discharge flow would be constant, which could change the soil chemistry of these drainages and increase salinity in fish habitat downstream.

The goals of the livestock grazing program to maintain forage production and ecological conditions while maximizing commodity production may not meet the needs of wildlife and fish species. Competition between livestock and wildlife for forage would be increased with maximization of commodity production. Enhancement projects would be insufficient to replace habitats lost to development and commodity production.

Activating suspended, nonuse AUMs (Table A20-1) would have impacts on wildlife and fisheries. Increased grazing could reduce suitable wildlife forage, displacing animals into areas that may not contain sufficient nutrients (decreasing fitness into the winter) or into private hayfields. Soil compaction could occur to the extent that optimal plant growth is not achieved or erosion is accelerated.

Allowing livestock water developments wherever necessary to facilitate livestock operations could lead to longer periods of grazing by livestock on crucial winter ranges or other important habitats, resulting in the loss of sufficient forage needed to sustain wildlife during the winter. Cattle would be introduced into areas they may not have typically grazed because of the lack of water. The loss of forage could cause the displacement of wildlife species to other areas already occupied or to private lands. This would limit the areas where there is no forage competition and could result in further habitat degradation for some species. Because these areas can only support a limited number of wildlife, a reduction in the overall wildlife population could result.

By emphasizing livestock production in grazing systems, any forage increases realized from management prescriptions and range improvement practices would be allocated to livestock. In addition, vegetation treatments could be detrimental to sage-grouse nesting habitats if the treatment is designed solely to increase grass production.

Approximately 866,990 acres would be open to leasing consideration, subject to the terms and conditions of the standard lease form (Map 2-2). Wildlife would be directly impacted through the loss and fragmentation of crucial winter habitats, potentially causing redistribution or avoidance of some areas. Additional wells would impact fisheries through increased surface runoff, causing stream siltation and sediment loading.

It is estimated that 7,804 wells (5,614 vertical wells and 2,190 directional wells) (5,924 pads) would be developed under Alternative 2. The number of disturbed acres is larger than under any of the other alternatives (46,739 acres of short-term disturbance; 18,689 acres of long-term disturbance). Development would take place in critical and sensitive habitats, such as crucial big game winter range and sage-grouse and white-tailed prairie dog habitats. Impacts on the Intensively Developed Fields could be to the extent of local population abandonment (except for the generalist species or those that adapt to habitat loss and high levels of disturbance). Timing limitations have been found to be inadequate to maintain species such as sage-grouse in a developed field (Holloran 2005). However, timing limitations are an important tool for species protection during critical life stages (i.e., egg incubation and parturition), if they are used in conjunction with the proper habitat management for that species. A blanket exception to seasonal protection measures in fields such as Riley Ridge and South Piney (where the habitat functionality is intact) could be devastating to species such as elk and their native winter range and parturition habitats. These animals would be displaced into areas not typically occupied, already inhabited (potentially creating density-dependency conflicts), or where increasing human-wildlife interactions would occur.

Traditional Leasing Areas would be afforded the same resource constraints regarding surface-disturbing and other disruptive activities until bottom-hole density exceeds one well per 160 acres when adjacent to existing Intensively Developed Fields or if designated by the RMG in consultation with the PFO. This objective encompasses the entire planning area except for the WSAs, which are administratively unavailable. Sage-grouse and elk in particular have not been found to adapt to high levels of disturbance. This action does not leave room for extraordinary circumstances (e.g., West Nile virus outbreak in sage-grouse) and the potential wildlife protection mechanisms that could be needed because of them. At the landscape level of planning (reserving Traditional Leasing Areas or the possibility of conversion to Intensively Developed Fields), mitigation may not be enough to maintain habitat functionality and species diversity.

The planning area would be open to geophysical exploration and operations except where prohibited by law. Geophysical activities in WSAs would be determined on a case-by-case basis subject to the WSA IMP. The presence of geophysical activity in these areas would displace wildlife for the duration of the operation or cause avian nest abandonment. These activities could alter sensitive habitats and cause habitat fragmentation through the use of thumper trucks and buggy drills.

Issuing new commercial SRPs for the Green and New Fork Rivers SRMA would increase human presence in the area and could impact fisheries by degrading water quality and riparian habitat and disturbing sensitive vegetation. New recreational developments and increased human presence could result in habitat fragmentation, wildlife disturbance, and watershed degradation from soil erosion and stream sedimentation.

This alternative would open the Boulder Lake, Scab Creek, and Upper Green River SRMAs to oil and gas leasing with CSU restrictions. These restrictions could be suitable for recreational purposes; however,

they may not be adequate to control habitat fragmentation sufficiently to maintain crucial big game winter ranges or other wildlife resources.

The use of snowmobiles on winter range could lead to wildlife disturbance, causing additional stress, depletion of energy reserves, and possible death. These seasonal closures would help to protect wildlife from human-caused disturbance resulting in offspring mortality and habitat degradation and would improve water quality by preventing vegetation loss or soil erosion.

Impacts from transportation and access management would be more extensive under this alternative than under the other alternatives. New road development would increase with the increased projections for oil and gas development and the emphasis on providing needed and appropriate ingress, egress, and access routes to and across public lands. This is a more intensive management strategy that would provide more opportunities to ensure that wildlife and their habitats are not affected by excessive human use.

OHV Open areas would be much smaller than under Alternative 1. Habitat degradation would occur in these areas, including soil compaction and erosion, disturbance to vegetation, and physical dispersal and abandonment of wildlife from the area. Limiting OHV use in the Desert General Use area to existing roads and trails would reduce impacts from uncontrolled OHV use on 237,360 acres.

Areas where OHV use is limited to designated roads and trails (as opposed to existing roads) would include the Lake Mountain WSA, Trapper's Point ACEC, and Native American burial sites. This would limit proliferation of new trails and the potential for harassment of wildlife and degradation of wildlife habitat. This action would help to eliminate excess roads, reducing fragmentation of habitats in these areas.

Motorized travel would be allowed on the Pinedale Pathway. This area is within a mule deer migration bottleneck, and human-caused disturbances could alter the migration pattern or cause additional stresses during a period of high energy usage. During the spring migration, the energy (fat) reserves are most depleted, creating a higher potential for deleterious impacts, including fetal abortions.

The primary objective for vegetation under this alternative would be to prevent the spread of noxious weeds and reduce the total area impacted. This would improve the health of wildlife habitat by allowing native vegetation to return to these areas. Special Status Plant Species would be maintained at a level that ensures long-term sustainability. This would not ensure the future pioneering of new habitats by protecting suitable habitat; however, federally listed plant species would be protected in accordance with the ESA, and known locations of sensitive species would be avoidance areas for surface-disturbing activities, providing protection to known populations.

This alternative allows discharge and point source discharge that is in compliance with WDEQ standards and encourages use of treated produced water (including irrigation of reclamation). If discharge is permitted in sagebrush systems, the integrity of the habitat could be compromised. This could be especially destructive in ephemeral drainages that contain suitable habitat for pygmy rabbits. The irrigation of reclamation to assist in habitat recovery could be beneficial in the short term; however, this planning area is in a desert community with a low annual precipitation. There is a possibility that the vegetative community would not be able to withstand the natural conditions after the irrigation equipment is removed, which could create a sink for the wildlife that subsequently moves into those areas.

Construction activities in flood plains and wetland/riparian areas would be allowed. These areas would have to meet PFC standards, but habitat for sage-grouse brood rearing, yellow-billed cuckoo nesting, crucial moose winter range, and pygmy rabbit denning might not be achieved when PFC is established. In

addition, the potential to increase the range of these species would be reduced or eliminated by the change in habitat function.

Wildland fire suppression activities in the planning area would be based on the AMR, with a high priority for response to wildland fires and for fuels reduction in areas of mixed land ownership and urban and industrial interfaces. This would be beneficial to species that do not require a climax forested vegetative community. However, species such as the Canada lynx require these habitat components to sustain the snowshoe hare prey base and maintain denning habitat.

Prescribed fire and mechanical treatments would be done to reduce hazardous fuels within the urban and industrial interface. In the long term, this tactic would improve forest health for many wildlife species such as mule deer and elk that summer and winter in these habitats. This in turn would be beneficial for predator species such as grizzly bears and gray wolves. Rehabilitation efforts such as fencing could impede movement or create an advantage for predator species.

The use of fire-retardant chemicals throughout the planning area could cause mortality to fish and other aquatic life if contact with water sources occurs.

This alternative would place increased emphasis on maximizing commodity production rather than on the habitat requirements for wildlife and fish. Sage-grouse would be disturbed during all stages of their development, affecting reproduction rates, nest success, and chick survival. Surface-disturbing activities would be designed to limit impacts within 2 miles of active sage-grouse leks; however, this does not account for habitat loss. These actions would lead to further sage-grouse abandonment of these areas.

There would be no management emphasis for maintaining big game crucial winter habitat or protecting parturition ranges. This could cause substantial habitat degradation and force big game to relocate to other habitat areas. Elk feedgrounds would be eliminated on public lands and would be available for oil and gas leasing. This would likely increase pressure on the feedgrounds on state lands, increase pressure on private lands (haystacks), increase pressure on the native winter range on the Wyoming Range, and increase elk-human interactions (e.g., vehicle collisions) and could lead to a die-off the first year from starvation. By eliminating the feedgrounds, the elk would also not herd together throughout the winter, potentially decreasing the brucellosis transmission rates. Because feedgrounds located on state and private lands would continue to operate, the impacts of concentrating elk through the winter and the facilitation of disease transmission, including brucellosis, chronic wasting disease, and bovine tuberculosis, would continue, although possibly at a lesser rate.

Activities would be designed to prevent take of raptors. However, continued disturbances could cause a raptor not to return to its nesting territory the following year or to initiate nesting.

Surface-disturbing activities would be allowed and would be subject to mitigation to minimize impacts on Special Status Species. In some cases, avoidance is the only method of mitigation that would ensure the continued propagation of the species.

Restricting instream activities from June 1 to August 15 in streams supporting populations of CRCT (streams providing habitat or flow) would reduce impacts (e.g., sedimentation and habitat manipulation) on CRCT at crucial life stages.

The emphasis on land use for commodity production would cause an increase in habitat fragmentation, in the amount of marginal habitats, and in competition between generalist and specialist wildlife species. Specialist species could be out-competed or driven out of preferred habitats. Areas focused on commodity production would have less diverse wildlife populations.

Impacts on wildlife and fish in the Rock Creek area would be similar to those under Alternative 1. However, under this alternative, the Deadline-Graphite elk winter range area would be open to oil and gas leasing with seasonal limitations. These authorizations could potentially increase human-caused disturbance of elk on crucial winter range.

The Trapper's Point ACEC (550 acres) would be managed to preserve relevant and important characteristics of the area, including cultural and historic features, viability of the big game migration bottleneck, and important livestock trailing use. Wildlife and fish would benefit from the management prescriptions, which serve to protect and improve the vegetation, forage and cover, watershed health, and habitat continuity. This area is a vital migration route for mule deer and pronghorn. Closure of the ACEC to surface-disturbing activities, mineral leasing, and OHV use would eliminate long-term habitat losses and help ensure the viability of the big game migration corridor. The protected area might not be of sufficient size under this alternative to fully protect the migration bottleneck area.

No ACEC would be designated in the New Fork Potholes area. Allowing development in this area would impact unique pothole riparian habitat. There would be a loss of migratory waterfowl nesting and brood-rearing habitat. The functionality of the potholes area as a stopover point for migrating waterfowl would also be reduced. Because this area provides habitat to a large population of migratory birds, allowing development in this area may result in increased "take" (as defined by the Migratory Bird Treaty Act).

Impacts on wildlife and fish in the WSAs would be similar to those under Alternative 1, except that OHV use in the Lake Mountain WSA would be limited to designated roads as opposed to existing roads and trails as under Alternative 1. This additional limitation would reduce vehicle presence in the WSA and related disturbances to wildlife and fisheries.

4.17.6 Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 3.

Impacts on wildlife and fisheries from paleontology and VRM actions would be the same as those under Alternative 1.

This alternative would provide the greatest opportunity to indirectly maintain habitat continuity and integrity from surface-disturbing activities and decrease human-associated disturbances by placing greater restrictions on surface occupancy near cultural resources.

This alternative proposes to treat more acres per year than do Alternatives 1 and 2; the goals are more oriented toward restoring mixed conifer and aspen stands to their historic range of variability than toward commercial sales. Although the intent is to restore a healthy forest ecosystem and to make the stand fire resilient, some intermixed stands of old growth are needed for wildlife diversity. Wildlife would initially be displaced by a treatment and, depending on the forage availability over time, could temporarily abandon these areas. Similar impacts under Alternative 2 would occur over a shorter time frame.

Impacts on wildlife and fisheries from lands and realty management actions would be less under this alternative than under Alternatives 1 and 2, because proposed withdrawal acreage (65,750 acres) would be increased and potential disposal acreage (790 acres) would be decreased. In general, withdrawal actions would help to maintain and protect wildlife and fish habitats, because withdrawn areas would be protected from certain surface-disturbing activities. Conversely, disposal of lands could impact wildlife and fish species and their habitats by disrupting migration routes, crucial winter range, calving and

fawning, or brooding and nesting areas. Acquisition of lands in migration routes and bottlenecks would result in the long-term sustainability of habitat through maintenance of wildlife migration routes.

The acreage of ROW avoidance and exclusion areas would be the largest under this alternative. No exceptions for activities in ROW exclusion areas would be allowed. Exclusion restrictions would affect wildlife by preventing surface-disturbing activities that are detrimental to resource values in areas of potential sensitive habitats and by reducing the potential for habitat fragmentation or increased human-caused disturbance.

Limiting linear ROW development to existing routes would protect habitat quality, minimize fragmentation in sensitive areas, and help to protect riparian areas. Limiting communication sites to existing developed sites and requiring self-supporting, non-guyed towers would help to minimize the amount of vegetation and wildlife habitats disturbed by site construction and associated activities and provide some protection against potential avian collisions.

Prohibiting wind energy development in raptor concentration areas, along neotropical bird migration routes, within 3 miles of greater sage-grouse leks, and in other wildlife-sensitive habitats would minimize the number of bird and bat fatalities resulting from collisions with wind turbines (NREL 1995), as well as potential habitat fragmentation and the permanent abandonment of these areas.

This alternative would provide a greater emphasis on actions directed toward range health. The reduction or elimination of grazing in Intensively Developed Fields would provide some benefit to wildlife by reducing competition for forage in these areas. However, the impacts from industrial development would partially or completely counter any benefits derived from the elimination of livestock grazing. Even with forage unused by livestock, industrial development and human activity and presence could cause wildlife to avoid these areas entirely.

Improving wildlife habitat, watersheds, and riparian areas while maintaining range condition at, or improving range condition toward the potential for the ecological site would increase the quality and quantity of forage for wildlife and livestock.

Reducing active AUMs to a number based on each grazing permittee’s actual use since 1988 would lower the number of livestock grazing on public lands over time, reducing competition for forage between livestock and wildlife. Unallocated forage would be allocated to other resources such as wildlife and recreation, increasing wildlife cover and forage. While these areas tend to be small and scattered, some benefits to wildlife habitat would be realized.

Adjusting grazing seasons in allotments containing elk parturition areas to begin after June 1 would reduce the potential for brucellosis transmission, contributing to the management of a healthy livestock herd and reducing the need for drastic elk management actions.

Prohibiting the placement of mineral supplements within one-quarter mile of live water and wetland/riparian areas, as well as sage-grouse leks, would prevent stream bank erosion, vegetation loss, and nutrient loading in surface water; preserve aquatic habitats; and prevent the degradation of sage-grouse nesting habitats.

This alternative would afford the greatest opportunity to provide the necessary mitigation measures and habitat requirements for wildlife in a planning area with high oil and gas development.

Approximately 78,270 acres would be considered Intensively Developed Fields, available for intensive oil and gas leasing, exploration, development, and production. Development would be regulated to conserve

important wildlife habitats; however, exceptions would be considered to allow year-round drilling and development operations on existing leases in the Jonah and Anticline Fields that are currently encumbered by seasonal restrictions. These considerations would be subject to NEPA analysis and the operator implementing offsetting mitigation. This exception would not apply to federally listed species or avian species protected under the Migratory Bird Treaty Act of 1918 (MBTA). Development is still taking place in some important habitats such as crucial big game winter range and sage-grouse habitats. This approach could provide needed tools to reduce human-caused disturbance and additional habitat fragmentation; at this level of development, timing limitations alone are not adequate to maintain the specialized wildlife species in these fields.

Approximately 420,780 acres would be Traditional Leasing Areas, subject to timing limitations, CSU and NSO stipulations, and COAs, as well as additional restrictions established for surface-disturbing and other disruptive activities (Map 2-3). Lease stipulations help to mitigate adverse impacts on wildlife and fish during breeding and parturition periods to ensure reproductive success and survival of young, reduce winter mortality associated with increased stress caused by human-induced disturbance, and reduce private landowner conflicts caused by displaced animals. BMPs would also be applied to mitigate impacts on sensitive habitats and other resources in areas or situations where timing limitations are not adequately mitigating impacts on wildlife.

Approximately 641,820 acres (Map 2-8) would be categorized as Unavailable Areas for oil and gas leasing. Existing leases would be subject to the existing lease terms and stipulations, and BMPs would be applied to mitigate impacts on sensitive habitats. These areas would become important refuge areas as development continues, particularly if more areas become intensively developed.

It is estimated that 5,209 new wells (3,736 vertical and 1,473 directional wells) would be developed, resulting in 31,139 acres of short-term disturbance and 13,325 acres of long-term disturbance. Stipulations and limitations would limit the pace at which new wells could be developed, giving an opportunity to maintain areas of critical habitat during periods of development and human-caused disturbance when mitigation efforts are not enough to maintain wildlife populations.

Prohibiting the use of explosive charges would prevent adverse impacts on wildlife from noise and other disturbances. This protection would reduce alteration or loss of wildlife and fish habitats and help prevent erosion and sedimentation in areas with sensitive soils or steep slopes. Prohibiting geophysical vehicle travel in developed recreational sites and NSO areas would protect sensitive vegetation and habitats and minimize wildlife disturbance, preventing impacts such as increased energy expenditure from dispersal, avoidance, and behavioral change owing to human presence.

The planning area would be closed to coal leasing; new mineral withdrawals would be pursued to protect wildlife habitat; and salable minerals activity would be evaluated on a case-by-case basis. These actions provide the greatest opportunity of all of the alternatives to prevent surface disturbances, human-caused disturbance, and habitat-fragmenting activities in wildlife habitats.

Under this alternative, the Boulder Lake, Scab Creek, and Green and New Fork River SRMAs would be unavailable for oil and gas leasing, preventing further development and maintaining the existing sensitive habitats (i.e., crucial winter ranges, parturition areas, and avian nesting and roosting areas).

Minimizing and consolidating the road infrastructure in the planning area would minimize the possibility of creating islands of isolated habitat. These areas can cause genetic isolation for species with small home ranges, such as the pygmy rabbit. Vehicle collisions in migration corridors and other areas would also be reduced.

Limiting the number of access points to county and state roads, designating common ROW routes, and designing new developments to minimize the number and miles of new roads and the main access points to new fields would help avoid creating islands of unusable wildlife habitat. It would also minimize human disturbance and truck traffic in sensitive habitats. Habitat fragmentation would be prevented and larger tracts of suitable habitat for wildlife would be maintained, allowing typical feeding, breeding, and sheltering functions.

Impacts on wildlife and fisheries from OHV use would be less than under Alternatives 1 or 2. Approximately 30,350 acres would be closed to motorized access year round. Limitation to designated roads and trails in 140,610 acres would help to control OHV use in sensitive wildlife areas and prevent habitat degradation and erosion. This would alleviate the potential for damage to other resources (e.g., destruction of vegetation, increased erosion) and the proliferation of unauthorized access. It would also protect vegetation, prevent additional erosion that could lead to sediment loading of streams, and alleviate wildlife habitat fragmentation and wildlife disturbances that could lead to dispersal or avoidance of otherwise suitable habitats.

No open OHV areas would be designated. This would be beneficial in preventing the degradation and eventual abandonment of wildlife habitat.

Prohibiting motorized snow vehicles in big game crucial winter range, WSAs, and the CCC Ponds ACEC would help preserve sensitive wildlife habitats and decrease disturbance during critical periods.

The elimination of chemical control methods for noxious weeds could inhibit weed control, and the use of mechanical methods could be less effective. This could retain wildlife habitat in a less-than-desired state for a longer period of time. However, restriction of the use of chemical vegetation and weed control treatments would eliminate herbicide drift outside of treatment areas and prevent herbicide loading in watersheds. This alternative would provide greater protection of sensitive environmental resources and wildlife and fish habitat.

Vegetation treatment actions would mimic natural systems of succession, creating habitat niches for a greater diversity of wildlife. Prescriptions would serve to help achieve the potential of ecological sites, which would help to maintain and improve wildlife and fish habitats.

Actions to protect Special Status Plant Species and their habitats from surface disturbance (e.g., ROW exclusion areas, mineral location withdrawal, geophysical surveying, limiting vehicle use to existing roads and trails, use of explosives) would assist in not only maintaining their current sustainability but would also expand their ranges, potentially preventing a future listing action.

Watershed management actions would assist in the prevention of degradation of sensitive soils, nutrient loading, and habitat fragmentation and reduce potential for surface runoff and stream sedimentation or contamination.

Restricting instream activities to June 1 through August 15 in streams supporting populations of CRCT (streams providing habitat or flow) would reduce impacts (e.g., sedimentation and habitat manipulation) to this species during crucial life stages.

This alternative would place the greatest emphasis on maintenance and enhancement of aquatic and wildlife resources through protection and enhancement of soils, water, vegetation, wildlife, fish, and other renewable resources, while providing for mineral extraction and energy development. Wildlife species would receive the greatest protection during sensitive life cycles (Appendices 3 and 18).

Impacts on wildlife and fisheries from fire and fuels management would be similar to those under Alternative 2; however, Alternative 3 would be slightly more restrictive in some areas. Fire would be reinstated to its natural role in the ecosystem, and other identified resource actions and management objectives would consider and accommodate fire management prescriptions where possible and feasible. This would allow for more natural succession of vegetative communities to take place, providing for more diversified wildlife habitat. Temporary displacement of some wildlife species would likely occur, but modified fire suppression would serve to improve wildlife habitat over the long term.

The absence of chemical management tools would help to preserve vegetation, water quality, and habitat integrity. This management strategy could result in less control of vegetation succession, leading to an increase in climax communities that could increase wildland fires; but would also be beneficial to wildlife species that require those habitat types (e.g., snowshoe hare and Canada lynx). In the event that a wildland fire does occur, the accumulation of fuels in these communities would cause these fires to burn at higher temperatures. Hot fires could result in sterilization of the soils, which would increase the time period for successful revegetation. This would reduce habitat function over a longer period of time. Increased runoff from burned areas could increase stream sedimentation and consequently impact fish and aquatic habitats.

Prohibiting the use of fire suppression chemicals, including foaming agents and surfactants, within 500 feet of surface water sources would prevent mortality of CRCT and other sensitive fish and amphibians. Aquatic species are particularly sensitive to chemicals because of the permeability of their tissue for respiratory functions and movement. In addition, hydrologic functions would be protected, maintaining habitats for other wildlife species, including moose, waterfowl, and amphibians.

Avoiding the transfer of water from sources that are known to contain whirling disease to those that do not, would help to contain the spread of that disease.

This alternative would provide the greatest protection mechanisms of all the alternatives by incorporating the most up-to-date research conducted within the planning area. The strategies outlined could provide the greatest success in maintaining and improving habitat quality and function, as well as species diversity within the planning area.

Intensively Developed Fields would contain less acreage and less sage-grouse lekking, nesting, brood-rearing, and winter concentration areas than under Alternatives 2 and 4. Development in the Intensively Developed Fields could exceed the thresholds of significant habitat requirements, and mitigation might not be adequate to maintain sage-grouse in those habitats. This alternative provides fewer acres to face this possibility.

Traditional Leasing Areas would also encompass fewer acres than under the other alternatives. Traditional Leasing and Unavailable Areas under this alternative would include actions that incorporate the findings of the most up-to-date research and would provide the greatest potential for sage-grouse management in areas with mineral development.

The impacts of maintaining elk feedgrounds would be similar to those under Alternative 1 and would include maintaining elk at their existing herd numbers, prolonging the necessity of feedgrounds, and maintaining the frequency of elk inoculated with the brucellosis virus and the susceptibility of concentrated elk herds to other diseases, including chronic wasting disease and bovine tuberculosis.

Intensively Developed Fields would encompass a smaller area (78,270 acres) that only affects mule deer and pronghorn that winter on the Mesa, minimizing the number of herds affected by impacts associated

with mineral development (i.e., habitat fragmentation, human-caused disturbances, and vehicle collisions).

In Traditional Leasing Areas, actions under Alternative 3 would protect big game species during sensitive time periods and minimize human presence and disturbance.

The Upper Green River bottleneck area would be unavailable for oil and gas leasing. No new main arterial access routes would be permitted in the Wind River Front MA, and the Deadline-Graphite elk winter range area (Map 2-3) would be unavailable for oil and gas leasing, preventing narrowing of migration bottlenecks and fragmentation of native elk winter range.

In Traditional Leasing Areas, actions would assist in maintaining sensitive species populations amidst development. These species do not necessarily occur within all of the areas designated as Traditional Leasing. Most of the known occurrences of white-tailed prairie dog towns exist in the Intensively Developed Fields and are therefore not subject to these more rigorous protection measures.

Actions to conserve sagebrush habitats would provide a larger number of contiguous acres of sagebrush habitat required for sagebrush-obligate species. Transportation planning and the piping of condensate and produced water would limit the amount of vehicle traffic along with the associated noise and additional human presence.

Actions to minimize fragmentation would prevent further access into areas not easily reached, resulting in less human disturbance and habitat degradation or fragmentation (from newly pioneered roads). The elimination of exceptions to wildlife COAs would protect populations from disturbance pressures during sensitive time periods.

Restricting instream activities from June 1 through August 15 in streams supporting populations of CRCT (streams providing habitat or flow) would reduce impacts (e.g., sedimentation and habitat manipulation) to this species at crucial life stages.

Prohibiting chemical use for the purpose of fisheries management would eliminate the chance of accidental fish mortality and misuse of chemicals, but would also greatly restrict opportunities to manage fish populations and reintroduce CRCT to their historic habitats.

In Intensively Developed Fields, take of raptors would be prohibited during the nesting season but would not eliminate future disturbance during the courtship and nest initiation periods. Use of migratory bird exclusion devices on sediment, evaporation, or other types of pits containing harmful substances or chemicals would reduce bird mortality.

Conducting surveys for raptor activity within 1 mile of proposed projects would appropriately incorporate the distance associated with nest disturbance for the majority of avian species found in the planning area.

In Traditional Leasing Areas and Unavailable Areas, stipulations and mitigation actions would sufficiently prevent impacts on raptors. One of the primary mechanisms of protecting raptors from take is restricting activities that promote the abandonment of eggs or of hatchlings or fledglings, before they are ready to leave the nest and independently find food and shelter. The timing restriction is designed to provide protection from such disturbances that would prevent the successful fledging of offspring.

Managing the Rock Creek ACEC as a ROW exclusion area, where ROWs would not be allowed except to benefit the CRCT or elk habitat, would maintain habitat continuity, prevent erosion and sedimentation, and prevent invasive plants from being introduced. Other management actions for the ACEC that would

reduce the potential for wildlife disturbance or habitat degradation and fragmentation include prohibiting geophysical exploration activities, prohibiting mineral leasing and exploration and development of locatable minerals, eliminating livestock grazing, and closing the area to OHV use. All management prescriptions under this alternative for the Rock Creek ACEC outside of the watershed and WSA would be more restrictive than under the other alternatives and serve to protect elk winter range and improve vegetation and cover, forage, watershed health, and habitat continuity.

In the Beaver Creek ACEC, prohibiting surface disturbance (including road construction) within 1,000 feet of streams and on slopes greater than 15% would provide greater protection to wildlife habitats than under Alternatives 1 or 2. All vehicle use, including geophysical exploration vehicles, would be limited to designated roads and trails. This would prevent the pioneering of new roads and degradation of vegetative communities that normally occurs when travel ventures away from established roads or trails. Restrictions on timber harvest activity would allow for natural succession to occur, and for dying trees to provide habitat for bats, owls, and cavity-nesting birds and animals. Lynx habitats and elk winter habitats would be preserved. The Beaver Creek ACEC would be managed as a VRM Class II area, which would help to preserve unique visual resources and benefit wildlife by restricting any development in these areas that would be disruptive to habitat. In addition, this would prevent wildlife disturbance from human presence, structures, and noise. Preventing new road alignments from being developed in undisturbed areas would protect existing wildlife habitat by maintaining vegetation and habitat continuity, limiting runoff and sedimentation of streams, and maintaining habitat integrity.

This alternative would provide the largest amount of acreage to protect the Trapper's Point migration corridor. This would maintain the integrity of the habitat function and prevent further disturbances to the mule deer and pronghorn that have used this area for hundreds of years.

The New Fork Potholes ACEC would be managed to protect unique pothole wildlife habitat, including habitat for migratory birds (e.g., the trumpeter swan and numerous waterfowl species). Closing the area to leasing, disposal, and mineral location operations would protect this area from surface disturbance and habitat fragmentation. Migratory waterfowl, trumpeter swans, migratory shorebirds, sandhill cranes, and migratory land bird nesting, brood-rearing, and foraging habitat would be protected from surface disturbance, noise, habitat fragmentation, and changes in hydrology. OHV use would be limited to designated roads and trails, with seasonal closures during crucial winter periods. This restriction would help to prevent the pioneering of new roads, which could accelerate erosion, destroy vegetation, and cause habitat fragmentation.

Management prescriptions in the White-tailed Prairie Dog ACEC would protect habitat for white-tailed prairie dogs and associated species (e.g., black-footed ferrets, burrowing owls, and mountain plovers).

Management prescriptions for the Miller Mountain MA would affect wildlife and fisheries by protecting and maintaining vegetation (e.g., forage and cover), habitat continuity, and watershed health. In addition, erosion and sedimentation events would be minimized by preventing disturbances on slopes greater than 15%. Restrictions on timber harvest activity would allow for natural succession to occur and for dying trees to provide habitat for bats, owls, and cavity-nesting birds and animals. These trees would also provide nutrients for saplings to take their place. The MA would be unavailable for oil and gas leasing, preventing surface disturbance and habitat fragmentation and day-to-day disruption of wildlife. OHV use would be limited to designated roads and trails; no net increase in miles of road would be allowed in the area; and no roads would be developed in talus slope areas. These actions would eliminate unnecessary roads, curtail road proliferation, reduce fragmentation of wildlife habitat, prevent additional habitat degradation, and eliminate potential competition between lynx and coyotes (coyotes would not normally use heavily timbered areas but would have access to more areas as more roads were constructed).

The Ross Butte ACEC would be managed to protect fragile soils and watersheds, sensitive plant species, and visual values. Wildlife and fisheries would be indirectly affected through improved vegetation and cover, forage, watershed health, and habitat continuity. OHV use within the Ross Butte MA would be limited to designated roads and trails. This would eliminate unnecessary roads, decreasing erosion, contribution of sediment to the Green River, and habitat fragmentation. It would also reduce wildlife disturbance during seasonally sensitive periods, as portions of the area include mule deer and pronghorn crucial winter ranges. Surface occupancy on erosive soils and in sensitive plant species habitats would be prohibited. Erosion and sedimentation events would be reduced by prohibiting surface disturbances on slopes greater than 10%. This would protect these areas from development and protect sensitive vegetative communities. The ACEC would be unavailable for oil and gas leasing, protecting habitats from surface disturbance and fragmentation. No new communications sites would be allowed within the Ross Butte area. This would help to minimize the amount of vegetation and wildlife habitats disturbed by site construction and provide some protection against potential avian collisions with towers or guy-wires.

Wildlife and fish would benefit from management actions in the CCC Ponds ACEC that serve to protect and improve vegetation, forage and cover, watershed health, and habitat continuity. Establishment of the ACEC would help to preserve the mule deer migration bottleneck that passes through the area. Since this area is a mule deer migration bottleneck and wintering area, OHV closures and seasonal limitations would help to limit the potential for adverse impacts during the sensitive winter season, and would also prevent larger herd impacts resulting from elimination of vital migration routes. Closing the ACEC to oil and gas leasing and minerals location would preserve the recreational experience; prevent fragmentation and degradation of wildlife habitat; and preserve areas used by wildlife for feeding, breeding, and sheltering.

Wildlife and fish would be affected by management actions in the Wind River Front MA that protect and improve vegetation, forage and cover, watershed health, and habit.

Impacts on wildlife and fisheries in the WSAs would be similar to those under Alternative 1, except that the Lake Mountain WSA would be closed to motorized access. This would prevent habitat fragmentation and degradation caused by the pioneering of new roads and disturbance from human presence.

Designation of the East Fork River WSR would prevent wildlife habitat fragmentation and degradation and disturbance of wildlife, and preserve areas used by wildlife for feeding, breeding, and sheltering. Habitat continuity would be maintained throughout the river corridor, providing nesting, foraging, and brood-rearing habitat.

The Scab Creek (860 acres) and Silver Creek WSR Units (1,350 acres) would be managed under a tentative classification of “wild.” Habitat continuity would be maintained throughout the river corridor, providing nesting, foraging, and brood-rearing habitat.

The Green River WSR Unit (7,100 acres) would prevent habitat fragmentation and degradation and disturbance of wildlife and preserve areas used by wildlife for feeding, breeding, and sheltering.

4.17.7 Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be expected from Alternative 4.

The impacts on wildlife and fisheries from coal, locatable and salable minerals, and the Rock Creek and Beaver Creek ACECs would be the same as those described under Alternative 1.

The impacts from OHV Open areas would be similar to, but somewhat less than those described under Alternative 3. Impacts on wildlife and fish from cultural resource management, forest management, access management and reclamation of access routes, and wildland fire management would be similar to those under Alternative 3. Impacts on wildlife and fisheries in the New Fork Potholes ACEC, Lake Mountain WSA, and WSR Units would be the same as those under Alternative 3.

Acquisition of lands in migration routes and bottlenecks would result in the long-term sustainability of habitat and management continuity.

Disposal of lands in riparian zones and crucial habitats would impact wildlife and fish species and their habitat by potentially disrupting migration routes, crucial winter range, and calving and fawning and brooding and nesting areas.

ROW management actions would provide more management flexibility; however, they would not provide the aggressive wildlife habitat management actions under Alternative 3. Placement of ROW corridors must consider potential fragmentation of sensitive wildlife habitats; as oil and gas demands increase, ROW corridors are stretching across miles of landscape. Water disposal pits even in Intensively Developed areas must be managed to prevent a source of West Nile virus (if that virus is ever found in Sublette County) and fitted with appropriate anti-avian use devices in case the waters contain pollution or high saline levels.

Limiting communication sites to existing developed sites and requiring self-supporting, nonguyed towers would help to minimize the amount of vegetation and wildlife habitats disturbed by site construction and associated activities and provide protections against potential avian collisions.

Prohibiting wind energy development in WSAs, ACECs, and other SD/MAs; along neotropical bird migration routes; within 3 miles of greater sage-grouse leks and winter concentration areas; and in raptor concentration areas would minimize the number of bird and bat fatalities resulting from collisions with wind turbines (NREL 1995).

Livestock grazing would result in various impacts on wildlife and fisheries. Implementing changes in grazing season of use, rotational grazing, and infrastructure development could maintain a higher level of habitat function for wildlife and livestock use. Changes in season of use may improve sage-grouse nesting cover and prevent more nests from predator detection, resulting in more sage-grouse nest success. Allocating some forage increases to wildlife and watershed protection could improve wildlife cover, forage, and habitat and mitigate impacts that livestock grazing might otherwise impose on the area. Establishment of forage reserves would provide management with the flexibility to rest other allotments during drought years, make habitat improvements, control wildland fire, implement prescribed burns, and react to other circumstances.

Water projects developed in crucial winter ranges could lead to a redistribution of livestock on crucial winter ranges. This could result in the loss of sufficient forage needed to maintain wildlife fitness during winter. A significant loss of forage likely would cause wildlife redistribution to areas that might be occupied by other big game herds or to private lands, increasing winter mortality and human conflicts. Native winter habitats can only support a limited wildlife population, which could result in reduced species diversity or viability. Adjusting grazing seasons in allotments containing elk parturition areas to begin after June 1 would reduce the potential for brucellosis transmission.

Mineral supplement blocks for livestock and wildlife use would be placed in locations that both promote proper grazing distribution and prevent inappropriate livestock use on riparian habitat, minimizing soil

compaction and runoff near surface waters, and could decrease grazing pressure and competition for riparian vegetation.

Closing riparian and other exclosures to grazing by livestock would allow these areas to achieve their management objectives (e.g., PFC, potential natural community [PNC], fish and wildlife habitat).

An estimated 7,136 wells (5,136 vertical wells and 2,000 directional wells) would be developed, resulting in 42,180 acres of short-term disturbance and 17,330 acres of long-term disturbance. These estimates are close to those projected under Alternative 2, which infers that a high commodity extraction could be attained without removing necessary stipulations and COAs important for the perpetuation of wildlife resources.

Actions in Intensively Developed Fields could push the thresholds of big game tolerance to disturbance on crucial winter ranges and parturition habitats. These animals will depend more on transitional ranges and areas of suboptimal conditions until reclamation efforts are realized. The level of disturbance to the soils in these areas may or may not allow reclamation efforts to be successful in bringing the field back to preconstruction conditions. Sage-grouse yearlings would continue to move to less disturbed areas outside of the Intensively Developed Fields, and other sagebrush-obligate species' habitats would be subject to island effects, which could limit genetic diversity and population distribution. Certain stipulations and restrictions are necessary to minimize impacts on sensitive habitats, critical life cycles for wildlife, and fragmentation of habitat. This approach to development could provide some alleviation to disturbance over time with the appropriate mitigation strategies; however, depending on the rate of development and the amount of habitat disturbed at any given time, there could still be localized population declines of some species until these mitigation efforts are realized. Expansion of the Intensively Developed Fields into the areas adjacent to the existing development will remove the emigration areas for these species and further exacerbate population stability and thresholds in undisturbed areas. These conditions are the same as under Alternatives 2 and 3. However, this designation under Alternative 4 includes more of the existing oil and gas fields than under Alternative 3 and less than under Alternative 2; therefore, the effects would be greater than under Alternative 3 and less than under Alternative 2. Alternative 4 also presents the possibility of removing wildlife timing stipulations on a case-by-case basis. This should only be considered in very specific cases and when mitigation measures can be implemented in such a way that disturbances can be minimized to the maximum extent practicable. Otherwise wildlife populations will be affected so profoundly that there may not be opportunities to conduct appropriate offsite mitigation or at a minimum maintain genetic corridors between development and nondevelopment areas.

Holloran (2005) studied the spatial relationship of sage-grouse nest distribution to the lek location, within 3 and 5 km of a lek. Within 3 km of the lek, 45% of the nests were observed, and a 5 km buffer included 64% of the nests. In addition, nesting habitat beyond 5 km from a lek may be important for population viability (Connelly et al. 2000), suggesting that protection should be afforded to these areas (Holloran 2005). These data indicate that a 2-mile buffer would inadequately protect sage-grouse leks, nesting success, and recruitment of yearlings within a Traditional Leasing Area. Research by Kaiser (2006) indicates that yearling male sage-grouse are dispersing outside of their natal nesting habitat. If this is a response to the disturbances in Intensively Developed Fields, they are likely moving to areas such as Traditional Leasing Areas and Unavailable Areas. The proportion of existing leases in these areas is high.

Actions in Traditional Leasing Areas would protect wildlife during critical seasons, such as big game winter foraging and sage-grouse strutting periods. Lease stipulations would help to mitigate adverse impacts on wildlife and fish during breeding and parturition periods to ensure reproductive success and survival of young, reduce winter mortality associated with increased stresses brought on by human-induced disturbances, and reduce private landowner conflicts caused by displaced wildlife. Limiting well

pad densities to one pad per 640-acre section, and other such scenarios would help maintain grouse populations in development areas. This benefit would only be maintained as long as the well density per section does not increase in that area; if it does, then additional mitigation requirements must be available because of how the Traditional Leasing Areas are laid across the landscape. These conditions are the same as under Alternatives 2 and 3; however, this designation under Alternative 4 covers a larger area than under Alternative 2 and a smaller area than under Alternative 3. Alternative 4 provides a one-half mile NSO around portions of the Unavailable Areas to deal with any issues caused by drainage to the adjacent private lands. The addition of the one-half mile NSO is a minimal amount of acreage compared to the Large Block NSO areas originally proposed. This will only infringe on wildlife habitat if proposals to make these areas Intensively Developed fields occur in the future.

In NSO areas, restrictive stipulations would mitigate impacts of conflicting resource use and could protect areas such as big game crucial winter range and sage-grouse lek sites that would be unable to withstand any disturbance at any time of year. However, conflicts could arise if these areas are determined to have oil or gas drainage issues. There may be opportunities to drill a location off-lease; however, this may not always be possible, and depending on the location, impacts could still occur. This designation does not include parcels that are already leased within these designated blocks, which could contribute to habitat fragmentation or to these areas becoming population sinks if the surrounding habitats are developed.

In Unavailable Areas, wildlife and fish species and habitat would be protected from surface-disturbing activities. There would be fewer acres associated with this protection under Alternative 4 than Alternative 3. By maintaining larger blocks of habitat as Unavailable Areas, BLM is better able to manage wildlife habitats and maintain wildlife populations on federal lands. This would provide more opportunities for seed sources to migrate back to Intensively Developed fields once they are producing and reclaimed. As leases expire, the lands must be maintained as Unavailable Areas, because of the potential for existing leased areas to become Intensively Developed fields. This may result in more pressure for offsite mitigation, resulting in projects being conducted farther away from the action area and in more pressure for projects on private lands.

Wildlife habitat would generally be protected only if a mineral commodity is not present for extraction. This puts more pressure on habitats outside of Intensively Developed Fields and the surrounding private and state lands to provide the necessary resources for wildlife populations to perpetuate. Appropriate mitigation and BMPs could alleviate human-caused disturbances; however, for some species, no appropriate mitigation practices or BMPs have yet been developed.

Geophysical actions during wildlife-sensitive time periods would likely disturb wildlife, causing reduced fitness, temporary habitat abandonment, or nest abandonment.

Management actions in the recreation program would limit the pioneering of new roads, limiting disturbances to wildlife including habitat alteration, and prevent surface-disturbing and other disruptive activities from occurring in these sensitive habitats.

Soil management actions would be very beneficial for the maintenance of wildlife habitats and the recovery of reclaimed sites.

Additional restrictions for seasonal use of recreational motorized snow equipment would be applied to big game crucial winter range, elk feedgrounds, and the Bench Corral area. OHV use on BLM roads would be limited on a seasonal basis. These actions would prevent disturbance to big game species during a time when maintaining energy reserves and low stress levels are critical and would limit the pioneering of new roads, thereby limiting habitat fragmentation, degradation, and wildlife disturbance during critical time periods.

Managing vegetation according to the ecological site and current inventory techniques would ensure that proper vegetation management techniques are used. Many techniques have not been proven to be beneficial on the landscape level. Some parts of the planning area may not require vegetation treatments if appropriate management techniques are already occurring. Inappropriate vegetation manipulations could result in declining wildlife populations and even short-term (40 year) declines could be enough to cause large-scale declines in relation to other habitat manipulations or degradations on the landscape.

Weed control actions would preserve the integrity of native vegetative communities, maintaining their value as wildlife habitat.

Resting treated areas from livestock grazing for a minimum of two full growing seasons, unless shorter durations are determined to be adequate through the appropriate level of environmental analysis, would allow sufficient time for natural regeneration and prevent impacts from foraging on the treatment.

Watershed management actions would protect habitat continuity and function for species that require these habitats for brood rearing (sage-grouse, yellow-billed cuckoo, migratory songbirds), crucial winter range (moose), and denning (pygmy rabbits) and would minimize the potential for erosion and associated impacts on aquatic habitats by reducing the potential for sedimentation and introduction of hazardous materials to water systems.

NSO restrictions and other actions would be protective of big game migration corridors and elk winter ranges, provided that the existing leases within these areas do not face drainage issues. Ultimately, if mineral development occurs in these corridors, every effort must be made to prevent further narrowing of the migration corridors or degradation of the native elk winter range.

Impacts of maintaining elk feedgrounds would be similar to those described under Alternative 1 and would include maintaining elk at their existing herd numbers, prolonging the necessity of feedgrounds, and maintaining the frequency of elk inoculated with the brucellosis virus and the susceptibility of concentrated elk herds to other diseases, including chronic wasting disease and bovine tuberculosis.

Impacts on wildlife and fisheries in the Trapper's Point ACEC would be similar to those under Alternative 3. However, the ACEC would be smaller in size (4,160 acres), which would not provide protection to the staging area at Cora Butte.

Impacts on wildlife and fisheries in the Miller Mountain MA would be largely similar to those under Alternative 3. Allowing surface disturbance on somewhat greater slopes and allowing some forest management activities could lead to erosion and degradation of some wildlife habitats. This area would be available for oil and gas leasing activities with timing limitations; CSU and NSO restrictions would protect wildlife from surface-disturbing and other disruptive activities during critical periods and protect sensitive areas from habitat destruction.

Impacts on wildlife and fisheries in the Ross Butte MA would be the same as those under Alternative 3.

Impacts on wildlife and fisheries in the Wind River Front MA would be similar to those under Alternative 3, except for the smaller size of the area (201,240 acres). In addition, forest management activities would be consistent with the HFRA and MA objectives. Maintaining a more viable ecosystem that can be sustained after a fire event is beneficial to the system as a whole.

4.18 SPECIAL DESIGNATIONS AND MANAGEMENT AREAS

This section describes potential impacts on ACECs and other SD/MAs from management actions included in Chapter 2. There are two previously existing and as many as seven potential ACECs, depending on the alternative, as discussed in Chapter 2 and illustrated on Maps 2-16, 2-19, 2-26, and 2-33. In addition, there are two previously existing WSAs that are common to all alternatives and four potential WSR areas under Alternatives 3 and 4.

4.18.1 Assumptions

The analysis was based on the following assumptions:

- WSAs in the planning area would continue to be managed under WSA IMP H-8550-1 until such time as Congress either designates all or portions of the WSAs as wilderness or releases them from any further consideration for wilderness, and the lands revert back to general land use management.
- Any resource-dependent activity approved in a WSA would be rigorously managed to ensure that it would not impair the area's wilderness characteristics or its suitability for designation as wilderness.
- Wilderness Interim Management is subject to Valid Existing Rights and the Grandfather Clause (see IMP) under all of the alternatives.
- Although areas considered or proposed for withdrawal would require approval by Congress, this analysis assumes the area would be approved and withdrawn.

4.18.2 Methods of Analysis

Impact analyses and conclusions are based on interdisciplinary team knowledge of resources within the planning area, a review of existing literature, and the professional judgment of experts within and outside BLM. Spatial analysis was conducted using ESRI's ArcGIS Desktop 9.1 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges of potential impacts or in qualitative terms if appropriate.

4.18.3 Areas of Critical Environmental Concern

FLPMA defines an ACEC as an area—

> *"Within the public lands where special management attention is required (when such areas are developed or used, or where no development is required) to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards." (FLPMA § 103(a)).*

The analysis of effects on ACECs from the implementation of management actions is limited to the protection of and prevention of damage to the relevant and important values. The relevant and important values and associated threats are documented in the *Evaluation of Relevance and Importance Criteria for Existing and Proposed ACECs*, BLM Pinedale Field Office. Impacts on resources not associated with the

relevance and importance criteria are discussed under the specific resource heading in this chapter. For example, sensitive plants are not part of the relevance and importance criteria for the Beaver Creek ACEC; any impacts on sensitive plants in the Beaver Creek area would be covered in the impact analysis for the vegetation section, not in the ACEC analysis. A separate impact analysis was conducted for each ACEC, because each area is unique and has different potential threats and relevant and important values. The analysis focuses on how the management actions proposed under each alternative address the identified threats.

In concert with BLM guidelines, the impact analysis considers management actions that "defend or guard against damage or loss" to the relevant and important values. The management actions associated with the alternatives could either degrade or protect the relevant and important values within each ACEC and either cause or prevent irreparable damage to such values. Degradation of relevant and important values would primarily occur from surface-disturbing activities, such as those associated with construction of ROWs (e.g., pipelines, transmission lines, communication lines), construction of oil and gas facilities (e.g., well pads, reserve pits, roads), and livestock range improvements. Other activities, such as vegetation manipulation and OHV recreation use, could affect relevant and important values by removing soil and vegetation and thereby creating intrusions on the landscape.

Protection of relevant and important values would primarily result from the implementation of management actions designed to protect natural resources. Management of soil, water, vegetation, and fish and wildlife would generally limit the extent of surface-disturbing activities and associated vegetation removal and facility construction. This is generally achieved through the designation of protective buffers, area closures, restrictions on surface use, and the implementation of mitigation measures.

Rock Creek

The relevant values to be managed in the Rock Creek area include important scenic values; habitat for an endemic, genetically pure population of CRCT; and native, crucial elk winter range for an elk population that is not feedground-dependent. The Rock Creek area would be designated an ACEC under Alternatives 1, 3, and 4 and would have no special designation under Alternative 2.

Impacts Common to All Alternatives

In all alternatives, the Rock Creek area would be contained mostly or wholly within the Lake Mountain WSA (Map 2-16). Impacts on the Rock Creek area from management within the WSA would be similar to those described for the Lake Mountain WSA in Section 4.18.4. Adverse effects on CRCT, aquatic habitat, and elk habitat would not result from surface-disturbing activities within the Lake Mountain WSA area. Management of the WSA as a ROW exclusion area and closure of the WSA to oil and gas leasing and development and other development activities would preserve the scenic and wildlife habitat values of the area.

Limitations on fire suppression vehicles and overall terrain limitations would make fire suppression activities more difficult and could increase the extent of burned acres in the Rock Creek drainage. This could harm aquatic habitat in the short term through increased sediment and ash input to streams, but would benefit elk and aquatic habitat in the long term through the regeneration of riparian vegetation, grasses, and aspen stands.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, managing the Rock Creek ACEC as an NSO area for surface-disturbing activities and as a ROW avoidance or exclusion area, deferring mineral leasing, and

withdrawing portions of the area from mineral location would ensure long-term reductions in sediment loading in Rock Creek, enhancing habitat for elk and CRCT. The portion of the ACEC outside the watershed is partially leased, and oil and gas activities would continue to occur there. These developments would not affect the sensitive resources protected within the Rock Creek drainage. Leasable, salable, and locatable mineral activity in the area outside the watershed could cause minimal, adverse impacts on the wildlife values of the ACEC from human presence, activity, and noise.

Temporary seasonal road closures in the area outside the Rock Creek watershed would result in long-term benefits through an overall reduction in produced sediment loading by closing roads during times of heavy snow melt and runoff. This benefit would accrue to watersheds outside Rock Creek, not to the Rock Creek area. Livestock grazing on riparian areas and fish habitats could impact CRCT by removing and altering riparian vegetation, increasing erosion, and destabilizing stream banks. Often, by the time these impacts are detected and management implemented to address them, the damage has already occurred to CRCT habitat and populations. Even closely monitored livestock grazing in sensitive habitats can produce unintended impacts.

Impacts Under Alternative 2

The Rock Creek ACEC designation would be removed under Alternative 2. In addition to the impacts common to all alternatives, impacts from OHV activity would occur because the area would be open to OHV use on designated roads and trails. OHV activity on the road in the Rock Creek area would involve several crossings of the creek, increasing soil and vegetation disturbance and the amount of sediment carried in Rock Creek. This would impact CRCT habitat, including spawning areas, and could result in a reduction of the CRCT population in Rock Creek. OHV activity could also disturb elk using the Rock Creek area. OHV activity on the road could have a minor impact on the scenic quality of the area.

Removal of the ACEC designation would also remove the focus from the important resource values associated with the watershed. This lack of focus would lower the area in priority for workload analysis and funding possibilities in the future, reducing the effectiveness of management in the future.

Impacts Under Alternative 3

In addition to the impacts common to all alternatives, closing the Rock Creek drainage portion of the ACEC to livestock grazing would eliminate potential impacts on riparian and upland vegetation and stream stability. Riparian vegetation could proceed more rapidly to a climax or potential condition, promoting stream stability and enhancing habitat for CRCT. Elimination of livestock grazing in this area would reduce the Upper North LaBarge allotment by 5,270 acres (approximately 290 AUMs). The permittee in the Upper North LaBarge allotment would be required to reduce the number of livestock or the season of use in the allotment to achieve the reduction in AUMs.

Compared to Alternative 1, more stringent management actions would apply to the 610 acres of the ACEC outside the Rock Creek drainage. Prohibiting geophysical exploration (except on existing oil and gas leases), surface occupancy, and the exploration and development of locatable minerals within this area would reduce impacts on soils, vegetation, visual resources, and wildlife. This would be a minor overall impact on the relevant characteristics of the Rock Creek ACEC. Big game and other wildlife would not be disturbed or their use patterns influenced by OHV use.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4.

Impacts from livestock grazing, mineral leasing, geophysical exploration, and locatable mineral development would be similar to those described under Alternative 1.

Limited fuels treatments would benefit critical resources such as CRCT habitat by preventing streamside vegetation burning and reducing erosion into Rock Creek. Total fire suppression would not be beneficial to the elk habitat, as conifer encroachment in aspen stands and succession of other vegetation types to decadent successional stages would reduce habitat quality for elk. Reduction in aspen stands would impact aquatic habitats by decreasing the ability of beaver to maintain their population and thus their dams. Beaver dams provide important over-wintering habitat for CRCT.

Beaver Creek

The relevant values to be managed in the Beaver Creek area include habitat for a genetically pure population of CRCT, and parturition habitat for elk. The Beaver Creek area would be designated an ACEC under Alternatives 1, 3 (expanded), and 4 and would have no special designation under Alternative 2.

Impacts Common to All Alternatives

Oil and gas activity would continue in the area, as existing leases would be retained and could be developed. The Beaver Creek area includes several producing wells. Oil and gas drilling and production activity on existing leases in the Beaver Creek area, including traffic on roads, would cause some amount of soil erosion. Some sediment movement into Beaver Creek could occur, reducing habitat quality and potentially reducing the reproductive rates of CRCT. Traffic related to oil and gas activity and recreational and other activities could also seasonally impact elk using parturition habitat (May 1 to June 30).

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

Although oil and gas leasing would continue and existing leases could be developed, impacts would be reduced through specific management prescriptions. Gas is currently being produced from three wells in the ACEC. New surface disturbance and related impacts of road construction would be minimized, limiting sedimentation impacts on CRCT and disturbance of parturition habitats. Prohibiting the use of explosive charges would help to reduce disturbance to elk and elk parturition habitat and sedimentation impacts on CRCT.

Withdrawal of the area from land disposal and mineral location and entry would minimize development and human presence, limiting habitat alteration and animal displacement on parturition ranges, and sedimentation and vegetation alteration impacts on CRCT.

Prohibiting creek diversions on public lands would maintain water quantity, quality, and stream stability for CRCT and other wildlife habitat.

Impacts Under Alternative 2

The Beaver Creek ACEC designation would be removed under Alternative 2. In addition to the impacts common to all alternatives, the following impacts would occur. Roads could be constructed in more areas, potentially leading to vegetation alteration, reduction in stream stability, and increased sedimentation

impacts on CRCT habitat and possible reduction in CRCT reproductive rates. Road construction could also disturb elk using the Beaver Creek area during the parturition period (May 1 to June 30).

Removal of the ACEC designation would also remove the focus on the important resource values associated with the watershed. This lack of focus would lower the area in priority for workload analysis and funding possibilities in the future, reducing the effectiveness of management in the future.

Impacts Under Alternative 3

Under Alternative 3, the Beaver Creek ACEC would be expanded to approximately 10,160 acres, more than doubling its existing size. This larger area would include all the forks of Beaver Creek between Trail Ridge and Narrow Ridge. In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 3.

Although the area would be closed to new oil and gas leasing, the expanded ACEC is currently completely leased. Most of the oil and gas leases in this area are held by production. New, expanded protections could be applied to leases only if existing leases were to expire and new leases were issued in the area. However, some protections could be applied at the APD stage through conditions of approval. Gas is currently being produced from six wells in the expanded ACEC area. Impacts from oil and gas development would be similar to those under Alternative 1.

More stringent restrictions would reduce impacts of road development from those under Alternative 1. Stream sedimentation, vegetation alteration, and elk displacement would be reduced.

A larger area would benefit from mineral withdrawal than under Alternative 1. The reduction in disturbance of vegetation, displacement of elk, and stream sedimentation would be greater because of the larger area of the withdrawal.

Prohibiting timber harvesting within the entire ACEC would minimize vegetation alteration, erosion, and sedimentation impacts on CRCT and elk. However, this action could limit efforts to control conifer encroachment in aspen stands or address other issues related to vegetation succession. Other means would have to be considered to address these potential issues and maintain the aspen stands that are essential for parturition and for maintenance of beaver habitat. Beaver ponds provide key over-wintering habitat for CRCT.

Limiting vehicle traffic, including geophysical exploration activities, to designated roads and trails would eliminate unnecessary roads and help to control habitat fragmentation.

Prohibiting the use of explosive charges would help to reduce disturbance to elk and to elk parturition habitat and sedimentation impacts on CRCT.

Prohibiting diversions of water from the Beaver Creek drainage would maintain natural instream flows and habitat for CRCT. Maintaining flows would also maintain riparian habitats.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, impacts on the Beaver Creek ACEC for most activities would be similar to those under Alternative 1, with the following exceptions.

Impacts from OHV use would be similar to those under Alternative 3.

The use of subsurface explosives on a case-by-case basis should have no impacts on CRCT and elk or their habitat.

Trapper's Point

The relevant values to be managed in the Trapper's Point area include important cultural sites, a regionally important and nationally recognized big game migration bottleneck, and traditional local grazing use of a livestock trail and gathering/sorting ranching TCP area.

The Trapper's Point area would be designated an ACEC under Alternatives 2 (550 acres), 3 (9,540 acres), and 4 (4,160 acres) and would have no special designation under Alternative 1.

Impacts Under Alternative 1, Continuation of Existing Management

Allowing surface disturbance or mineral development in this area could lead to degradation or elimination of the big game migration through the bottleneck area. Disruption of the mule deer and pronghorn migrations through this area could have far-reaching impacts, including elimination of pronghorn from Grand Teton National Park and unknown impacts on the pronghorn and mule deer populations in Sublette, Teton, and Sweetwater Counties. Other impacts from development in the Trapper's Point area would include loss of forage for wildlife and livestock, disruption of livestock use on the Upper Green River stock driveway, vegetation loss, and soil erosion.

Allowing additional fencing in the bottleneck area would add obstacles to migrating animals and could reach a density or severity sufficient to disrupt migrations.

Allowing OHV use on existing roads and trails and in all seasons would cause stress on migrating mule deer and pronghorn and could lead to vegetation loss and further fragmentation of habitat.

Impacts Under Alternative 2

Approximately 550 acres would be designated as the Trapper's Point ACEC. This represents the area proposed by the Trapper's Point Working Group led by Wyoming State Representative Monte Olsen in 2003. The area would be buffered on two sides by areas with NSO stipulations (Map 2-2).

Closing the ACEC to oil and gas leasing and most other surface-disturbing activities would preserve the viability of the area as a big game migration corridor. There are no current oil and gas leases in this area. This alternative would protect the core bottleneck area where mule deer and pronghorn cross U.S. Highway 191, but would not protect adjacent staging areas leading up to the crossing. It is not known whether the area protected by this alternative would be sufficient to maintain the viability of the migration bottleneck in the long term.

Closing the ACEC to oil and gas leasing and other surface-disturbing activities would also preserve intact the many NRHP-eligible historic properties and other cultural sites in the area. The TCP area important to local ranching for trailing, gathering, and sorting of cattle on the Green River Drift would be maintained without obstructions from development.

Prohibiting additional fences within the ACEC would maintain the current viability of the crossing area. The animals are able to successfully negotiate the current system of fences. Prohibiting the construction of additional fences would prevent the threshold of disruption of the migration from being reached. Cultural sites would also be protected.

The ACEC lands would not be withdrawn from locatable mineral development or operation of the public land laws. While the potential for locatable mineral development in this area is remote, locatable mineral activities could severely impact the viability of big game migration, ranching operations, and integrity of NRHP-eligible historic properties. Locatable mineral claims could result in digging of pits or other excavations. These excavations would further narrow the migration bottleneck, would interfere with movement of livestock, and could damage or destroy cultural resources.

Limiting OHV use to designated roads and trails and enacting a seasonal closure would reduce fragmentation of habitat in the bottleneck area, reduce stress on migrating animals, and prevent destruction of cultural sites from off-road driving.

Impacts Under Alternative 3

Approximately 9,540 acres would be designated as the Trapper's Point ACEC. The protections of the big game migration bottleneck, livestock trailing and gathering operations, and NRHP-eligible historic sites would extend over a much larger area.

This alternative would also protect staging and feeding areas for big game as they approach the bottleneck. Animals would have more opportunity to prepare for passage through the bottleneck and highway crossing, and would experience less stress in the bottleneck area. This could contribute to increased winter survival, particularly for pronghorn, and maintenance of higher populations of pronghorn and mule deer.

A withdrawal from public land laws, including disposal and mineral location, would eliminate the potential for impacts from mining of locatable minerals.

Impacts Under Alternative 4, Proposed RMP

Approximately 4,160 acres would be designated as the Trapper's Point ACEC. The management actions under this alternative would be identical to those identified under Alternative 3. The difference between Alternatives 3 and 4 is the size of the ACEC.

The Cora Butte area stretching to the northwest of the bottleneck, not included in the ACEC under Alternative 4, is crucial winter range for mule deer and would be closed to human presence during the winter months under this alternative. The big game crucial staging and feeding areas would be protected from surface-disturbing activities, and subsequent habitat fragmentation would not occur, thus relieving some stress as big game navigate through the corridor.

The Trapper's Point ACEC under this alternative, while smaller than the ACEC under Alternative 3, is probably sufficient to maintain the viability of big game migration through the Trapper's Point area.

New Fork Potholes

The relevant values to be managed in the New Fork Potholes area include important scenic values, unique riparian habitat, and unique pothole geology. The New Fork Potholes area would be designated an ACEC under Alternatives 3 and 4 and would have no special designation under Alternatives 1 and 2.

Impacts Under Alternative 1, Continuation of Existing Management

Oil and gas development (e.g., pads, roads, pipelines) and geophysical operations on new and existing leases would potentially result in alteration of the water table and water quality, loss of primitive recreation experiences and high scenic values, and loss or fragmentation of wildlife habitat, including

fragmentation of big game habitats and disruption of migratory bird and waterfowl habitats. Allowing surface disturbance could have unforeseen effects on the water table and water quality of the area. It is unknown whether drilling gas wells, for instance, could impact the water table in the area or the physical structure that maintains water at a high level in the potholes area.

Development activities, increased human presence, and presence of infrastructure would diminish the scenic quality and alter the back-country recreation values of the area. This type of development could also displace nesting waterfowl, reduce vegetation cover, or cause other vegetation or habitat impacts, including fragmentation, which would reduce the quality of the wildlife and waterfowl habitat in the area. Impacts on waterfowl nesting habitat could result in reduced reproductive rates and populations, particularly for trumpeter swans, which nest in few areas of the planning area.

Impacts Under Alternative 2

The impacts on the New Fork Potholes area under Alternative 2 would be the same as those under Alternative 1.

Impacts Under Alternative 3

Under Alternative 3, the New Fork Potholes would be designated as an ACEC. Closing the ACEC to oil and gas leasing, locatable mineral entry, and other surface-disturbing activities would maintain scenic values, vegetation health, and the hydrologic regime of the potholes. Restricting development in this sensitive area would ensure the long-term viability of the pristine pothole habitat, which would benefit big game and migratory bird and waterfowl populations. Brood-rearing habitat for the trumpeter swan, a BLM sensitive species, and habitat, including brood-rearing habitats, for migratory waterfowl and shorebird species would be maintained. These potholes provide shelter from predators and valuable food sources. In addition, adverse impacts on the water table and water quality would be prevented.

Existing mineral leases would remain valid along with the right to develop those leases. About 64% of the ACEC is currently leased for oil and gas development. COA would be the only way to address resource protection in these instances. Some sedimentation of water and loss of wildlife habitat could occur with development of existing leases. An APD for a gas well in the area is currently being considered.

Limiting OHV use to designated roads and trails and implementing seasonal closures during the crucial winter range time frame (November 15 to April 30) would decrease potential wildlife harassment or stress to wildlife from human presence. Impacts on vegetation and the potential for increased erosion from off-road driving would be prevented.

Recreation users would benefit from the creation of the ACEC, as it would protect the remote backcountry experience that currently exists. Limiting any kind of development would ensure the quality of the recreation experience.

ACEC designation would serve to focus priorities for funding and workloads on the management of the unique resources in the New Fork Potholes area, benefiting the resources by increasing the potential of meeting management objectives.

Impacts Under Alternative 4, Proposed RMP

The impacts on the New Fork Potholes area under Alternative 4 would be the same as those under Alternative 3.

Upper Green River

The relevant values to be managed in the Upper Green River area include an essential point in mule deer migrations and high scenic and recreational values, including 11 developed river access and camping sites. The Upper Green River area would be designated an ACEC under Alternative 3 (12,270 acres). The area would be designated an SRMA under Alternatives 1, 2, and 4.

Impacts Common to All Alternatives

Human presence at developed camping and boat launch sites has the potential to disturb or displace migrating mule deer and other big game. Human presence would likely be low at the times of the year when animals make these migrations, making the probability of impacts low.

Livestock grazing in the Upper Green River area would have the potential to alter vegetation communities and wildlife habitats. In the past, livestock grazing has not caused vegetation changes to the extent of impacting the big game migration. Livestock are not present in the public land allotments on the Upper Green River at the time when big game are migrating. This impact is unlikely to occur.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 1.

The Upper Green River area would be designated an SRMA (5,160 acres) under Alternative 1. Allowing mineral development with CSU stipulations would limit the impact of development on visual and recreational values; however, the recreation values would be substantially diminished if development of mineral leases were to occur. The natural and relatively unaltered character of the area would be irretrievably altered by fluid mineral development activities and facilities. Site-specific postlease actions (e.g., APDs and ROW authorizations) in areas with existing valid rights would be allowed, subject to surface use restrictions on a case-by-case basis, as supported through project-specific NEPA analysis. Surface disturbance could occur on existing and new leases, which could result in wildlife disturbance, degradation of visual quality, soil erosion, loss of livestock and wildlife forage, and loss of wildlife cover. Wildlife could be displaced from the area of development, reducing the viability of the migration route and the river crossing bottleneck. The CSU stipulation applied to mineral leases would protect recreation values on lands located within approximately 1,200 feet of either side of the river.

Restricting OHV use to existing roads and trails would limit damage to important natural resource values.

Impacts Under Alternative 2

The impacts on the Upper Green River area under Alternative 2 would be the same as those under Alternative 1, including the impacts common to all alternatives.

Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 3.

Under Alternative 3, the Upper Green River ACEC (12,270 acres) would be designated as an ACEC. The ACEC would be larger than the SRMA designated under Alternative 1.

This alternative would provide the greatest level of protection to the wildlife resources in the Upper Green River area. Closing the ACEC to oil and gas leasing and withdrawing it from locatable mineral development would prevent vegetation and wildlife habitat alterations and would reduce displacement of migrating wildlife because of human presence and industrial activity, although human presence from recreation would not be diminished. Surface disturbance could still occur on existing leases. Expanding the acreage of the ACEC would provide protection to wildlife and recreation values over a larger area.

Restricting OHV use to designated roads and trails and allowing no net gain in miles of roads and trails throughout the ACEC would reduce user conflicts and soil erosion and could improve the visual qualities of the area as roads not designated for use are reclaimed. OHV use opportunities in the ACEC would be limited, reducing the quality of experience for some users, but enhancing the experience for others.

Designating the area as an ACEC rather than an SRMA would change the focus of management in the Upper Green River area. Management of recreation resources and facilities would no longer be the highest priority in the area. If funds for maintenance of facilities were not available, some facilities could be closed, and a reduction in user benefits could occur. The possibility of this impact is remote.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts are anticipated from Alternative 4.

Under Alternative 4, the Upper Green River SRMA would be enlarged to 7,180 acres. Making the area available for oil and gas leasing with an NSO stipulation would provide similar protections to those under Alternative 3. There would be some potential for locatable mineral claims, most likely claims for gold. Gold is not known to be present in economic quantities; however, a discovery could be made. The potential for locatable mineral claims in this area is small. Activities related to locatable mineral claims, including surface disturbance, dredging, human activity, and noise could displace migrating wildlife, alter vegetation and habitats, and detract from the recreation experience. Impacts from economically viable locatable discoveries could be substantial; however, the potential for locatable minerals is low, and impacts would not be likely. Recreational mining for locatable minerals could create minor impacts related to surface disturbance, human presence, and noise.

Management to maintain the integrity of big game migration routes could alter the placement, orientation, or design of facilities, roads, fences, and other associated improvements, increasing the cost of design and construction or potentially resulting in project disapproval.

White-Tailed Prairie Dog

The relevant value to be managed in the White-tailed Prairie Dog ACEC is habitat for the white-tailed prairie dog. The White-tailed Prairie Dog ACEC would be designated under Alternative 3. There would be no special designation for white-tailed prairie dog habitat under Alternatives 1, 2, and 4, although there would be management prescriptions to conserve prairie dog habitats in those alternatives.

Impacts Common to All Alternatives

Prairie dogs may compete with cattle for forage under drought conditions. Drought can also cause white-tailed prairie dogs to enter hibernation early (Bakko and Nahorniak 1986), and prairie dogs without adequate fat stores may not survive the winter. While most spread of noxious weeds is owing to vehicles, livestock can also contribute to the spread of noxious and other weeds, potentially reducing the forage base available for prairie dogs. The likelihood of these impacts because of livestock grazing is small.

White-tailed prairie dogs can be displaced from habitats if sagebrush stands become too dense or are encroached by other species. Managing the public lands in the planning area to meet the Standards for Rangeland Health (USDI, BLM 1997) should minimize this impact. Livestock grazing management can also be used to help create early vegetation seral stages and habitat for white-tailed prairie dogs.

Oil and gas exploration and development would impact prairie dogs through direct habitat disturbances resulting from construction of well pads, roads, pipelines, compressor stations, and other infrastructure. Impacts would include vegetation community alteration resulting in habitat destruction and degradation, direct prairie dog mortality, and removal of potential black-footed ferret reintroduction areas. Prairie dogs would also be indirectly impacted through habitat fragmentation and increased human activity. Structures and facilities that provide artificial nesting sites for raptors, including structures not primarily built for this purpose, would increase predation on white-tailed prairie dogs. This would contribute to the decline of the white-tailed prairie dog population.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, off-road OHV use in the 237,000-acre Desert General Use OHV Open area could damage vegetation, introduce noxious weeds, and injure or kill prairie dogs.

Impacts Under Alternative 2

Potential impacts on white-tailed prairie dogs would be greatest under this alternative. In addition to the impacts common to all alternatives, the following impacts are anticipated under Alternative 2.

Impacts from lands and realty actions and mineral development, particularly gas field development, would be greatest under this alternative, because more wells, roads, and other facilities would be developed and fewer surface disturbance restrictions would apply. Allowing surface disturbance in all prairie dog towns, including those larger than 12.5 acres, would increase vegetation alteration, burrow destruction, and direct mortality and would reduce the availability of sites for black-footed ferret reintroduction.

Competition with livestock for forage and potential impacts on prairie dog habitats from livestock use would be greatest under this alternative. Increasing livestock use to 157,308 AUMs would increase forage utilization by livestock, the potential for introduction of weeds, and alteration of vegetation communities.

Eliminating the Desert General OHV Open area would reduce the amount of off-road OHV use in sensitive prairie dog habitats and could also reduce the amount of recreational shooting of prairie dogs.

Impacts Under Alternative 3

The White-tailed Prairie Dog ACEC would be designated under this alternative. In addition to the impacts common to all alternatives, the following impacts would be anticipated under Alternative 3.

Acquisition of prairie dog habitats for protection would benefit the species by increasing the extent of protected viable habitat. Reduced overall levels of oil and gas development under this alternative would result in fewer ancillary roads, pipelines, and other facilities associated with gas field development, lessening impacts on prairie dog habitat from vegetation removal and alteration, burrow destruction, and direct mortality.

Reducing livestock grazing use to approximately 84,000 AUMs would reduce competition for forage between livestock and prairie dogs. Introduction of weeds and alteration of vegetation communities from livestock grazing would also be reduced.

Prohibiting surface-disturbing activities within prairie dog towns of any size and requiring raptor-inhibiting devices on all aboveground facilities within one-quarter mile of towns would reduce prairie dog habitat loss and predation. The structure of prairie dog towns would be protected, allowing for continued movement of colonies and increased foraging opportunities. Potential black-footed ferret introduction sites would also be protected.

Impacts from OHV use on prairie dogs would be less under this alternative. OHV use in the ACEC would be limited to designated roads and trails, eliminating unnecessary roads and fragmentation of sensitive prairie dog habitats. This could also reduce the amount of recreational shooting in off-road areas in prairie dog habitats.

Prohibiting prairie dog poisoning on BLM-administered lands would reduce mortality rates and could enable population growth for white-tailed prairie dogs.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be anticipated under Alternative 4.

Impacts from livestock grazing management would be similar to those under Alternative 1.

Impacts from OHV management and prohibition of prairie dog poisoning would be similar to those under Alternative 3.

Prairie dog habitats would not be protected through acquisition of lands by BLM. The impact of this action should be small, because most current prairie dog habitats occur on BLM-administered public lands.

While the number of oil and gas wells predicted is roughly similar to Alternatives 1 and 2, increased protective restrictions would reduce impacts on prairie dogs from those alternatives. Avoiding surface-disturbing activities and requiring raptor-inhibiting devices on all aboveground facilities within one-quarter mile of towns that are more than 12.5 acres would reduce prairie dog habitat loss and predation. The structure of prairie dog towns would be protected, allowing for continued movement of colonies and increased foraging opportunities. Potential black-footed ferret introduction sites would also be protected. Impacts could be somewhat higher than under Alternative 3, but the protections under this alternative should be sufficient to protect prairie dog habitats and populations.

Miller Mountain

The Miller Mountain MA would be designated under Alternatives 3 and 4 for the protection of open space, natural landscapes, and big game winter ranges. There would be no special designation for the Miller Mountain area under Alternatives 1 and 2.

Impacts Under Alternative 1, Continuation of Existing Management

Allowing commercial timber production in the area would potentially increase soil erosion, degrade wildlife habitat and visual values, and decrease the opportunity for open space.

Allowing for the exchange or disposal of lands in the Miller Mountain area could lead to fragmentation of public land and development of private lands. The ability to exchange lands in this area could also help to block up scattered private land holdings in the area, making the public lands more contiguous and more easily managed. Impacts would include increased soil erosion, increased human activity and habitat fragmentation, reduction of scenic quality, and decreased opportunity for open space.

Mineral location or oil and gas development in the area, including well pads, roads, pipelines, and locatable mineral exploration or development would cause impacts on the visual qualities of the area, habitat integrity, and soil stability.

Increases in road density would fragment wildlife habitats, including elk parturition areas and crucial elk winter range. Fragmentation of habitats reduces the usable portion of habitat blocks, and can reach the point where large blocks of habitat are no longer usable by wildlife because of human activity, discontinuity of vegetation, and changes in vegetation.

Surface disturbance on slopes greater than 15% (11,410 acres) could result in increased erosion of unstable soils and reduce the scenic quality of the area.

Impacts Under Alternative 2

Impacts on wildlife habitat, scenic values, and open space would be greatest under Alternative 2. Oil and gas or other development under reduced protections for crucial big game winter ranges could lead to fragmentation, vegetation alteration and removal, and increased human presence. Elk could be displaced from the winter range and parturition habitats, potentially reducing survival and reproductive rates.

Impacts Under Alternative 3

Approximately 66,440 acres would be designated as the Miller Mountain MA.

Prohibiting commercial timber harvest in the area would help preserve natural landscape values and reduce potential erosion. This would also prevent habitat fragmentation, preserve cover for wintering big game, preserve lynx habitat, and provide nesting habitat for neotropical migrants. However, conifer encroachment in aspen stands or decadent stands of trees could degrade habitat values for elk, mule deer, and cavity-nesting birds.

Closing the area to oil and gas leasing, land disposal, and mineral location would protect visual and recreation values, and minimize erosion and the fragmentation of crucial wildlife habitat. Development of existing leases (53% of the MA) would have similar impacts on those under Alternative 1.

Prohibiting surface disturbance on slopes greater than 15% and limiting OHV use to designated roads and trails would minimize soil erosion, vegetation removal and alteration, and disturbance to wildlife. Prohibiting road construction in talus rockslide areas would prevent increased erosion and damage to sensitive habitats and scenic areas. Additional fragmentation of crucial wildlife habitats would be minimized. Opportunities for semiprimitive motorized activities would be reduced.

Impacts Under Alternative 4, Proposed RMP

Approximately 66,440 acres would be designated as the Miller Mountain MA.

Impacts from land tenure actions would be similar to those under Alternative 1.

Timber production could impact the open space and natural landscape values and lead to greater erosion. In the long term, timber management actions could enhance wildlife habitat values through regeneration of aspen and enhancing the variety of vegetation successional stages present on the landscape.

Oil and gas or other mineral extraction activities could impact the open space, natural landscape values, and crucial wildlife habitat through the construction of roads and other facilities, human presence and activity, and noise associated with development. Crucial winter range and parturition areas could be fragmented, reducing the effectiveness of those habitats. Displacement of elk from crucial winter range or parturition habitats could result in reduced survival or reproductive rates.

Impacts from OHV management would be similar to those under Alternative 3.

Ross Butte

The relevant values to be managed in the Ross Butte area include significant cultural resources, archeological landscapes and sacred sites, a unique community of Wyoming sensitive plant species, high-quality paleontological resources, open space and dispersed recreation opportunities, and unique geology/unstable soils. The Ross Butte area would be designated an ACEC under Alternative 3 (35,670 acres). The area would be designated an MA under Alternative 4. There would be no special designation for the Ross Butte area under Alternatives 1 and 2.

Impacts Common to All Alternatives

Existing oil and gas leases are present on approximately 15,695 acres of the Ross Butte area. Drilling of oil and gas wells and development of ancillary facilities (e.g., pipelines, roads, and compression stations) would disturb fragile and unstable soils. Previously undiscovered archeological and paleontological resources could be damaged if intercepted during the construction process. Development in these areas would impact the scenic quality of the buttes and badlands by interrupting the color, form, and lines of the natural landscape. Reclamation of soils and vegetation in the Ross Butte area would be particularly difficult. Some plant communities and slopes could not be reclaimed to their predisturbance state.

Location and development of hard rock mineral claims could cause disturbance or mortality of sensitive plants or accelerated soil erosion from disturbance of soils through digging of test pits, prospects, or mineral production sites. The potential for locatable minerals in this area is remote, making this impact unlikely.

Development of salable minerals could cause similar impacts on locatable minerals. The potential for salable minerals (sand and gravel) is low to moderate. Some resources exist, but quantities and access may not be conducive to commercial production. If salable minerals were developed, the area of disturbance would be greater than for locatable minerals.

OHV activity on the badlands and slopes would damage fragile and erosive soils and the various sensitive plant species present. OHV tracks would create artificial channels for surface water flow, accelerating erosion rates. OHV use could also crush sensitive plants or pull them from the soil; it could also compact the soil, changing water infiltration and availability and other site characteristics and causing the loss of the Special Status Plant Species present.

Any activity that accelerates soil erosion would also increase the chance of damage to archeological and paleontological resources.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be anticipated under Alternative 1.

Installation of communication towers would involve construction of roads capable of supporting heavy equipment and cement trucks over fragile soils and steep slopes. Communication towers are generally constructed on the highest points available in the landscape. Roads to reach the highest points of the Ross Butte area would need extensive engineering and improvement to achieve grades navigable by heavy equipment and trucks. These roads could extend for long distances to achieve the required grades. The road bed and cuts would be visible from long distances and would degrade the scenic quality of the area.

Communication sites would also require regular maintenance, necessitating travel through crucial winter ranges during winter closures. Mule deer on crucial winter ranges could be disturbed or displaced by this activity. Maintenance activities would be required only monthly or once every 2 months, making this impact minor.

Oil and gas leasing would continue in the Ross Butte area. The impacts of mineral development as described above could occur over a larger area as new leases are issued and developed.

Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be anticipated under Alternative 2. Impacts on the Ross Butte area would be greatest under this alternative. Increased anticipated oil and gas development would intensify the impacts described under Alternative 1. More wells developed would result in more soil and vegetation disturbance under this alternative.

Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be anticipated under Alternative 3.

Designation of the Ross Butte ACEC and implementation of the accompanying management actions would minimize surface disturbance, making impacts on the relevant and important characteristics least under Alternative 3. Making the ACEC unavailable for oil and gas leasing would maintain the fragile soils and vegetation communities in portions of the ACEC that are currently unleased. Prohibiting surface occupancy on erosive soils, sensitive plant species habitat, and slopes greater than 10% would also prevent accelerated erosion and damage or destruction of sensitive plants. There would be no impacts from road construction, heavy equipment traffic, tower construction, or periodic maintenance related to new cellular phone towers or other communication site developments.

Limiting OHV use to designated roads and trails would minimize the amount of soil and vegetation damage and accelerated erosion.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be anticipated under Alternative 4.

Designation of the Ross Butte MA and implementation of management actions would reduce surface disturbance compared to that under Alternative 1. Impacts from OHV use would be similar to those under

Alternative 3. Making new oil and gas leases in the area available with NSO stipulations would make the impacts of oil and gas development similar to those under Alternative 3.

Impacts from construction of new communication sites would be somewhat greater than under Alternative 3. Allowing construction of new facilities at the present site would add to impacts on rock alignments and the setting of the TCP in the area.

Conditioning development of existing leases or new proposed projects to avoid or protect erosive soils and sensitive plant communities should achieve protection of those resources. This more flexible stipulation would allow project proponents to develop project plans that protect the relevant and important characteristics of the area. However, without total protection, Special Status Plant Species could be adversely affected, causing the loss of some of the populations, which could affect the species population throughout its range.

CCC Ponds

The relevant values to be managed in the CCC Ponds area include a bottleneck on a well-defined mule deer migration route and recreational values, including a developed, nonmotorized trail system; fishing ponds; and interpretive facilities. The CCC Ponds area would be designated an ACEC under Alternative 3 (5,530 acres). The area would be designated an SRMA under Alternative 4 (1,040 acres). There would be no special designation for the CCC Ponds area under Alternatives 1 and 2.

Impacts Common to All Alternatives

Existing oil and gas leases could sustain surface-disturbing activities that would diminish scenic, recreation, and wildlife habitat quality. Well pad, road and pipeline construction, drilling, and production would include surface disturbance, human presence and activity, vegetation removal, and noise. Development or other activities in this area would have unknown impacts on the mule deer migration. Impeding or severing this migration route would impact the mule deer herd across the entire Wind River Front area. In particular, adding stress to migrating big game during the fall migration could impact animal fat stores, fitness for winter survival, and reproductive rates.

Moderate or heavy levels of human presence within the CCC Ponds area during the spring and fall migration periods could disrupt or displace mule deer during their migration.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 1.

Impacts from development of oil and gas leases would occur only on existing leases (35% of the area), because no new leases would be available. Stipulations applied to all activities within one-quarter mile of the CCC Ponds would protect recreational values in the immediate vicinity of the developed recreation sites, but would not be sufficient to protect the mule deer migration bottleneck.

Exploration and development of locatable minerals could cause vegetation removal, soil disturbance, noise, reduction in recreational and scenic quality, and displacement of migrating big game. The potential for locatable minerals is low, making the likelihood of this impact remote.

Prohibiting motorized vehicle use on the Pinedale Pathway would reduce disturbance of migrating and wintering wildlife, particularly mule deer, in this migration bottleneck area. Walking, skiing, and biking use on the Pinedale Pathway would still have some potential to disrupt and displace mule deer.

Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 2.

Impacts from locatable minerals would be similar to those under Alternative 1.

Additional oil and gas leasing in the CCC Ponds area could result in vegetation changes, disruption of big game, and reductions in scenic quality over a larger area. Allowing motorized vehicle use on the Pinedale Pathway would cause additional stress to migrating mule deer and could further impact the integrity of the migration route.

Impacts Under Alternative 3

The CCC Ponds ACEC would be designated (5,530 acres). In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 3. Alternative 3 would provide the greatest level of protection of the relevant and important characteristics of the CCC Ponds area.

Impacts from oil and gas development and use of the Pinedale Pathway would be similar to those under Alternative 1.

There would be no impact on vegetation, recreation sites, or big game from locatable mineral activities.

Limiting OHV and over-the-snow motorized equipment use to designated roads would reduce disturbance and displacement of wildlife, including migrating mule deer. The opportunity to use over-the-snow motorized equipment would be minimally reduced. The CCC Ponds ACEC is a small area, and other portions of the PFO and the Bridger-Teton National Forest are more popular snowmobiling areas.

Designing projects to accommodate big game migration in the CCC Ponds area could result in moving or realigning projects, conducting activities in seasons that do not conflict with migration activity, redesigning projects to be smaller or less visible, or disapproving proposed projects. These actions would increase the cost of projects, but would preserve the use of the migration bottleneck by big game.

Impacts Under Alternative 4, Proposed RMP

The CCC Ponds SRMA would be designated (1,040 acres). In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 4.

Impacts from oil and gas development, OHV use, and project design to accommodate mule deer migration would be similar to those identified under Alternative 3, over the smaller-acreage SRMA area that would be designated under Alternative 4.

There would be no impact on vegetation, recreation sites, or big game from locatable mineral activities. The area protected from locatable mineral development would be smaller than under Alternative 3.

Wind River Front

The relevant values to be managed in the Wind River Front area include cultural and historic artifacts and sites; big game winter and transitional habitats and migration routes and bottlenecks; and greater sage-grouse lekking, nesting, and brood-rearing habitats. The area would be designated an MA under Alternatives 1 (243,040 acres), 3 (358,400 acres), and 4 (201,240 acres). There would be no special designation for the Wind River Front area under Alternative 2.

Impacts Common to All Alternatives

Livestock grazing would occur in most of the Wind River Front area. Livestock grazing has the potential to alter vegetation communities, trample riparian areas, and compete with wildlife for forage. Livestock could also damage recreation sites by rubbing on or breaking structures and trampling or otherwise damaging campsites and other areas. Conversely, livestock grazing can also be used to manage vegetation to achieve desired seral stages or habitat qualities, such as vegetation height or density.

Development of existing oil and gas leases, including well pad, pipeline, and road construction, would disturb vegetation, impact scenic quality, and disturb or displace wildlife from preferred habitats. Noise, fragmentation, and human presence and activity would impact greater sage-grouse lek attendance, breeding, and nest success and big game habitat usage.

Locatable mineral exploration and development would entail surface disturbance, vegetation removal or alteration, human presence and activity, noise, and presence of vehicles or structures. These activities could impact greater sage-grouse lek attendance, breeding and nest success, and big game habitat usage. The potential for locatable mineral development is remote, making this impact unlikely.

Salable mineral development would entail surface disturbance, vegetation removal or alteration, human presence and activity, noise, and presence of vehicles or structures. These activities could impact greater sage-grouse lek attendance, breeding and nest success, and big game habitat usage.

Recreation users and other human activities could cause impacts, including trampling, disruption, or displacement of livestock and wildlife; accidental wildland fire ignition; and accumulation of trash.

Impacts Under Alternative 1, Continuation of Existing Management

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 1.

A large area of the Wind River Front would be unavailable for future oil and gas leasing. Impacts related to oil and gas development would be limited to the area currently leased. Closing the area to oil and gas leasing and geophysical operations would protect the integrity of nationally important seismic information gathered at the U.S. Air Force (USAF) Detachment.

Impacts Under Alternative 2

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 2.

Oil and gas drilling within 6 miles of the USAF Detachment would compromise global nuclear detonation monitoring activities conducted at the facility, and data quality could suffer. Impacts on the seismic monitoring activities of the Detachment could have national and international implications.

Impacts Under Alternative 3

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 3.

The impacts of oil and gas development would be similar to those under Alternative 1.

Prohibiting geophysical exploration in the MA would prevent vegetation damage, disruption of wildlife, and disturbance to the recreating public.

The impacts of surface-disturbing activities would be mitigated. This could involve redesigning or moving proposed projects, applying seasonal restrictions to project construction, or disallowing projects. These requirements would minimize vegetation alteration, human activity in wildlife habitats during sensitive periods, disruption of recreational activities, and degradation of scenic values.

Prohibiting commercial timber harvesting could threaten forest health and degrade mule deer parturition habitat.

Impacts Under Alternative 4, Proposed RMP

In addition to the impacts common to all alternatives, the following impacts would be anticipated from Alternative 4.

The impacts of oil and gas development would be similar to those under Alternative 1.

Allowing forest management activities consistent with the HFRA would allow for projects designed to promote forest health and improve wildlife habitats.

4.18.4 Wilderness Study Areas

Impacts Common to All Alternatives

Both of the WSAs would be managed under the IMP. There are almost no discretionary actions that the RMP can take that would affect either area. There are no proposed actions contrary to managing the areas to protect their wilderness character. Therefore, the impact of the IMP is that the wilderness character of the areas would be preserved. The areas' opportunities for solitude and primitive, unconfined recreation, as well as any special features that further qualify them for consideration as wilderness, would be preserved. At the same time, activities that would adversely affect the wilderness character of the areas would be prohibited.

Impacts Under Alternative 1, Continuation of Existing Management

Because the Lake Mountain WSA is not closed to all motor vehicle use, it would continue to see motor vehicle use on existing roads. This activity has the potential to adversely affect the wilderness characteristics of the area. Motor vehicle use could cause additional surface disturbance if roads and camping areas were extended, and by the fact that motorized activity is not compatible with the concept of wilderness. Motor vehicle use would impact perceptions of solitude and would be contrary to the concept of primitive, unconfined recreation.

Classification of the WSAs as VRM Class I would provide an additional degree of protection above that provided by the IMP. Like the Wilderness IMP, the Class I VRM objective requires that the visual

character of the area be preserved. The impact of Class I would be to exclude projects from the area that would impact the visual quality.

Impacts Under Alternative 2

Potential impacts because of OHV use would be identical to those under Alternative 1.

Under this alternative, both WSAs would be designated as VRM Class II. In spite of this, there is no likelihood of impacts on the WSAs because of the umbrella protection provided by the Wilderness IMP, the primary authority under which the WSAs are managed (see Impacts Common to all Alternatives).

Impacts Under Alternative 3

This alternative would maximize protection for the wilderness values of both the WSAs because both would be closed to all motor vehicle use and both would be managed under a Class I VRM objective.

Impacts Under Alternative 4, Proposed RMP

Impacts under this alternative would be the same as under Alternative 3.

4.18.5 Wild and Scenic Rivers

Methods of Analysis

BLM assessed the suitability of eligible waterways through the RMP process. Factors considered (see Section 4(a) of the Wild and Scenic Rivers Act of 1973 [WSRA]) include—

- The characteristics that do or do not make the area a worthy addition to the National Wild and Scenic Rivers System (NWSRS).
- The status of landownership and land and resource uses in the area, including private land and incompatible uses.
- Reasonably foreseeable potential uses of the public lands involved and related waters that would be enhanced, foreclosed, or curtailed if the area were included in the NWSRS, and the values that may be foreclosed or diminished if the public lands are not protected as part of the NWSRS.
- Public, state, local, tribal, or federal interests in designation or nondesignation of any part or all of a waterway involved, including the extent to which the administration of any or all of the waterway, as well as the costs thereof, may be shared by state, local, or other agencies and individuals.
- The estimated costs of acquiring necessary lands, interests in lands, and administering the area if it was added to the NWSRS. Section 6 of the WSRA outlines policies and limitations for acquiring lands or interests in lands by donation, exchange, consent of owners, easement, transfer, assignment of rights, or condemnation within and outside established river boundaries.
- The ability of BLM to manage and/or protect the public lands involved as part of the NWSRS or by another mechanism (existing or potential), to protect identified values other than WSR designation.

- Historical or existing rights that could be adversely affected. In the suitability review, adequate consideration was given to rights held by other landowners and applicants, lessees, claimants, or authorized users of the public lands involved.
- Other issues and concerns, if any.

The 10 waterways found eligible were analyzed using the above factors by a BLM planning team in preparation for this RMP in March 2002. The full report—*Final Report, Pinedale Field Office Review of Potential Wild and Scenic Rivers in the Pinedale Resource Management Plan Planning Area*, prepared for BLM by Jonas Consulting, Flagstaff, Arizona, December 2, 2002—is available for review in the PFO.

Impacts Under Alternative 1, Continuation of Existing Management

Under indefinite interim management, the qualities that qualified the 10 waterways as eligible for inclusion in the NWSRS would be afforded protection. The undeveloped nature of the waterways would be protected.

Impacts Under Alternative 2

Under this alternative, none of the eligible waterways would be recommended for designation under the WSRA. All would be subject to the changes brought about over time from resource use and development that, in the long term, would impact the wild, scenic, recreational, fisheries, historical, cultural, or other ecological values that qualified them as eligible for consideration.

Impacts Under Alternative 3

This alternative would provide long-term protection for the wild, scenic, recreational, cultural, fishery, historical, wildlife, or other ecological values found to be present in the 10 eligible waterway segments. The values identified above would increase in value over time as the majority of the planning area changes through development. It would displace development-oriented uses such as water impoundment or diversion, prevent actions such as disposal of public land, and impact mineral development or other surface-disturbing activities on designated public land parcels. Recreational uses would generally be enhanced, and funding for management would be more readily available because the waterways would be part of a national system.

The segments proposed for inclusion in the WSR system in this alternative are all located entirely on BLM-administered public lands. No costs would be incurred in land acquisition to manage the segments.

The Green River segment contains a number of existing water rights and several ditches for diverting the water. Inclusion of the Green River segment in the WSR system could help to ensure future availability of the water. Although the proposed management actions provide for construction of some new structures, construction of new irrigation or water access ditches could be made more difficult by the ROW avoidance area and requirement that new structures not detract from the outstandingly remarkable characteristics of the area.

Two of the four segments (Scab Creek, Silver Creek) are located within the Scab Creek Wilderness Study Area. Potential uses of these lands are restricted by the IMP for lands under wilderness review. The limitations on these segments would be compatible with previously existing limitations under that policy. Water rights from these streams are held by private landowners downstream of the proposed segments. Protection of the potential WSR segments would assist in making water available to these users in the

future. Ditches for accessing water would be required to conform to the IMP and the requirement that new structures not affect the natural qualities of the area.

The East Fork River segment is located upstream of private lands and adjacent to the USFS boundary. Protection of this segment would assist in making water available to downstream water right holders in the future. Prohibition of ROWs and diversions under this alternative would be incompatible with existing or future adjudicated water rights.

Impacts Under Alternative 4, Proposed RMP

Under this alternative, portions of the Green River, East Fork River, and combined Scab Creek units would be recommended for designation under the WSRA. The remaining waterways would be dropped from consideration. The segments proposed for inclusion in the WSR system under this alternative are all located entirely on BLM-administered public lands. No costs would be incurred in land acquisition to manage the segments.

For the units dropped from consideration, the impacts would be identical to those under Alternative 2.

Lands recommended for designation would be managed to protect the values identified during the eligibility review. Long-term protection would be afforded the designated segments. The identified values would increase in value over time as development changes the majority of the planning area. Actions compatible with preservation would be allowed. Actions that would impair or change the nature of the segments would be displaced. The public lands would be closed to most surface-disturbing activities and would not be available for disposal, mineral leasing, or related exploration and development.

Transmission lines, water impoundments, or diversions would not be allowed. The visual quality of the lands would be preserved.

Recreational uses would generally be enhanced, and funding for management would be more readily available since the waterways would be part of a national system.

The Green River segment contains a number of existing water rights and several ditches to divert the water. Inclusion of the Green River segment in the WSR system could help to ensure future availability of the water. While the proposed management actions provide for construction of some new structures, construction of new irrigation or water access ditches could be made more difficult by the ROW avoidance area and requirement that new structures not detract from the outstandingly remarkable characteristics of the area.

Two of the four segments (Scab Creek and Silver Creek) are located within the Scab Creek Wilderness Study Area. The IMP for lands under wilderness review restricts potential uses of these lands. The limitations on these segments would be compatible with previously existing limitations under that policy. Private landowners downstream of the proposed segments hold water rights for these streams. Protection of the potential WSR segments would assist in making water available to these users in the future. Ditches to access water would be required to conform to the IMP and to the requirement that new structures not affect the natural qualities of the area.

Allowing ROWs for access to adjudicated water rights would make the area compatible with existing or future adjudicated rights. Construction of water access facilities could detract from the naturalness of the area. Design of facilities to maintain the outstandingly remarkable characteristics of the area would minimize this impact and preserve the segment’s value as part of the WSR system.

4.19 CUMULATIVE IMPACTS

This section defines cumulative impacts, describes the methodology used for assessing these impacts, describes projects and activities considered in this assessment, and presents the results organized by resource topic.

Cumulative impacts are the effects on the environment that result from implementing any of the alternatives in combination with other actions outside the scope of this plan, either within the planning area or outside it. The CEQ regulations for implementing NEPA define cumulative impacts as—

> *"The impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." (40 CFR §1508.7).*

The real effect of any single action cannot be determined by considering that action in isolation, but must be determined by considering the likely result of that action in conjunction with many others. The cumulative impact analysis for this Proposed RMP Final EIS evaluates the potential impacts associated with the management alternatives in combination with the potential impacts associated with other relevant activities that have occurred, are occurring, or are likely to occur in the vicinity of the planning area.

4.19.1 Impact Assessment Methodology

Land use planning is BLM's broadest level of decisionmaking. BLM planning-level decisions are programmatic decisions that allocate resources or specify allowable uses in all or portions of the planning area to emphasize certain management direction. Site-specific actions are rarely addressed in an RMP. As a result, the cumulative impact analysis is also broad and general in nature. It will present ranges and qualitative conclusions as opposed to bounded quantified details. These cumulative impacts will then be considered in subsequent NEPA documents that analyze specific projects or programs. Examples include oil and gas field development plans, livestock grazing allotment management plans, and individual authorizations such as ROWs or SRPs.

The Proposed RMP Final EIS is in itself a cumulative impact analysis, in that the decisions contained in each alternative form an entire program for allocation and management of uses on the public lands as a whole.

Analysis and description of the identifiable present effects of past actions are required to the extent that they are relevant and useful in analyzing whether the reasonably foreseeable effects of the Pinedale RMP alternatives may have a continuing, additive, and significant relationship to those present effects. Based on scoping, agencies have discretion on what is useful concerning past action for the agency's analysis of the effects of present action and its reasonable alternatives. BLM has focused this analysis on the current aggregate effects of past actions. The manifestation of past actions is the Affected Environment (Chapter 3). Specifics presented in Chapter 3 are not repeated here.

Effects of past actions and activities on resources are manifested in the current condition of the resource, which is described in Chapter 3 (Affected Environment) for resources on lands administered by BLM within the planning area. The cumulative impact analysis is based on numerous assumptions and projections about future actions and their effects. Detailed information about specific future actions may be unavailable. General terms such as low, moderate, and high are used to describe the intensity of

effects. The cumulative impact analysis also compares the relative intensity of effects between alternatives.

CEQ guidance directs cumulative impact analysis to focus on important issues of national, regional, or local significance. This analysis focuses on RMP actions that, when combined with other past, present, and reasonably foreseeable future actions, would collectively be significant. Not all issues identified for direct or indirect impact assessment in this Proposed RMP Final EIS are analyzed for cumulative effects. Because of the wide geographic scope of a cumulative impact assessment and the variety of activities assessed, cumulative impacts are commonly examined at a more qualitative and less detailed level than are direct and indirect impacts.

Public documents prepared by federal, state, and local government agencies are the primary sources of information regarding past, present, and future actions. Actions undertaken by private persons and entities are assumed to be captured in the information made available by such agencies. Speculative or uncommitted projects are not included in the projections. These projections are not planning decisions. Using them in this analysis does not constitute approval by BLM or any authorizing agency. These projections do not set a limit or cap on future BLM actions. Unforeseen changes in such factors as economics; public demand; and federal, state, and local laws and policies could result in different outcomes than those projected for this analysis.

The potential cumulative impacts are described for each affected resource within a defined cumulative impact analysis area (CIAA). The CIAA covers different geographic areas depending on the specific resource being evaluated. The CIAAs are described in each of the resource sections below. CIAAs that extend beyond the planning area are largely for resources that are mobile or migrate, compared to resources that are stationary. For example, the air quality CIAA is large because it is based on the complex interaction between climatic factors, terrain, and the potential for significant impacts to occur in sensitive areas within the airshed. Smaller CIAAs were established for resources that are stationary such as cultural resources, minerals, and visual resources. In some cases these CIAAs might be the same as the planning area boundary. Activities and development that occur within or outside the CIAAs have the potential to create cumulative impacts on the specific resource being analyzed.

BLM considered the following factors in this cumulative impact assessment:

- Federal, nonfederal, and private actions
- The potential for synergistic effects or outcomes
- The potential for effects to cross political and administrative boundaries
- Other spatial and temporal characteristics of each affected resource
- The comparative scale of cumulative impacts across alternatives
- Scoping comments.

4.19.2 Projects and Activities Considered

The following activities were identified as having the greatest likelihood to generate potential cumulative impacts when added to activities associated with the Pinedale RMP alternatives:

- BLM land management plans and activities in adjacent planning areas
- Regional oil and gas development activities (e.g., exploration, production, and pipeline development)
- Regional recreation activities (e.g., hunting, OHV use, dispersed recreation)
- Economic development activities in Lincoln, Sublette, and Sweetwater counties.

Activities and development that occur within the CIAAs have the potential to create cumulative impacts on the specific resource being analyzed. Oil and gas development presents the highest likelihood for impacts within the Pinedale planning area and in southwest Wyoming as a whole. Maps 4-3 and 4-4 show existing and reasonably foreseeable oil and gas development projects that could fall within the various CIAAs. These projects are also encompassed by the oil and gas RFD for each BLM planning area in southwest Wyoming (Table 4-26). These numbers represent potential oil and gas development based on the economic and geologic potential of BLM-administered public land and mineral estate. The reasonably foreseeable development scenario for oil and gas within the planning area takes into account past well abandonment rates as well as new development in determining the level of surface disturbance anticipated during the life of the plan. Other actions that would create the potential for cumulative impacts are listed in Table 4-27, Summary of Other Activities Considered. The projects listed in these two tables are not presented as an exhaustive list of actions, but every effort has been made to present a representative list of actions that could contribute to cumulative impacts.

Table 4-26. Summary of Oil and Gas Reasonably Foreseeable Development for Public Lands and Mineral Estate in Southwestern Wyoming

Planning Area	Existing Wells	Public Land and Mineral Estate RFD	Private and State Lands RFD	Total Oil and Gas RFD	Total Potential Wells (existing plus RFD)
Kemmerer FO	1,562	1,221	1,459	2,680	4,242
Pinedale FO	2,970	7,804	1,247	9,051	12,021
Rawlins FO	3,450	4,087	5,111	9,198	12,648
Rock Springs FO	1,800	1,200	N/A[1]	1,200	3,000
Bridger-Teton National Forest	N/A[1]	N/A[1]	N/A[1]	N/A[1]	N/A[1]
Total	**9,782[2]**	**14,312[2]**	**7,817[2]**	**22,129[2]**	**31,911[2]**

[1] Not available
[2] These totals would be increased by development in the Bridger-Teton National Forest.

Table 4-27. Summary of Other Activities Considered

Project Title	Project Description
“AccessYes” walk-in areas and hunter management areas (WGFD)	Private acreage listed under the walk-in program is increasing and often provides access to enclosed BLM lands, as well as the private lands that are enrolled in the program.
Aspen treatments	Project includes restoration of aspen communities, which will improve diversity and complexity of watersheds and provide a healthy environment for those dependent resources.
Big Sandy and Little Sandy Rivers riparian exclosures	Designed to enhance riparian plant communities and fishery habitats as mitigation for sheep-to-cattle conversions.
Big Sandy Rock Sill	Provides artificial habitat for increasing fish populations in the Big Sandy River.
BLM Wild Horse Gathers	BLM wild horse gathers from habitat management areas (HMA) in adjacent BLM offices.
Bone Draw	Designed to increase game fish populations in the Big Sandy River.

Project Title	Project Description
Carbon Basin Coal Lease	Projected surface mine life of 11 years with a production rate of initially 1.2 million tons per year, reaching a maximum of 4.2 million tons per year with total reserves of 31.1 million tons. Underground mine life would occur simultaneously with surface mining, lasting for about 17 years with an average reasonably foreseeable production of 6.6 million tons per year. Total underground mining production would be 118 million tons. Projected reasonably foreseeable surface disturbance would be 288 acres per year for a total of 4,896 acres of surface disturbance throughout the life of the mine. Total mine life for both surface and underground mining is expected to be 20 years.
Comprehensive Conservation Plan (CCP) for the Cokeville Meadows National Wildlife Refuge	USFWS is developing a CCP for the Cokeville Meadows National Wildlife Refuge. Plan completion is expected in 2009.
CCP for the National Elk Refuge	USFWS is developing a CCP for the National Elk Refuge on the north side of Jackson, Wyoming. The 25,000-acre refuge includes nearly 1,600 acres of open water and marsh lands, 47 different mammals, and nearly 175 species of birds. Plan completion is expected in 2006.
CCP for the Seedskadee National Wildlife Refuge	Completed in 2002.
Countywide transportation development	Planning, development, reconstruction, and maintenance of the county road net in two counties in the planning area.
Colorado River cutthroat trout (CRCT) conservation population maintenance and enhancement project	Project includes the maintenance or restoration of watersheds, the spatial and temporal connectivity within and between watersheds, water quality or groundwater, and sediment regimes and transport.
CRCT passage and road drainage features	Project includes the reconstruction or removal of roads and drainages that pose risk to aquatic habitats, removal of culvert barriers, and removal of stream channel crossings.
Eden/Farson Irrigation Project	Furnishes an irrigation water supply for 17,010 acres in the vicinity of the towns of Farson and Eden in southwestern Wyoming. Project features include improvements to and maintenance of the reservoirs and drainage systems.
FMC's Proposed Haul Road	Proposed project consisting of a paved haul road, six pipelines, and one fiber-optic line from FMC's Westvaco mine/plant site to its Granger plant site. FMC is requesting a 400-foot wide corridor for construction, with 200-foot wide segments during operations with certain exceptions (i.e., cut and fill areas), and two bridges (to cross over the Union Pacific Railroad tracks and the Black's Fork River).
Green River RMP	Comprehensive land use plan focuses on similar resource issues and management to the south of the planning area. Green River RMP manages portions of the Pinedale planning area CIAAs for air, cultural, forestry, recreation, vegetation, VRM, watersheds, and wildlife management.
Habitat Extension Services (WGFD)	Habitat treatments on private lands to benefit wildlife.

Project Title	Project Description
Hay Reservoir Geophysical Project	Proposed geophysical project that lies within the BLM Rock Springs Field Office planning area (55%) and the Rawlins Field Office planning area (45%). The south boundary of the proposed project lies approximately 20 miles north of Interstate 80. It extends northward past Hay Reservoir and ends 3 miles north of Five Fingers Butte.
Haystacks Geophysical Project	Geophysical operations in the Haystacks area. The project has been completed.
Jim Bridger Flue Pond Expansion Project	The project is completed.
Jonah Cryogenic Plant	Cryogenic plant at terminus of the Jonah Field gas-gathering system.
Monell CO_2 Pipeline Project	Proposed CO_2 pipeline-related facilities along an existing pipeline from the Exxon/Mobil Shute Creek CO_2 pipeline system in Sweetwater County, Wyoming, to the existing Monell Federal Unit. Proposed facilities include metering equipment, a booster station, and cathodic protection.
Native Fish Restoration (WGFD)	Restore native fish to traditional waterways on private, state, or WGFD lands.
PacifiCorp Point of Rocks to Rock Springs Transmission Powerline Project	The project is completed.
Pioneer Pipeline ROW	Construction of a 12- to 16-inch refined petroleum pipeline across federal lands in southwest Wyoming. The completed pipeline extends from Sinclair, Wyoming, west to an existing block valve in Croydon, Utah.
Quantum Geophysical Project	The project is completed.
Range-wide Three Species Conservation Agreement and Strategy	In progress. This plan will include the protection of habitat and populations of flannelmouth sucker, bluehead sucker, and roundtail chubs. Activities will be outlined in the plan that will decrease impacts from federal and state management actions.
Rock Creek riparian exclosures and habitat improvements	In progress. Designed to enhance riparian habitat and water quality in the Rock Creek corridor, which contains a CRCT core conservation population.
Sage-grouse Conservation Plans	Prepared plans for recovery of the greater sage-grouse.
South Jonah Geophysical Project	Geophysical operations using vibroseis method to collect subsurface data on 400 square miles of public land.
Veritas DGC Land Incorporated LaBarge 3D Geophysical Project	Proposed geophysical project located west of LaBarge, Wyoming, in portions of Sublette and Lincoln counties. The general project boundaries would be LaBarge Creek on the south, South Piney Creek on the north, the Calpet Highway (State Highway 235 and Sublette County Road 134) on the east, and the BLM-U.S. Forest Service boundary on the west.
Warren Bridge Fish Habitat Structures	Completed/ongoing maintenance of instream structures that provide habitat for sport fish and native nongame fish species.
Exploratory Drilling Wolverine Proposal	Proposal for three exploratory wells north of State Highway 28 in Sweetwater County. Two wells have already been drilled.

4.19.3 Air Resources

The CIAA used to analyze cumulative impacts on air quality extends far beyond the planning area, as shown on Map 4-5. More details on regional areas of consideration and the specific locations of areas outside the planning area that were addressed are found in the AQTSD (Appendix 19).

Sources of potential cumulative impacts on air quality would include emissions from CBNG and conventional oil and gas development on existing and new leases within and outside the planning area. Wildland fires and prescribed burns that occurred within the CIAA would result in impacts on air quality from emissions of particulates and polyaromatic hydrocarbons. Impacts from wildland fires would also result in reduced visibility. Vehicular activity would produce emissions that could impact air quality primarily along the Interstate 80 corridor.

Permitted stationary sources of air emissions would also continue to contribute to potential cumulative impacts on regional air quality. The Wyoming Statewide Emission Inventory conducted by TRC Mariah indicates that there will be an increase of future emissions of NO_x, SO_2, PM less than 10 microns in diameter (PM_{10}), and PM less than 2.5 microns in diameter ($PM_{2.5}$) in the planning area and for the State of Wyoming. The Wyoming statewide RFD emissions increases were calculated by subtracting the state-permitted emissions through June 30, 2003, from all NEPA-authorized and other quantifiable emissions from June 30, 2004. The planning area emissions are 2001 base-year emissions subtracted from 2020 emissions. Potential emissions increases are summarized in Table 4-28. For further details, refer to Appendix 19.

Table 4-28. Summary of Emission Increases as Estimated by the Wyoming Statewide Emission Inventory and BLM Emission Inventory

Air Pollutant	Emissions (tons per year)					
	Wyoming Statewide Complete[1]		BLM Sources[2]			
	Wyoming	Pinedale Planning Area	1	2	3	4
NO_x	26,511	1,719	23,524	25,050	18,877	23,170
SO_2	30	44	145	156	115	140
PM_{10}	(1,072)	103	4,829	5,134	3,912	4,957
$PM_{2.5}$	(1,343)	102	3,539	3,749	2,864	3,308

[1] Includes the sum of 1) all permitted source changes from January 1, 2001, through June 30, 2003; 2) Wyoming Oil and Gas Commission change in well emissions for 2002; and 3) reasonably foreseeable development (RFD) that refers only to oil and gas projects and is the change in emissions after June 30, 2003 for authorized NEPA and other quantifiable emissions. (Specifically, the RFD case is defined by TRC as "…1) the NEPA-authorized but not yet developed portions of the Wyoming NEPA projects, and 2) not yet authorized NEPA projects for which air quality analyses were in progress and for which emissions had been quantified.)

[2] Changes in emissions from 2001 to 2021 for the planning area (Tables A19-5 through A19-7 in Appendix 19)

Particulate emissions estimated for the planning area (Tables A19-5 through A19-7 in Appendix 19) are much higher than the Wyoming statewide RFD case. This is expected because many of the particulate sources (for example, construction) do not require an air permit and would not be counted in the Wyoming Statewide RFD case, which takes into account emissions from future NEPA projects that have been approved and other quantifiable emissions from WDEQ permitted emissions (see footnote in the above table for more details).

Ambient air monitoring data show low concentrations for criteria pollutants (except ozone) in the area (Chapter 3). Taking into account the emission information estimated for this analysis and project-specific air quality analyses conducted in the area such as that for the Jonah Infill Drilling project, BLM concluded that increases in concentrations of CO, NO_x, sulfur dioxide SO_2, PM_{10}, and $PM_{2.5}$ in the planning area are unlikely to cause an exceedance of the National Ambient Air Quality Standards (NAAQS), because the existing concentrations are low (less than 50% of NAAQS).

More recently, ozone data have been collected at three monitoring sites in the area beginning in 2005. These stations recorded elevated ozone levels during 2005, 2006, and 2008 (Table 3-5). The elevated ozone levels have been recorded during the winter months, primarily in February, which is an atypical time compared with other areas of the country where elevated ozone levels have been observed. Typically, ozone is thought to be a summertime problem in urban areas. Elevated ozone concentrations are uncommon during the winter months; however, the data collected at the three monitoring stations do not appear to be an anomaly because these conditions were recorded in February 2005, 2006, and 2008. There are several hypotheses regarding the cause(s) of these elevated ozone events, including stratospheric ozone intrusion, ozone transport from other areas, and a combination of unique meteorological, land surface, and topographical conditions acting upon local scale emissions.

Because a quantitative relationship between the expected air emissions calculated above and the subsequent potential cumulative impacts on ozone and the air quality values of visibility and atmospheric deposition are not known, it is not possible to quantify potential impacts on these air quality values from the sources in the ROI. These cannot be quantified because of the complex nature of the formation of ozone, the complexity of visibility impairment, and atmospheric deposition in the atmosphere.

However, because air quality analyses from recent energy development projects such as the Pinedale Supplemental EIS (SEIS) project (USDI, BLM 2007) and Jonah (USDI, BLM 2006) estimate potential impacts on visibility, emissions described in Section 4.2 might contribute to impacts on visibility (Table 4-29 and Table 4-30). The sources modeled for Jonah and the Pinedale SEIS have some similarities to the Pinedale planning area analysis.

Table 4-29. Summary of 2005 Air Quality Impacts from Well-Field Related Activities in the Pinedale Anticline Planning Area

Air Quality Impact	Predicted Impact Summary
Increased concentrations of NO_2, SO_2, PM10, and $PM_{2.5}$	Predicted concentrations are in compliance with applicable National Ambient Air Quality Standards and Wyoming Ambient Air Quality Standards at all locations; predicted near-field concentrations are below the prevention of significant deterioration (PSD) increments[1] ; predicted far-field concentrations are below PSD increments.
Visibility (regional haze) at Class I and Sensitive Class II areas (far-field)	Predicted impacts are greater than 1.0 deciview (dv) threshold for a maximum of 75 days per year at the Bridger Wilderness, 13 days at the Fitzpatrick Wilderness, 4 days at Grand Teton National Park, 12 days at the Gros Ventre Wilderness, 21 days at the Popo Agie Wilderness, 612 days at the Wind River Roadless Area, and below 1.0 dv at all other sensitive areas.
Visibility (regional haze) (mid-field communities)	Predicted impacts are greater than 1.0 dv threshold for a maximum of 141 days per year at Boulder, 65 days at Cora, and 94 days at Pinedale.
Atmospheric/terrestrial deposition	Predicted impacts from sulfur and nitrogen deposition are less than the total deposition level of concern at all analyzed areas.
Sensitive lake acid neutralization capacity (ANC)	Predicted impacts resulted in less than the level of acceptable change (LAC) at all acid-sensitive lakes.

[1] All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.

Table 4-30. Summary of Potential Impacts From the Jonah Infill EIS

Air Quality Component	Comment
Air Pollutant Concentrations	
Criteria Air Pollutants	Near-field total concentrations are in compliance with applicable National Ambient Air Quality Standards (NAAQS) and Wyoming Ambient Air Quality Standards (WAAQS) Near-field project concentrations may exceed PM10 24-hour PSD Class II increment Far-field total concentrations are in compliance with applicable NAAQS and WAAQS Far-field project concentrations are well below applicable PSD Class I increments
Visibility	
Days with > 1.0 Δdv	Potential visibility impacts from the Jonah Infill project may exceed the Federal Land Managers' Air Quality Related Values Work Group (FLAG) visibility threshold in Bridger Wilderness Potential cumulative visibility impacts were greater than the FLAG visibility threshold in Bridger Wilderness and the Wind River Roadless Area
Atmospheric Deposition	
Lake Chemistry LAC	Cumulative decreases in ANC were less than the lake chemistry LAC for sensitive lakes

[1] All NEPA analysis comparisons to the PSD increments are intended to evaluate a threshold of concern and do not represent a regulatory PSD Increment Consumption Analysis.

Potential impacts from Jonah and the Pinedale SEIS are included as examples of quantitative cumulative potential impacts. Potential impacts from the planning area may be generally similar to the potential impacts estimated for specific projects. For example, potential significant visibility impacts for Jonah suggest that planning area visibility impacts may be significant.

The Pinedale Anticline and Jonah Infill EIS suggest visibility impacts on Bridger, Fitzpatrick, Popo Agie, and Wind River Roadless areas, as well as communities within the planning area. In addition, preliminary results from air quality analyses for BLM projects in and near the planning area suggest that potential impacts on visibility and atmospheric deposition may be significant. Recent monitoring within the planning area indicates that high ozone concentrations have occurred during the last two winters. BLM expects that several EISs will be available in the near future, which will provide more information regarding these potential impacts. These are—

- Pinedale Anticline Revised Supplemental EIS: Contact project lead Caleb Hiner in the PFO at Caleb_Hiner@blm.gov
- Continental Divide/Creston: Contact project lead Dave Simons in the Rawlins FO at David_Simons@blm.gov
- Moxa Arch: Contact project lead Michele Easley in the Kemmerer FO at Michele_Easley@blm.gov
- Hiawatha: Contact project lead Susan Davis in the Rock Springs FO at Susan_Davis@blm.gov.

BLM has chosen to describe potential air quality impacts in the Pinedale RMP and surrounding areas qualitatively. In the near future, BLM plans to analyze RMP cumulative far-field air quality impacts quantitatively with screening dispersion modeling. This would be part of a statewide analysis BLM refers to as the "State of the Atmosphere" study.

The State of the Atmosphere study will provide an annual summary of potential cumulative far-field impacts on criteria air pollutant concentrations, Class I visibility, and atmospheric deposition throughout the State of Wyoming. BLM intends to rely on dispersion model results from the State of the Atmosphere study, as well as air quality monitoring and project EIS modeling results, to describe potential cumulative far-field air quality impacts in future BLM RMPs.

Global Climate Change

The assessment of greenhouse gas (GHG) emissions and climate change is still in its formative phase; therefore, it is not yet possible to know with confidence the net impact on climate. However, the Intergovernmental Panel on Climate Change (IPCC 2007) recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in globally average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic [man-made] greenhouse gas concentrations."

The lack of scientific tools designed to predict climate change at regional or local scales limits the ability to quantify potential future impacts. However, potential impacts on air quality due to climate change are likely to be varied. For example, if global climate change results in a warmer and drier climate, increased particulate matter impacts could occur due to increased wind blown dust from drier and less stable soils. Cool season plant species' spatial ranges are predicted to move north and to higher elevations, and extinction of endemic threatened/endangered plants may be accelerated. Due to loss of habitat or competition from other species whose ranges may shift northward, the population of some animal species may be reduced. Less snow at lower elevations would be likely to impact the timing and quantity of snowmelt, which, in turn, could result in a longer wildfire season.

4.19.4 Cultural Resources

The CIAA used to analyze cumulative impacts on cultural resources includes the viewshed (5 miles) of the Lander Trail that extends outside the planning area (Map 4-6). Impacts on cultural resources would primarily be contained within the planning area, but could extend outside this area where development activity creates visual intrusions to the portions of the Lander Trail that extend outside the planning area.

Potential cumulative impacts on cultural resources would result from surface-disturbing activities that cause erosion or vibration from traffic and/or machinery, soil compaction, and landscape alteration. Oil and gas development would cause the greatest amount of cumulative effect on cultural resources from construction of well pads, roads, pipelines, and diverse ancillary facilities. These development actions could result in damage to or loss of cultural resources. Direct impacts on cultural resources can occur from unanticipated subsurface discoveries (cultural resources discovered during project construction activities). Unanticipated discoveries generally result in the irretrievable loss of some or occasionally all of the cultural resource involved. Even when salvage excavations result in the retrieval of some or a substantial amount of data, the nature of archeological discovery during surface-disturbing activities results in the partial loss of information (e.g., spatial data, associated materials that wind up in the spoil piles). Surface-disturbing activities (e.g., mineral development, livestock grazing improvements, dispersed recreation) on private, state, and other federal lands within the CIAA would substantially increase the level of cumulative impact on cultural resources.

The cumulative loss of archeological data, artifacts, and information resulting from illegal artifact collecting cannot be underestimated. It is estimated that virtually every new site recorded since 1990 has been subject to prior artifact pilfering. Because the primary target of artifact pilferers includes the diagnostic artifacts, collectively called "arrowheads" by the looters, loss of these diagnostic temporal

indicators has a severe impact on the archeological record. The problem is exacerbated in areas of development, with numerous roads accessing many areas and with concentrations of people in and directly adjacent to significant cultural resources. In addition, lithic and bone tools, groundstone, and even lithic debitage (called "chips" by collectors) are removed. Some sites recorded 20 to 30 years ago containing substantial surface assemblages now are completely devoid of surface archeological materials. When surface-disturbing activities are proposed in such areas, lack of surface material may result in archeological clearance. When surface-disturbing activity is then implemented, an archeological discovery can be made. This is one primary reason why so many unexpected discoveries occur in the planning area. The cumulative impact of this situation is severe.

Rock art and rock alignment sites have suffered cumulatively. Direct impact (e.g., vandalizing the rock surface, excavating into or removal of the alignment) is severe at many of the recorded rock art sites in the planning area, such as the LaBarge Bluffs site, Chevron Petroglyphs, "Big Chief Panel" (where a petroglyph panel was physically removed by chiseling out a 2-foot square of the sandstone face), and the Calpet site. Natural erosion also has a cumulative impact, most noteworthy at the Calpet Rock Art Site, where the famous "bowhunter shooting an elk" petroglyph (featured on the cover of Dr. George Frison's *Prehistoric Hunters of the High Plains*, second edition) is now almost completely eroded away. The cumulative impact at rock art and rock alignment sites has also been severe. These sites are poorly understood in the overall prehistory of the planning area. Their loss or destruction results in irreparable damage to a rich and fascinating element of the prehistoric cultural heritage of Wyoming.

Surface-disturbing activities that occur in close proximity to sensitive Native American sites and some historic sites would potentially introduce visual intrusions to those sites where the setting contributes to their NRHP eligibility. This would result in a cumulative loss of the integrity of the setting of sensitive Native American sites and the viewshed of historic trails. This has been the case, for example, along the Lander Trail in the Deer Hills area and in direct proximity to the "Piney Rock Art site" (private surface), where an operator placed an oil well and pump jack whose grasshopper pump is run 24 hours a day, 7 days a week by a noisy diesel motor. The cumulative impact is the direct introduction of visible, audible, and atmospheric elements that are out of character with the historic property.

Projects implemented on land owned by the State of Wyoming and on private surface where BLM's cultural resource process does not apply could result in substantial cumulative effects. For example, BLM took substantial measures to protect and manage the Lander Trail where it was crossed by the Anticline development. Development of the lone State of Wyoming section resulted in a large gas pad development 100 yards from the Lander Trail that lacked any screening, visual mitigation, or other protective measures. This lone project directly impacted and will result in a cumulative adverse effect to the Lander Trail setting, despite some 5 years of concerted effort among BLM, SHPO, the Oregon-California Trails Association, Shell Oil, and Ultra Resources to maintain an intact historic setting.

Changes in private land use and zoning have resulted in substantial alteration of historic setting along the Lander Trail. The Fairbanks/Schwabacher development at Sand Springs and the subdivision proposed along the Lander Trail just west of the New Fork River are two examples. Development on private surface has had considerable cumulative impacts on the Lander Trail and Sublette Cutoff. In some areas, the trails have been obliterated (for example, the Sublette Cutoff by U.S. Highway 189; portions of the Lander Trail west of Buckskin Crossing). In other areas of private land, the Trail has demonstrated a remarkable resilience (e.g., by Muddy Creek and up South Piney Creek) but the setting has been compromised by ranch development (e.g., buildings, corrals, irrigated meadows).

The cumulative effect on archeological resources—especially on private land, but also on state land—has been monumental. Because so much of the private land in Sublette County was deeded because of direct proximity to perennial water sources, the past 130 years of agricultural development has been

concentrated here. These extremely high prehistoric site density areas have been impacted the greatest, primarily by irrigation projects, but also by the very fact of ranch construction, the growth of towns, and general private land development.

Potential impacts on cultural resources would be in part mitigated by CRMP actions; implementation of federal regulatory laws, actions, and guidelines designed to protect cultural resources; and through consultation processes with the SHPO and Native American tribal representatives. However, it is anticipated that such measures would not prevent many impacts from occurring. Severe impacts would be likely to occur in situations in which undocumented NRHP-eligible archeological sites are impacted but not recognized. Significant impacts would also likely occur to the Lander and Sublette Cutoff Trails as a result of oil and gas development and to select sites considered sensitive to Native Americans because of further encroachment of the viewshed and natural setting.

Instances in which BLM is involved in project permitting, potential impacts on NRHP-eligible archeological sites would be less likely to occur under Alternative 3 and (to a lesser extent) under Alternative 4, as a result of fewer proposed developments, more restrictive stipulations, and less overall surface disturbance. Potential impacts on historic sites and trails would be least likely to occur under Alternative 3 because of additional restrictions on oil and gas and other development, increased visual and surface-disturbing buffers around the Lander and Sublette Cutoff Trails, and the designation of a VRM Class II area around the Lander Trail. Alternative 2 would present the greatest potential for impacts on historic sites and trails because of a lack of restrictions on oil and gas and other development.

4.19.5 Forestry

The CIAA used to analyze cumulative impacts on forest management extends outside the planning area, following fourth-order watershed (eight-digit Hydrologic Unit Code [HUC]) boundaries (Map 4-7). The CIAA is composed of fourth-order watersheds that completely or partially overlap the planning area. The fourth-order watersheds were used as the basic unit of analysis because the scope of cumulative influence would be at the watershed scale and is not expected to extend beyond this scale.

Some of the cumulative impacts on forest management would result from surface-disturbing actions that remove forest cover. Because mineral development activities would take place mainly outside of forested areas, cumulative impacts would be minimal. However, woodland forest communities occur in areas that have a higher potential for oil and gas development, thus creating the potential for impacts on these areas. Impacts would include direct removal of forest cover to develop well sites, roads, and surface infrastructure. These areas would be taken out of timber harvest production for the life of the well or mining operations. Mineral resource development activity can also benefit forest management by providing opportunities for increased accessibility to potential harvest or management areas.

Management actions designed to protect sensitive resources would, in some cases, result in the exclusion of forestland from harvesting of forest products or other mechanical forest health treatments, limiting options available for forest stand restoration.

Cumulative impacts of forestry under Alternative 2 would be substantive. Alternative 2 emphasizes commercial production of forest products without emphasis on restoration or old growth outside of the HFRA-defined old-growth stands. The continued emphasis on production would emphasize larger tree removal and commercial use of the woodlands. Studies in Montana after the 2000 fires showed that stands harvested with emphasis on commercial timber burned at higher intensities and caused more soil damage than in unlogged areas. Restoration to more fire-resilient and -resistant stands would not occur.

Cumulative impacts under Alternatives 3 and 4 would also be substantive. The focus of these alternatives is on restoration of the forest and woodlands of the planning area to presuppression composition structure and function. These alternatives potentially would treat many more acres than under Alternative 2 and concentrate on small tree removal and removal of insect- and disease-affected trees. Woodland treatments in these alternatives could treat up to 700 acres per year. In the long term, this aggressive restoration of forests and woodlands would impact the structure, composition, and function of these areas in a shorter time span than Alternative 2. This would affect not only the vegetation, but also VRM by creating a more varied vegetative mosaic on the landscape, replicating presuppression landscapes. Cumulative effects would also occur to fire management. Restoring aspen stands would create natural fuel breaks to limit the spread of large wildland fires. Restoration of fire-resilient vegetation would also open more AMR options for suppression activities and make WFURB management easier and more cost effective.

4.19.6 Lands and Realty Management

The CIAA used to analyze cumulative impacts on the uses administered by the lands and realty program includes the entire planning area.

Impacts on lands and realty management would result from actions that affect the location and design of proposed ROWs. These actions are primarily the result of implementing surface use restrictions (e.g., VRM designations, land use closures, NSO stipulations) and management prescriptions designed to protect natural resources. These actions would limit or restrict ROW project design and where ROWs would be permitted. The greatest impacts would occur in areas managed to meet VRM Class II objectives, as avoidance or exclusion areas for ROWs, and in areas managed with NSO stipulations.

The actions and activities considered in this analysis, including land use restrictions for the preservation of sensitive resources, would not prevent BLM from accommodating major utility and transportation corridors. The degree of impact would be lowest under Alternative 2 because of fewer land use restrictions for the protection of sensitive resources. Conversely, the implementation of increased restrictions to protect sensitive resources under Alternative 3 would result in the greatest level of impact on lands and realty.

4.19.7 Livestock Grazing

The CIAA used to analyze cumulative impacts on livestock grazing includes all grazing allotments within the planning area (Map 3-4). Livestock are managed within the boundaries of these allotments and therefore could be affected by activities occurring in these areas.

Potential cumulative impacts on livestock grazing operations would result from a combination of activities and land uses occurring within the CIAA. Such impacts would result primarily from surface-disturbing activities, human disturbance, and the presence of wildlife that compete with livestock for rangeland resources. These activities result in livestock displacement, direct removal and indirect degradation of forage, and direct and indirect costs to the grazing permittee. Reclamation efforts and vegetation treatments would reduce impacts on livestock grazing; however, construction of roads and well pads and the constant presence of humans and wildlife would result in long-term and/or permanent impacts.

An increase in human population would create additional demands for recreational use of the public lands used for grazing and could result in livestock displacement, increases in noxious weed infestation, and costs to operators and public land management areas.

As the demand for housing increases, ranchlands could be converted to subdivisions; the subsequent reduction of base properties would lead to grazing permit transfers and possibly grazing permit relinquishment.

Oil and gas development activities and related construction of roads, pipelines, and well pads would lead to a cumulative increase in soil disturbance, vegetation removal, noxious and invasive weed proliferation, and livestock displacement. Impacts would be greater in areas with high-density mineral development projects. These impacts could result in substantial rangeland degradation and thereby jeopardize compliance with the Wyoming Standards for Rangeland Health (USDI, BLM 1997) on some allotments. The implementation of BLM's mitigation guidelines, reclamation requirements, restrictions on surface use, rangeland guidelines, vegetation treatments, and monitoring efforts would provide protection to forage resources on federal lands, which would help reduce overall effects on livestock grazing resources and operations.

The promotion of natural fire in the ecosystem, along with vegetation treatments to improve habitats, will place more of the vegetation communities in the lower seral stage. Generally, this improves and increases the forage resource, and from the standpoint of the CIAA, would offset forage losses that may occur from large-scale industrial development.

4.19.8 Minerals

The CIAA used to analyze cumulative impacts on minerals management includes the entire planning area. Management activities occurring within the planning area are not expected to affect mineral resource management outside of the planning area.

Leasable Minerals

Cumulative impacts on mineral development would occur from surface use restrictions (e.g., VRM designations, closure/withdrawal, NSO, CSU, and seasonal limitations) that ultimately result in a decrease in the number of oil and gas wells drilled during the planning period, withdrawal of lands from locatable mineral entry, and closure of areas to salable mineral development. Surface use restrictions, such as timing restrictions, could also cause an operator to move to nearby private or state land with no such restrictions, and drill a well that could result in drainage of federal reserves and a loss of federal revenue. Such restrictions are implemented to protect sensitive resources and prevent user and resource conflicts. The evaluation of cumulative impacts on mineral development activity considers the relative changes in the level of mineral resource development among the various alternatives (Table 4-2, on page 4-51). Oil and gas development is expected to continue under all alternatives, with Alternative 2 having the greatest amount of wells drilled during the planning period, and Alternative 3 the least because of restrictions for protection of sensitive resources.

Alternative 1 would be the second least restrictive to oil and gas exploration and development activities. The 7,192 wells (federal minerals) projected under this alternative would potentially extract 19,104 BCF of natural gas and 157 million barrels of oil over the life of the plan, which represents a 7% reduction in the projected number of wells and a 5% reduction in the projected gas and oil volume from the unrestricted estimates. Approximately 172,500 acres would be unavailable for fluid mineral leasing, exploration, development, or production. Existing leased in-holdings in this latter category would be available for exploration, development, and production, as prescribed in the lease contract. Approximately 41,300 acres would be constrained by an NSO restriction. Under the NSO, federal fluid minerals could be leased, but the leaseholder/operator would have to use offsite methods such as directional drilling to access the mineral resource. About 253,220 acres would be constrained by CSU restrictions. Under this

designation, federal oil and gas minerals could be leased. Surface disturbance would be prohibited or restricted, but development could occur if the impact on the affected resource were mitigated. Approximately 936,050 acres would be available for leasing and development, but would be constrained by TLSs. TLS restrictions limit the time of the year activities could occur. About 187,540 acres would be available for fluid mineral leasing and development with standard lease stipulations.

Alternative 2 would be the least restrictive to oil and gas exploration and development activities because a larger percent of the planning area would be available for leasing without major restrictions. The 7,804 wells (federal minerals) projected under this alternative would potentially extract 20,052 BCF of natural gas and 157 million barrels of oil over the life of the plan, which is a 1% reduction in the projected number of wells and projected gas and oil volume from the unrestricted estimates. Approximately 175,040 acres of federal mineral estate would be available for intensive fluid mineral leasing, exploration, development, and production; approximately 1,014,462 acres would be designated Traditional Leasing Areas and would be available for restricted fluid mineral leasing, exploration, development, and production; and 21,850 acres would be unavailable for leasing, exploration, development, and production. Existing leased in-holdings in this latter category would be available for exploration, development, and production, as prescribed in the lease contract.

Alternative 3 would be the most restrictive to the development of leasable minerals, primarily because a greater amount of the planning area would be unavailable for leasing or a greater array of leasable mineral development activities would be subject to NSO, CSU, and timing stipulations (Table 2-32, p. 2-169 and Table 2-33, p. 2-176). These actions would potentially lead to a delay in development and/or moving of well locations, access roads, pipeline, or ancillary facilities. As established in the Impacts Common to All Alternatives, Impacts from Alternative 1, and Impacts from Alternative 2 sections, fluid mineral resources underlying lands unavailable to leasing and without remnant existing leases would be unrecoverable. Resources underlying areas unavailable for leasing, but with remnant existing leases would require substantial mitigation or offsite development actions such as directional drilling and would experience increased development costs. Leased hydrocarbon resources located beyond the technical or economic reach of directional drilling would be considered inaccessible and therefore unrecoverable.

The 5,209 wells (federal minerals) projected under this alternative would potentially extract 16,730 BCF of natural gas and 130 million barrels of oil over the life of the plan, which is a 28% reduction in the projected number of wells and an 18% reduction in projected gas and oil volume from the unrestricted estimates. It is also a 23% reduction in the number of wells projected and a 13% reduction when compared to Alternative 1. Approximately 67,210 acres would be available for intensive fluid mineral leasing, exploration, development, and production; approximately 420,780 acres would be designated Traditional Leasing Areas and would be available for restricted fluid mineral leasing, exploration, development, and production; and 641,821 acres would be unavailable for leasing, exploration, development, and production. Existing leased in-holdings in this latter category would be available for exploration, development, and production, as prescribed in the lease contract.

Overall, the management actions proposed under Alternative 4 would result in impacts similar to those under Alternative 1; however, a substantial amount of the planning area (441,100 acres) would still be unavailable for fluid mineral development (Table 2-32, p. 2-169 and Table 2-33, p. 2-176). As established in the Impacts Common to All Alternatives, Impacts from Alternative 1, and Impacts from Alternative 2 sections, fluid mineral resources underlying lands unavailable to leasing and without remnant existing leases would be unrecoverable. Resource underlying areas unavailable for leasing, but with remnant existing leases would require substantial mitigation or offsite development actions such as directional drilling and would experience increased development costs. Leased hydrocarbon resources located beyond the technical or economic reach for directional drilling would be considered inaccessible and therefore unrecoverable.

The 7,136 wells (federal minerals) projected under this alternative would potentially extract 19,168 BCF of natural gas and 150 million barrels of oil over the life of the plan, which is an 8% reduction in the projected number of wells, a 5% reduction in projected gas and oil volume from the unrestricted estimates, and a 1% reduction from Alternative 1. Approximately 175,040 acres in Intensively Developed Fields would be available for intensive fluid mineral leasing, exploration, development, and production; approximately 465,210 acres would be designated Traditional Leasing Areas and would be available for restricted fluid mineral leasing, exploration, development, and production; and 441,100 acres would be unavailable for leasing, exploration, development, and production. Existing leased in-holdings in NSOs and Unavailable Areas would be available for exploration, development, and production, as granted by the lease contract.

The projects and activities considered are not expected to cause the costs of development and extraction to escalate to the point where the economics of leasable mineral development would be marginal. Therefore, no significant cumulative impacts on coal are anticipated.

Locatable Minerals

Cumulative impacts on mineral development would occur from surface use restrictions (e.g., VRM designations, closure/withdrawal, NSO, CSU, and seasonal limitations) that ultimately result in withdrawal of lands from locatable mineral entry. Locatable minerals in the planning area are considered to have low or no potential for development. Impacts on such marginal deposits that are individually minor may cumulatively reduce or prevent exploration and production of locatable commodities. This effect would be at a maximum level under Alternative 3, which has the most cumulative seasonal and spatial restrictions. The least restrictions would be under Alternative 2, with Alternative 4 being between the two as far as cumulative impacts.

Cumulative impacts that would totally preclude locatable mineral development would result from the withdrawal of land from mineral location. The largest cumulative acreages for withdrawals are under Alternative 3, with Alternative 2 being the least restrictive and Alternative 4 being between the other two. Mineral resources in other ownerships may not be developed if the adjacent public lands are withdrawn from mineral entry, because the deposit may not be economically feasible to develop if only a portion is available.

The projects and activities considered are not expected to cause a substantial reduction in the development of locatable minerals. Therefore, no significant cumulative impacts on locatable minerals are anticipated.

Salable Minerals

The cumulative impacts on salable minerals are tied closely to the level of oil and gas development, because more wells and access roads will require more aggregate. Cumulative impacts on mineral development would occur from surface use restrictions (e.g., VRM designations, closure/withdrawal, NSO, and CSU) that ultimately result in a decrease in the closure of areas to salable mineral development. Also, the cumulative level of various temporal and spatial restrictions will affect salable development. Those restrictions, which would also adversely affect the probable level of oil and gas development, are at a maximum under Alternative 3 and lowest under Alternative 2.

Salable minerals development is also closely tied to available access and distance from point of use. Anything that restricts access or results in a longer haul distance because of relocation of the mining operation could make the particular salable mineral deposit uneconomic to develop. Alternative 3 would be most likely to restrict salable minerals in this way. Surface use restrictions, such as timing restrictions

for wildlife, could also cause an operator to move to nearby state or private land with no such restrictions and open a pit that creates additional surface disturbance as well as loss of federal revenue.

The projects and activities considered are not expected to cause a substantial reduction in the development of common variety minerals. Therefore, no significant cumulative impacts on common variety minerals are anticipated.

4.19.9 Paleontology and Natural History

The CIAA used to analyze cumulative impacts on paleontological resources includes the entire planning area. Management activities occurring within the planning area are not expected to affect paleontological resources outside of the planning area.

Potential cumulative impacts on paleontological resources would result primarily from surface-disturbing activities that cause erosion or vibration from traffic and/or machinery, soil compaction, and landscape alteration. Such activity could result in exposure, damage, and/or destruction of paleontological resources. The policies associated with the paleontological resource management program, which require identification and mitigation of paleontological resources prior to surface-disturbing activities, would help to reduce potential impacts. Implementation of these requirements would also increase the potential for identification, recordation, and collection of paleontological resources. However, even with identification and mitigation requirements, the potential exists for damage or destruction of previously unknown paleontological resources discovered during construction. In addition, OHV use, dispersed recreation, and other surface-disturbing activities not subject to a permitting process could result in exposure, damage, or destruction of paleontological resources.

Surface-disturbing and recreational activities that occur on private and state lands would result in substantial impacts on paleontological resources because of the lack of legal protections afforded to these resources on these lands. Approximately 400,000 acres of state and private land occurs within the CIAA, on which activities and development are expected to cause substantial damage to or destruction of paleontological resources or result in the improper collection of scientifically important paleontological resources.

Because of the legal protections afforded paleontological resources, there are no substantial differences in the potential for cumulative impacts among the management alternatives.

4.19.10 Recreation and Visitor Services

The CIAA used to analyze cumulative impacts on recreation resources includes the planning area, all big game herd units that intersect the planning area, and the CIAA for greater sage-grouse (Map 4-8). Wildlife populations are managed within these boundaries and therefore could be impacted by activities occurring in these areas. Because hunting is a major recreation activity within the planning area, any activities that affect game populations would in turn impact recreation activities and reduce recreation benefits.

Cumulative impacts on recreation would potentially occur from a mixture of land uses that results in conflicts for unconfined, dispersed recreational opportunities. Such impacts are a result of both increased recreational activity occurring within and outside of the planning area and user conflicts generated from planned actions. Surface-disturbing activities (primarily oil and gas development) would alter recreational settings and degrade some recreational experiences through increased visual intrusions, noise levels, traffic volumes, and concerns for public health and safety. In areas where development occurs, hunting

opportunities would be diminished because of the displacement or loss of game animals. This would further increase cumulative effects on recreation by degrading a major recreation activity. Seasonal restrictions designed to protect sensitive resources could reduce recreational opportunities for some users by limiting access to certain areas; however, such restrictions could also enhance the experience of other users who desire solitude and primitive recreation opportunities. Cumulative impacts would likely be greater in all portions of the CIAA where mineral development is more intense, and near state and private lands because of the lack of protections afforded to natural resources in these areas.

Major cumulative impacts on recreation would likely occur under Alternatives 1, 2, 3, and 4, because activities within the CIAA would result in long-term elimination or reduction of recreation use and increased use at developed facilities as user demand for visitor amenities increases. Under these alternatives, the current and projected pace of development in some moderate-to-high potential fluid mineral development areas would displace recreation users. Recreationists would likely avoid large tracts of public lands where fluid mineral-related activities occur and wildlife or other values are diminished, displaced, or substantially altered. Recreation use would likely diminish as the landscape and associated scenic qualities evolve from backcountry or middle country to urban. Cumulative impacts would be most extensive under Alternative 2 because of increased development and fewer restrictions to protect sensitive resources.

4.19.11 Socioeconomics

The CIAA used to analyze cumulative impacts on socioeconomics extends beyond the planning area, which is made up of Lincoln, Sublette, and Sweetwater counties (Map 3-7). The socioeconomic impacts of BLM actions on these counties are described in Section 4.10. The cumulative socioeconomic impacts associated with oil and gas development throughout southwestern Wyoming extends beyond the study area boundaries. The cumulative socioeconomic impacts associated with oil and gas development and production in southwestern Wyoming are summarized in Table 4-26, which includes oil and gas activities in Kemmerer, Rawlins, and Rock Springs Field Offices and Bridget-Teton National Forest. Examining the cumulative socioeconomic oil and gas activity reveals that the percentage of existing wells within the PFO accounts for 30% of the total amount of existing wells in southwestern Wyoming. The potential for total wells within PFO represents 38% of total estimated wells in southwestern Wyoming, although it is likely a smaller percentage since Bridger-Teton estimates were not available and were therefore not included in the estimates.

The cumulative oil and gas activity expected to occur throughout southwestern Wyoming will likely increase the intensity of the social and economic impacts in the region. For example, the oil and gas boom currently occurring throughout portions of southwestern Wyoming has already intensified the demand for housing, social services, law enforcement, infrastructure, services addressing drug use, and others. Therefore, as the oil and gas sector continues to expand at an accelerated pace, it is reasonable to assume that the socioeconomic impacts will be intensified throughout that region of the state. There will also be a substantial increase in employment labor income and mineral tax revenues paid to local, state, and federal government entities.

The intensity of development in the oil and gas sector is determined by pace and timing, which are determined to a large extent by public policy and also by market forces. Even though leasing of oil and gas is a discretionary action, the pace of development reflects market forces established by various factors beyond the management decision of BLM. These include national and international energy demand and prices, production factors within the CIAA, and business strategies of operators. As a result, it is difficult to estimate the pace of development, which means the actual cumulative impacts might vary if the rate of

production changes during the study period. It also means that the intensity and duration of the boom will vary depending on pace, and the resultant bust will be heightened if pace is accelerated.

It is likely that communities within the study area will be affected by the "boom and bust" cycle and the intensity or magnitude of this cycle will be a function of pace. Moreover, it is anticipated that this phenomenon will likely cause hardships for areas that must improve or expand infrastructure and services to accommodate the large, temporary increases in population. However, these hardships will be offset to some extent by the tax revenues generated by the oil and gas activity.

As mentioned above, many of the cumulative socioeconomic impacts associated with oil and gas development are already occurring in the region. Assuming that the current pace of development is either sustained or increased, the demand for oil and gas employees will continue to outstrip the supply. Moreover, it is likely that individuals from outside the area will continue filling the bulk of these jobs into the future. Even though many of the oil and gas workers come from outside the region, it is likely there will be a growth in population in certain parts of the study area that can be directly attributed to the oil and gas development.

Increasing employment from oil and gas development throughout southwestern Wyoming is expected to impact communities such as Rock Springs, Green River, Kemmerer, Pinedale, Rawlins, and the other small communities scattered throughout the area. But the ability to absorb the anticipated impacts will vary depending on the individual community's ability to absorb the anticipated growth. Nonetheless, even though Rock Springs had undergone declines in population back in the 1990s, because it serves as an oil and gas service center, it too, will feel the pressures associated with the oil and gas boom, as will communities like Rawlins, Green River, Pinedale, and Kemmerer. The larger impacted communities in southwestern Wyoming may be in a slightly better position to absorb increases in population relative to the smaller ones. If the oil and gas development continues at either the current pace or an accelerated pace, all of the impacted communities will be challenged to keep up with the demands associated with rapid oil and gas development. For instance, communities and unincorporated areas that are impacted as new individuals move into the area might not be able to fully absorb changes in population as they occur. If these increases occur in the short term, many of these communities will likely experience a boom and bust cycle that is driven by oil and gas development.

Increased oil and gas development throughout the region will increase the mineral tax revenues and royalty payments that can be used by local and state government to help mitigate the anticipated impacts. For some counties, the increases are expected to be significant and will remain a major source of revenue for many years to come for various jurisdictions.

It should be noted that even though substantial tax revenues and royalty payments are produced from oil and gas activity, rapid oil and gas development can alter the attitudes and opinions of local area residents. Generally, this happens because of an increase in conflicts between conservation-minded individuals and groups and the pro-development community. Despite these conflicts, residents within the CIAA have long held the opinion that a need exists to balance conservation of natural resources with the economic viability of resource-based industries. As such, residents generally support the development of minerals and energy, as long as these activities do not damage wildlife habitat or degrade the quality of recreational experiences. Consequently, some local residents will support further development activities, whereas others will be dissatisfied if development activities were to reduce hunting opportunities or degrade recreational activities. In addition, others might be dissatisfied if areas within the CIAA are not left in an undisturbed state.

Changes in population trends in the study area brought on by increased oil and gas development may cause a change in custom and culture, because some areas have a long-standing history of growth driven

by minerals development, and some do not. For example, communities such as Rock Springs and Rawlins developed, in part, around mineral extraction industries; therefore, they would likely support oil and gas development. However, other communities that have been more dependent on, for example, agriculture and recreation, may be less inclined to welcome the changes in custom and culture as population changes to support an economy dominated by oil and gas activity. But it is inevitable that changes will occur and will likely bring to the area new individuals who might possess different opinions and values from current residents. This can lead to changes in overall social trends in localized areas.

No significant cumulative impacts on environmental justice would occur under any alternative, because minority and/or low-income populations would not be disproportionately affected compared with other segments of the general population.

4.19.12 Soils

The CIAA used to analyze cumulative impacts on soils includes the entire planning area. As with the alternative impact analysis, cumulative impacts on the soil resource focus on accelerated soil erosion. Surface-disturbing activities occurring within the planning area are not expected to affect soil resources outside the planning area. However, watershed impacts (sediment delivery to stream systems, sedimentation, changes in frequency, duration and volume runoff) could extend beyond the planning area.

Cumulative impacts on soils would result from all surface-disturbing activities and the associated accelerated erosion. Oil and gas development activities and related construction of roads, pipelines, and well pads would be the primary cause of such disturbance, though activities such as OHV use, forestry and woodland treatments, vegetation management, and nonenergy surface-disturbing activities would all contribute cumulatively. Impacts would be more severe in the southern portions of the CIAA where development is more intense. Impacts from the ubiquitous extent of livestock grazing would be in addition to surface disturbances throughout the planning area. These impacts are exacerbated by erosion occurring from past actions, such as the historic down-cutting of streams and ephemeral drainages and those parts of the road network that were poorly designed or resulted from unregulated OHV use. Such actions have altered the timing and frequency of runoff and associated soil erosion. The narrow confined channels resulting from incision and head cuts, and the subsequent base-level adjustments, have resulted in a drainage system in which water exits the watershed more rapidly and with greater energy.

The implementation of BLM's mitigation guidelines, restrictions on surface use, continued implementation of healthy rangeland standards, and monitoring efforts would provide protection to soils on federal lands and lands with federal subsurface minerals, which would help reduce cumulative effects.

The mitigation methods discussed above would have little impact on approximately 400,000 acres within the CIAA that are in state and private ownership. The absence of more stringent requirements for surface-disturbing activities and political and economic pressures for development could result in greater soil loss on state and private lands. These impacts would not vary substantially among the alternatives because activities on state and private lands would not be affected by management of BLM-administered lands.

4.19.13 Transportation, Access, and Travel Management

Transportation and Access

The CIAA used to analyze cumulative impacts on the uses administered by the transportation and access program includes the entire planning area.

Impacts on transportation and access management would result from actions that affect the location and design of proposed projects. These actions are primarily the result of implementing surface use restrictions (e.g., VRM designations, land use closures, NSO stipulations) and management prescriptions designed to protect natural resources. These actions would limit or restrict transportation project design and where transportation systems would be permitted. The greatest impacts would occur in areas managed to meet VRM Class II objectives, as avoidance or exclusion areas for transportation, and in areas managed with NSO stipulations.

The actions and activities considered in this analysis, including land use restrictions for the preservation of sensitive resources, would not result in the inability of BLM to accommodate major transportation corridors. The degree of impact would be lowest under Alternative 2 because of fewer land use restrictions for the protection of sensitive resources. Conversely, the implementation of increased restrictions to protect sensitive resources under Alternative 3 would result in the greatest level of impact on transportation and access.

Off-Highway Vehicle Management

The CIAA used to analyze cumulative impacts on OHV management includes the entire planning area. Management activities occurring within the planning area are not expected to affect OHV management outside of the planning area.

Potential effects on OHV use would result primarily from mineral development activities, which increase the amount of roads available for OHV use. However, such development would also increase traffic on roads and trails and increase the potential for long-term conflicts between commercial and recreational use of these roads. Construction of pipelines, fences, and transmission lines would increase hazards to OHV users and reduce public safety in certain areas.

Potential long-term and short-term cumulative impacts on OHV use would also occur from land use restrictions established to protect sensitive resources. Such restrictions would include seasonal, temporary, or complete OHV closures in sensitive areas of the planning area, which would cause a cumulative decrease in the amount of area available to OHV use.

The potential for cumulative impacts on OHV management would be similar under all alternatives because of the similarities in management prescriptions. However, the greatest potential for cumulative impacts on OHV management would occur under Alternative 3 because of increased surface use restrictions and permanent road closures (closed on 30,350 acres versus 13,620 and 8,400 acres under Alternatives 1 and 2, respectively).

4.19.14 Vegetation

The CIAA used to analyze cumulative impacts on vegetation extends outside the planning area, following fourth-order watershed (eight-digit HUC) boundaries (Map 4-9). The CIAA is composed of fourth-order watersheds that completely or partially overlap the planning area. Fourth-order watersheds were used as the basic unit of analysis because the scope of cumulative influence would be at the watershed scale and is not expected to extend beyond this scale.

Cumulative effects on vegetation within the CIAA would result primarily from surface-disturbing activities that directly remove vegetation, such as mineral development and associated infrastructure, rangeland improvements, and dispersed recreation. This would also indirectly affect vegetation by reducing the forage base, thereby increasing wildlife and livestock grazing on existing vegetation

resources. Furthermore, the displacement of wildlife associated with surface-disturbing and other disruptive activities would also serve to increase grazing on nondisturbed vegetation resources. Surface disturbance would increase the proliferation of noxious and invasive weeds, which would increase the need for weed-controlling activities. Vegetation treatments would cause short-term impacts on vegetation by decreasing vegetation production and increasing establishment of early successional species. Long-term effects would include increased production and diversity of vegetation communities.

Oil and gas development would cause the greatest amount of surface disturbance through construction of well pads, roads, pipelines, and other facilities. Cumulative impacts would likely be greater in the southern portions of the CIAA where mineral development is more intense, and on state and private lands because of the lack of protections afforded to natural resources in these areas. Special Status Plant Species, under the ESA and Wyoming BLM sensitive species guidance, would be protected on federal lands by site-specific mitigation, including exclusion or avoidance of all surface-disturbing activities; however, protection of these species on private and state lands may not occur, resulting in potentially significant impacts on these species.

The degree of impact on vegetation communities would depend on the timing of activities and whether the amount of activity within the CIAA outpaces successful reclamation and revegetation efforts in disturbed areas. The implementation of BLM's mitigation guidelines, best management practices, and restrictions on surface use would help to reduce overall effects. However, given the level of anticipated mineral development and that most of the native shrub communities (e.g., sagebrush) require in excess of 20 years to reestablish to pre-disturbance conditions, surface disturbance impacts are expected under all alternatives, with the greatest amount of impacts on the plant communities being found under Alternative 2. Impacts under Alternatives 3 and 4 would be similar but to a lesser extent. Development activities under all the alternatives would result in the removal of unique attributes of vegetation communities and would also reduce the ability of vegetation resources to support other resource values. In addition, all alternatives would result in substantial proliferation of noxious and invasive weeds into areas considered weed-free, and a substantial increase would occur in noxious and invasive weeds where they already exist.

4.19.15 Visual Resources

The CIAA used to analyze cumulative impacts on visual resources includes the planning area and the viewshed (5 miles) of the Lander Trail that extends outside the planning area (Map 4-10). Most of the effects on visual resources would be limited to the planning area; however, activities occurring within the planning area have the potential to create visual intrusions into the viewshed of the Lander Trail.

Potential impacts on visual resource management would result primarily from surface disturbance activities that cause visual intrusions and degrade the visual quality of the CIAA. Activities related to oil and gas development, wind energy projects, pipeline projects, and communication towers would have the potential to degrade visual resources and result in inconsistencies with VRM Class objectives. Cumulative impacts would likely be greater in the southern portions of the CIAA where mineral development is more intense, and near state and private lands because of BLM's lack of authority on these lands.

Impacts would be greatest under Alternative 2 because of increased mineral development and fewer surface use restrictions. Impacts would be least extensive under Alternative 3, which provides the greatest protection to VRM Class I and II areas and proposes the lowest level of oil and gas development. Activities and actions considered in this analysis are not anticipated to be incompatible with designated VRM Class objectives.

4.19.16 Watershed and Water Quality

The CIAA used to analyze cumulative impacts on water quality and watershed resources extends outside the planning area, following fourth-order watershed (eight-digit HUC) boundaries (Map 4-11). The CIAA is composed of fourth-order watersheds that completely or partially overlap the planning area. Fourth-order watersheds were used as the basic unit of analysis because impacts from management actions proposed under the final RMP and other existing activity plans are not expected to have cumulative, hydrologic influence beyond this scale. Given that hydrologic influence of the surrounding area is primarily focused in the stream channels and that delineation of the CIAA was based on watershed boundaries, the area of analysis is sufficient. The hydrologic influence of the planning area on areas outside the planning area is primarily the result of the timing and quality of the water flowing from the area. This effect extends down the main drainage channels (Snake and Green Rivers) for varying distances depending on the volume and content of the flows.

In general, degradation of the water resource can be a rapid process, whereas recovery is often much slower. The cumulative impacts on watersheds and water quality are dependent primarily on the health of the vegetative community, the amount of surface disturbance, the amount of pollutants, and the degree to which groundwater quality and quantity are degraded through human activity.

BMPs, reclamation efforts, and monitoring of environmental conditions all work to minimize the impacts of development and the resulting disturbance to the hydrologic cycle, but they are not completely effective. Therefore, the greater the level of disturbance, through whatever source and means, to the vegetation, the land surface, and subsurface structure, the greater the disruption to the water resource.

New disturbances often have the most noticeable effects, but they can combine with existing disturbances as well.

The State of Wyoming monitors water quality at the point of discharge. If the discharge of produced water from an approved location has sufficient energy to erode the existing channel banks, additional salts and sediments may be incorporated into the water column.

Surface discharge of produced water and grazing should be considered as creating cumulative impacts on the water and watershed resources. The additional water source(s) may aid in distribution of livestock and reduce concentration of grazing pressures. These same factors can also combine to concentrate grazing in areas that do not have the vegetation and/or topography to deal with either continuous overland flow or concentrated grazing pressures. This is especially true for areas where water is discharged to ephemeral channels and allowed to flow overland.

The increasing population in the planning area, influenced by the ongoing gas development, would increase residential water use. While it is not possible to predict the specific increase in water use due to BLM-authorized activities, it should be recognized that an increase in the use of surface and ground waters would occur.

4.19.17 Wildland Fire and Fuels

The CIAA used to analyze cumulative impacts on fire management includes the entire planning area. Because of noncontinuous fuels, low historic fire incidence, and significant fuel breaks (e.g., state and county roads), management activities occurring within the planning area would not be expected to affect fire management outside of the planning area for the majority of the planning area.

However, approximately 150,000 acres (including WSAs and SD/MAs) bordering the Bridger-Teton National Forest are considered for WFURB under Alternatives 3 and 4. This could impact portions of the forest as well as the planning area. The Bridger-Teton National Forest has approved these boundary areas for WFURB, so crossagency management of WFURB can be possible.

Cumulative impacts would occur as a result of the increased development and recreation activities occurring within the planning area. As recreation, mineral development, and other construction activities (e.g., power lines, pipelines) increase as a whole over the planning area, so does the potential for wildland fire occurrence and the need for suppression-oriented AMR. With increased development and attendant infrastructure (e.g., power lines, compressors, pipelines, and fuel tanks) comes a corresponding increase in the potential for fire suppression to occur within WUI areas. Suppression activities within WUI areas can be more dangerous, time-consuming, and expensive than suppression in undeveloped areas. Particularly critical would be the extra caution required for firefighter safety within an active gas field. This increased development would also impact the fuels management activities within the oil and gas fields. Increasing the amount of oil and gas development would require more WUI/industrial interface fuels treatment projects and would tax BLM's ability to plan, fund, and implement these projects. This increased development would also segment the areas impacted to the degree that landscape-scale prescribed fire and AMR would be limited.

Cumulative impacts would occur under Alternatives 1 and 2. Continued suppression-oriented AMR wildland fire tactics will keep small wildland fires within the historic averages, but large (100+ acres) fires will increase in size as fuel continues to build up in the wildland. This would have a long-term substantive impact.

Cumulative impacts would occur as a result of implementing WFURB under Alternatives 3 and 4. There is approximately one fire every other year within this area that could potentially be managed for WFURB. Dependent on weather conditions, location, and seasonality, the frequency could be further reduced. Thus, a wildland managed as a WFURB may be an occasional event (every 3 to 5 years), which magnifies its importance to the ecosystem. The cumulative effects would be those of reintroducing fire into the ecosystem and creating a more resilient forested ecosystem. Under Alternative 2, continued AMR wildland fire tactics will keep small wildland fires within the historic averages, but large (100+ acre) fires will increase in size as fuel continues to build up in the wildland. There could be substantive cumulative impacts from WFURB. These would include potentially large acreages of wildland fire on both the planning area and the Bridger-Teton National Forest. The reintroduction of fire into the ecosystem, thereby making forest stands more resilient to wildland fire, is also a substantive impact.

Cumulative impacts on fire management are substantive under all alternatives. Cumulative impacts would be greatest under Alternative 2 because of anticipated increases in development activities and access and limited ability to use wildland fire (both prescribed and natural ignitions) to manage fuel loadings. Prescribed fire under Alternative 2 would be used to achieve project goals on limited areas. Under Alternative 3, restrictions on development and access would reduce the potential for human-caused wildland fires and WUI situations, thereby minimizing potential cumulative impacts on fire management. Under Alternatives 3 and 4, there would be substantive impacts because of WFURB use. Additional cumulative impacts under these alternatives would result because they direct the use of prescribed fire and mechanical treatments for returning vegetative conditions to Condition Class 1 to increase resilience and resistance to wildland fires.

4.19.18 Wildlife and Fish Habitat

The CIAAs used to analyze potential impacts on wildlife and fisheries vary by species. The CIAAs for pronghorn, mule deer, elk, and moose comprise the herd management areas (for each species) that intersect the planning area (Maps 4-12, 4-13, 4-14, and 4-15). The CIAA for pronghorn extends into the Greater Yellowstone Ecosystem because of their long-distance migration corridor. The CIAA for greater sage-grouse includes portions of the Lower Green River and southwest greater sage-grouse local planning areas (identified in the WGFD Wyoming Greater Sage-Grouse Conservation Plan 2003) (Map 4-16). The CIAA for all other wildlife comprises the planning area. The CIAA for fisheries covers the same area as the CIAA for water quality and watershed resources. It extends outside the planning area, following fourth-order watershed (eight-digit HUC) boundaries (Map 4-11).

Cumulative effects on wildlife and fisheries within the CIAAs would result primarily from surface-disturbing and other disruptive activities such as mineral development and associated infrastructure, rangeland improvements, fences of all kinds, vegetation treatments, geophysical exploration, urban expansion and subdivision of private lands, and dispersed recreation. These activities could result in short-term and long-term habitat fragmentation and animal displacement. Habitats could become unavailable to wildlife because of human disturbance factors (e.g., traffic, noise, livestock grazing activities) during sensitive time periods such as winter, birthing, nesting, and early rearing of young. Loss of vegetation from development activities would degrade habitat and increase forage competition among grazing animals. Livestock grazing practices would further increase cumulative impacts through direct competition for forage, water, and space, and by limiting the ability to manage vegetation for fish and wildlife needs. These impacts would also reduce the capability to maintain current population objectives.

Oil and gas development would cause the greatest amount of surface disturbance through construction of well pads, roads, pipelines, and other facilities. Reclamation and mitigation efforts would reduce impacts on wildlife habitat and fisheries; however, construction and maintenance of roads and well pads and the presence of humans would result in long-term or permanent impacts. Cumulative impacts would likely be greater in the southern portions of the CIAA where mineral development is more intense, in areas where development overlaps with crucial and winter wildlife ranges, and on state and private lands because of the lack of protections afforded to natural resources in these areas. Special Status Species, under the ESA and Wyoming BLM sensitive species guidance, would be protected on federal lands by site-specific mitigation, including exclusion or avoidance of all surface-disturbing activities; however, protection of nonfederally listed species on private and state lands may not occur, resulting in potentially significant impacts on these species. Specifically, energy development in the Moxa Arch field in the Kemmerer FO is expanding, and there is seismic exploration in the Lander FO. As development expands throughout southwestern Wyoming, the ability of big game species and sage-grouse to disperse into habitats outside of the Upper Green River Valley becomes limited. This may create isolated populations in areas where habitats remain intact.

The degree of impact would depend on the timing of development activities and whether the amount of activity within each CIAA outpaces the successful reclamation and revegetation efforts in disturbed areas. Because of this pace of development (whether federal mineral, commercial, or private residence), more pressure would be put on habitats outside of the development (likely private lands) as wildlife is displaced from the disturbances.

Impacts on wildlife would likely occur under all alternatives because of substantial loss of vital, high-value habitats. The success of disturbed land reclamation, both short and long term, would determine the duration of impacts. Given the constancy of all other stressors, the potential for cumulative impacts would be greatest under Alternative 2 because of anticipated increases in development and fewer restrictions on such activity on public lands. Under Alternative 3, increased restrictions on mineral development and

other surface-disturbing activities would reduce the potential for surface disturbance and subsequent degradation of wildlife habitat. Alternative 4 provides a middle ground between these two alternatives.

Crucial winter range and birthing habitat are important areas to the viability of the elk herd. Persistent disturbance in elk-sensitive habitats would shift the areas of use and weaken the tendency of the animals to return to the disturbed area. If animals return to disturbed habitat, populations could be lower and use of the habitat could be unpredictable. Mineral development activities would likely cause displacement of animals and selection of alternative habitats and would likely inhibit elk movement between winter ranges and birthing areas. Should migration be disrupted and key habitats continue to be degraded over a short period of time, it is likely that long-term displacement of elk from these habitats would occur. Depending on the rate of forage loss, herd sizes could decrease over time and dependency on elk feedgrounds could increase.

Although there are few published studies on the reaction of pronghorn to disruptive human activities, roads, fences, and pipelines are known to fragment habitat and impede or block pronghorn movement. The density in which these occur could have a large effect on pronghorn migration and use of habitat. Mineral development activities would cause the greatest level of impact on pronghorn through habitat fragmentation caused by the proliferation of roads, pipelines, and wells. This would potentially reduce or eliminate migration corridors between key habitats and disrupt crucial winter range continuity. There has already been a loss of six of the eight migration corridors between the Greater Yellowstone Ecosystem and the Green River Basin because of habitat conversion for agriculture, roads, or reservoirs through canyons (Berger et al. 2006).

If an ACEC would not be designated in the Trapper's Point area, development in this area would impact the already bottlenecked migration route of thousands of mule deer and pronghorn that move through the area annually. Deer and pronghorn populations from Grand Teton National Park to the Little Colorado Desert in the BLM Rock Springs FO would potentially be affected. This area is a historic migration corridor for mule deer and pronghorn and a historic corridor for cattle trailing. The wildlife disturbance threshold and the result of further surface disturbance and habitat fragmentation regarding these populations is unknown. This natural migration corridor averages 2 km in width and narrows to 121 m in some bottlenecks by habitat conversion, roads, and reservoirs. The possibility of adaptation of alternative routes is low and has not been supported by the collapse of previously existing pronghorn migration routes or current research. Analyses of 16 bidirectional spring and autumn migrations have revealed an invariant use of the same corridor, as well as an unsuccessful apparent attempt to use an alternate route during spring migration. After blockage by a highway and multiple efforts to cross a 3,500-m mountain chain, a collared female retraced her course and followed the historic and still-functioning corridor to reach summer grounds. Further blockage of this corridor could result in the loss of an entire population from a National Park, leaving a conspicuous gap in the function of predator-prey interactions (Berger et al. 2006). In regard to Trapper's Point and other existing or newly discovered migration routes or bottlenecks, disturbance threshold and the result of further surface disturbance and habitat fragmentation regarding these big game populations is unknown.

There are few published studies on the reaction of mule deer to roads and/or disruptive human activities; however, like elk, mule deer tend to avoid areas of disruptive activity and are more sensitive to activity in shrub versus forested habitat. Mineral development activities would cause the greatest level of impact on mule deer habitats within the CIAA through direct loss of habitat, animal displacement, disruption of migration corridors, and selection of alternative habitats (of which there are few). The displacement of mule deer from high-use to low-use areas has the potential to influence survival and reproduction (Sawyer et al. 2006). Should the loss of migration corridors take place and the loss of birthing habitat increase over the short term, it is possible that long-term displacement of mule deer from these habitats would occur. Sawyer et al (2006) further determined that mule deer were not simply moving to alternative habitats in

substantial numbers when development occurred. These findings might suggest that habitats are already saturated to carrying capacity, and that there are actually limited alternative habitats available to support displaced animals. Concentrating animals in habitats can decrease over-winter survival and ultimately lead to population reductions as discussed by Bartmann et al. (1992), White et al. (1987) and Hobbs (1989).

The majority of cumulative effects on greater sage-grouse habitat within the CIAA would result from surface-disturbing and other disruptive activities in the form of direct habitat loss, habitat fragmentation, and bird displacement. Many areas leased for oil and gas development are located in areas of greater sage-grouse lek concentration; therefore, related development activities that take place in these areas would likely cause long-term displacement of sage-grouse through habitat loss and lek abandonment. This would contribute to current population declines, resulting in a potentially significant impact on greater sage-grouse. Seasonal restrictions on mineral development that are applied within a specified distance of leks during breeding and nesting time periods would be likely to slow rates of overall habitat loss, lek abandonment, and resulting population decline; however, these limitations would not prevent further habitat destruction from occurring. Vegetation treatments in the form of prescribed burns could also affect greater sage-grouse through removal of large areas of sagebrush, conversion of sagebrush habitats, and an increase in invasive species. Provided that the use of vegetation treatments is evaluated carefully before implementation, effects of those treatments would not lead to long-term displacement of greater sage-grouse.

The health of fisheries within the CIAA is directly related to the overall health and functional capabilities of riparian resources, which in turn are a reflection of watershed health. Any activities that affect the ecological condition of the watershed and its vegetative cover would indirectly affect the aquatic environment. It is assumed that any substantial unmitigated disturbances to the soils or changes in vegetative cover would have an adverse effect on watershed health and water quality and would therefore have an adverse effect on associated fisheries. The degree of impact attributed to any one disturbance or series of disturbances is influenced by location within the watershed, time and degree of disturbance, existing vegetation, and precipitation. Conventional oil and gas and CBNG development activities would be the primary cause of surface disturbance and related impacts on fisheries on public lands in the PFO.

Surface disturbances result in accelerated erosion and runoff, increasing stream flow and sediment and nutrient loads to local channels. Sedimentation of a given channel can impact fisheries by reducing habitat complexity, which results in a lower diversity of prey organisms. Increased turbidity also results from increased sediment input, which decreases light penetration and inhibits visual predation by fish. Surface disturbance near streams that results in substantial removal of riparian vegetation can increase current velocity, which puts additional strain on fish and reduces nutrient cycling. In addition to increased sediment input, stream bank disturbance can impact fisheries by creating bank instability, which can alter flow regimes and destroy pool-riffle formations necessary for fish survival. Increased nutrient loading of streams can impact fisheries by increasing primary production above natural levels, which degrades habitat and decreases oxygen levels. Surface disturbance and timing restrictions and stipulations afforded all streams and riparian areas within the planning area would help to reduce impacts.

Because stream systems within the planning area are not entirely under BLM management and cross onto state and private ownerships, the connectivity of these streams is sometimes incomplete. Thus, the metapopulations for fish species such as CRCT are also disconnected. Many times this occurs because of irrigation diversions or other such barriers that do not allow for migration between smaller headwater streams via the larger streams and rivers. At places some streams would be nearly dewatered. Population objectives sometimes reflect these discontinuities, and re-establishment of connectivity is usually a major goal. Without this connectivity and with a continuation of additional fragmentation within the entire CIAA, populations of many fish species would continue to be threatened.

Projects that cause water depletions to the Colorado River through use of water for drilling activities (typically deep wells and coalbed methane wells) and thus contribute to reduced peak discharges and pulse flows, would create effects on downstream species. Fees are paid to the USFWS to offset these depletions; the use and success of mitigation that is purchased from these funds is unknown, but is believed to be effective. Water depletions reduce the ability of the river system to create and maintain important habitats (e.g., pool-riffle formation, side channels, and spawning gravels), limit productivity and nutrient supply, alter plant species and diversity, and reduce food supply brought about by high spring flows.

4.19.19 Special Designations and Management Areas

The CIAA used to analyze cumulative impacts on SD/MAs includes the entire planning area, the Bridger Wilderness, and the Wind River Front SRMA managed by the BLM Rock Springs FO (Map 4-17). These areas of special designation are adjacent to the planning area and therefore could be affected by activities occurring within it.

As development of public, private, and state-owned lands continues, the importance of protecting SD/MAs would increase. The values of the ACECs and other SD/MAs, including wildlife migration routes, sensitive plant habitats, recreational and open space, and archeological and paleontological values would increase as development proceeds on surrounding areas. As solitude and primitive recreation experiences become rarer, additional people would be drawn to the WSAs and other SD/MAs for their open space and undeveloped characteristics. Increased human presence could impact some values of the SD/MAs, particularly wildlife values such as migration bottlenecks; but this impact would be less than the impact of industrial development in the areas.

4.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA §102(2)C requires a discussion of any irreversible or irretrievable commitments of resources that would be involved in the proposal should it be implemented. An irretrievable commitment of a resource is one in which the resource or its use is lost for a period of time (e.g., extraction of any locatable mineral ore or fluid mineral). An irreversible commitment of a resource is one that cannot be reversed (e.g., the extinction of a species or disturbance to protected cultural resources).

Implementation of the Pinedale RMP would result in surface-disturbing activities, including mineral and energy development, dispersed recreation, livestock grazing, and infrastructure development that would result in irreversible or irretrievable commitments of resources. These surface-disturbing activities would result in long-term or permanent alterations to soil, removal of vegetation cover, fragmentation of wildlife habitat, and damage to cultural and paleontological resources. Wildlife dependent on the affected habitats may be displaced and populations may be reduced as the carrying capacity of the range is reduced. Increases in sediment, salinity, and nonpoint source pollution that result from these activities could result in degradation of water quality and an irretrievable loss of water utility, aquatic habitats, and aquatic-dependent species. However, management prescriptions and mitigation prescribed under the alternatives are intended to reduce the magnitude of these impacts by preventing habitat loss in some areas and reclaiming soil, vegetation, and habitat resources. Although reclamation of some disturbed sites would occur, the level of habitat diversity and quality that existed prior to disturbance would likely not be achieved for several decades and may never return to pre-disturbance conditions. This would likely result in permanent reductions in wildlife populations and impairment of water quality and vegetation communities in some areas.

An irretrievable commitment of nonrenewable fossil fuels (i.e., oil and gas) would occur from the development of wells and subsequent extraction of fluid minerals over the next 20 years. The number of additional wells proposed for development within the planning area ranges from 5,300 to 8,724, depending on the alternative.

4.21 UNAVOIDABLE ADVERSE IMPACTS

NEPA §102(2)C requires disclosure of any adverse environmental effects that cannot be avoided should the proposed plan be implemented. Unavoidable adverse impacts are those that remain following the implementation of mitigation measures or impacts for which there are no mitigation measures. Some unavoidable adverse impacts would occur as a result of implementing the Pinedale RMP. Others are a result of public use of BLM-managed lands within the planning area.

Continuing to allow surface-disturbing activities consistent with the BLM multiple-use mandate would result in unavoidable adverse impacts. Although these impacts are mitigated to the extent possible, unavoidable damage is inevitable. Permanent conversion of vegetation resources to other uses such as transportation, recreation, and mineral and energy development reduces the quantity and quality of vegetation resources. Energy and mineral development activities on public lands create long-term visual intrusions, soil erosion and compaction, habitat degradation and fragmentation, and water quality impairment. Portions of the planning area with more intense recreational use would continue to experience scarring, increased soil erosion, loss of vegetation, and degradation of water and wildlife resources. Although these impacts are unavoidable, they are generally concentrated in areas that are already disturbed, which limits the spread of impacts on more remote or less frequented areas.

Development of the additional oil and gas wells predicted on BLM surface and federal mineral estate, potentially quadrupling the number of wells in the planning area, would cause air quality related impacts. Under all alternatives, production and release into the atmosphere of HAPs, VOCs, CO, SO_2, NO_x, and PM_{10} would increase. Although it is not anticipated that the concentrations of these substances would increase to the point where an exceedance of the NAAQS or WAAQS would occur, the increases over the low historical background concentrations would be noticeable and/or visible to the average person. Impacts would persist as long as development continued, unless improved methods for controlling and/or treating emissions were developed. These impacts would be apparent throughout the planning area and potentially throughout the CIAA for air quality (Map 4-5).

Because large portions of the crucial big game habitats coincide with leased areas of oil and gas potential, impacts on wildlife habitat would be unavoidable. Although oil and gas well sites and their associated infrastructure would be mitigated to the extent possible (Appendices 2 and 3) and best management practices would be employed (Appendix 5), long-term and possibly permanent habitat degradation and displacement of wildlife populations would be unavoidable. In addition, competition is anticipated for forage resources among wildlife and livestock. The extent of these impacts would vary by location of development activities, season, and drought cycle.

Inadvertent damage and/or destruction of cultural and paleontological resources from increased visitation and surface-disturbing activities would be unavoidable. Although mitigation measures would include identification and mitigation of resources prior to surface-disturbing activities, some unanticipated discoveries of unknown cultural and paleontological resources would occur. The number of sites anticipated to be inadvertently damaged is unknown.

Conflicts between user types such as recreationists who seek more primitive types of recreation and motorized users who share those recreational areas are unavoidable adverse impacts. As recreation

demand increases, recreational use would disperse to other areas of the planning area, which could create conflicts with other existing uses of those areas. Recreation use would be displaced from areas of intense mineral development, which will increase the extent and frequency of conflict between these incompatible user groups in other areas.

Numerous land use restrictions imposed throughout the planning area to protect sensitive resources and other important values would impact the ability of operators, individuals, and groups to use the public lands without limitations and result in forgone opportunities to use resources within the planning area. Although attempts would be made to minimize these impacts by limiting the level of protection necessary to accomplish management objectives and by providing alternative use areas for impacted activities, unavoidable adverse impacts would occur.

4.22 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

NEPA §102(C) requires discussion of the relationship between local, short-term uses of man's environment and the maintenance and enhancement of long-term productivity of resources.

Any use of the natural resources within the planning area is likely to adversely impact long-term productivity of these natural resources. The short-term uses that would result in the greatest impact on long-term productivity include mineral and energy development, dispersed recreation, forest harvest, livestock grazing, and infrastructure development. These uses result in surface-disturbing and other disruptive activities that remove vegetation, increase soil erosion and compaction, create visual intrusions and landscape alterations, increase noise, impair water quality, and degrade and fragment wildlife habitat. Although management actions, best management practices, surface use restrictions, and lease stipulations are intended to minimize the effect of short-term uses, some impact on long-term productivity of resources would occur regardless of management approach. Given this situation, BLM will strive to achieve the most effective and practicable balance between short-term uses and long-term productivity through science-based and flexible management, application of mitigation measures and BMPs, monitoring, continuous evaluation of current management policies and practices, and revision of management prescriptions where necessary and feasible.