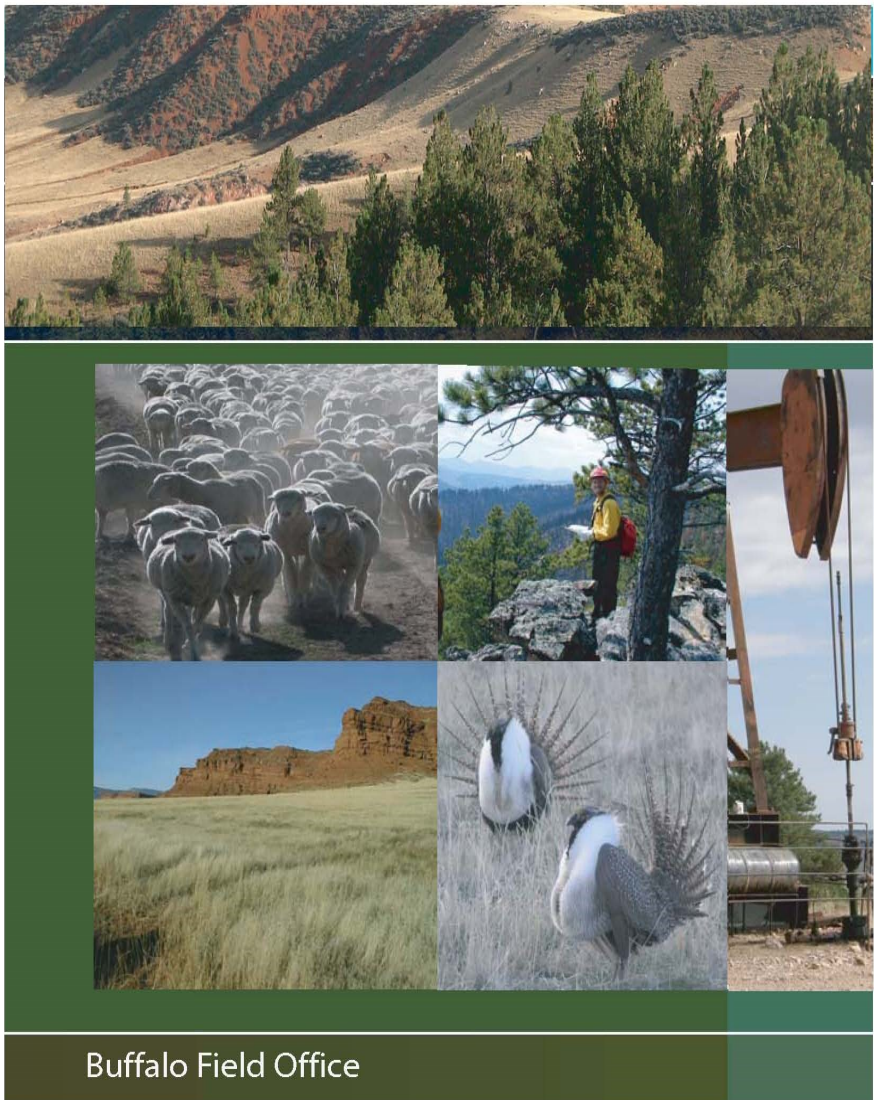
Proposed Resource Management Plan and Final Environmental Impact Statement for the Buffalo Field Office Planning Area



Volume 2 of 3

Chapter 4
(up to and including Section 4.4.8)

May 2015

BLM

Buffalo Field Office

The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

BLM/WY/PL-15/014+1610

Volume 2 of 3

Proposed Resource Management Plan and Final Environmental Impact Statement for the Buffalo Field Office Planning Area

Volume 2 of 3

Chapter 4

(up to and including section 4.4.8)

U.S. Department of the Interior
Bureau of Land Management
Buffalo Field Office, Wyoming

May 2015

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Chapter 4. Environmental Consequences

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Introduction

This chapter describes potential effects on the existing natural and social environmental conditions in the Bureau of Land Management (BLM) Buffalo, Wyoming, planning area (see Chapter 3) under the alternatives described in Chapter 2. BLM planning regulations and Council on Environmental Quality (CEQ) National Environmental Policy Act (NEPA) implementing regulations at 40 Code of Federal Regulations (CFR) 1500–1508 require an analysis of these effects. This chapter describes potential effects under each alternative using the same order for resource topics as Chapters 2 and 3. Identical organization for the chapters allows readers to compare management actions (Chapter 2), existing environmental conditions (Chapter 3), and potential effects (Chapter 4) for the same resources.

The analysis of environmental consequences focuses on key planning issues (see Chapter 1) raised during the scoping process.

This chapter has 10 main sections:

- Physical Resources
- Mineral Resources
- Fire and Fuels Management
- Biological Resources
- Heritage and Visual Resources
- Land Resources
- Special Designations
- Socioeconomic Resources
- Irreversible or Irretrievable Commitment of Resources
- Unavoidable Adverse Impacts

The individual resource sections provide detailed analyses of effects under each alternative. The presentation order of these sections does not reflect their level of importance.

The subsection under each resource heading entitled Impacts Common to All Alternatives describes potential effects from management actions common to all alternatives. Effects included in this section are not repeated for individual alternatives. When effects would vary by alternative, they are addressed by alternative, and only potential effects under that alternative are described. If there would be no effects on given resource, that is stated within *Impacts Common to All Alternatives* section and there are no additional headings or discussion for that subject. Where potential effects from more than one management program would be very similar, they might be grouped under a single subheading (e.g., air quality and soil and water resources in the physical resources section).

During the effects analyses, each resource specialist considered management actions for other resources and programs areas. If no potential effects were identified by the resource specialist or by the public during scoping, the resources and programs are not further addressed. When management of a resource or program could affect the subject resource, those potential effects are described in detail.

Under all alternatives, the BLM would continue to comply with standard operating procedures resulting from federal laws, regulations, and policies. These standard operating procedures constitute day-to-day implementation of policy and management, and could result in certain projects being redesigned or eliminated from consideration, or could require mitigation measures

for potential adverse effects. Associated limitations or complications (e.g., increased processing times or costs) are not considered effects and are not further addressed in this chapter.

Sections at the end of this chapter describe irreversible or irretrievable commitments of resources and unavoidable adverse impacts.

Methods and Assumptions

This section describes methods and assumptions employed during the analyses, defines the types of effects projected throughout the impact sections, defines significance, categorizes effect levels, discusses the availability of data, and identifies several themes that relate to multiple resource classes.

Impact analyses and conclusions are based on interdisciplinary team knowledge of the resources and the planning area, information provided by BLM experts or experts from other agencies, and information in pertinent existing literature. Spatial analysis was performed using the Environmental Systems Research Institute, Inc. ArcGIS Desktop 10.0 computer software. The baseline used to determine potential effects is existing conditions as described in Chapter 3, Affected Environment. Analysis assumptions were developed to help guide the determination of effects. The Resource Management Plan (RMP) and Environmental Impact Statement (EIS) provides a broad management framework; the analyses described in this chapter represent the best estimates of effects because exact locations of development or management often are not known. Effects are quantified to the extent practical based on available data. In the absence of quantitative data, best professional judgment was the basis for the analysis. Effects are sometimes described using ranges of potential effects or in qualitative terms, if appropriate.

Analysis Assumptions

Several assumptions were made to facilitate the analysis of potential effects. These assumptions set guidelines and provide reasonably foreseeable projected levels of development in the planning area during the planning period. These assumptions should not be interpreted as constraining or redefining the management objectives and actions proposed under each alternative and described in Chapter 2. If there were no assumptions for a particular resource or program, the heading is not included in the resource section.

General Assumptions

- Key planning issues identified in Chapter 1 provide the focus for the scope of effects analyses in this chapter.
- Existing state and federal environmental legislation and regulatory programs would remain relatively unchanged and in effect (i.e., analyses are based on current, rather than projected future regulations).
- To the extent possible and within legal and regulatory parameters, BLM management and planning decisions will be consistent with the planning and management decisions of other agencies, state and local governments, and Native American tribes with jurisdictions intermingled with the Buffalo planning area.
- The life of the RMP (planning period) is 20 years.
- Reasonably foreseeable action (RFA) or activity scenarios for all land and resource uses (including minerals) have been developed and presented based on historical, existing, and projected activity levels for all programs.

- The alternative ultimately implemented will comply with standard practices, best management practices (BMPs), guidelines for surface-disturbing activities, and mitigation guidelines (see Appendix J (p. 2155) and Appendix D (p. 1863)). In other words, the practices and guidelines included identified in Appendix J (p. 2155) and Appendix D (p. 1863) are considered a component of each alternative. Appendix J (p. 2155) lists standard practices used in the planning area to mitigate the adverse effects of surface-disturbing activities (the Wyoming BLM mitigation guidelines for surface-disturbing and disruptive activities).
- The analysis of effects focuses on the anticipated effects of management actions and allowable uses proposed under each alternative. The effects of past and present actions are encompassed in the description of existing conditions (Chapter 3, Affected Environment).
- Discussions of effects are based on best available data. Knowledge of the planning area and professional judgment, based on observations and analyses of conditions and responses in similar areas, are used to infer environmental effects when data are limited.
- Acreage figures and other numbers used in the analyses are approximate projections for comparison and analytical purposes only. Readers should not assume numbers reflect exact measurements or precise calculations.
- Climate change is occurring and could affect surface resources in the planning area.
- The exact locations of future surface-disturbing activities cannot be predicted at the RMP level. For analysis purposes, surface-disturbing activities are assumed to occur in vegetation types in proportion to their availability in the planning area. Affected acreages for vegetation types are not absolute, but provide a basis for relative comparison among alternatives.
- Measures to mitigate adverse effects will be applied as described in Chapter 2 and applicable appendices.
- Sufficient funding and personnel would be available to implement the alternatives described in Chapter 2.
- Appropriate maintenance would be performed to maintain the functional capability of all developments.
- Monitoring will be completed as indicated, along with any needed adjustments or revisions.
- The comparison of effects among resources is intended to provide an impartial assessment to inform the decision maker and the public.

Types of Effects

The analyses consider direct, indirect, and cumulative effects, consistent with direction at 40 CFR 1502.16.

- *Direct effects* are caused by an action or by implementation of an alternative and occur at the same time and place as that action or implementation. For example, for the action of building a road, a direct adverse effect is surface disturbance. Surface disturbance is the effect of heavy equipment (the cause) removing existing vegetation, wildlife habitat, and topsoil as it grades the road location.
- *Indirect effects* also result from an action or implementation of an alternative, but usually occur later in time or removed in distance from the action or implementation. For the action of building a road, an indirect effect could occur days after the surface is disturbed and some distance from the disturbance. Heavy precipitation following the removal of vegetation and disturbance of the ground surface could erode soil and transport sediment into streams. This effect on stream-water quality would be considered indirect.
- *Cumulative effects* result from individually minor but collectively significant actions over time. A cumulative effect is the effect on the environment that results from the incremental effect

of the federal action when added to other past, present, and reasonably foreseeable future actions, federal and non-federal.

Actions anticipated during the planning period on all lands in the planning area, including private, State of Wyoming, and federal (U.S. [United States] Department of Defense and U.S. Department of Agriculture [USDA] U.S. Forest Service [USFS]) lands, have been considered in the analyses to the extent reasonable and practicable. Many public and private entities could make decisions about other actions in the planning area, although the locations, timing, and magnitude of these actions cannot be accurately predicted. Assumptions about actions outside of BLM jurisdiction considered in the cumulative effects analyses include:

- Mineral exploration and development will continue on state and private lands.
- Mineral exploration and development will remain minimal in the Bighorn National Forest.
- Use of communications sites will increase.

Irreversible commitments of resources result from actions that permanently change resources. Irretrievable commitments of resources result from actions that cause the permanent loss of resources. Residual effects are those that remain following the implementation of mitigation measures, and include effects for which there are no mitigation measures. Short-term uses versus long-term productivity refers to the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity of environmental resources.

Determination of Significance

Any type (e.g., direct, indirect, or cumulative) or combination of effects can be determined "significant." A determination of significant requires consideration of the context and intensity of the effect. This means that an action must be analyzed in several contexts—such as the immediate vicinity, affected interests, and locality. Both short-term and long-term effects are relevant. Intensity refers to the severity of the effect. This environmental analysis uses the terms "negligible," "minor," "moderate," and "major" to describe the significance of effects.

Determining significance is a complex process. The significance of an effect is dynamic and therefore could change during the planning period. Significance can be "actual" and supportable by fact, or "perceived" and perhaps not fully supportable even with rigorous study. For this environmental analysis, the approach to establishing significance was based on, but not limited to, legal requirements, public perception, monitoring data, and professional judgment.

Specific significance criteria are presented for each resource topic. The criteria provide thresholds beyond which effects would be considered significant. The discussion of each resource ends with a summary regarding the significance of effects.

Scale of Impacts

The following terms are used to define the extent of environmental consequences:

- Negligible – The effect on the resource would be barely detectable; less than one percent of the resource would be affected. This level of effect is considered to be not significant.
- Minor – The effect on the resource would be slight but detectable; there would be a small change in the resource. This could include effects on 1 percent to 5 percent of the resource. This level of effect is considered to be not significant.

- Moderate – The effect on the resource would be readily apparent; there would be a measurable change in the resource. This could include effects on between 5 percent and 10 percent of the resource. This level of effect is considered to be potentially significant.
- Major – The effect on the resource would be great; there would be a highly noticeable, long-term, or permanent measurable change in the resource. This could include effects on more than 10 percent of the resource. This level of effect is considered to be significant.

Availability of Data and Incomplete Information

The BLM used the best information available and pertinent to the decisions to be made through this RMP, and has expended considerable effort to acquire and convert resource data into a digital format for use in the plan. Data have been acquired from BLM sources and outside sources, such as the state.

Some information was not available for use in developing this plan, usually because there have been no inventories or inventories are not complete. Specific data not available include:

- Inventory and assessment of roads and trails
- Invasive plant species occurrence
- Definitive SSS occurrence (plant and animal)
- Certain wildlife data (definitive occurrence for many species)

Because these data are not available, effects cannot be appropriately quantified given the proposed management of certain resources. In these cases, potential effects are described in qualitative terms or, in some cases, stated as unknown. Subsequent project-level analyses will provide the opportunity to collect and examine site-specific inventory data necessary to determine the appropriate application of the RMP-level guidance. In addition, inventory efforts identified in Chapter 2 will continue to update and refine the information used to implement this plan.

Themes Relating to Multiple Resources

Split Estate

In split estate situations, different parties own the surface rights and subsurface rights (such as the rights to develop minerals) for a parcel of land. In these situations, mineral rights are considered the dominant estate, meaning they take precedence over other rights associated with the property, including those associated with owning the surface. However, the owner of the mineral estate must consider the interests of the surface estate owner. The fluid mineral rights lessee has the right to "use so much of the leased lands as is necessary to explore for, drill for, mine, extract, remove and dispose of all the leased resource" (43 CFR 3101.1-2).

During the early homesteading days, the federal government did not retain rights to the minerals or retained only the rights to coal (i.e., the Homestead Act or the Enlarged Homestead Act). However, concern grew regarding the need for strategic minerals to fuel the national economy. Later homestead acts, such as the Stockraising Homestead Act of 1916, granted land patents to private parties, but reserved the mineral rights to the federal government. The BLM must comply with the provisions of the laws under which the surface was patented. However, many of those laws do not identify the rights of the surface owner in split estate mineral development situations.

BLM involvement in split estate applies primarily to situations where the surface rights are in non-federal ownership and the rights to development of the mineral resources are publicly held and managed by the federal government. BLM authority in regards to split estate management varies by mineral type. For example with coal, Section 714 of Surface Mining Control and

Reclamation Act gives qualified surface owners veto power over surface coal leasing on their property (43 CFR 3427). The remainder of this section is specific to fluid minerals as it is the predominant use within the planning area. The Energy Policy Act requires that the BLM consult with affected property owners, representatives of the oil and gas industry, and other interested parties as it performs permit reviews (BLM 2006e). BLM policy requires that the minerals operator to engage the surface owner in negotiations for the purpose of obtaining a surface use agreement. The surface owner is invited to attend all meetings the BLM has with the minerals operator and invited to identify their concerns.

During a permit review, the BLM recommends the same level of resource protection to the surface owner's lands that would be provided on federally owned surface (BLM 2007n). The BLM carefully considers the surface owner's views and the effects on the surface owner's uses of the land before determining mitigation requirements and approving operations. The BLM must fulfill the requirements of NEPA, the National Historic Preservation Act (NHPA), the Endangered Species Act (ESA), the Clean Water Act (CWA), and other applicable laws, policies, and decisions regarding surface resources. If the surface owner's wishes are contrary to the BLM recommendations, the BLM will generally adopt the surface owner's request unless the request is contrary to the BLM's planning decisions, non-discretionary laws, current policy, or would result in avoidable significant impacts.

Split estate is a common occurrence in the planning area; the BLM manages 782,102 acres of surface estate and 4,803,277 acres of mineral estate. Table 4.1, "Surface Estate and Associated BLM-Administered Fluid Mineral Estate in the Buffalo Field Office Planning Area" (p. 648) lists surface ownership in the planning area and the number of acres of corresponding BLM-administered mineral estate.

Table 4.1. Surface Estate and Associated BLM-Administered Fluid Mineral Estate in the Buffalo Field Office Planning Area

Surface Owner	Surface Land (acres)	BLM Fluid Mineral Estate (acres)
BLM	782,102	781,013
Department of Defense	4,166	4,166
Private	5,167,265	3,963,663
State of Wyoming	538,606	54,435

Source: BLM 2012f

Note: BLM actions are those actions that BLM authorizes

BLM Bureau of Land Management

Surface Disturbance

Surface disturbance is the result of any action or activity that alters vegetation, surface and near-surface soil resources, or surface geologic features beyond natural site conditions and on a scale that affects the value of other public lands (BLM 2007j). Examples of surface-disturbing activities include operation of heavy equipment to construct well pads, roads, pits and reservoirs; installation of pipelines and powerlines; and the performance of several types of vegetative treatments (e.g., prescribed fire). Surface-disturbing activities can be authorized or prohibited.

Most land and resource uses (e.g., mineral development, fire, forest products sales, rights-of-way (ROW) actions, and renewable-energy development) can result in surface disturbance and have the potential to affect multiple resources (e.g., soils, water, vegetation, wildlife, cultural and

paleontology resources, and recreation). Surface disturbance is defined here to avoid redundancy in the individual resource sections. Table 4.2, "Total Projected Surface Disturbance from Reasonable Foreseeable Actions in the Buffalo Planning Area" (p. 649) summarizes the projected surface disturbance under each alternative during the anticipated duration of the planning period.

Table 4.2. Total Projected Surface Disturbance from Reasonable Foreseeable Actions in the Buffalo Planning Area

Type of Disturbance	Alternative A	Alternative B	Alternative C	Alternative D
Total acres disturbed from BLM actions	322,026	422,903	422,544	486,957
Total acres reclaimed from BLM actions	221,888	344,752	291,923	358,871
Total acres of long-term disturbance from BLM actions	100,138	78,152	130,621	128,086
Total acres disturbed from non-BLM actions	2,123,460	1,890,239	2,531,611	2,168,799
Total acres reclaimed from non-BLM actions	1,943,463	1,766,623	2,174,564	1,965,851
Total acres of long-term disturbance from non-BLM actions	179,998	123,617	357,048	202,949

Source: Stilwell et al. 2012; Appendix G (p. 1937)

Note: BLM Actions are those actions authorized by BLM.

BLM Bureau of Land Management

Disruptive Activities

Disruptive activities are uses of and activities on public land likely to alter the behavior of, displace, or cause excessive stress to existing animal or human populations, and that occur at a specific location or time. In this context, disruptive activity(ies) refers to actions that alter behavior or cause the displacement of individuals such that reproductive success is adversely affected, or an individual's physiological ability to cope with environmental stress is compromised. The term disruptive activities does not apply to the physical disturbance of the land surface, vegetation, or features. Examples of disruptive activities include noise, human foot or vehicle traffic, domestic livestock roundups, or other human presence, regardless of the activity. When the BLM restricts disruptive activities, sound above ambient levels, light greater than background levels, and the presence of people and their activities could be prohibited or limited. The term is commonly used in conjunction with protecting wildlife during crucial life stages (e.g., breeding, nesting, and birthing), although it can apply to any resource value on the public lands. This land use restriction is not intended to prohibit all activity or authorized uses.

4.1. Physical Resources

4.1.1. Air Quality

For the Buffalo planning area, air resources were evaluated to examine how potential BLM initiatives, decisions, and alternatives would affect air quality in the region ("region" includes the planning area and federal Class I areas within 100 miles). The actions associated with each alternative may affect future air quality within this region. Impacts to air quality include changes of pollutants, visibility and atmospheric deposition. Beneficial impacts are those that decrease emissions, either from control measures or a reduction in activities that generate emissions. Direct impacts are the result of the proposed action and occur at the same time. Indirect impacts may also result from the proposed action, but would occur later in time and/or are further removed from the planning area. Indirect impacts may be assessed with the application of air quality modeling tools to help identify the impacts of emissions on regional air quality and may result in the identification and implementation of BMPs or other technologies that would reduce emissions. This section evaluates the potential impacts on air quality from specific activities authorized or performed by the BLM in the Buffalo planning area for each alternative by examining the expected levels of emissions associated with various activities in the planning area. No air quality modeling was performed as part of this analysis.

4.1.1.1. Methods and Assumptions

The air quality impact analysis for the Buffalo planning area used an emissions comparison approach that included the following:

- Identify actions and activities that generate air pollutant emissions.
- Prepare current base year (2005) equipment, production, and activity data.
- Estimate future equipment and activity for the selected future years (2015 and 2024).
- Calculate base year and future emissions associated with expected activity for each alternative based on equipment, emission factors, and activity data.
- Compare future year totals with base year for each of the alternatives to evaluate changes from the baseline and among the alternatives.

The Buffalo RMP presents a qualitative description of potential impacts, and includes emission inventories of BLM actions in the Buffalo planning area. Appendix M (p. 2239) provides a detailed description of the assumptions, activity data, emission factors, and general approach followed in estimating emissions for the various resource sectors and pollutants.

The following air pollutants were identified as being pollutants that could potentially be emitted directly (or in the case of ozone produced in the atmosphere by photochemical processes), by management activities authorized, permitted, allowed or performed under this RMP. Emissions of each of these pollutants (except ozone) were estimated for each identified activity and addressed for each alternative in this analysis:

- Criteria pollutants (Carbon Monoxide [CO], Nitrogen Oxide [NO_X], Particulate Matter less than 2.5 microns in diameter [$PM_{2.5}$], Particulate Matter less than 10 microns in diameter [PM_{10}], Sulfur Dioxide [SO_2])
- Organics and toxics (Hazardous Air Pollutants [HAPs] and Volatile Organic Compounds [VOCs])
- Greenhouse gases (GHGs) (Carbon Dioxide [CO_2], Methane [CH_4], Nitrous Oxide [N_2O])

Components of air quality that may be impacted include visibility, air pollutant concentrations, atmospheric deposition, and lake chemistry. Impacts on these components are affected by the magnitude and spatial and temporal distribution of the primary and precursor emissions and their interaction with local and regional meteorological conditions and topographic features. For this analysis, the changes in emissions for each of the alternatives were assessed to qualitatively determine if the resulting impacts would be significant enough to potentially violate the National Ambient Air Quality Standards (NAAQS) or the Wyoming Ambient Air Quality Standards (WAAQS), or possibly exceed screening levels of concern for visibility and atmospheric deposition. Air quality modeling can be used to simulate expected future air quality concentrations and the effects on visibility and deposition, but at this stage of the planning process, sufficient project-specific data were not available for such an assessment. Future mineral development projects will be required to conduct a full NEPA analysis of the impacts of proposed projects including air quality. Because of the level of coal mining activity in the Powder River Basin (PRB), air quality modeling studies have been conducted to assess impacts for the region. The Chapter 3 *Air Quality* section provides a summary of air quality modeling projects that have been conducted in the last several years, or are ongoing.

The following list of emission generating activities were identified as those management activities authorized, permitted, allowed or performed under this RMP that could potentially emit identified air pollutants and could potentially cause impacts to air quality within the planning area and Class I areas within 100 miles (150 kilometers) of the planning area. Emissions of air pollutants were estimated for the baseline year (2005) and projected for two future years (2015 and 2024) for each identified resource activity and addressed for each alternative in this analysis.

- Leasable Fluid Minerals – Conventional Natural Gas Development
- Leasable Fluid Minerals – Coalbed Natural Gas Development
- Leasable Fluid Minerals – Oil Development
- Leasable Solid Minerals – Coal Mining
- Locatable Minerals – Bentonite Mining
- Locatable Minerals – Uranium Mining
- Salable Minerals – Sand, Gravel, and other Mineral Development
- Fire and Fuels Management – Prescribed Fire
- Forest Products
- Land Resources – Rights-of-Way and Corridors and Renewable Energy Projects
- Land Resources – Travel and Transportation Management
- Land Resources – Livestock Grazing Management

The Buffalo Field Office (BFO) resource specialists provided the construction, operations, developed acreage, and production activity data used to estimate emissions for resource emission sources. Other activity data were derived from the surface disturbance and RFA tables (Appendix G (p. 1937)). For conventional natural gas, coalbed natural gas (CBNG), and oil development, emissions were prepared for activities on federal mineral estate in the planning area. The estimation of emissions from coal mining activity relied on information contained in the Environmental Protection Agency's (EPA's) National Emission Inventory (NEI) (EPA 2011a) and the Final Mineral Occurrence and Development Potential Report (BLM 2009c) for the planning area. Because of this, the emission estimates for coal mining activities do not vary amongst the alternatives.

Emission factors used to estimate proposed emissions were obtained from (1) the EPA NONROAD2008a Emissions Model (EPA 2008); (2) the Wyoming Department of Environmental Quality (DEQ) best available control technology (BACT) standards for natural gas-fired internal

combustion engines (Wyoming DEQ 2013c); (3) the EPA MOBILE6.2.03 mobile emissions factor model for on-road motor vehicles (EPA 2003); (4) EPA AP-42 Compilation of Air Pollutant Emissions Factors (EPA 1995); (5) the American Petroleum Institute (API) Compendium of Greenhouse Gas Emissions Estimation Methodologies for Oil and Natural Gas Industry (American Petroleum Institute 2009); (6) EPA State Inventory Tool Module (EPA 2011c); (7) the Western Governors Association Western Regional Air Partnership (WRAP) (Western Regional Air Partnership 2005); (8) 40 CFR Part 98 — Subpart W; (9) Wyoming DEQ Guidance on Oil and Gas Production Facilities (Wyoming DEQ 2013a); and (10) EPA's NEI (EPA 2013b). The Technical Support Document (TSD) for Air Quality (Appendix M (p. 2239)) includes detailed information regarding the data and assumptions used to estimate emissions for each project alternative and the emission totals for each activity per year.

Methods and assumptions used in this impact analysis include the following:

- Air pollutant emissions presented in this analysis are useful for comparing the relative amounts of emissions for each alternative and may not represent actual future emissions. Emissions estimates are based on predictions of future mineral resource development scenarios rather than actual development projects.
- Stationary sources associated with oil and gas development will operate in accordance with Wyoming DEQ's *Oil and Gas Production Facilities Permitting Guidance, Chapter 6, Section 2* revised March 2010 (U.S. Secretary of the Interior 2010).
- Emissions from the following management actions were not estimated because the potential for development was considered low: phosphate mining, oil shale development, geothermal development, gemstones and other lapidary materials development.
- Emissions from the following management actions were not included because (1) the level of activity is not expected to change between alternatives, *and* (2) the magnitude of emissions from the activity is considered to be very small in comparison to other management activities, or (3) sufficient operational or production data were not available to quantify emissions: wild (unplanned) fires, invasive species and pest management, grassland and shrubland management, and activities related to heritage and visual resources, cultural resources, paleontology, recreation, socioeconomic resources, and fish and wildlife resources.
- Activity factors (or the quantification of activity for each resource provided by the BFO) are appropriate for the base year and future timeframes.
- EPA off-road emission standards were used to estimate emissions for non-road sources in project years 2005, 2015, 2024. This approach simulates the replacement of existing sources by new lower-emitting equipment with future EPA off-road emission standards.

The purpose of the Buffalo Air RMP is to further clarify air quality goals, objectives, and management actions set forth in the Buffalo RMP and EIS. The Air RMP (Appendix N (p. 2479)) was developed in cooperation with EPA Region 8, the Wyoming DEQ-Air Quality Division (AQD), and the USFS to address how the BLM will manage air resources in the planning area. The Wyoming DEQ-AQD is the state regulatory authority responsible for ensuring compliance with the NAAQS and WAAQS, and the Air RMP is not intended to circumvent that authority. The Air RMP outlines specific requirements for proponents of projects that have the potential to generate air emissions and impact air resources within the planning area. Where applicable, the Air RMP refers to the goals and objectives found in the Buffalo RMP and EIS. Table 4.3, "State of Wyoming Presumptive BACT Requirements" (p. 653) provides an overview of activities/sources and control requirements mandated by the State of Wyoming Presumptive BACT regulations. The Air RMP outlines the control requirements in greater detail. The Air RMP is a "living

document" and may be modified to comply with law, regulation, and policy to address new information and changing circumstances.

Table 4.3. State of Wyoming Presumptive BACT Requirements

Activity/Source	Minimum Control Percentage	Minimum Potential VOC Emissions (tons/year)	Notes
Flashing/Storage Tanks and Separation Vessels	98%	10	Control devices may be removed after one year if flashing emissions have decreased to below 8 tons/year.
Dehydrations Units	98%	8	Control devices may be removed after one year if flashing emissions have decreased to below 8 tons/year and all units are equipped with flash separators and still vent condensers.
Pneumatic Pumps	98%	None	
Pneumatic Controllers	None	None	Control achieved by use of low or no-bleed controllers or by the controller discharge steams being routed to a closed loop system.
VOCs volatile organic compounds			

In June 2011, the USDA, Department of the Interior (DOI), and the EPA signed the *Memorandum of Understanding (MOU) among the U.S. Department of Agriculture, U.S. Department of Interior, and U.S. Environmental Protection Agency Regarding Air Quality Analyses and Mitigation for Federal Oil and Gas Decisions Through the National Environmental Policy Act Process*. This MOU outlines an approach to the analysis of impacts to air quality and Air Quality Related Values (AQRVs), such as visibility in Class I and sensitive Class II areas, in connection with oil and gas development on federal lands, and identifies a path to protect air quality while allowing for oil and gas development on federally managed lands. This MOU specifically addresses oil and natural gas development projects, but not other projects or resources that contribute to air quality impacts in the planning area. Because the RMP is a broad level planning document that defines allocations and projects levels of development and other land uses in a general sense, it lacks much of the specificity of future emission sources and levels that are necessary to accurately simulate future air quality impacts. Air quality impact modeling is more appropriately analyzed in the implementation level (i.e., for specific oil and gas field development projects) NEPA documents, and this type of modeling would be conducted under the guidelines of the MOU. In lieu of air quality modeling, the BLM developed the Air RMP (Appendix N (p. 2479)) which includes requirements (Section N.2.4, "Modeling" (p. 2488)) for when modeling will required.

For this analysis a base year emission inventory was developed for 2005 based on available historical equipment counts, records of production and activity, and other information. In addition to the base inventory, two future-year inventories (2015 and 2024) were prepared based on various alternative levels of activity, operations, and equipment usage for all of the activities associated with each of the managed resources. For all of the alternatives examined for the base and future years, coal mining and oil and natural gas (conventional and coalbed) development are the largest contributors to total air emissions compared to other managed activities in the

planning area. For coal mining, the emissions were estimated based on emissions prepared by the State of Wyoming as contained in EPA NEI (EPA 2011a) and production rate data and forecasts included in the Final Mineral Occurrence and Development Potential Report (BLM 2009c) for the Buffalo planning area. For oil and natural gas development, the emission estimates are based on reasonable foreseeable estimates of well counts, production and development rates, and existing technologies used in the field.

For the Buffalo planning area, activities associated with oil and natural gas development and coal mining result in the largest emissions for the majority of pollutants. Table 4.4, "Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Base Year 2005" (p. 654) presents a summary of estimated emissions (tons/year) for all resource activities for each pollutant for the base year 2005. The table presents emission estimates for oil and natural gas development sources on federal land and combined cumulative totals for these activities on federal and non-federal land within the planning area.

Table 4.4. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Base Year 2005

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**6,889**	**1,754**	**933**	**32**	**3,441**	**11,595**	**1,233**
TOTAL - Cumulative	**7,757**	**1,853**	**1,194**	**35**	**3,580**	**31,352**	**3,258**
Leasable Minerals – Natural Gas Development – Federal	28	5	96	0	48	216	33
Leasable Minerals – Coalbed Natural Gas Development – Federal	402	44	72	1	42	10,688	1,090
Leasable Minerals – Oil Development – Federal	38	4	4	0	4	0	0
Total Oil and Gas Minerals Develop-ment – Fed-eral	**469**	**53**	**172**	**1**	**94**	**10,904**	**1,123**
Leasable Minerals – Natural Gas Development – All	53	10	181	0	92	413	62

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
Leasable Minerals – Coalbed Natural Gas Development – All	1,204	134	243	3	133	30,247	3,086
Leasable Minerals – Oil Development – All	79	8	9	0	9	1	0
Total Oil and Gas Minerals Develop-ment – All	**1,336**	**152**	**433**	**4**	**234**	**30,660**	**3,148**
Leasable Solid Minerals – Coal	4,621	1,426	509	19	1,222	---	---
Locatable Minerals – Bentonite Mining	828	96	8	0	7	1	0
Locatable Minerals – Uranium Mining	38	5	26	1	10	2	41
Salable Minerals – Sand, Gravel, and other Minerals	763	89	172	4	80	13	1
Total Non-Oil and Gas Minerals	**6,250**	**1,616**	**715**	**24**	**1,319**	**16**	**42**
Fire and Fuels Management	73	60	20	6	685	36	4
Forests and Woodlands Management	37	4	0	0	2	1	0
Land Resources – Rights-of-Way and Renewable Energy Projects	39	5	14	0	7	1	0
Land Re-sources – Comprehen-sive Trails and Travel Management	18	17	11	2	1,331	638	64

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
Livestock Grazing	3	0	0	0	3	0	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

4.1.1.2. Impacts Common to All Alternatives

The Wyoming DEQ has the authority to implement emission controls for sources requiring air permits under Wyoming Air Quality Standards and Regulations and to ensure that these sources do not contribute to an exceedance of an ambient air quality standard. To facilitate this process, the BLM currently implements a program to share emission source information with the Wyoming DEQ and other government agencies. This program would continue under all alternatives. In addition, the BLM would require mitigation to minimize impacts, such as fugitive dust emissions in proximity to high use roadways, populated areas, and resource-sensitive areas.

Because of the amount of existing and planned resource development activity, emissions of NO_X, VOCs, and CO from coal mining and oil and natural gas development could impact air quality under each of the alternatives. These emissions are precursors to ozone and fine particulates ($PM_{2.5}$) which are both secondary pollutants and ambient concentrations could increase and also affect visibility and atmospheric deposition. Emissions of primary coarse (PM_{10}) and fine ($PM_{2.5}$) particulates from these activities could also affect local and regional air quality by decreasing visibility and increasing deposition. Emissions for SO_2 from managed activities in the planning area are relatively small and are not expected to result in any major impacts. Except for the NO_X emissions from sand and gravel sources and the CO and VOC emissions from Travel and Transportation Management (TTM) which could contribute to impacts on ambient ozone and particulate concentrations, the emissions from all other resource emission source categories are relatively small and are not expected to contribute to any major adverse impacts on air quality in the planning area.

Management actions and resource uses under each of the alternatives may impact AQRVs in the nearby federal Class I area of Wind Cave National Park and the Northern Cheyenne Indian Reservation, with potentially smaller impacts at the more distant Badlands Wilderness Area. Although minerals development and production (primarily coal mining), and oil and gas production would be the primary sources of emissions, other resource management actions that would produce combustive and/or fugitive dust emissions include sand and gravel development, and uranium and bentonite mining.

Prior to project approval, the BLM would conduct environmental analyses in compliance with NEPA. Appendix N (p. 2479) includes additional information on potential BMPs and mitigation measures that may be applied in the planning area. For major projects, such as the development of a large natural gas field or mineral development project (or any project that is likely to have an impact on air quality), the BLM may require proponents to demonstrate compliance with ambient air quality standards and other federal, state, and local air quality regulations. This demonstration

may include air dispersion modeling, photochemical grid modeling, and the application of mitigation measures and control technologies prior to project authorization by the BLM.

4.1.1.3. Alternative A

Under Alternative A, resources would be managed under the existing RMP (BLM 1985c). Table 4.5, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative A – 2015" (p. 658) and Table 4.6, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative A – 2024" (p. 660) present the emission estimates for planned activities associated with the No Action Alternative (Alternative A) for 2015 and 2024, respectively. These tables provide emission estimates for the activities listed above and provide totals for activities on federal land and cumulative totals for all activities under the current management scenario. The tables also present percent difference changes in the emission totals compared to the 2005 base year totals. Figure 4.1, "Contributions of Each Category to PM_{10} Emissions under Alternative A for 2015" (p. 662) through Figure 4.7, "Contributions of Each Category to HAP Emissions under Alternative A for 2015" (p. 665) present the relative contributions of the various activities to total emissions for Alternative A for 2015 for PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, VOCs, and HAPs, respectively. The figures provide relative contributions from the major activity sectors: leasable fluid minerals (oil and natural gas), leasable solid minerals (coal), locatable minerals (bentonite & uranium), and salable minerals (sand & gravel), fire and fuels management, forest products, ROWs, TTM, and livestock grazing management. Because the relative contributions of emissions do not change significantly in 2024 or amongst the other alternatives, emission pie charts for 2024 and for all other alternatives are not shown.

As noted above, the major contributor to emissions of PM_{10} and $PM_{2.5}$ are from coal and bentonite mining. For NO_X, and SO_2, the largest contributors are from coal mining and oil development. For the planning area sources, equipment, and activities associated with the non-oil and natural gas mineral development include coal, bentonite, and uranium mining and sand and gravel operations. For CO, similar relative contributions are provided from coal mining, fire and fuels management, and TTM. For VOC emissions, contributions are primarily from the travel transportation management sector reflecting emissions from off-road engines and off-road vehicles (all-terrain vehicles [ATVs], motorcycles, snowmobiles, etc.), followed by contributions from the oil and gas development sector. For HAP emissions, similar contributions are provided from the oil and gas, non-oil and gas, and TTM sectors/activities. Of all the activity sectors examined, emissions from livestock grazing management are the lowest and these activities are de minimus contributors to emissions in the planning area.

The current management scenario includes actions that either increase or decrease the development or use of certain resources and associated activities in 2015 and 2024 compared to the base year 2005, and this results in either increases and decreases in emissions for certain categories and pollutants. Specific increases in resource use include the number of federal and non-federal natural gas and oil wells in 2015 and 2024, compared to 2005. For example, there is a planned increase of nearly 40 natural gas wells and 168 oil wells under Alternative A. Specific decreases for Alternative A include a fewer number of CBNG wells developed and a slight reduction in the total acreage used for forest products. For some resources, although there are slight increases in resource development numbers (e.g., number of wells, acreage, etc.) and activities, the emission factors for equipment expected to be used in the future are lower, reflecting cleaner engine and fuel technology, resulting in a net decrease in emissions.

Overall, compared to the 2005 base year, except for VOCs and HAPs, emissions for all other pollutants are estimated to increase for Alternative A in 2015. Except for VOC and HAP emissions, emissions for all pollutants are expected to be relatively the same or slightly increase further in 2024. VOC and HAP emissions show a decrease in 2015 and further in 2024, likely reflecting the expected introduction of cleaner engine technology for off-road construction and maintenance engines and other equipment.

It is possible that increases in NO_X and $PM_{2.5}$ emissions could lead to increases in ambient ozone concentrations and total fine particulates and may possibly contribute to violations of the current NAAQS and WAAQS.

Table 4.5. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative A – 2015

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**8,913**	**2,271**	**1,780**	**137**	**4,845**	**6,602**	**679**
TOTAL – Cumulative	**9,672**	**2,390**	**2,864**	**236**	**5,161**	**18,530**	**1,896**
Percent Change over Base Year – Federal Lands Only	**29%**	**29%**	**91%**	**327%**	**41%**	**-43%**	**-45%**
Percent Change over Base Year – Cumulative	**25%**	**29%**	**140%**	**580%**	**44%**	**-41%**	**-42%**
Leasable Minerals – Natural Gas Development – Federal	47	10	152	1	68	262	39
Leasable Minerals – Coalbed Natural Gas Development – Federal	223	24	40	0	23	5,671	573
Leasable Minerals – Oil Development – Federal	204	49	796	94	185	33	3
Total Oil and Gas Minerals Develop-ment – Fed-eral	**474**	**83**	**989**	**95**	**276**	**5,967**	**616**

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Leasable Minerals – Natural Gas Development – All	92	20	299	2	133	517	77
Leasable Minerals – Coalbed Natural Gas Development – All	740	85	161	2	84	17,310	1,748
Leasable Minerals – Oil Development – All	401	97	1,612	190	375	67	7
Total Oil and Gas Minerals Develop-ment – All	**1,073**	**185**	**2,049**	**194**	**578**	**13,448**	**1,383**
Leasable Solid Minerals – Coal	5,700	1,759	630	23	1,507	---	---
Locatable Minerals – Bentonite Mining	1,608	177	4	0	5	1	0
Locatable Minerals – Uranium Mining	45	6	25	1	10	2	0
Salable Minerals – Sand, Gravel, and other Minerals	835	95	65	3	33	8	1
Total Non-Oil and Gas Minerals	**8,188**	**2,038**	**724**	**27**	**1,556**	**11**	**1**
Fire and Fuels Management	151	126	43	12	1,448	75	8
Forest and Woodlands Management	35	4	0	0	2	1	0
Land Resources – Rights-of-Way and Renewable Energy Projects	45	5	2	0	1	0	0

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Land Resources – Comprehensive Trails and Travel Management	17	15	22	2	1,559	548	55
Livestock Grazing	3	0	0	0	3	0	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Table 4.6. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative A – 2024

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**9,258**	**2,380**	**1,779**	**138**	**4,910**	**1,480**	**164**
TOTAL – Cumulative	**9,779**	**2,474**	**2,849**	**237**	**5,214**	**5,590**	**594**
Percent Change over Base Year – Federal Lands Only	**34%**	**36%**	**91%**	**330%**	**43%**	**-87%**	**-87%**
Percent Change over Base Year – Cumulative	**26%**	**33%**	**139%**	**583%**	**46%**	**-82%**	**-82%**
Leasable Minerals – Natural Gas Development – Federal	52	11	170	1	78	302	45
Leasable Minerals – Coalbed Natural Gas Development – Federal	47	6	16	0	8	683	69
Leasable Minerals – Oil Development – Federal	230	51	797	94	186	33	3

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
Total Oil and Gas Minerals Development – Federal	**329**	**68**	**984**	**95**	**271**	**1,018**	**117**
Leasable Minerals – Natural Gas Development – All	102	22	340	2	154	606	90
Leasable Minerals – Coalbed Natural Gas Development – All	289	38	99	2	45	4,456	451
Leasable Minerals – Oil Development – All	458	103	1,614	190	376	67	7
Total Oil and Gas Minerals Development– All	**849**	**163**	**2,053**	**194**	**575**	**5,129**	**548**
Leasable Solid Minerals – Coal	6,088	1,879	672	25	1,610	---	---
Locatable Minerals – Bentonite Mining	1,608	177	2	0	5	1	0
Locatable Minerals – Uranium Mining	30	5	22	1	9	2	0
Salable Minerals – Sand, Gravel, and other Minerals	816	91	21	3	14	7	1
Total Non-Oil and Gas Minerals	**8,542**	**2,152**	**717**	**28**	**1,638**	**9**	**1**
Fire and Fuels Management	151	126	43	12	1,448	75	8
Forests and Woodlands Management	35	4	0	0	2	1	0

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	VOCs	HAPs
Land Resources – Rights-of-Way and Renewable Energy Projects	111	11	2	0	2	1	0
Land Resources – Comprehensive Trails and Travel Management	11	10	30	3	1,463	371	37
Livestock Grazing	80	8	4	0	86	4	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

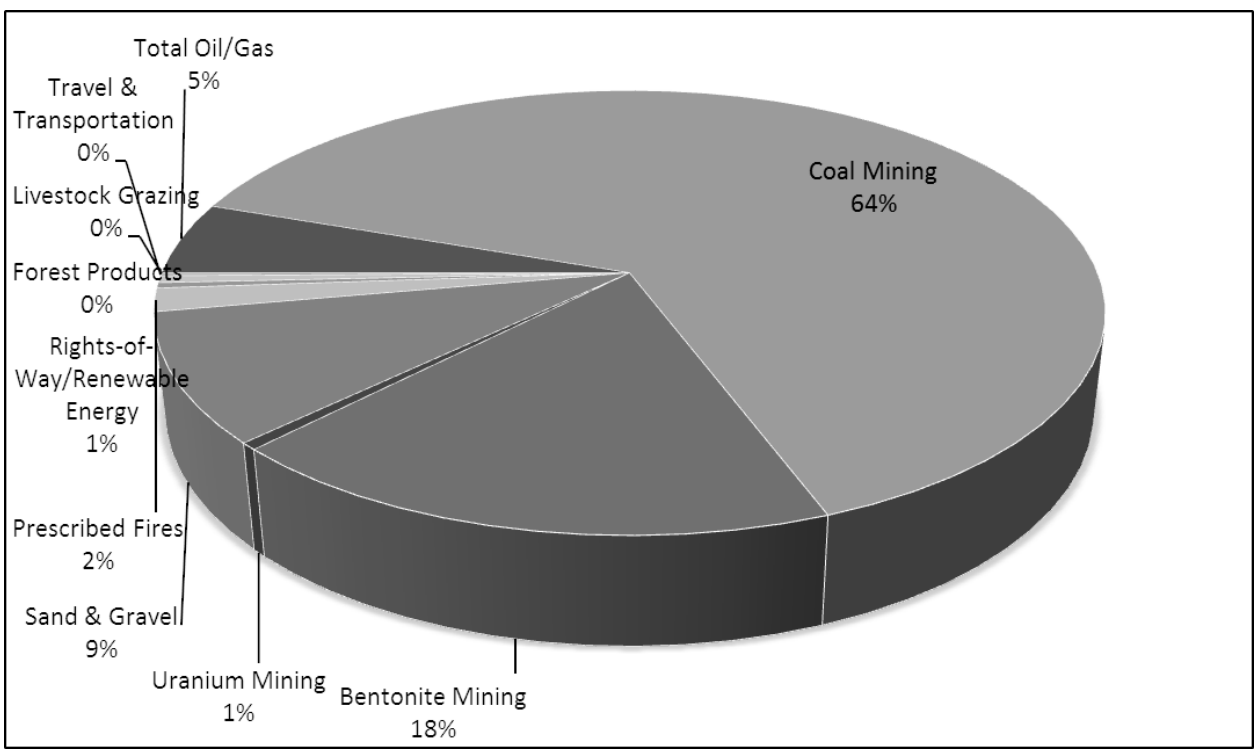

Figure 4.1. Contributions of Each Category to PM_{10} Emissions under Alternative A for 2015

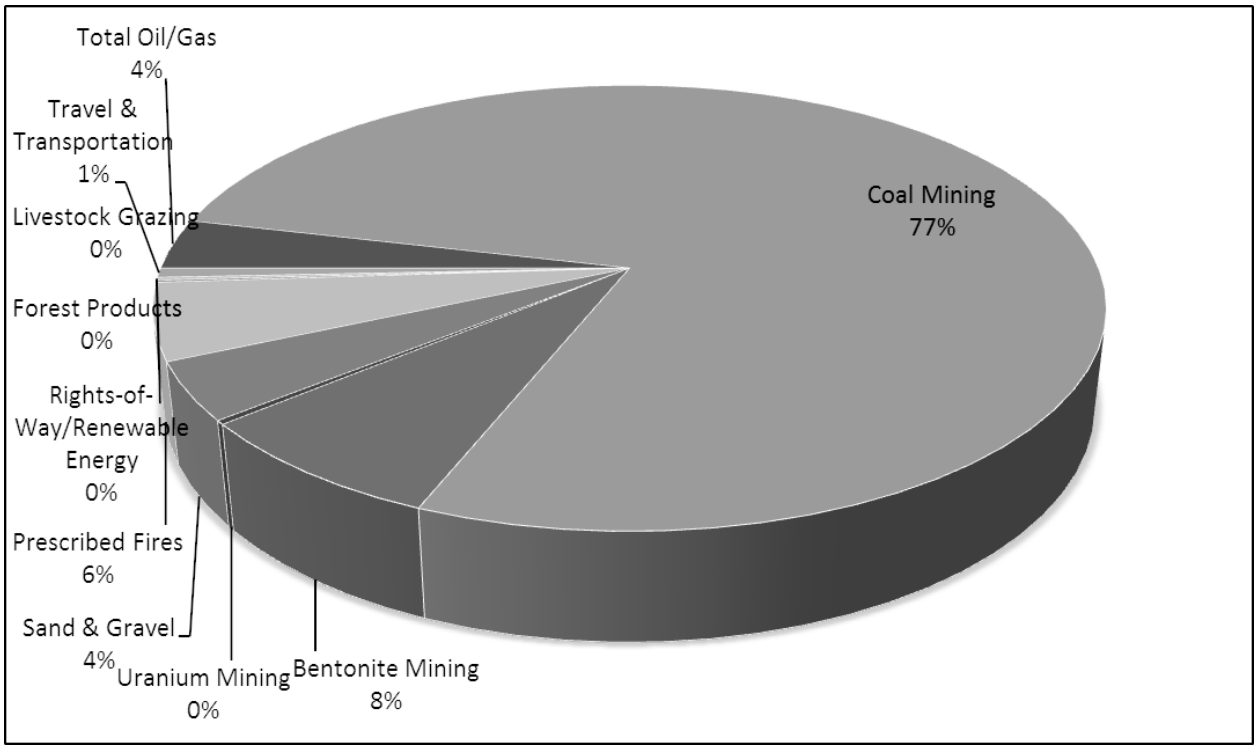

Figure 4.2. Contributions of Each Category to $PM_{2.5}$ Emissions under Alternative A for 2015

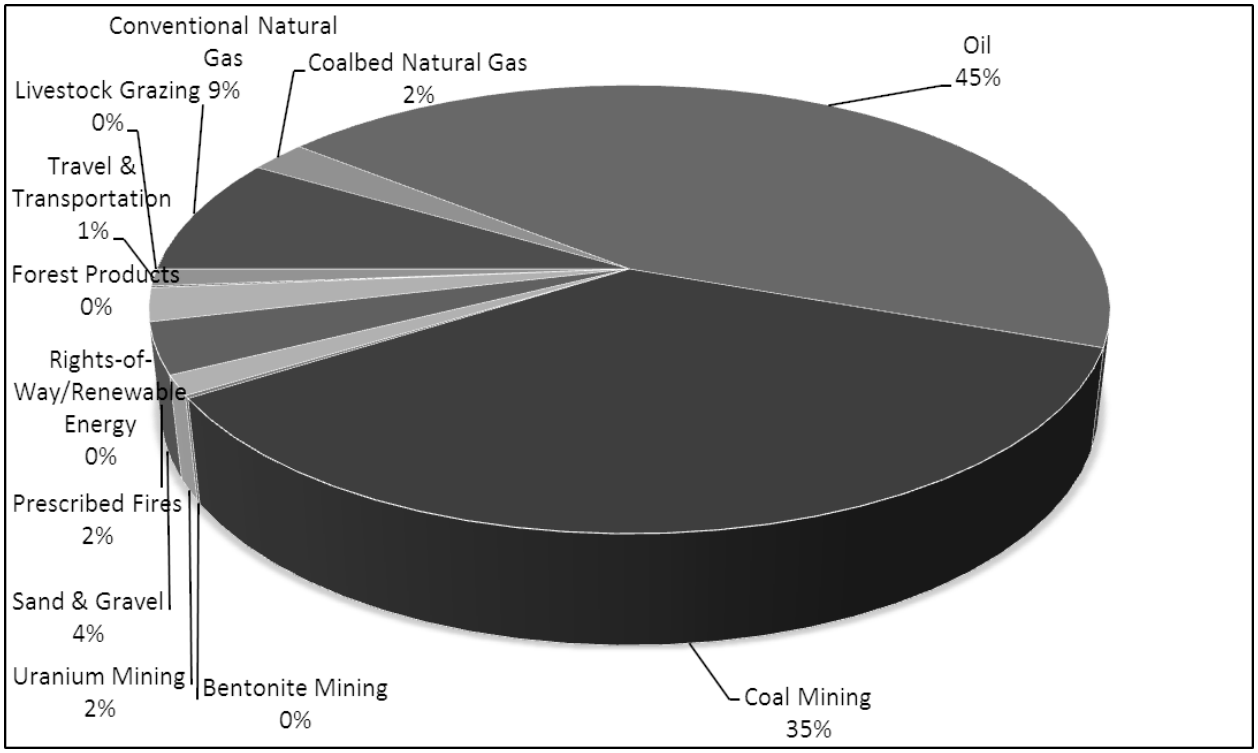

Figure 4.3. Contributions of Each Category to NO_X Emissions under Alternative A for 2015

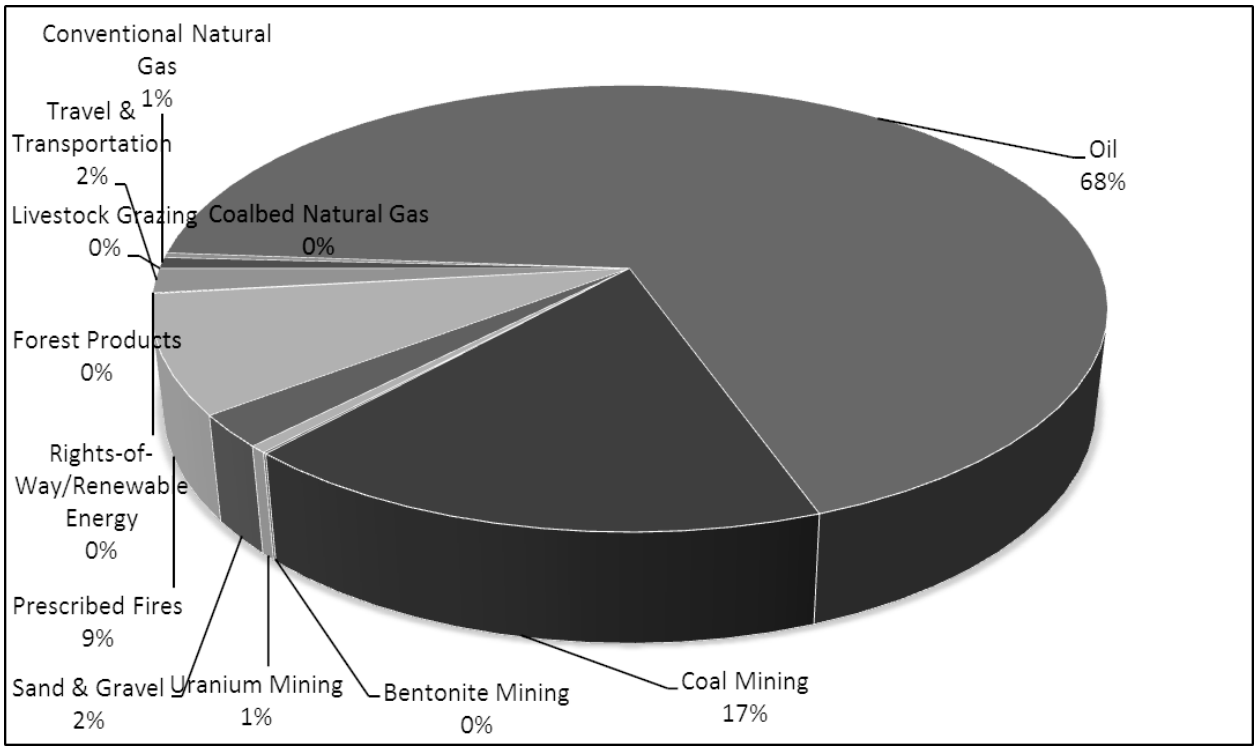

Figure 4.4. Contributions of Each Category to SO_2 Emissions under Alternative A for 2015

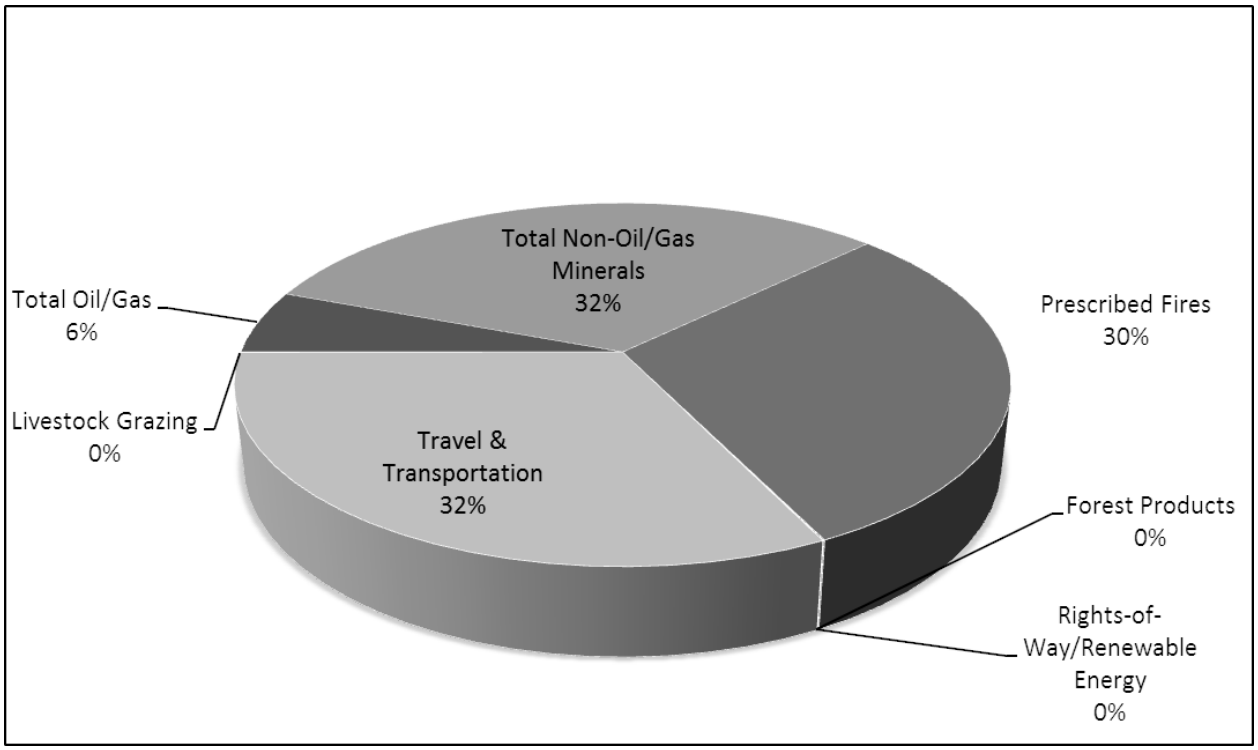

Figure 4.5. Contributions of Each Category to CO Emissions under Alternative A for 2015

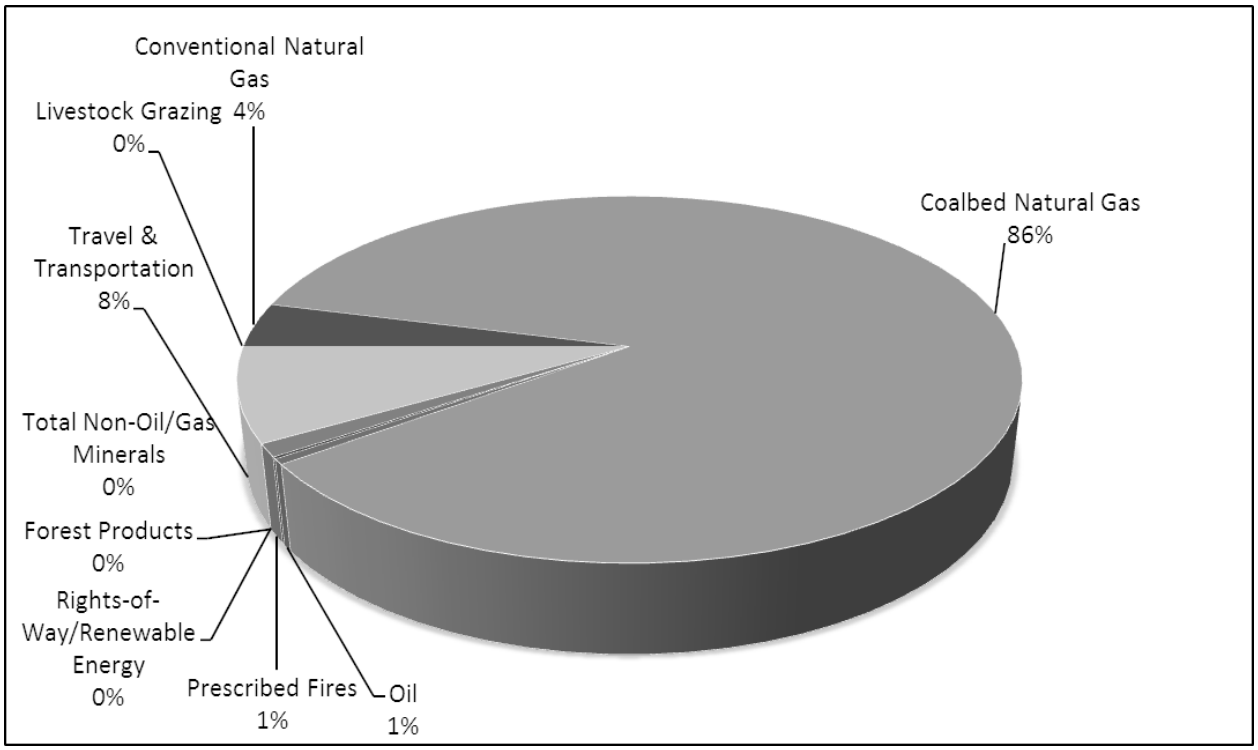

Figure 4.6. Contributions of Each Category to VOC Emissions under Alternative A for 2015

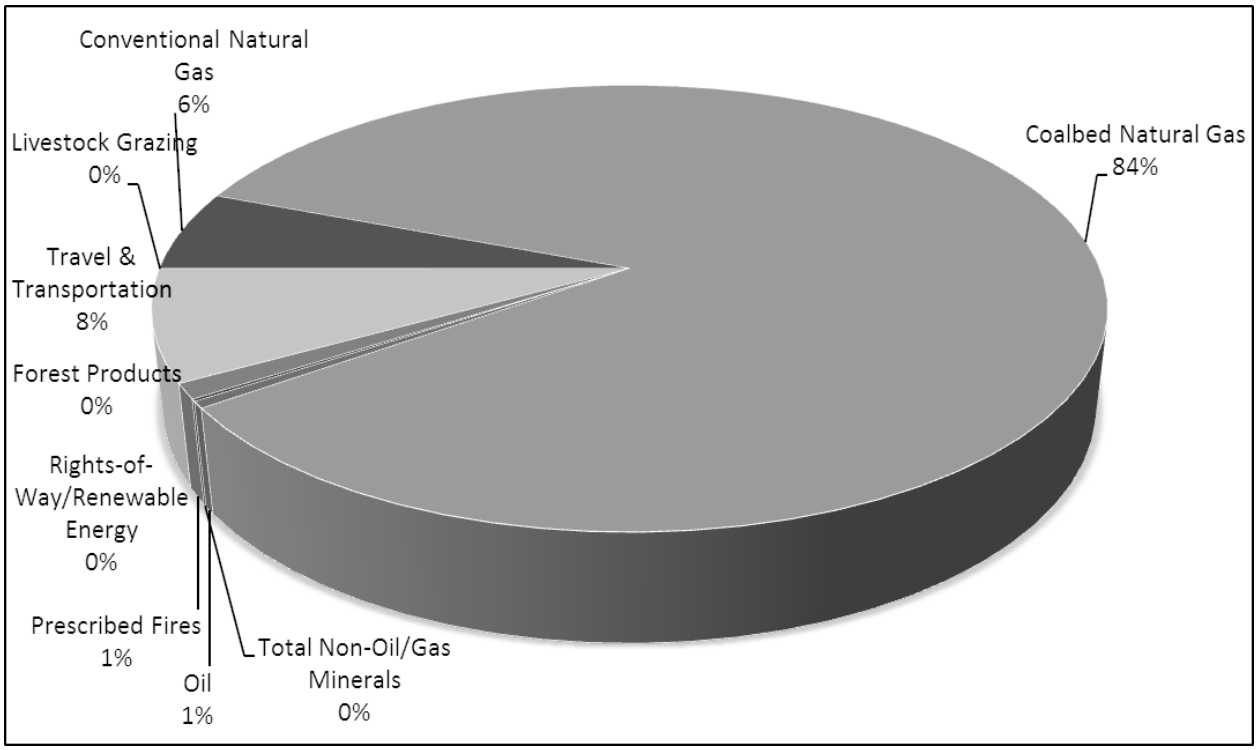

Figure 4.7. Contributions of Each Category to HAP Emissions under Alternative A for 2015

4.1.1.4. Alternative B

Alternative B represents the most restrictive use of resources reflecting the highest degree of conservation for physical, biological, heritage, and visual resources. This alternative limits the amount of resource growth and development activities, including the number of oil and natural gas wells, and the acreage developed and used in mining and other surface disturbing activities. Because of this, the emissions for this alternative are the lowest of all alternatives. Table 4.7, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative B – 2015" (p. 666) and Table 4.8, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative B – 2024" (p. 668) present the emission estimates for planned activities associated with Alternative B for 2015 and 2024, respectively. Although the overall emissions for Alternative B are lower than Alternative A, the relative contributions of the various activities to total emissions for Alternative B for 2015 and 2024 for PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, VOCs, and HAPs are similar to those presented for Alternative A in Figure 4.1, "Contributions of Each Category to PM_{10} Emissions under Alternative A for 2015" (p. 662) through Figure 4.7, "Contributions of Each Category to HAP Emissions under Alternative A for 2015" (p. 665) above.

Compared to the 2005 base year, 2015 emissions are estimated to be similar or increase slightly for PM_{10}, $PM_{2.5}$, SO_2, and CO, and are expected to be relatively the same or slightly increase further in 2024. Emissions of NO_X, VOCs, and HAPs are expected to decrease in both 2015 and 2024 compared to 2005, likely reflecting restrictions on oil and gas development and the expected introduction of cleaner engine technology for off-road construction and maintenance engines and other equipment. Compared to 2005, emissions under this alternative are likely to contribute less to ambient ozone concentrations and total fine particulates, and overall impacts on air quality are expected to be the least of all of the alternatives.

Table 4.7. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative B – 2015

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**7,200**	**1,966**	**813**	**31**	**3,514**	**6,113**	**625**
TOTAL – Cumulative	**7,958**	**2,084**	**1,896**	**130**	**3,830**	**18,039**	**1,842**
Percent Change over Base Year – Federal Lands Only	**5%**	**12%**	**-13%**	**–3%**	**2%**	**-47%**	**-49%**
Percent Change over Base Year – Cumulative	**3%**	**12%**	**59%**	**275%**	**7%**	**-42%**	**-43%**
Leasable Minerals – Natural Gas Development – Federal	23	5	77	0	39	173	26

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Leasable Minerals – Coalbed Natural Gas Development – Federal	195	21	29	0	18	5,368	542
Leasable Minerals – Oil Development – Federal	105	11	7	0	4	1	0
Total Oil and Gas Minerals Development – Federal	**323**	**36**	**113**	**1**	**61**	**5,541**	**568**
Leasable Minerals – Natural Gas Development – All	68	14	224	1	104	426	64
Leasable Minerals – Coalbed Natural Gas Development – All	712	81	149	2	79	17,006	1,718
Leasable Minerals – Oil Development – All	302	59	823	96	194	34	3
Total Oil and Gas Minerals Development– All	**1,081**	**154**	**1,196**	**100**	**377**	**17,467**	**1,785**
Leasable Solid Minerals – Coal	5,700	1,759	630	23	1,507	---	---
Locatable Minerals – Bentonite Mining	804	89	2	0	3	0	0
Locatable Minerals – Uranium Mining	23	3	13	0	5	1	0
Salable Minerals – Sand, Gravel, and other Minerals	231	26	21	1	10	3	0

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Total Non-Oil and Gas Minerals	**6,758**	**1,877**	**665**	**25**	**1,525**	**4**	**0**
Fire and Fuels Management	38	32	11	3	362	19	2
Forest and Woodlands Management	30	3	0	0	2	1	0
Land Resources – Rights-of-Way and Renewable Energy Projects	32	3	2	0	1	0	0
Land Resources – Comprehensive Trails and Travel Management	17	15	22	2	1,559	548	55
Livestock Grazing	3	0	0	0	3	0	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Table 4.8. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative B – 2024

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**7,355**	**2,056**	**800**	**32**	**3,487**	**600**	**66**
TOTAL – Cumulative	**7,874**	**2,150**	**1,868**	**131**	**3,796**	**4,708**	**497**
Percent Change over Base Year – Federal Lands Only	**7%**	**17%**	**-14%**	**0%**	**1%**	**-95%**	**-95%**
Percent Change over Base Year – Cumulative	**2%**	**16%**	**56%**	**278%**	**6%**	**-85%**	**-85%**

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Leasable Minerals – Natural Gas Development – Federal	18	4	58	0	29	128	19
Leasable Minerals – Coalbed Natural Gas Development – Federal	9	1	4	0	2	77	8
Leasable Minerals – Oil Development – Federal	79	8	6	0	4	0	0
Total Oil and Gas Minerals Development – Federal	**106**	**13**	**68**	**1**	**35**	**206**	**27**
Leasable Minerals – Natural Gas Development – All	69	15	227	1	106	430	64
Leasable Minerals – Coalbed Natural Gas Development – All	250	33	85	2	39	3,850	390
Leasable Minerals – Oil Development – All	307	60	824	96	194	34	3
Total Oil and Gas Minerals Development– All	**625**	**107**	**1,136**	**99**	**339**	**4,314**	**457**
Leasable Solid Minerals – Coal	6,088	1,879	672	25	1,610	---	---
Locatable Minerals – Bentonite Mining	804	89	1	0	2	0	0
Locatable Minerals – Uranium Mining	15	2	11	0	5	1	0

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Salable Minerals – Sand, Gravel, and other Minerals	229	25	7	1	4	2	0
Total Non-Oil and Gas Minerals	**7,136**	**1,995**	**691**	**26**	**1,621**	**3**	**0**
Fire and Fuels Management	38	32	11	3	362	19	2
Forest and Woodlands Management	30	3	0	0	2	1	0
Land Resources – Rights-of-Way and Renewable Energy Projects	32	3	1	0	1	0	0
Land Resources – Comprehensive Trails and Travel Management	11	10	30	3	1,463	371	37
Livestock Grazing	3	0	0	0	3	0	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

4.1.1.5. Alternative C

Alternative C is the least restrictive alternative in terms of planned growth and development, number of wells/projects, etc. and the emissions for this alternative are the highest of all alternatives. Table 4.9, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative C – 2015" (p. 671) and Table 4.10, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative C – 2024" (p. 673) present the emission estimates for planned activities associated with Alternative C for 2015 and 2024, respectively. The relative contributions of the various activities to total emissions for Alternative C for 2015 and 2024 for PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, VOCs, and HAPs are similar to those presented for Alternative A in Figure 4.1, "Contributions of Each Category to PM_{10} Emissions under Alternative A for 2015" (p. 662) through Figure 4.7, "Contributions of Each Category to HAP Emissions under Alternative A for 2015" (p. 665) above.

Reflecting the least amount of constraint on the development and use of physical resources, Alternative C includes the allowance for additional oil and natural gas wells to be developed, increased activity in fire, fuel, and vegetation management activities, and overall increases in mining activity for leasable minerals. For example, resource development activities would be restricted in WSAs, but would be allowed in special recreation management areas (SRMAs). Compared to the 2005 base year, emissions are estimated to increase substantially in 2015 and 2024 for all pollutants except VOCs and HAPs. For 2024, emissions of VOCs and HAPs are expected to decrease compared to 2005. VOC emissions increase slightly in 2015 and then decrease in 2024 compared to 2005. HAP emissions show a decrease in 2015 and further in 2024. The longer term decreases in VOCs and HAPs likely reflect the expected introduction of cleaner engine technology for off-road construction and maintenance engines and other equipment. Compared to 2005, emissions under this alternative are likely to contribute to ambient ozone concentrations and total fine particulates, and overall impacts on air quality are expected to be the most of all of the alternatives. The increases in NO_X and $PM_{2.5}$ emissions could lead to increases in ambient ozone concentrations and total fine particulates, including degraded visibility and increased deposition, and may possibly contribute to violations of the current WAAQS and NAAQS.

Table 4.9. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative C – 2015

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**13,413**	**3,089**	**2,268**	**182**	**7,828**	**8,454**	**866**
TOTAL – Cumulative	**14,170**	**3,207**	**3,350**	**281**	**8,144**	**20,382**	**2,083**
Percent Change over Base Year – Federal Lands Only	**95%**	**76%**	**143%**	**468%**	**127%**	**–27%**	**-30%**
Percent Change over Base Year – Cumulative	**83%**	**73%**	**181%**	**711%**	**127%**	**–35%**	**-36%**
Leasable Minerals – Natural Gas Development – Federal	49	11	159	1	71	270	41
Leasable Minerals – Coalbed Natural Gas Development – Federal	369	45	102	2	49	7,328	740
Leasable Minerals – Oil Development – Federal	213	52	866	102	201	36	4

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Total Oil and Gas Minerals Development – Federal	**632**	**107**	**1,127**	**105**	**321**	**7,634**	**784**
Leasable Minerals – Natural Gas Development – All	94	20	305	2	136	526	79
Leasable Minerals – Coalbed Natural Gas Development – All	885	105	222	4	110	18,967	1,916
Leasable Minerals – Oil Development – All	410	100	1,683	198	391	70	7
Total Oil and Gas Minerals Development– All	**1,389**	**226**	**2,210**	**204**	**637**	**19,562**	**2,001**
Leasable Solid Minerals – Coal	5,700	1,759	630	23	1,507	---	---
Locatable Minerals – Bentonite Mining	3,111	438	47	2	70	8	1
Locatable Minerals – Uranium Mining	80	11	44	1	18	4	0
Salable Minerals – Sand, Gravel, and other Minerals	3,027	339	261	13	0	32	3
Total Non-Oil and Gas Minerals	**11,917**	**2,547**	**983**	**39**	**1,596**	**44**	**4**
Fire and Fuels Management	453	379	128	35	4,343	225	23
Forest and Woodlands Management	194	19	0	0	2	1	0

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Land Resources – Rights-of-Way and Renewable Energy Projects	196	20	8	0	4	1	0
Land Resources – Comprehensive Trails and Travel Management	17	15	22	2	1,559	548	55
Livestock Grazing Management	3	0	0	0	3	0	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Table 4.10. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative C – 2024

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**13,643**	**3,180**	**2,112**	**182**	**7,906**	**4,983**	**519**
TOTAL – Cumulative	**14,161**	**3,274**	**3,180**	**281**	**8,210**	**9,094**	**950**
Percent Change over Base Year – Federal Lands Only	**98%**	**81%**	**126%**	**467%**	**130**	**-57%**	**-58%**
Percent Change over Base Year – Cumulative	**83%**	**77%**	**166%**	**709%**	**129%**	**-71%**	**-71%**
Leasable Minerals – Natural Gas Development – Federal	55	12	180	1	82	317	47
Leasable Minerals – Coalbed Natural Gas Development – Federal	252	33	85	2	38	3,994	405

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Leasable Minerals – Oil Development – Federal	243	55	867	102	202	36	4
Total Oil and Gas Minerals Development – Federal	**550**	**100**	**1,133**	**105**	**322**	**4,348**	**455**
Leasable Minerals – Natural Gas Development – All	105	23	350	2	159	621	92
Leasable Minerals – Coalbed Natural Gas Development – All	492	64	166	4	74	7,767	787
Leasable Minerals – Oil Development – All	471	107	1,684	198	393	70	7
Total Oil and Gas Minerals Development– All	**1,068**	**193**	**2,201**	**204**	**626**	**8,458**	**886**
Leasable Solid Minerals – Coal	6,088	1,879	672	25	1,610	---	---
Locatable Minerals – Bentonite Mining	3,109	437	23	2	61	7	1
Locatable Minerals – Uranium Mining	52	8	38	1	16	4	0
Salable Minerals – Sand, Gravel, and other Minerals	2,986	327	85	11	0	27	3
Total Non-Oil and Gas Minerals	**12,235**	**2,651**	**819**	**39**	**1,688**	**38**	**4**
Fire and Fuels Management	453	379	128	35	4,343	225	23

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Forest and Woodlands Management	194	20	0	0	2	1	0
Land Resources – Rights-of-Way and Renewable Energy Projects	196	20	3	0	2	1	0
Land Resources – Comprehensive Trails and Travel Management	11	10	30	3	1,463	371	37
Livestock Grazing	3	0	0	0	86	0	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

4.1.1.6. Alternative D

Alternative D represents a balance between resource use and resource conservation and the level of planned activities associated with Alternative D lies between the least amount of activity in Alternative B and the greatest amount of activity associated with Alternative C. Table 4.11, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative D – 2015" (p. 676) and Table 4.12, "Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative D – 2024" (p. 678) present the emission estimates for planned activities associated with Alternative D (Proposed RMP) for 2015 and 2024, respectively. The relative contributions of the various activities to total emissions for Alternative D for 2015 and 2024 for PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, VOCs, and HAPs are similar to those presented for Alternative A in Figure 4.1, "Contributions of Each Category to PM_{10} Emissions under Alternative A for 2015" (p. 662) through Figure 4.7, "Contributions of Each Category to HAP Emissions under Alternative A for 2015" (p. 665) above.

Compared to the 2005 base year, emissions are estimated to increase in 2015 and 2024 for all pollutants except VOCs and HAPs, which are expected to decrease slightly in 2015 and decrease further in 2024. As seen in the other alternatives, the longer term decreases in VOCs and HAPs likely reflect the expected introduction of cleaner engine and fuel technology for off-road construction and maintenance engines and other equipment.

Compared to 2005, emissions under this alternative are likely to contribute to ambient ozone concentrations and total fine particulates, affecting visibility and atmospheric deposition, with the

magnitude of impacts between those of Alternative B and Alternative C. The expected level of impacts may possibly contribute to violations of the current 8-hour average ozone standard.

Table 4.11. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative D – 2015

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**9,886**	**2,449**	**1,896**	**140**	**5,366**	**7,302**	**752**
TOTAL – Cumulative	**10,647**	**2,567**	**2,980**	**239**	**6,069**	**19,230**	**1,969**
Percent Change over Base Year – Federal Lands Only	44%	40%	103%	336%	56%	-37%	-39%
Percent Change over Base Year – Cumulative	37%	39%	150%	589%	70%	-39%	-40%
Leasable Minerals – Natural Gas Development – Federal	46	10	150	1	67	260	39
Leasable Minerals – Coalbed Natural Gas Development – Federal	283	33	66	1	34	6,359	642
Leasable Minerals – Oil Development – Federal	201	47	772	91	610	32	3
Total Oil and Gas Minerals Develop-ment – Fed-eral	**531**	**90**	**988**	**93**	**711**	**6,651**	**685**
Leasable Minerals – Natural Gas Development – All	91	20	296	2	133	515	77
Leasable Minerals – Coalbed Natural Gas Development – All	802	93	187	3	95	17,998	1,818

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Leasable Minerals – Oil Development – All	398	96	1,589	187	1,186	66	7
Total Oil and Gas Minerals Develop-ment– All	**1,291**	**209**	**2,072**	**192**	**1,414**	**18,579**	**1,901**
Leasable Solid Minerals – Coal	5,700	1,759	630	23	1,507	---	---
Locatable Minerals – Bentonite Mining	1,448	231	33	1	50	6	1
Locatable Minerals – Uranium Mining	68	10	38	1	16	4	4
Salable Minerals – Sand, Gravel, and other Minerals	1,572	176	134	7	67	17	1
Total Non-Oil and Gas Minerals	**8,789**	**2,176**	**836**	**32**	**1,640**	**26**	**5**
Fire and Fuels Management	151	126	43	12	1,448	75	8
Forest and Woodlands Management	85	9	0	0	2	1	0
Land Resources – Rights-of-Way and Renewable Energy Projects	311	32	7	0	4	1	0
Land Re-sources – Comprehen-sive Trails and Travel Management	17	15	22	2	1,559	548	55

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Livestock Grazing	3	0	0	0	3	0	0

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Table 4.12. Estimated Annual Emissions (tons/year) for Activities within the Buffalo Planning Area – Alternative D – 2024

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
TOTAL – Federal Lands Only	**10,098**	**2,541**	**1,825**	**140**	**5,419**	**2,857**	**305**
TOTAL – Cumulative	**10,619**	**2,636**	**2,895**	**239**	**6,232**	**6,968**	**736**
Percent Change over Base Year – Federal Lands Only	**47%**	**45%**	**96%**	**336%**	**57%**	**-75%**	**-75%**
Percent Change over Base Year – Cumulative	**37%**	**42%**	**142%**	**588%**	**74%**	**-78%**	**-77%**
Leasable Minerals – Natural Gas Development – Federal	50	11	167	1	76	297	44
Leasable Minerals – Coalbed Natural Gas Development – Federal	132	17	45	1	20	2,059	209
Leasable Minerals – Oil Development – Federal	225	50	773	91	709	32	3
Total Oil and Gas Minerals Development – Federal	**408**	**78**	**985**	**93**	**805**	**2,388**	**256**

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Leasable Minerals – Natural Gas Development – All	101	22	337	2	153	600	89
Leasable Minerals – Coalbed Natural Gas Development – All	369	48	125	3	56	5,831	591
Leasable Minerals – Oil Development – All	453	101	1,590	187	1,408	66	7
Total Oil and Gas Minerals Develop-ment– All	**923**	**171**	**2,052**	**192**	**1,616**	**6,498**	**686**
Leasable Solid Minerals – Coal	6,088	1,879	672	25	1,610	---	---
Locatable Minerals – Bentonite Mining	1,448	230	17	1	43	5	0
Locatable Minerals – Uranium Mining	45	7	33	1	14	3	3
Salable Minerals – Sand, Gravel, and other Minerals	1,549	170	44	6	29	14	1
Total Non-Oil and Gas Minerals	**9,129**	**2,286**	**765**	**33**	**1,696**	**22**	**4**
Fire and Fuels Management	151	126	43	12	1,448	75	8
Forest and Woodlands Management	85	9	0	0	2	1	0
Land Resources – Rights-of-Way and Renewable Energy Projects	311	32	3	0	2	1	0

Resource	Criteria Pollutants					Organics & Toxics	
	PM_{10}	$PM_{2.5}$	NO_X	SO_2	CO	VOCs	HAPs
Land Resources – Comprehensive Trails and Travel Management	11	10	30	3	1,463	371	37
Livestock Grazing Management	3	0	0	0	3	0	0

Source: Appendix M (p. 2239)

% percent
CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

4.1.1.7. Cumulative Impacts

Analysis of Cumulative Impacts

Because no air quality modeling was conducted as part of this analysis, cumulative impacts to air quality over the life of the plan were analyzed for each alternative by comparing cumulative emissions with statewide emission totals. The 2005 Wyoming DEQ statewide emissions inventory for 42 different source categories was obtained from the EPA National Emissions Inventory (EPA 2013c). Emissions from various resources reflecting BLM actions and activities, non-BLM activities (for oil, natural gas, and CBNG development), and the cumulative totals for the planning area are compared to Wyoming statewide emissions for all anthropogenic sources in Table 4.13, "Comparison of Emissions from BLM and Non-BLM Activities in the Buffalo Planning Area to Cumulative Annual Statewide Emissions for 2005" (p. 681) for 2005 and for each of the 2015 alternatives. Due to the uncertainty inherent in estimating emissions beyond 10 years or so in the future, comparisons are not made with the 2024 emission estimates. The totals for 2005 and each of the alternatives show that emissions from BLM-managed activities in the Buffalo planning area are 3 percent or less of statewide totals.

Emissions for BLM and non-BLM activities for natural gas, oil, and CBNG development were computed based on information provided by BLM. Information on non-federal activities was not provided for any of the other resources. Also, because of the way the emissions were calculated for TTM (e.g., for public use of snowmobiles and ATVs, etc.), these activities were assumed to take place on federal and non-federal lands. As such, the emissions included under the non-BLM actions in Table 4.13, "Comparison of Emissions from BLM and Non-BLM Activities in the Buffalo Planning Area to Cumulative Annual Statewide Emissions for 2005" (p. 681) represent those activities from non-federal oil, natural gas, and CBNG development only.

In examining the emission totals, it is evident that the concentrations of CO, NO_X, and SO_2 (and to a lesser extent $PM_{2.5}$ and PM_{10}) in the planning area could potentially increase slightly in certain areas, but would not likely contribute to exceedances of the air quality standards. Through 2011, the peak ozone concentration in the planning area was 82 percent of the 8-hour

ozone standard, while peak 24-hour and annual $PM_{2.5}$ and peak 24-hour PM_{10} concentrations were less than 70 percent of the applicable standards. If the existing NAAQS for ozone is lowered in the near future by EPA, this may become an important issue in the planning area. Because the emissions from BLM activities in the planning area are relatively small compared to state totals, the potential cumulative impacts on atmospheric deposition and lake acidification would likely not change significantly over the course of the plan. Likewise, total nitrogen and sulfur deposition would likely be the same and would not exceed levels of concern, and impacts on visibility would likely be minimal over the life of the plan.

For specific future proposed large-scale development projects (i.e., development of a new natural gas field) in the planning area, the BLM will likely require a more refined assessment of incremental and cumulative impacts using appropriate air quality modeling tools. These tools are able to simulate both incremental and cumulative impacts of emissions from a variety of anthropogenic and biogenic sources contributing to observed air quality in the planning area including impacts on concentrations, deposition, and visibility. The BLM will continue to work with the EPA and the State of Wyoming to ensure that emissions from activities on BLM-administered land do not contribute to any violations of the applicable NAAQS or WAAQs.

Table 4.13. Comparison of Emissions from BLM and Non-BLM Activities in the Buffalo Planning Area to Cumulative Annual Statewide Emissions for 2005

Pollutant	Estimated BLM Emissions in the Buffalo Planning Area (tons per year)	Estimated Non-BLM Emissions in the Buffalo Planning Area (tons per year)	2005 Wyoming Statewide Emissions (tons per year)	Total (tons per year)	Percent Contribution of Activities within the Buffalo Planning Area Emissions to Statewide Emissions
Base Year - 2005					
PM_{10}	6,889	868	846,689	854,446	0.91
$PM_{2.5}$	1,754	99	133,849	135,702	1.37
NO_X	933	261	185,813	187,007	0.64
SO_2	32	3	122,389	122,424	0.03
CO	3,441	139	399,257	402,837	0.89
VOCs	11,595	19,756	79,575	110,927	28.26
Alternative A - 2015					
PM_{10}	8,913	759	846,689	856,361	1.13
$PM_{2.5}$	2,271	118	133,849	136,239	1.75
NO_X	1,780	1,084	185,813	188,677	1.52
SO_2	137	99	122,389	122,625	0.19
CO	4,845	316	399,257	404,418	1.28
VOCs	6,602	11,928	79,575	98,105	18.89
Alternative B - 2015					
PM_{10}	7,200	758	846,689	854,509	0.93
$PM_{2.5}$	1,966	118	133,849	135,933	1.53
NO_X	813	1,083	185,813	187,709	1.01
SO_2	31	99	122,389	122,519	0.11
CO	3,514	316	399,257	403,087	0.95
VOCs	6,133	11,926	79,575	97,614	18.48
Alternative C - 2015					
PM_{10}	13,413	757	846,689	860,859	1.65
$PM_{2.5}$	3,089	118	133,849	137,056	2.34
NO_X	2,268	1,083	185,813	189,163	1.77

Pollutant	Estimated BLM Emissions in the Buffalo Planning Area (tons per year)	Estimated Non-BLM Emissions in the Buffalo Planning Area (tons per year)	2005 Wyoming Statewide Emissions (tons per year)	Total (tons per year)	Percent Contribution of Activities within the Buffalo Planning Area Emissions to Statewide Emissions
SO_2	182	99	122,389	122,670	0.23
CO	7,828	316	399,257	407,401	2.00
VOCs	8,454	316	79,575	88,345	9.93
Alternative D - 2015					
PM_{10}	9,886	760	846,689	857,336	1.24
$PM_{2.5}$	2,449	119	133,849	136,416	1.88
NO_X	1,896	1,084	185,813	188,793	1.58
SO_2	140	99	122,389	122,628	0.19
CO	5,366	703	399,257	405,326	1.50
VOCs	7,302	11,928	79,575	98,805	19.46

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

4.1.1.8. Analysis of Greenhouse Gases

Concentrations of certain gases in the earth's atmosphere have been identified as being effective at trapping heat reflected off the earth's surface thereby creating a "greenhouse effect." As concentrations of these GHGs increase, the atmosphere warms, the composition of the atmosphere changes and global climate is affected. Concentrations of GHG have increased dramatically in the earth's atmosphere in the past century. Anthropogenic (man-made) sources and other human activities have been attributed by the EPA and others to these increases particularly for CO_2, CH_4, N_2O, and fluorinated gases (DOI 2010a).

The EPA has determined that six GHGs are air pollutants and subject to regulation under the Clean Air Act (CAA): CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Of these GHGs, CO_2, CH_4, N_2O are commonly emitted by the types of activities included in this analysis, while the remaining three GHGs are emitted in extremely small quantities or are not emitted at all. GHG emissions from management actions and activities were estimated for each alternative in this analysis for CO_2, CH_4, and N_2O.

As the major component of natural gas, CH_4 emissions from and oil and gas exploration, production, and transportation can be considerable. Emissions of CH_4 from the extraction of coal from surface mines can also be significant. Emissions of CO_2 and N_2O from fossil fuel combustion and fire can also be of concern. This analysis quantified emissions of CO_2, CH_4, and N_2O from the management actions and activities for each alternative for all of the resources listed above.

Each GHG component has been given a Global Warming Potential (GWP) number that takes into account the intensity of the substance's heat trapping effect and its longevity in the atmosphere as compared to CO_2. This analysis used the EPA GWPs of 21 for CH_4, and 310 for N_2O. The estimated quantity emitted for each GHG was multiplied by its GWP and summed with the other

GHG to obtain total GHG emitted in CO_2 equivalents in short tons. CO_2 equivalents were then converted to million metric tons (MMt), the typical reporting unit for GHG emissions. Table 4.14, "Estimated Annual Greenhouse Gas Emissions (tons per year) Summary for Activities within the Buffalo Planning Area" (p.)" shows the estimated annual emissions of the GHG for each alternative. Appendix M (p. 2239) includes additional details on the GHG emissions calculations.

Table 4.14. Estimated Annual Greenhouse Gas Emissions (tons per year) Summary for Activities within the Buffalo Planning Area

	Greenhouse Gases				
Scenario	**CO_2**	**CH_4**	**N_2O**	**CO_2 equivalents**	**CO_2 equivalents (million metric tons)**
Base Year – 2005					
Base Year	171,773	449,830	3	9,619,295	8.74
Forecast Year – 2015					
Alternative A	238,700	489,474	8	10,520,190	9.55
Alternative B	168,872	489,311	3	10,445,431	9.48
Alternative C	318,894	485,791	18	10,526,071	9.56
Alternative D	269,562	487,824	8	10,516,397	9.55
Forecast Year – 2024					
Alternative A	243,043	498,805	8	10,720,482	9.74
Alternative B	153,937	494,876	3	10,547,311	9.58
Alternative C	330,865	506,140	18	10,965,398	9.96
Alternative D	274,398	501,211	8	10,802,378	9.81

Source: Appendix M (p. 2239)

CH_4 methane
CO_2 carbon dioxide
N_2O nitrous oxide

Alternative C shows the highest increases in GHG emissions due primarily to the higher projected oil and gas production activities. The total GHG emissions for all of the alternatives are fairly comparable because they are dominated by CH_4 emissions from surface coal mining operations in the PRB, which is the largest contributor compared to other activities in the planning area. Oil and gas production is the second major contributor to GHG emissions for all alternatives. The largest sources of GHG emissions within the oil and gas sector include CO_2 emissions from natural gas compressors and drill rig engines, and fugitive CH_4 emissions from wellhead equipment, pneumatic devices and tanks. The estimated GHG emissions are based on "worst case" estimates of production rates and operational characteristics and likely result in overestimated total GHG emissions. Considerable reductions in these estimated emissions may be realized at the time of actual development through control technologies such as electric compressor engines, "green completions," low or no bleed pneumatic devices, and capture and control of leaks and vents.

Table 4.15, "Buffalo Planning Area GHG Emissions as Percentage of Wyoming Statewide GHG Emissions " (p. 684) shows the comparison of project related GHG emissions for each of the alternatives to a statewide inventory of GHG emissions that was completed in 2007. The inventory was compiled for the Wyoming DEQ by the Center for Climate Strategies and was based on actual emissions for 2005 and projected emissions for 2010 and 2020. GHG emissions estimated for each of the alternatives comprise approximately 13 percent of statewide GHG emissions. This is driven mainly by CH_4 emissions associated with surface coal mining in the PRB. The total estimated GHG emissions for 2015 for Alternative D (Proposed RMP) of 9.17 MMt are approximately equal to 0.13 percent of the total U.S. 2008 GHG emissions of 6,956 MMt (EPA

2010). Assessing the impacts of GHG emissions on global climate change requires modeling on a global scale which is beyond the scope of this analysis. Potential impacts on climate change are influenced by GHG emission sources from around the globe and it is not possible to distinguish the impacts to global climate change from GHG emissions originating from the planning area.

Table 4.15. Buffalo Planning Area GHG Emissions as Percentage of Wyoming Statewide GHG Emissions

Buffalo Planning Area		Wyoming Statewide Inventory		Percent Contribution
Scenario	**Estimated GHG Emissions (MMt CO_2 equivalents)**	**Year**	**Estimated GHG Emissions (MMt CO_2 equivalents)**	**BFO GHGs to Wyoming GHGs**
Base Year -2005	8.74	Actual Estimated 2005	55.6	15.7%
Alternative A -2015	9.76	Projected 2020	69.4	14.1%
Alternative B -2015	9.66	Projected 2020	69.4	13.9%
Alternative C -2015	9.92	Projected 2020	69.4	14.3%
Alternative D -2015	9.82	Projected 2020	69.4	14.2%

Source: Center for Climate Strategies 2007

BFO Buffalo Field Office
CO_2 carbon dioxide
GHG greenhouse gas
MMt million metric tons

Table 4.16, "Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Base Year 2005" (p. 684) presents GHG emission estimations for the 2005 base year for all resource activities, and Table 4.17, "Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative A – 2015" (p. 685) through Table 4.24, "Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative D – 2024" (p. 694) present this information for each of the alternatives for 2015 and 2024. As noted above, the largest sources of CO_2 emissions are from activities associated with the development of leasable fluid minerals while the largest source of CH_4 emissions is from coal mining operations in the PRB.

Table 4.16. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Base Year 2005

Resource	Greenhouse Gases			
	CO_2	**CH_4**	**N_2O**	**CO_2 Equivalents**
TOTAL – Federal Lands Only	**91,489**	**402,230**	**3**	**8,539,190**
TOTAL – Cumulative	**171,773**	**449,830**	**3**	**9,619,295**
Leasable Minerals – Natural Gas Development – Federal	38,256	1,562	0	71,166
Leasable Minerals – Coalbed Natural Gas Development – Federal	22,079	25,257	0	552,534

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Leasable Minerals – Oil Development – Federal	1,036	0	0	1,043
Leasable Oil and Gas Minerals – Federal	**61,371**	**26,819**	**1**	**624,743**
Leasable Minerals – Natural Gas Development – All	72,278	2,950	1	134,437
Leasable Minerals – Coalbed Natural Gas Development – All	67,738	71,470	1	1,568,756
Leasable Minerals – Oil Development – All	1,640	0	0	1,655
Total Oil and Gas Minerals Development – All	**141,655**	**74,420**	**1**	**1,704,848**
Leasable Minerals – Coal	---	374,975	---	7,874,484
Locatable Minerals – Bentonite Mining	1,101	0	0	1,102
Locatable Minerals – Uranium Mining	1,256	0	0	1,262
Salable Minerals – Sand, Gravel, and other Minerals	18,170	0	---	18,174
Total Non-Oil and Gas Minerals	**20,528**	**374,976**	**0**	**7,895,022**
Fire and Fuels Management	13	37	2	1,502
Forests and Woodlands Management	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	1,508	0	---	1,508
Land Resources – Comprehensive Trails and Travel Management	7,965	8	---	8,132
Livestock Grazing	75	389	---	8,253
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.17. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative A – 2015

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**132,480**	**470,102**	**6**	**10,006,632**
TOTAL – Cumulative	**247,316**	**500,009**	**8**	**10,750,063**

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Leasable Minerals – Natural Gas Development – Federal	50,073	1,867	0	89,419
Leasable Minerals – Coalbed Natural Gas Development – Federal	12,420	13,436	0	294,609
Leasable Minerals – Oil Development – Federal	36,232	610	1	49,376
Leasable Oil and Gas Minerals – Federal	**98,726**	**15,913**	**2**	**433,405**
Leasable Minerals – Natural Gas Development – All	97,832	3,632	1	174,369
Leasable Minerals – Coalbed Natural Gas Development – All	42,846	41,002	0	903,993
Leasable Minerals – Oil Development – All	72,883	1,186	2	98,473
Total Oil and Gas Minerals Development – All	**213,561**	**45,820**	**3**	**1,176,836**
Leasable Minerals – Coal	---	453,714	---	9,527,984
Locatable Minerals – Bentonite Mining	1,130	0	0	1,130
Locatable Minerals – Uranium Mining	1,734	0	0	1,740
Salable Minerals – Sand, Gravel, and other Minerals	18,435	0	---	18,437
Total Non-Oil and Gas Minerals	**21,299**	**453,714**	**0**	**9,549,292**
Fire and Fuels Management	9	79	5	3,157
Forests and Woodlands Management	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	543	0	---	543
Land Resources – Comprehensive Trails and Travel Management	11,799	7	---	11,952
Livestock Grazing	75	389	---	8,253
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.18. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative A – 2024

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**134,105**	**487,047**	**6**	**10,364,092**
TOTAL – Cumulative	**243,257**	**498,805**	**8**	**10,720,695**
Leasable Minerals – Natural Gas Development – Federal	57,505	2,170	1	103,240
Leasable Minerals – Coalbed Natural Gas Development – Federal	2,992	1,615	0	36,915
Leasable Minerals – Oil Development – Federal	36,199	709	1	51,426
Leasable Oil and Gas Minerals – Federal	**96,696**	**4,494**	**2**	**191,581**
Leasable Minerals – Natural Gas Development – All	114,450	4,309	1	205,266
Leasable Minerals – Coalbed Natural Gas Development – All	18,548	10,535	0	239,824
Leasable Minerals – Oil Development – All	72,850	1,408	2	103,095
Total Oil and Gas Minerals Development – All	**205,847**	**16,252**	**3**	**548,184**
Leasable Minerals – Coal	---	481,281	---	10,106,906
Locatable Minerals – Bentonite Mining	1,130	0	0	1,130
Locatable Minerals – Uranium Mining	1,196	0	0	1,200
Salable Minerals – Sand, Gravel, and other Minerals	18,439	0	---	18,441
Total Non-Oil and Gas Minerals	**20,764**	**481,282**	**0**	**10,127,677**
Fire and Fuels Management	9	79	5	3,157
Forests and Woodlands Management	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	1,658	0	---	1,658

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Land Resources – Comprehensive Trails and Travel Management	13,131	6	---	13,247
Livestock Grazing	1,818	1,187	---	26,742
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.19. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative B – 2015

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**61,654**	**468,505**	**2**	**9,900,759**
TOTAL – Cumulative	**176,313**	**498,412**	**3**	**10,644,009**
Leasable Minerals – Natural Gas Development – Federal	30,622	1,250	0	56,949
Leasable Minerals – Coalbed Natural Gas Development – Federal	10,562	12,719	0	277,689
Leasable Minerals – Oil Development – Federal	834	407	0	9,378
Leasable Oil and Gas Minerals – Federal	**42,018**	**14,375**	**0**	**344,016**
Leasable Minerals – Natural Gas Development – All	78,342	3,014	1	141,855
Leasable Minerals – Coalbed Natural Gas Development – All	40,851	40,285	0	886,935
Leasable Minerals – Oil Development – All	37,484	983	1	58,475
Total Oil and Gas Minerals Development – All	**156,677**	**44,282**	**2**	**1,087,266**
Leasable Minerals – Coal	---	453,714	---	9,527,984
Locatable Minerals – Bentonite Mining	563	0	0	564
Locatable Minerals – Uranium Mining	867	0	0	871
Salable Minerals – Sand, Gravel, and other Minerals	5,793	0	---	5,793
Total Non-Oil and Gas Minerals	**7,222**	**453,714**	**0**	**9,535,212**

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Fire and Fuels Management	1	20	1	788
Forests and Woodlands Management	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	508	0	---	508
Land Resources – Travel and Transportation Management	11,799	7	---	11,952
Livestock Grazing	76	389	---	8,254
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.20. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative B – 2024

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**45,152**	**483,118**	**1**	**10,191,081**
TOTAL – Cumulative	**154,119**	**494,876**	**3**	**10,547,493**
Leasable Minerals – Natural Gas Development – Federal	22,966	936	0	42,694
Leasable Minerals – Coalbed Natural Gas Development – Federal	562	181	0	4,363
Leasable Minerals – Oil Development – Federal	868	305	0	7,276
Leasable Oil and Gas Minerals – Federal	**24,396**	**1,422**	**0**	**54,333**
Leasable Minerals – Natural Gas Development – All	79,864	3,075	1	144,667
Leasable Minerals – Coalbed Natural Gas Development – All	15,980	9,101	0	207,134
Leasable Minerals – Oil Development – All	37,519	1,003	1	58,945
Total Oil and Gas Minerals Development – All	**133,363**	**13,180**	**2**	**410,745**
Leasable Minerals – Coal	---	481,281	---	10,106,906

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Locatable Minerals – Bentonite Mining	563	0	0	564
Locatable Minerals – Uranium Mining	598	0	0	601
Salable Minerals – Sand, Gravel, and other Minerals	5,794	0	---	5,794
Total Non-Oil and Gas Minerals	**6,955**	**481,281**	**0**	**10,113,865**
Fire and Fuels Management	1	20	1	788
Forest Products	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	564	0	---	564
Land Resources – Travel and Transportation Management	13,131	6	---	13,247
Livestock Grazing	76	389	---	8,254
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.21. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative C – 2015

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**219,212**	**474,248**	**16**	**10,183,467**
TOTAL – Cumulative	**333,908**	**504,155**	**18**	**10,926,759**
Leasable Minerals – Natural Gas Development – Federal	51,803	1,922	0	92,308
Leasable Minerals – Coalbed Natural Gas Development – Federal	22,543	17,351	0	386,954
Leasable Minerals – Oil Development – Federal	39,382	628	1	52,935
Leasable Oil and Gas Minerals – Federal	**113,727**	**19,900**	**2**	**532,197**
Leasable Minerals – Natural Gas Development – All	99,565	3,687	1	177,262
Leasable Minerals – Coalbed Natural Gas Development – All	52,826	44,917	0	996,195

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Leasable Minerals – Oil Development – All	76,032	1,204	2	102,032
Total Oil and Gas Minerals Development – All	**228,424**	**49,808**	**4**	**1,275,489**
Leasable Minerals – Coal	---	453,714	---	9,527,984
Locatable Minerals – Bentonite Mining	14,867	0	0	14,875
Locatable Minerals – Uranium Mining	3,036	0	0	3,046
Salable Minerals – Sand, Gravel, and other Minerals	73,556	0	---	73,565
Total Non-Oil and Gas Minerals	**91,459**	**453,715**	**0**	**9,619,470**
Fire and Fuels Management	27	236	14	9,470
Forest Products	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	2,094	0	---	2,094
Land Resources – Travel and Transportation Management	11,800	7	---	11,953
Livestock Grazing	76	389	---	8,254
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.22. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative C – 2024

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**222,222**	**494,382**	**16**	**10,609,303**
TOTAL – Cumulative	**331,234**	**506,140**	**18**	**10,965,767**
Leasable Minerals – Natural Gas Development – Federal	60,577	2,280	1	108,629
Leasable Minerals – Coalbed Natural Gas Development – Federal	16,237	9,444	0	214,590
Leasable Minerals – Oil Development – Federal	39,342	745	1	55,354

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Leasable Oil and Gas Minerals – Federal	**116,156**	**12,469**	**2**	**378,573**
Leasable Minerals – Natural Gas Development – All	117,526	4,419	1	210,659
Leasable Minerals – Coalbed Natural Gas Development – All	31,649	18,364	0	417,355
Leasable Minerals – Oil Development – All	75,993	1,444	2	107,023
Total Oil and Gas Minerals Development – All	**225,169**	**24,227**	**4**	**735,037**
Leasable Minerals – Coal	---	481,281	---	10,106,906
Locatable Minerals – Bentonite Mining	14,869	0	0	14,876
Locatable Minerals – Uranium Mining	2,094	0	0	2,101
Salable Minerals – Sand, Gravel, and other Minerals	73,571	0	---	73,578
Total Non-Oil and Gas Minerals	**90,534**	**481,282**	**0**	**10,197,461**
Fire and Fuels Management	27	236	14	9,470
Forest Products	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	2,267	0	---	2,268
Land Resources – Travel and Transportation Management	13,132	6	---	13,248
Livestock Grazing	76	389	---	8,254
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.23. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative D – 2015

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**165,993**	**471,704**	**6**	**10,073,791**
TOTAL – Cumulative	**280,838**	**501,611**	**8**	**10,817,231**
Leasable Minerals – Natural Gas Development – Federal	49,492	1,849	0	88,454

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Leasable Minerals – Coalbed Natural Gas Development – Federal	16,622	15,062	0	332,967
Leasable Minerals – Oil Development – Federal	35,163	604	1	48,171
Leasable Oil and Gas Minerals – Federal	**101,277**	**17,515**	**2**	**469,593**
Leasable Minerals – Natural Gas Development – All	97,255	3,613	1	173,408
Leasable Minerals – Coalbed Natural Gas Development – All	47,053	42,628	0	942,356
Leasable Minerals – Oil Development – All	71,814	1,180	2	97,268
Total Oil and Gas Minerals Development – All	**216,122**	**47,422**	**3**	**1,213,033**
Leasable Minerals – Coal	---	453,714	---	9,527,984
Locatable Minerals – Bentonite Mining	10,533	0	0	10,539
Locatable Minerals – Uranium Mining	2,605	0	0	2,614
Salable Minerals – Sand, Gravel, and other Minerals	37,789	0	---	37,794
Total Non-Oil and Gas Minerals	**50,928**	**453,714**	**0**	**9,578,931**
Fire and Fuels Management	9	79	5	3,157
Forests and Woodlands Management	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	1,871	0	---	1,871
Land Resources –Comprehensive Trails and Travel Management	11,800	7	---	11,953
Livestock Grazing	78	389	---	8,257
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

Table 4.24. Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Alternative D – 2024

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
TOTAL – Federal Lands Only	**165,519**	**489,454**	**6**	**10,446,048**
TOTAL – Cumulative	**274,679**	**501,211**	**8**	**10,802,658**
Leasable Minerals – Natural Gas Development – Federal	56,479	2,134	1	101,448
Leasable Minerals – Coalbed Natural Gas Development – Federal	8,492	4,867	0	110,721
Leasable Minerals – Oil Development – Federal	35,132	697	1	50,099
Leasable Oil and Gas Minerals – Federal	**100,102**	**7,698**	**2**	**262,267**
Leasable Minerals – Natural Gas Development – All	113,427	4,273	1	203,477
Leasable Minerals – Coalbed Natural Gas Development – All	23,770	13,787	0	313,353
Leasable Minerals – Oil Development – All	71,783	1,396	2	101,767
Total Oil and Gas Minerals Development – All	**209,261**	**19,456**	**3**	**618,877**
Leasable Minerals – Coal	---	481,281	---	10,106,906
Locatable Minerals – Bentonite Mining	10,534	0	0	10,540
Locatable Minerals – Uranium Mining	1,798	0	0	1,804
Salable Minerals – Sand, Gravel, and other Minerals	37,797	0	---	37,801
Total Non-Oil and Gas Minerals	**50,130**	**481,282**	**0**	**10,157,051**
Fire and Fuels Management	9	79	5	3,157
Forests and Woodlands Management	29	0	---	29
Land Resources – Rights-of-Way and Renewable Energy Projects	2,039	0	---	2,039

Resource	Greenhouse Gases			
	CO_2	CH_4	N_2O	CO_2 Equivalents
Land Resources – Comprehensive Trails and Travel Management	13,132	6	---	13,248
Livestock Grazing	78	389	---	8,257
CO_2 carbon dioxide CH_4 methane N_2O nitrous oxide				

4.1.1.9. Summary and Comparisons

Table 4.25, "Estimated Annual Emissions Summary (tons/year) for Activities within the Buffalo Planning Area " (p. 696) presents emission totals by pollutant species for each of the alternatives. This information is displayed graphically in Figure 4.8, "Emission Estimates for 2015 from Activities within the Buffalo Planning Area" (p. 697) and Figure 4.9, "Emission Estimates for 2024 from Activities within the Buffalo Planning Area" (p. 697). A consistent methodology was followed to estimate emissions from BLM-managed activities within the planning area for a base year (2005) and two future years. As detailed in Appendix M (p. 2239), the emissions were estimated using available equipment counts and activity information for the base year (2005) and reasonable further development activity forecast information for the future years, by alternative, so that direct comparisons could be made with the base year emissions and among the alternatives. There likely exist inherent inaccuracies in the 2005 base year inventory, especially regarding information on equipment and activity levels within the planning area. Nevertheless, this inventory was developed and used for comparison with the future year inventories, which are based on best estimate future development, equipment usage and activity levels, so that inferences could be made on the potential impacts resulting from the expected changes in emissions and resulting air quality within the planning area.

Over the past several years, other agencies have developed both base year and future year emission estimates for the three counties (Campbell, Sheridan, and Johnson Counties) that make up the planning area. For example, the State of Wyoming has compiled state-wide emissions for all major anthropogenic source categories (electric generation units, other major point sources, area sources, non-road sources, and on-road sources) that have been provided to the EPA for inclusion in the NEI. The inventory is updated every three years, with the latest update compiled for 2011. Table 4.26, "Annual Total Emissions Summary (tons/year) for Campbell, Johnson and Sheridan Counties, WY from the National Emission Inventory" (p. 698) presents emission estimates for all source categories for the years 2005, 2008, and 2011. This table shows some wide variations in emissions totals between 2005 and 2011, possibly reflecting major changes or differences in the year-to-year level of resource development (e.g., coal mining, natural gas extraction, etc.), that were possibly affected by the national recession. It should also be recognized that the latest year (2011) emission inventory is likely more accurate due to better information (e.g., activity levels, equipment counts, etc.) or different methodologies that were followed in compiling the inventory, compared to the 2005 inventory. The emissions in this table cannot be compared directly to the emissions for BLM activities, because they include emissions from all source categories. However, one item to note is that the BLM VOC emissions for 2005 are much larger than the NEI emissions. This is possibly due to a more accurate estimate of VOC emissions from evaporation ponds for the various natural gas and oil development fields in the planning area in the BLM inventory.

Because coal mining is a major source of emissions in Campbell County, Table 4.27, "Annual Coal Mine Emissions Summary (tons/year) for Campbell County, WY from the National Emission Inventory" (p. 699) presents criteria pollutant emissions for the year 2005, 2008, and 2011 from the NEI. The emissions for coal mining for 2005 are quite different in this inventory than those estimated in the BLM analysis as presented in Table 4.4, "Estimated Annual Emissions (tons/year) for Activities in the Buffalo Planning Area – Base Year 2005" (p. 654). Again, this likely reflects differences in the quantity and quality of equipment and activity data, and differences in emission estimation methodologies (e.g., emission factors for various vehicles, engines, and other equipment) used in developing each of the inventories.

In addition to coal mining, oil and natural gas development are also major sources of criteria pollutant emissions in the planning area. As noted above, other regulatory agencies have compiled both base and future-year emission inventories for Wyoming and the Mountain West supporting various air quality planning and management activities. The WRAP, a multi-state planning group responsible for addressing regional haze and other regional air quality issues, has developed updated oil and gas development emission inventories for various basins in the Mountain West, including the PRB. Table 4.28, "Annual Oil and Gas Emissions Summary (tons/year) for Campbell, Johnson, and Sheridan Counties, Wyoming from the Western Regional Air Partnership Inventory" (p. 699), presents criteria pollutant emissions for 2006, 2009, and 2015 (projected). The 2006 and 2009 emissions are based on actual equipment and activity data for these years, while the 2015 emissions are projected from the 2006 emissions based on future development forecasts for the area.

For some species (e.g., NO_X), the WRAP emissions are significantly larger than those in the BLM inventory, but similar to the emissions for coal mines, the emissions from the WRAP inventory are not directly comparable to the BLM inventory, because of the likely differences in assumed equipment counts, activity levels, emission factors, and emission estimation methodologies used/followed in compiling the inventories. Like the BLM inventory presented in Table 4.25, "Estimated Annual Emissions Summary (tons/year) for Activities within the Buffalo Planning Area " (p. 696), the WRAP inventory forecasts an increase of emissions between 2006 and 2015 from the oil and gas sector, which may contribute to air quality impacts in the future. However, the 2009 emission totals show larger increases for certain species (PM_{10}, $PM_{2.5}$, NO_X, and VOCs), but it is difficult to determine whether this is the result of better information and updated emission estimation methodologies, or reflects true increases solely due to increased development activity within the planning area.

Table 4.25. Estimated Annual Emissions Summary (tons/year) for Activities within the Buffalo Planning Area

	Criteria Pollutants					Toxics & Organics	
Scenario	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**	**HAPs**
Base Year – 2005							
Base Year	7,757	1,853	1,194	35	3,580	31,352	3,258
Forecast Year – 2015							
Alternative A	9,512	2,373	2,840	236	5,147	14,084	1,447
Alternative B	7,820	2,070	1,876	130	3,817	14,198	1,454
Alternative C	13,892	3,178	3,310	281	8,119	12,632	1,300
Alternative D	10,437	2,545	2,949	238	6,050	13,411	1,381
Forecast Year – 2024							
Alternative A	9,775	2,474	2,847	237	5,213	5,590	594
Alternative B	7,871	2,150	1,866	131	3,789	4,708	497

	Criteria Pollutants					Toxics & Organics	
Scenario	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**	**HAPs**
Alternative C	14,155	3,273	3,177	280	8,208	9,094	949
Alternative D	10,614	2,635	2,892	239	6,230	6,967	735

Source: Appendix M (p. 2239)

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

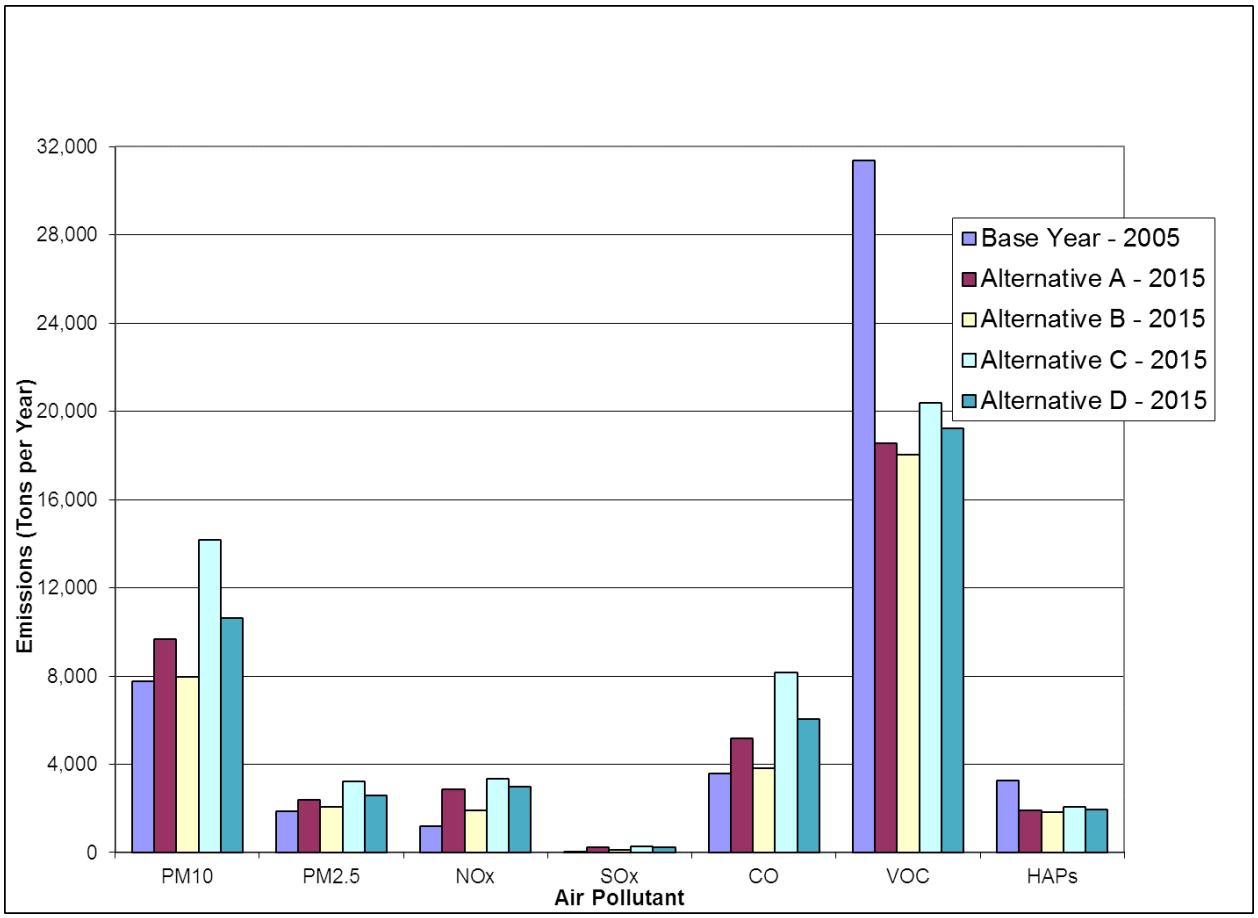

Figure 4.8. Emission Estimates for 2015 from Activities within the Buffalo Planning Area

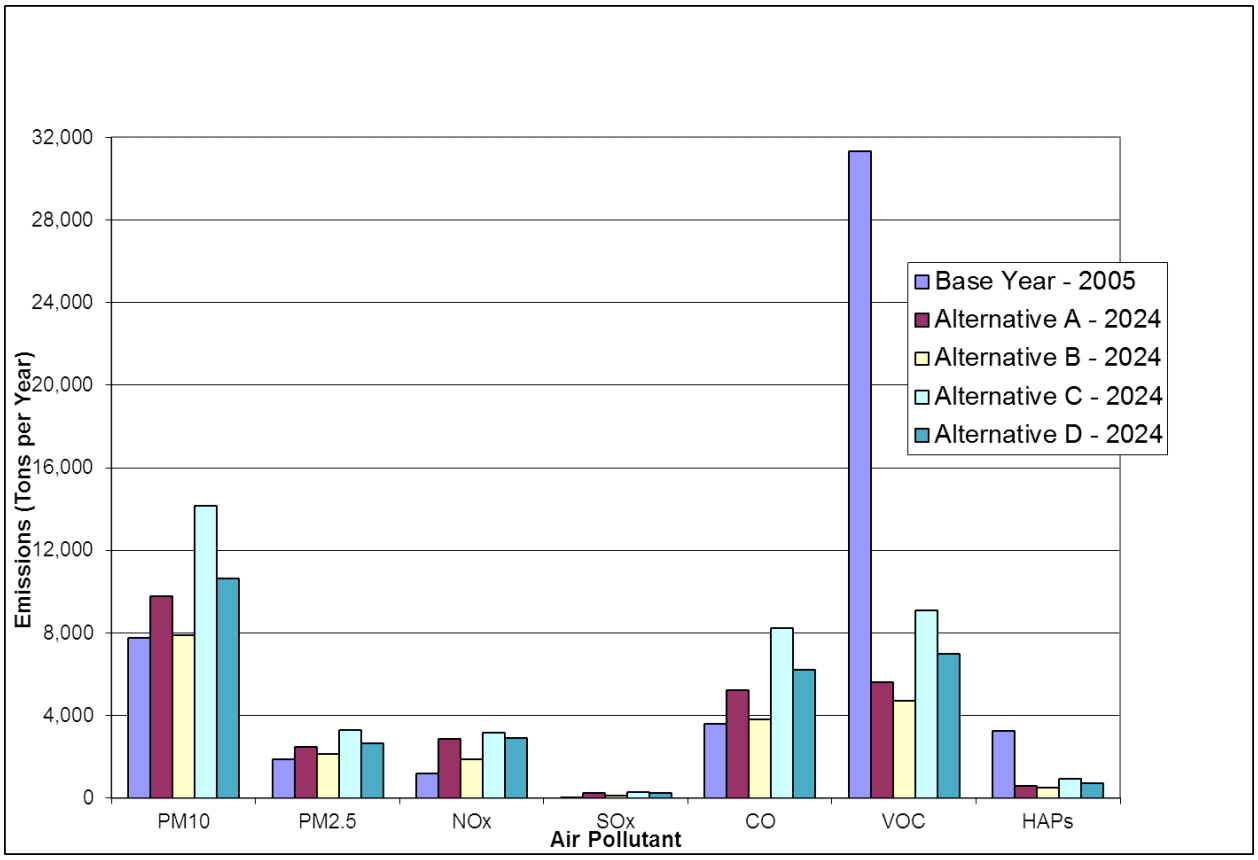

Figure 4.9. Emission Estimates for 2024 from Activities within the Buffalo Planning Area

Table 4.26. Annual Total Emissions Summary (tons/year) for Campbell, Johnson and Sheridan Counties, WY from the National Emission Inventory

	Criteria Pollutants					Organics
Year	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**
2005 Annual Emissions						
EGU	1,152	838	6,221	9,316	715	87
Point	5,834	5,231	1,209	52	2,109	692
Area	40,478	6,285	6,188	868	26,995	9,348
Nonroad	177	173	4,380	328	6,703	969
Onroad	199	171	6,640	148	22,014	1,679
Total	**47,841**	**12,698**	**24,638**	**10,713**	**58,536**	**12,775**
2008 Annual Emissions						
EGU	1,871	809	6,148	9,506	1,351	86
Point	11,784	5,171	15,196	1,067	10,812	5,055
Area	162,396	21,520	10,186	659	31,636	10,824
Nonroad	230	214	5,432	85	6,498	980
Onroad	264	228	6,497	34	26,715	1,921
Total	**176,546**	**27,942**	**43,459**	**11,352**	**77,011**	**18,865**
2011 Annual Emissions						
EGU	1,494	240	4,326	4,237	1,717	86
Point	13,544	5,263	34,598	1,566	26,794	3,033
Area	28,904	7,682	5,451	399	64,085	17,184

	Criteria Pollutants					Organics
Year	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**
Nonroad	59	56	479	1	4,730	894
Onroad	125	99	2,934	12	12,307	1,126
Total	**44,126**	**13,340**	**47,788**	**6,215**	**109,634**	**22,323**

Source: EPA 2013c

CO carbon monoxide
HAPs hazardous air pollutants
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Table 4.27. Annual Coal Mine Emissions Summary (tons/year) for Campbell County, WY from the National Emission Inventory

	Criteria Pollutants					Organics
Year	**PM_{10}**	**$PM_{2.5}$**	**NO_X**	**SO_2**	**CO**	**VOCs**
2005	5,825	5,223	33	23	34	4
2008	8,883	3,916	2,422	80	1,317	14
2011	11,120	4,180	27,618	565	22,198	209

Source: EPA 2013c

CO carbon monoxide
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds

Table 4.28. Annual Oil and Gas Emissions Summary (tons/year) for Campbell, Johnson, and Sheridan Counties, Wyoming from the Western Regional Air Partnership Inventory

	Criteria Pollutants				Organics
County	**PM_{10}**	**NO_X**	**SO_2**	**CO**	**VOCs**
2006 Annual Emissions					
Campbell	364	9,726	333	6,698	6,608
Johnson	95	4,135	82	1,835	1,658
Sheridan	67	1,506	64	1,088	339
Total	**527**	**15,367**	**479**	**9,621**	**8,605**
2009 Annual Emissions					
Campbell	283	16,089	44	12,303	10,314
Johnson	95	6,160	16	3,989	3,987
Sheridan	59	4,091	9	3,745	2,132
Total	**437**	**26,341**	**69**	**20,037**	**16,432**
Projected 2015 Annual Emissions					
Campbell	284	9,701	236	10,641	8,189
Johnson	129	4,594	99	3,323	2,886
Sheridan	127	2,118	113	2,278	666

	Criteria Pollutants				Organics
County	**PM_{10}**	**NO_X**	**SO_2**	**CO**	**VOCs**
Total	**540**	**16,414**	**449**	**16,242**	**11,740**

Source: 2006 emissions based on WRAP oil and gas emissions inventory Phase III; 2009 emissions based on WRAP oil and gas emissions inventory Phase IV; 2015 emissions based on WRAP oil and gas emissions inventory Phase III mid-term projection

CO carbon monoxide
NO_X nitrogen oxides
PM_{10} particulate matter less than 10 microns in diameter
$PM_{2.5}$ particulate matter less than 2.5 microns in diameter
SO_2 sulfur dioxide
VOCs volatile organic compounds
WRAP Western Regional Air Partnership

4.1.1.10. Conclusion

For this analysis, emissions were estimated for the proposed management actions in each alternative for seven criteria pollutants (PM_{10}, $PM_{2.5}$, NO_X, SO_2, CO, VOCs, HAPs, and the following GHGs: CO_2, CH_4, and N_2O. Emissions were estimated for the base year (2005) while emissions for all alternatives were estimated for 2015 and 2024, the latter two years reflecting short-term and long-term estimates, respectively.

Estimated emissions for the years 2015 and 2024 were compared to base year emissions to determine the expected future change in emission levels for each alternative. Except for VOC emissions, for the majority of the pollutants examined, emissions are estimated to increase slightly compared to base year levels for all alternatives except Alternative B, which shows either similar values in the future years or decreases in emissions compared to 2005. The increases in emissions for all other alternatives reflect expected projected increases primarily in oil and natural gas development and other mineral development activity in the area. The large decrease in VOC emissions in the future years reflects a decrease in the number of evaporation ponds expected to be used in oil and gas development.

An examination of emissions from all activities shows that the Alternative B estimates would be the lowest of the alternatives because this alternative includes the greatest constraints on resource development and use, especially for oil, natural gas, and mineral development. Because of this, Alternative B would result in the least amount of impacts to air quality resources. Compared to 2005 totals, Alternative B shows increases in PM_{10}, $PM_{2.5}$, NO_X, CO, and SO_2 emissions in both future years, and a major decrease in VOC and HAP emissions. The largest estimated increases in emissions are expected from Alternative C (except for VOCs and HAPs) because this alternative reflects the least amount of constraints on natural resource development and the greatest amount of development and resource use. As such, Alternative C is expected to result in the highest impacts on air quality resources in the planning area.

As presented above, other air quality management agencies have developed both base and future year emission estimates that support air quality management analyses in Wyoming and throughout the Mountain West. The emission inventories developed by the State of Wyoming, the WRAP, and the EPA likely differ in the quality and quantity of the equipment and activity level data used, and the methodologies followed in developing the inventories. Therefore, because of these differences, the emission inventories developed by these other agencies are useful to review and examine but cannot be directly compared to the BLM emission inventories. Nevertheless, the inventories are somewhat consistent in showing increases in criteria pollutant emissions in

the future years, which could result in impacts on air quality including ambient concentrations, visibility, and atmospheric deposition within the planning area.

As noted above, energy development activities of leasable fluid and solid minerals include sources and equipment that contribute the majority of emissions in the planning area, while a number of other resources have negligible or no impacts on Air Quality within the area.

4.1.2. Geological Resources

As discussed in Chapter 3, none of the geological features occurring on public lands in the planning area are considered unique enough to warrant special management or conservation measures. Therefore, the geological resources of the planning area consist of mineral resources. See the *Mineral Resources* section, and the subsections under that for information regarding anticipated impacts to the three federal mineral classifications (Locatables, Leasables, and Salables). See the *Paleontological Resources* section for anticipated impacts to the Dry Creek Petrified Tree Environmental Education Area (EEA) (containing public lands with exposed portions of petrified trees), and the *Cave and Karst Resources* section for anticipated impacts to cave and karst resources. See the *Health and Safety* section for anticipated impacts to various geological and natural hazards occurring in the planning area.

4.1.3. Soil

This section describes potential effects on soils in the planning area from BLM management of resources and resource uses under the alternatives. The *Soil* section of Chapter 3 describes existing soil conditions. Stable and productive soil in the planning area provides the foundation for other resources (e.g., biological resources) and for resource uses (e.g., livestock grazing). Actions that disturb or compact soil, disrupt soil stability, or reduce soil productivity are considered adverse. Conversely, actions that avoid or minimize soil compaction or erosion, stabilize soil, or increase soil productivity are considered beneficial.

4.1.3.1. Methods and Assumptions

For purposes of this broad-scale analysis, the primary indicator of adverse effects on soil resources is the amount of surface disturbance from management decisions for soils and other resources, particularly surface disturbance on soils with a severe erosion hazard, soils with Limited Reclamation Potential (LRP), soils with low reclamation suitability, and steep slopes. This chapter cumulatively refers to these areas as sensitive soils. The analysis of effects on soil resources is based on the factors contributing to site degradation and their inherent risks. The types of projected effects on soils under the alternatives are similar; however, the potential amount of acres disturbed is anticipated to vary by specific allowable uses and management actions associated with individual alternatives, as described below. The projected amount of surface disturbance in the planning area is identified in the *Reasonable Foreseeable Development and Reasonable Foreseeable Action Scenarios* (see Appendix G (p. 1937)).

Short-term adverse effects on soils would result during initial surface disturbance before revegetation is completed, or before practices are implemented or structures installed to minimize erosion. There would be long-term adverse effects due to accelerated erosion in locations where bare soils were allowed to remain exposed to water and wind. Other long-term adverse effects would be due in part to changes in vegetative communities, and the loss of productivity

in areas where facilities and structures remove or greatly alter the soil profile, restricting the reestablishment of vegetation.

Assumptions

- Spatial analysis was conducted using the Natural Resources Conservation Service (NRCS) Soil Data Viewer ArcGIS Extension and the Environmental Systems Research Institute, Inc., ArcGIS Desktop 9.3 computer software using the NRCS Soil Survey Geographic Database (SSURGO) datasets. Effects are described qualitatively and, where possible quantitatively.
- The BLM would use published and preliminary (NRCS 2011c) county soil survey information to predict soil behavior, limitations, or suitability for a given activity or action. NRCS SSURGO soils data, properties, suitabilities, limitations, and local, regional and national interpretations are used for analysis.
- For analysis purposes with the geographic information systems (GIS) tools described above, if the dominant hazard condition (%) within a Soil Map Unit (SMU) has a severe management hazard rating, the entire (SMU) is rated severe. However, there could be areas in the (SMU) that could have a rating of slight or moderate.
- Any disturbance proposed on a soil identified as a "sensitive soil" has the potential to have a major impact to the soil resource, since soil erosion affects an area larger than the physical disturbance. Reclamation in these areas is challenging. Extra steps are necessary to conserve the soil resource.
- Surface disturbance on sensitive soils is distributed across the landscape in the same proportion the soils occur on the land. In other words, if five percent of the soils in the planning area are highly erosive, it is assumed that five percent of the projected total disturbance would occur on highly erosive soils. In general on BLM-administered surface in the planning area, 28 percent of the soils have high erosion potential. This assumption applies only to Alternative C, which allows for unrestricted surface disturbance throughout the planning area.
- For analysis purposes, water erosion is the primary mechanism for loss of soil productivity.
- Using the GIS tools described above, SMUs containing miscellaneous areas such as badlands, rock outcrops, and areas susceptible to mass movement were chosen from the data sets (referred to above) for the planning area. For the analysis, the areas consisting of the miscellaneous areas could be substantially less due to generalization in the applicable GIS shape file polygons.
- The BLM will use soil survey data and interpretations to predict soil behavior, limitation, or suitability for a given activity or action. Soil interpretations are developed by the cooperators in the National Cooperative Soil Survey (NCSS) and maintained by the NRCS. Soil interpretations (see Glossary) are ever evolving; therefore, as new or updated soil interpretations become available they may supersede prior interpretations. Soil interpretations do not preclude activities or actions, rather, they provide a reasonable guide to the risks, limitations, and probable outcomes of a particular use or practice. The information is not site-specific and does not eliminate the need for onsite investigation of the soil.
- Roads and trails would be properly designed and built in accordance with BLM Manual 9113 (BLM 1985b).
- Linear disturbances such as pipelines, utility corridors, and transmission lines will be managed consistent with other resource requirements and BMP's including but not limited to corridors and collocating disturbances.

Significance Criteria

In addition to the scale of effects identified in Methods and Assumptions, an adverse effect on soil resources would potentially be substantial if erosion were to result in soil losses to the extent that a site could no longer support the native vegetative community composition and cover.

4.1.3.2. Impacts Common to All Alternatives

Soil

Using soils surveys and onsite investigations would ensure proper use of soil resources. Applying appropriate mitigation (including project relocation or denial) and requiring an approved reclamation plan would ensure all disturbances were effectively remediated to BLM standards. The soils management actions common to all alternatives would have a major beneficial effect on soil resources.

BFO has described the existing environment for erosion potential in acres and percent of the field office and displayed as specific SMU polygons in Map 3. Erosion rates are inherently difficult to predict. The BFO chose to describe the existing environment and place restrictions on the sensitive areas. Depending upon a host of soil and site variables and disturbance type, BLM may recommend avoiding these sensitive areas or mitigating the disturbances on a site-specific basis. BLM policy is to minimize any soil loss from permitted disturbances. All proposed disturbances will have a site-specific NEPA analysis and are required to have a construction, stabilization, and reclamation plan that specifically addresses erosion based on the existing soil and site conditions. The Wyoming DEQ also requires erosion control measures in their Storm Water Pollutant Prevention Plan (SWPPP) permitting process to help prevent erosion and sediment transport.

The BFO used the Revised Universal Soil-Loss Equation model to predict the average soil loss in tons per acre per year. The Revised Universal Soil-Loss Equation model (http:/www.ars.usda.gov/Research/docs.htm?docid=5974) is an erosion model designed to predict the longtime average annual soil loss carried from runoff from specific slopes in specified management conditions. Table 4.29, "Soil Loss by Percent Slope" (p. 703) displays the soil loss in tons per acre per year relative to slope, with the other values remaining the same. Model assumptions are bare soil conditions before the addition of BMPs.

Table 4.29. Soil Loss by Percent Slope

Slope percent	Soil Loss (Tons/Acre/Year)
0.2	0.4
0.5	0.7
1	1.2
2	2.2
3	3.1
4	4.2
5	5.2
6	6.3
8	8.4
10	11.2
12	14.4
14	17.7
16	21.0
20	27.4
25	35.3
30	42.9
40	57.1

Slope percent	Soil Loss (Tons/Acre/Year)
50	70.1
60	81.6

The Revised Universal Soil-Loss Equation model uses environmental and site features including: (R) rainfall-runoff erosivity, (K) soil erodibility, (L) length of slope and (S) slope steepness, and (C) cover management and (P) erosion control practice factor to determine predicted soil loss in tons per acre per year. The factors used in the table above include: an R of (20), K of (.32), L (100 feet), S (variable), C of (1 no cover), and P of (1.2 no BMPs). Soil loss is calculated as Soil loss=R*K*LS*C*P.

Physical Resources

Management actions common to all alternatives for **Cave and Karst Resources** would not affect soil resources because the actions are procedural (inventories).

Air Quality
Air quality management actions common to all alternatives include implementation of measures to mitigate effects to air quality, such as dust suppression and cooperative efforts to reduce dust emissions. These actions would help keep soil in place, and would have a moderate beneficial effect on soil resources because the actions would reduce soil loss, but not prevent it.

Water Resources
Water management actions common to all alternatives include managing surface-disturbing activities to prevent degradation of water quality, including reducing channel and bank erosion, and managing water to meet *Wyoming Standards for Healthy Rangelands*. These actions are designed to reduce or prevent soil erosion and would be applied across the entire planning area. Therefore, water management actions would have a beneficial effect on soil resources.

Mineral Resources

Mining activities (locatable, coal, and salable) have the potential for the most long-term effects on soil resources. Soils would be completely removed from the active mining areas; therefore, soil functionality at those sites would be restored following the cessation of mining. Heavy equipment could compact soils not directly mined, and soil would be at risk for erosion, sedimentation, and ponding of surface runoff. Reclamation planning would be required and implemented to meet reclamation goals and objectives (Appendix O (p. 2495)).

The potential acreage available for mining in the planning area is extensive, but foreseeable mining activity is much less.

Locatable Minerals
BLM surface overlaying federal mineral estate in the planning area is available for potential locatable mineral exploration and development (777,310 acres) unless formally withdrawn. However, foreseeable locatable minerals development is anticipated to affect a maximum of 1,455 acres (0.2% of available area), which would have a negligible adverse effect on soil resources.

Leasable Minerals – Coal
Similarly, the potential acreage available for coal leasing is extensive, but the foreseeable activity would disturb a maximum of 195,700 acres (4.1% of available acreage) confined

to central Campbell County and north-central Sheridan County. Overall, there would be minor adverse effects on soil resources from coal leasing due to the localized extent in the planning area.

Leasable Minerals – Fluids

Federal fluid mineral estate in the planning area would be available to fluid mineral leasing unless identified as closed. Although fluid minerals include oil and gas and geothermal resources, there is no geothermal potential in the planning area and no geothermal development is forecast. Therefore, the fluid mineral discussion is limited to oil and gas.

Fluid minerals development would affect soils during exploration, drilling, production, and abandonment. Effects on soils could include removal of vegetation, exposure of the soil, mixing of soil horizons, loss of topsoil productivity, soil compaction, and increased susceptibility to water and wind erosion. Increased erosion and surface runoff would occur from soil compaction and the channelization of surface runoff, which reduces plant productivity, alters species composition, and increases soil surface exposed to wind and water erosion. Drainages that receive this concentrated, increased flow often erode downward, further increasing erosion and sediment loading downstream. Effects are short-term and long-term–short-term within the initial areas of surface disturbance before the soils are stabilized and vegetation reclamation is in progress; long-term when areas such as roads and facility locations are not reclaimed after initial construction.

Oil and gas development involves cross-country travel to stake well locations and associated roads and pipelines. Geophysical exploration also requires cross-country travel. Frequently, these cross-country routes are not the locations of eventual roads or pipelines. Each cross-country trip crushes native vegetation and increases soil susceptibility to erosion. Travel on steep slopes and highly erodible soils allows for a higher potential for waterborne sediments to reach drainages. In addition, surface flows increase along vehicle tracks in loamy and clayey soils from an increase in soil compaction and reduced infiltration. Research has shown that it is common for water infiltration in wheel tracks to be reduced to approximately 50 percent of the infiltration rate without traffic (House et al. 2001; Baumhardt and Jones 2002). House et al. (2001) measured reductions in infiltration rates from 12 percent to 80 percent. House et al. (2001) and Baumhardt and Jones (2002) found water content of the soil at the time of compaction had a significant effect on infiltration, as did the compacting loads. Compaction primarily destroys the large pores necessary for retaining water available for plant growth. Baumhardt and Jones (2002) found water movement in vehicle tracks is twice as quick as in non-traffic areas. Damage from compaction can persist for years (House et al. 2001).

Water disposal methods from oil and gas fluid mineral production has the potential to adversely affect soil resources. These potential methods include infiltration and evaporation ponds, discharge to drainages, land application, and subsurface disposal. Potential effects include increased erosion, changes in plant communities, and changes in soil physical, chemical, and biological properties.

Although there would be major local adverse effects where the fluid minerals development occurred, the foreseeable development scenarios for all alternatives predict less than one percent of soil area would be physically disturbed. Since soil erosion affects an area larger than the physical disturbance the overall effect would be minor adverse at the planning-area scale.

Salable Minerals

Most BLM surface overlying federal mineral estate would be available for salable minerals exploration and development (777,310 acres). Foreseeable salable minerals development

is anticipated to affect a maximum of 2,090 acres (0.3% of available federal mineral estate). Therefore, there would be negligible adverse effects on soil resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Fire and fuels management includes wildland fire response, soil stabilization following wildfire, planned or prescribed fire, and mechanical fuels treatment. In the short term, fire and fuels management actions reduce canopy and ground cover, thereby exposing soils to wind and water erosion and increasing runoff potential. Reduced infiltration from extremely hot fires in some areas would result in higher runoff and hill slope erosion. Effects on soil and water resources from resource-damaging fires include dramatic increases in peak flows (two to five times predisturbance conditions, depending on burn characteristics) and increases in salts, nutrients, and metals in the initial flush flows (1 to 2 years). Erosion, including slumps, debris flows, and other dramatic soil loss events can occur in wildland fire areas for 5 to 25 years depending on the burn characteristics, intensity of rain events, soils, and geology of the area (Hurteau et al. 2008). Over the long term, erosion would be reduced as vegetation recovers.

Suppression activities result in temporary surface disturbance and soil compaction from increased vehicle traffic, staging, and fire camps. Compared to effects on water and soil resources from wildland fire, effects from suppression activities would likely be negligible. The construction of fire lines would increase erosion as a result the removal of vegetation, duff, and the organic layer of the soil. Fire lines would vary in length, width, and depth; therefore, soil erosion would be highly variable. Concentrated surface runoff and increased erosion could occur, especially in areas with steep slopes and soils with low reclamation suitability.

Effects on soils from planned (prescribed) fire are typically less severe than from unplanned (wildland) fire. Prescribed fire ignitions can be controlled to times of year when there is less likelihood of damage to soils from excessive heating. Prescribed fires reduce fuel loading, which minimizes the risk of catastrophic wildland fires; therefore, short-term effects associated with prescribed fire generate long-term benefits by reducing the risk of highly damaging catastrophic wildland fires.

The use of prescribed fire to restore desired ecological conditions of rangelands, forests, or woodlands would improve soil quality in the long term. The use of prescribed fire to modify ecological communities, reduces canopy cover, disturbs the soil surface, and increases erosion in the short term. However, over the long term, prescribed fire effectively improves the health and vigor of the vegetative community, reducing soil erosion by reducing the chance of widespread vegetation loss from insects, disease, and catastrophic wildland fire. Improving the health and vigor of ecological systems would increase ground cover and reduce surface erosion. Generally, there should be beneficial effects on soil resources in the planning area from prescribed fire and fuels management.

Fire and fuels management actions common to all alternatives that would affect soil resources include adherence to national and local fire plans and policies, consultation with a resource advisor, implementation of stabilization and rehabilitation standards, and fireline rehabilitation. These actions would benefit soil resources at the local scale. However, at the planning-area scale, there would be negligible beneficial effects on soil resources from fire and fuels management actions because of the limited acreage predicted to be disturbed by fire.

Biological Resources

Management actions for biological resources are designed to protect biological resources typically by limiting surface-disturbing activities, which benefits soil resources. The *Physical Resources* and *Mineral Resources* sections above describe how surface-disturbing activities affect soil resources.

There are no management actions common to all alternatives for **Forests and Woodlands**, **Special Status Species – Plants**, or **Special Status Species – Fish** that would affect soil resources.

Vegetation – Grassland and Shrubland Communities
Grassland and shrubland management actions common to all alternatives that would beneficially effect soil resources include managing vegetative communities in accordance with Wyoming Standards for Healthy Rangelands, using an integrated approach to manage the health and diversity of plant communities, and managing surface-disturbing activities to reduce adverse effects on vegetation. Grasslands and shrublands are the dominant vegetative communities in the planning area, comprising 718,636 acres (92%) on BLM-administered lands. Grassland and shrubland management actions would have a major beneficial effect on soil resources.

Vegetation – Riparian/Wetland Resources
The BLM would manage riparian and wetland vegetative communities to achieve and maintain Proper Functioning Condition (PFC). Achieving or maintaining PFC in riparian areas promotes the growth of deep-rooted riparian vegetation that dissipates streamflow energy, stabilizes stream banks from cutting action, and filters sediment. PFC also promotes adequate amounts of vegetative cover to stabilize soils, provides organic material, and cycle nutrients. Vegetation management prescriptions would be implemented to meet the *Standards for Healthy Rangelands*, which would maintain soil erosion and deposition at acceptable levels. Achieving the *Standards for Healthy Rangelands* would benefit soils. Preventing the degradation, loss, or destruction of riparian and wetland habitats also would protect soils.

Collectively, riparian and wetland management actions common to all alternatives would have a negligible beneficial effect on soil resources because of the limited amount (207 acres, or 0.03%) of riparian and wetland communities on BLM-administered lands in the planning area.

Invasive Species and Pest Management
Limiting surface disturbance, using certified weed seed-free products, and requiring that disturbed areas be revegetated and treated for invasive species would benefit soil resources. Many invasive species have relatively sparse canopies and shallow roots, which results in increased erosion compared to native vegetation (BLM 2008c). For example Kentucky bluegrass (*Poa pratensis*) has a shallow root system that cannot stabilize stream banks as well as deep-rooted native species such as sedges (*Carex* spp.) and rushes (*Juncus* spp.). Invasive species can adversely affect soil function and reduce soil biodiversity. Treatments to control invasive species could result in short-term localized effects on soil stability because vegetation would be removed and make soil susceptible to erosion. However, in the long term, controlling invasive species would benefit soil if treatments resulted in increased native plant cover. These management actions would have a beneficial effect on soil resources.

Fish and Wildlife Resources – Fish
Fisheries management actions common to all alternatives include mitigation for surface-disturbing activities and managing non-native riparian vegetation for the benefit of native and desirable

non-native fish. The *Physical Resources* and *Mineral Resources* sections above describe how surface-disturbing activities affect soil resources. There are 51,745 acres (1.1%) of BLM surface associated with fish-bearing waters. Therefore, fisheries management actions would have a minor beneficial effect on soil resources.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Wildlife and special status wildlife management actions common to all alternatives include mitigation for surface-disturbing activities; maintaining or improving wildlife habitats; protecting crucial wildlife habitats; managing, maintaining, and restoring Greater Sage-Grouse habitat; and establishing a permanent disturbance-free buffer for bald eagle nests. Collectively, these wildlife and special status wildlife management actions would have a beneficial effect on soil resources because wildlife habitat is present throughout the planning area.

Heritage and Visual Resources

There are no **Cultural Resources**, **Paleontological Resources**, or **Visual Resources** actions common to all alternatives that would affect soil resources. Areas with high-quality or important paleontological resources are typically small (fewer than 40 acres), which would result in relocating activities but would not prevent surface-disturbing activities. Therefore, effects on soil resources from **Paleontological Resource** management actions would not differ among alternatives and are not further discussed in the soils section.

Land Resources

The following programs do not have any management actions common to all alternatives that would affect soil resources: **Lands and Realty**, **Renewable Energy**, and **Lands with Wilderness Characteristics**.

The lands and realty program does not include management actions common to all alternatives or that vary by alternative that would directly affect surface-disturbing activities. Therefore the **Lands and Realty** program would not affect soil resources and is not discussed in the *Soils* section.

Forest Products
Management actions common to all alternatives include a prohibition on timber harvest within 200 feet of surface waters and a personal-use forest product sales program. The amount of live plants harvested for personal use is very small and not considered to affect soil resources. The area in the planning area affected by the water buffer would be 5,584 acres, which is less than one percent of BLM surface. This would protect soils in the localized area, but result in negligible beneficial effects on soil resources at the planning area scale.

Rights-of-Way and Corridors
Management actions common to all alternatives include the designation of ROW corridors and locating new ROW adjacent to existing disturbances. These actions would minimize additional surface disturbance, but not prevent disturbance resulting in an adverse effect on soil resources.

Travel and Transportation Management
Management actions common to all alternatives include minimizing surface disturbance and

erosion, closing roads temporarily or permanently where resource damage is occurring, reclaiming roads if they are heavily eroded, and prohibiting motorized travel if soils would be damaged. TTM will follow a holistic approach, including the inventory, design, construction, maintenance, and reclamation of roads and trails, which would limit adverse effects on soil resources.

Motorized travel increases soil disturbance, resulting in increased soil compaction, rutting, surface runoff, and subsequent erosion. Effects would be greatest in areas of concentrated use that are not constructed or maintained for the present or future intended use. Travel during wet soil conditions on improperly designed and constructed roads could lead to rutting and the creation of alternative routes, parallel, and braided roads. Ruts can provide a channel for concentrated flow to accelerate soil erosion. BLM roads that are properly designed, graded, and maintained would improve road conditions. This could result in decreased soil disturbances associated with creation of parallel or braided roads and associated runoff and subsequent erosion. Poorly designed and improperly maintained roads would be the most susceptible to erosion due to runoff, compacted surfaces, and lack of vegetative cover. Typically, poorly designed and improperly maintained roads are incised and channel water, which leads to erosion within and adjacent to the road. Design standards minimize surface runoff and subsequent soil erosion for new roads. Road reclamation reduces erosion, surface runoff, nonpoint sources of sediment, and other adverse effects on soils.

Because the management actions are designed to protect soil resources, the effects are beneficial while the scarcity of public access roadways on BLM surface in the planning area, limit the beneficial effects on the soil resources. Surface disturbance related to roads constructed for other uses such as minerals development are included under ROW and the program for which the road was constructed.

Recreation

Recreation management actions common to all alternatives include avoiding riparian habitat for developed facilities and camping, and providing for dispersed recreation opportunities throughout the planning area. *Travel and Transportation Management* above addresses effects on soil resources from vehicle use for recreational purposes. Effects on soils associated with recreation include localized soil compaction and erosion. Effects would depend on duration and circumstance of use. Disturbance would be the greatest in areas of concentrated use, such as hiking trails, developed facilities, and dispersed camping sites. Improvement and maintenance of recreation sites localizes soil disturbances.

Based on the low level of recreation use and the acreage of riparian areas on BLM surface (less than one percent of BLM-administered lands in the planning area) there would be negligible adverse effects to soils resources.

Livestock Grazing Management

Most of the BLM surface acreage in the planning area would be available for livestock grazing. Livestock would be managed in accordance with the *Wyoming Standards for Healthy Rangelands* to sustain vegetative communities and special habitats.

Livestock grazing has the potential to affect soil physical properties (compaction and erosion), chemical properties (near-surface soil chemistry) and biological properties (microbiology). Livestock grazing reduces vegetative cover, causes surface disturbance from hoof action, and compacts soils in localized areas. Water or wind erosion of soils could be accelerated if insufficient litter or plant cover is left after the grazing season, or if plant composition changes. Livestock grazing can affect soil structure if biological or physical soil crusts are damaged. Overgrazing can reduce the amount of organic matter, the carbon storing ability, and the kinds and

numbers of microorganisms living in soils. The most noticeable effects occur around waterbodies, salt blocks, fencelines, and other areas where animals frequently congregate. In such areas, increased effects on soil would be expected. In contrast, dispersed distribution and periodic rotation of livestock would be expected to broaden the extent of effects on soil resources, but decrease their intensity. This would be expected to decrease the overall effects on soil resources and improve their overall resiliency to the effects of grazing.

Water sources and other range improvements improve the distribution of livestock, and prevent livestock concentration and overuse of forage that leads to increased surface runoff and soil erosion. Constructing range improvements results in short-term localized compaction and soil erosion. With proper planning and effective management of range projects, any adverse effects on soil resources would be minimized. Grazing management and range improvements would improve or maintain desired long-term range health, which would minimize adverse effects on soil resources from livestock grazing.

Management in accordance with the *Wyoming Standards for Healthy Rangelands* (Appendix P (p. 2501)) generally is effective in managing adverse effects on soils from domestic livestock grazing. Managing in accordance with these standards would have a beneficial effect on soil resources.

Special Designations

There are no management actions common to all alternatives related to **Areas of Critical Environmental Concern (ACECs), Scenic or Back Country Byways (BCBs), Wild and Scenic Rivers (WSRs), or Wilderness Study Areas (WSAs)** that would affect soil resources.

Byway designation would not affect other activities and are not addressed by alternative. WSR and WSA designation is not foreseen during the planning period. Therefore, no effect on soil resources from management of these special designations would be anticipated. The only special designation addressed by alternative in this section is ACECs.

Socioeconomic Resources

There are no **Social and Economic Conditions** or **Health and Safety** management actions common to all alternatives or under individual alternatives that would have a measurable effect on soil resources. Therefore, the soil section does not further address **Socioeconomic Resources**.

4.1.3.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended and maintained.

Soil
Surface-disturbing activities affect soils to varying degrees depending on the types, amounts, and locations of disturbance; soil type; time of year; climatic factors; and surface hydrology. Surface-disturbing activities remove protective vegetative cover and crusts and can alter soil physical, chemical, and biological properties. This increases soil susceptibility to water and wind erosion, and decreases soil quality and site productivity. Surface-disturbing activities also can affect biologic soil crusts. These crusts are comprised of cyanobacteria, lichens, and mosses, which help to stabilize soils, which reduces erosion and increases soil productivity.

All soils are susceptible to accelerated erosion. Accelerated erosion is in excess of natural erosion rates and occurs when soil particles are detached and removed as a result of human or animal activities. Soils with severe erosion hazards and soils with LRP are the most vulnerable. Once disturbed, it is difficult and costly to stabilize these areas. The potential for accelerated erosion from proposed surface disturbances on highly erosive soils is approximately 40 percent greater (USFS 2004) than predicted for less-erodible soils.

Seasonally prohibiting surface-disturbing activities in areas of severe erosion hazard would have a minor beneficial effect on soil resources. Specific mitigation and BMPs are more effective in controlling erosion than a seasonal timing restriction. Wind and water can cause severe erosion. Wind speeds, direction, and timing are variable, which makes a timing restriction ineffective for preventing wind erosion. This restriction provides protection during the normal wet period, March 1 to June 15, but provides no protection during the remainder of the year. There is a secondary precipitation peak in September and October, and major storms can occur throughout the year. The seasonal restriction also conflicts with the optimum seeding dates to stabilize the soil. Finally, the authorized officer can waive this action on a project-specific basis without defined criteria. This has been applied inconsistently, thereby allowing for potential adverse effects on soil resources.

There are 215,496 acres (28%) of BLM surface and 669,739 acres (20%) of federal mineral estate defined as having a severe erosion hazard; the BLM could apply the timing limitation to surface-disturbing activity in these areas. Although soils with severe erosion hazard do account for more than 10 percent of soils resources, because timing restrictions are generally ineffective, this management would have a lesser beneficial effect on soil resources.

Prohibiting surface-disturbing activities on slopes of more than 25 percent (see Map 4) can result in an adverse effect on soil resources when the prohibition is waived by the authorized officer. Surface occupancy is usually a long-term disturbance that results in long-term adverse effects on soil resources; steep slopes are difficult to stabilize and reclaim using traditional methods. Current management does not define waiver criteria, which has led to inconsistent restriction application thus resulting in adverse effects. Alternative A is potentially inconsistent with the Wyoming BLM guidance for mitigation of surface-disturbing and disruptive activities, and with the use of conventional construction equipment. Alternative A applies to 170,590 acres (22%) of BLM surface with slopes greater than or equal to 25 percent and 412,145 acres (12%) of federal fluid mineral estate. With the inconsistency in waiver application, and conflicts with the BLM mitigation policy, this management would have a greater adverse effect on soil resources.

Restrictions of surface-disturbing activities on soils with poor reclamation suitability do not protect soil resources, primarily because of the provision for waivers without defined criteria. The risk of BMP failure is great on low-reclamation suitability soils. Soils with poor reclamation suitability are present on 455,090 acres (58%) of BLM surface and 1,514,445 acres (45%) of federal fluid mineral estate. The inconsistent protection of soils with poor reclamation suitability would have an adverse effect

Current restrictions of surface-disturbing activities on LRP areas do not protect soil resources, primarily because of the extremely limiting soil and site conditions and the provision for waivers without defined criteria. LRP sites exhibit little opportunity for meeting the Wyoming State Reclamation Policy requirements. Reclamation of these sites is often impractical and/or unrealistic due to physical, biological, and/or chemical challenges. LRP areas potentially occur on 218,928 acres (28%) of BLM surface and 685,950 acres (20%) of federal fluid mineral estate. The inadequate protection of these sites would have an adverse effect on soil resources.

Overall, the soils management actions would result in a minor adverse effect on the soils resource.

Physical Resources

Air Quality

Air quality management actions under Alternative A would have no effect on soil resources.

Water Resources

There are two water management actions under Alternative A affecting soil resources that were not included in the 1985 RMP; they relate to on-channel reservoir placement and surface discharge of produced water. Without a previous management decision, these actions are considered on a project-specific basis, which has led to inconsistent management. Inconsistent management would have an adverse effect on soil resources on 32,912 acres (4.2%) of drainage channel on BLM surface and 397,753 acres (8%) of drainage channel over federal mineral estate.

The only water management action from the 1985 RMP affecting soil resources is a 500-foot restriction on surface-disturbing activities around springs, reservoirs, water wells, and perennial streams. Like many management actions in the 1985 RMP, the prohibition can be waived and waiver criteria were not defined; this has resulted in inconsistent management. This action would have an adverse effect on soil resources because it would fail to adequately protect the 2.5 percent (19,861 acres) of soils on BLM surface and the 2.8 percent (95,172 acres) of soils over federal fluid mineral estate within the water buffer. Overall, water management under Alternative A would have moderate adverse effects on the soil resource.

Cave and Karst Resources

Cave and karst resources are associated with steep slopes, rock outcrops, and similar sensitive soil types. Management actions that protect caves would therefore also protect soil resources. However, because there are no cave and karst management actions in the 1985 RMP, management in cave and karst areas are considered on a project-specific basis; this has led to inconsistent management of surface-disturbing activities. Cave and karst resources could be present on 13 percent (101,455 acres) of BLM surface and 4.4 percent (212,626 acres) of federal mineral estate. The potential for surface-disturbing activities in cave and karst areas is relatively low, related both to the difficult topography and limited potential for mineral resources. Although cave and karst resources comprise more than 10 percent of BLM surface, because of the limited foreseeable activity, the lack of previous management actions to consistently protect cave and karst resources would have a minor adverse effect on soil resources.

Mineral Resources

Impacts Common to All Alternatives above describes how mining activities would affect soil resources.

Locatable Minerals

Under Alternative A, 554 acres (0.1% of soils over federal locatable minerals) are predicted to be disturbed by locatable minerals development. This would have a negligible adverse effect on soil resources.

Leasable Minerals – Coal

The surface disturbance prediction of 195,700 acres of coal development is 4.1

percent of the federal mineral estate. This would have a minor adverse effect on soil resources under Alternative A.

Leasable Minerals – Fluids
Alternative A would continue to lease and allow for development of federal oil and gas. Fluid minerals development would affect soil resources as described above under *Impacts Common to All Alternatives*. Drilling and development would occur mostly in areas with high and moderate potential for oil and gas (see Map 23) spread over the next 15 to 20 years. The approximate total acres disturbed associated with the construction of well sites, access roads, and pipelines would be 10,575 acres. This represents 0.6 percent of soil resources over federal fluid mineral estate (3,386,530 acres). Since soil erosion affects an area larger than the physical disturbance the overall effect would be minor adverse at the planning-area scale.

Salable Minerals
Under Alternative A, 530 acres (0.01% of soils over federal salable minerals) of soils are predicted to be disturbed by salable minerals development. This would have a negligible adverse effect on soil resources.

Fire and Fuels Management

Impacts Common to All Alternatives above describes how fire and fuels management generally affects soil resources. The following paragraphs describe more specific effects on soil resources from management actions under Alternative A.

Unplanned Fire (Wildfire)
Response to unplanned wildland fire varies from full suppression to use of fire as a management tool under Alternative A. The use of some types of suppression equipment is limited in some areas, and fire and suppression damage will be rehabilitated. These actions would limit erosion and benefit soil resources. However, with a predicted 27,596 acres affected by wildfires, the benefits of these management actions would be negligible at the planning-area scale.

Planned Fire (Prescribed Fire)
Prescribed fire would be implemented to support vegetation and wildlife objectives, which also would result in long-term benefits to soil resources. With a predicted 14,000 acres (1.7%) of BLM surface to be treated by prescribed fire and mechanical treatments, there would be minor beneficial effects on soil resources from these management actions at the planning-area scale.

Biological Resources

Vegetation – Forests and Woodlands
Timber harvest and other vegetative treatments would be designed to improve biodiversity and water quality. Disturbance associated with forest treatment activities would reduce canopy cover, disturb the soil surface, and increase erosion in the short term. Reduction of the canopy cover exposes the soil surface to rain-splash erosion and can increase rilling and gullying. Forest litter, duff, and organic material forming ground cover are the most important components for protecting the mineral soil from erosion in forested systems (Elliot et al. 1996). Studies of the effects of logging roads show that post-storm turbidity can be attributed more to erosion from roads than any other source (Dunne and Leopold 1978).

Meeting the Desired Future Condition (DFC) in the long term with these vegetative treatments would contribute to properly functioning watersheds that support productive plant communities. Improving the health and vigor of forests would result in increased ground cover and would reduce surface erosion.

Up to 6,000 acres (0.8% of BLM surface) of forest and woodland treatments are predicted under Alternative A. Forest and woodland management under Alternative A would have a negligible beneficial effect on soil resources.

Vegetation – Grassland and Shrubland Communities
Impacts Common to All Alternatives above describes effects on soil resources from grassland and shrubland management. There is only one management action that varies across the alternatives. This management action relates to whether non-native species can be used during reclamation. There was no decision in the 1985 RMP regarding this management action; therefore, under Alternative A, species used for reclamation would need to be consistent with the BLM reclamation policy, which does allow the use of non-native species under specific circumstances. A primary goal of reclamation is soil stabilization, and vegetation species used in reclamation are chosen with this goal in mind. The effect on soils from this management action would be moderate and beneficial. Although this management action stabilizes all surface disturbances, the desired native ecological condition maybe slow to reestablish.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would be prohibited. Like many management actions in the 1985 RMP, the prohibition can be waived and waiver criteria were not defined. This has led to inconsistent management. Continuing this management would have a minor adverse effect on soil resources because it fails to adequately protect the 2.5 percent (23,831 acres) of soils on BLM surface within the water buffer.

Invasive Species and Pest Management
Impacts Common to All Alternatives above describes the types of effects on soil resources from invasive species and pest management. The only related management action in the 1985 RMP was to control noxious weeds in cooperation with the counties. Under Alternative A, 8,000 acres (1.02%) of BLM surface are predicted to be treated. This would have a minor beneficial effect on soil resources.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
There are no fisheries management actions in the 1985 RMP that affect soil resources. Fisheries management is considered on a project-specific basis; therefore, mitigation has been inconsistently applied to surface-disturbing activities potentially affecting the soil resources. There are 51,745 acres (1%) of BLM surface within 0.25 mile of fish-bearing waters and 818 acres (0.1%) of BLM surface associated with specials status fish bearing waters. Therefore, fisheries management under Alternative A would have a negligible beneficial effect on soil resources.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
There are a number of management actions under Alternative A that prohibit surface-disturbing activities for the protection of wildlife and special status wildlife species; these actions would benefit soil resources locally where soil disturbances are prevented. Typically, these management actions provide the opportunity for waivers, which reduces the benefits to soil resources. The timing limitations for various wildlife species also do not benefit soil resources because they simply delay surface-disturbing activities.

The two largest acreages where surface disturbances are prohibited are 138,452 acres (17.7%) of BLM surface where timber harvest is prohibited in crucial elk habitat and permanent buffers around active raptor nests (385,148 acres, or 49%, of BLM surface and 2,298,687 acres, or 48%, of federal fluid mineral estate). These actions would have a minor beneficial effect on soil resources.

Special Status Species – Plants
There are no management actions in the 1985 RMP that specifically address special status plant species; therefore, management is considered on a project-specific basis and consistent with the BLM special status species policy and the ESA. Surface-disturbing activities would avoid special status plant populations. In addition, special status plant species have narrow habitat requirements and therefore are not widespread in the planning area. Special status plant management under Alternative A would have a negligible beneficial effect on soil resources.

Heritage and Visual Resources

Cultural Resources
Current management includes placing a no surface occupancy (NSO) stipulation on mineral leases associated with the Bozeman Trail. The stipulation is typically less than 0.25 mile in width. Management of cultural resources under Alternative A would have a negligible beneficial effect on soil resources due to the limited acreage affected (0.46%) of BLM surface.

Visual Resources
The 1985 RMP manages visual resources in accordance with their Visual Resource Management (VRM) class. (VRM) Class II is the only class in the 1985 RMP likely to reduce surface-disturbing activities and therefore affect soil resources. The objective of (VRM) Class II designation is to retain the existing character of the landscape; management actions can be seen but they should not attract attention. There are 127,594 acres (16.3%) of BLM surface classified as (VRM) Class II. However, because surface disturbance is reduced but not prohibited and (VRM) management has been inconsistently applied, benefits to soil resources would be negligible.

Land Resources

Forest Products
Management actions under Alternative A include the sale of minor forest products, sale of commercial timber, and regeneration standards. Regeneration standards would not reduce the initial surface disturbance from harvest activities, but would help forest and woodland vegetation recover; this would reduce the duration of the long-term effects of vegetation removal. A maximum of 6,000 acres (0.8%) of forest product-related activity is predicted to occur on BLM surface. This would have a negligible adverse effect on soil resources.

Renewable Energy
There are no renewable energy decisions in the 1985 RMP; therefore, proposals are considered on a project-specific basis. Although there have been no renewable energy projects to date, 20,000 acres (2.6%) of disturbance on BLM surface are predicted during the planning period. Renewable energy development at this scale would have a minor adverse effect on the soil resources.

Rights-of-Way and Corridors
The only decision in the 1985 RMP specifically limiting ROW activity is a conditional prohibition on communications sites on North Middle Pumpkin Butte. The predicted

disturbance from ROW actions is 38,762 acres (4.96%) of BLM surface, which would have a minor adverse effect on soil resources.

Travel and Transportation Management
The 1985 RMP identified areas and routes where motorized vehicle is allowed (subject to restrictions) or excluded. However, implementation has been inconsistent. Existing roads have not been mapped for effective travel management enforcement.

Impacts Common to All Alternatives above describes road- and trail-related effects on soil resources. Off-road vehicle use can cause undue environmental degradation and accelerate soil erosion. The severity would depend on soil conditions (moist or wet versus dry or frozen), frequency, vehicle weight and type, and tire width or tread. Effects would be greatest in areas of concentrated use that are not maintained or improved. Continuous travel leads to compaction. There are several adverse environmental effects associated with compaction, including increased soil erosion, reduced soil permeability to air and water, reduced soil moisture, reduced soil depth and organic matter, and reduced nutrient cycling. While soil compaction can recover to some degree during periods of non-use, erosion usually continues whether or not use stops. Accelerated erosion resulting from motor vehicle use generally is constrained to isolated incidences. Limiting travel to designated routes confines the effects to areas disturbed or hardened from vehicle use.

TTM under Alternative A would have a minor adverse effect on soil resources based on the potential number of existing roads many of which are pioneered roads without erosion protections.

Recreation
Fluid and locatable mineral activity is not allowed in developed recreation sites under Alternative A. The prohibition on mineral activity would benefit soil resources locally. There are no decisions in the 1985 RMP limiting soils disturbance from recreational activities; therefore, recreational activities and developments are considered on a project-specific basis. This has led to inconsistent management. There would be negligible adverse effects on soil resources because of the low level of recreational use in the planning area.

Lands with Wilderness Characteristics
At present, there are no areas outside WSAs in the planning area managed for the preservation of wilderness characteristics. Therefore, there would be no effect on soil resources.

Livestock Grazing Management
Current livestock grazing management actions that directly affect soil resources include adjusting grazing use following timber harvest; allowing range improvements; conducting resource monitoring; continuing with the currently authorized areas and levels of grazing use; and resting pastures for a year followed by a year of grazing deferment following vegetative treatments. *Impacts Common to All Alternatives* describes effects on soils from livestock grazing common to all alternatives. Projected surface disturbances are the same across the alternatives. At present, livestock grazing is not authorized on approximately 10,000 acres (1.3%) of BLM surface due to rugged topography and steep slopes, and where livestock grazing is determined to be incompatible with other resource uses or values. Cumulatively, these management actions would have a minor beneficial effect on soil resources.

Special Designations

Areas of Critical Environmental Concern
The 1985 RMP did not designate ACECs. Therefore, there would be no effect on soil resources from ACEC management under Alternative A.

4.1.3.4. Alternative B

Soil
Alternative B prohibits surface-disturbing activities on soils with a severe erosion hazard, which would have a beneficial effect on soil resources. Management would be consistent because Alternative B does not allow waivers. The Alternative B prohibition would apply year-round and would protect soils from erosion from wind and seasonal storms throughout the year. Alternative B would protect 215,496 acres (28%) of BLM surface and 669,739 acres (20%) of the federal fluid minerals estate.

Prohibiting surface-disturbing activities on slopes equal to or greater than 25 percent would have a beneficial effect on soil resources. This alternative would avoid most soils with a severe water erosion hazard and avoid sites susceptible to mass failure, which are frequently on steep slopes and occur throughout the planning area. This restriction also is consistent with Appendix J (p. 2155). This restriction is consistent with the use of conventional construction equipment. Alternative B would achieve consistency in application because it does not allow exemptions. Alternative B would protect 170,590 acres (22%) of BLM surface and 412,145 acres (12%) of federal fluid mineral estate.

Prohibiting surface-disturbing activities on soils with poor reclamation suitability would have a beneficial effect on soil resources. Alternative B would prevent disturbance on areas with poor reclamation suitability, is clearly defined, and would be consistently applied because it allows no exemptions. Alternative B would protect soils on 455,090 acres (58%) of BLM surface and 1,514,445 acres (45%) of federal fluid mineral estate.

Prohibiting surface-disturbing activities on areas identified as LRP areas such as but not limited to badlands, rock outcrops, and slopes susceptible to mass movement would have a beneficial effect on soil resources. These sites exhibit little opportunity for meeting the Wyoming State Reclamation Policy requirements; therefore, Alternative B prohibits disturbance of these sites. Alternative B would protect 218,928 acres (28%) of BLM surface and 685,950 acres (20%) of federal fluid mineral estate. Overall soil management actions in Alternative B would have major beneficial effects on the soil resource.

Physical Resources

Air Quality
Air quality management actions under Alternative B would not affect soil resources.

Water Resources
Alternative B includes three water management actions that would affect soils resources, as follows: a prohibition on on-channel reservoir placement, a prohibition on surface discharge of produced water, and a 500-foot prohibition of surface-disturbing activities around springs, non-CBNG, reservoirs, water wells, perennial streams, and their associated riparian habitat. These management actions are unconditional. The 500-foot buffer would protect 2.5 percent, or 19,861 acres, of the soils on BLM surface and 2.8 percent, or 95,172 acres, of soils over federal fluid mineral estate. There are 32,912 acres (4.2%) of drainage channel on BLM surface and

397,753 acres (8.3%) of drainage channel over federal mineral estate that would be protected by the on-channel reservoir and surface discharge prohibitions. Collectively, these water management actions would have a moderate beneficial effect on soil resources.

Cave and Karst Resources
Alternative B prohibits surface-disturbing activities, including minerals development and timber harvest, in cave and karst areas. The prohibitions are unconditional. Cave and karst resources could be present on 13 percent (101,455 acres) of BLM surface and 4.4 percent (212,626 acres) of federal mineral estate. Management actions to protect cave and karst resources would have a major beneficial effect on soil resources.

Mineral Resources

The *Impacts Common to All Alternatives* section above describes how minerals activities affect soil resources. In general, Alternative B substantially reduces the area available for mineral exploration and development compared to Alternative A, but does not reduce projected development as much as it reduces available area.

Locatable Minerals
Under Alternative B, 277 acres (0.03% of federal locatable minerals) of soils are predicted to be disturbed by locatable minerals development. This would have a negligible adverse effect on soil resources.

Leasable Minerals – Coal
The Alternative B surface disturbance prediction of 186,600 acres of coal development is 3.9 percent of the federal mineral estate. This represents a minor adverse effect on soil resources.

Leasable Minerals – Fluids
Alternative B would continue to lease and allow for the development of the federal fluid mineral estate, but with increased protections for soils and other resources. Alternative B would impose what are considered major constraints for development on 642,232 acres (19%) of the federal mineral estate. The approximate total acres disturbed associated with the construction of well sites, access roads, and pipelines is 286, which represents 0.3 percent of soil resources over the federal fluid minerals estate. Even with erosion extending beyond the physical disturbances, the overall affected area should remain less than one percent of the soil resources. Therefore, management under Alternative B would have a negligible adverse effect on soil resources.

Salable Minerals
Under Alternative B, salable minerals development is predicted to disturb 114 acres (0.003% of federal salable minerals). This would have a negligible adverse effect on soil resources.

Fire and Fuels Management

The *Impacts Common to All Alternatives* section above describes how fire and fuels management generally affects soil resources. The following paragraphs describe more specific effects on soil resources from management actions under Alternative B.

Unplanned Fire (Wildfire)
Under Alternative B, response to unplanned wildland fire varies from full suppression to monitoring fire as a management tool. The use of heavy equipment is limited to existing roads and trails. All fire and suppression damage will be rehabilitated. These actions would limit erosion and benefit the soil resources. However, with a predicted 27,596 acres (3.5%) of BLM surface to be affected by wildfires, the benefit of these management actions would be minor at the planning-area scale.

Planned Fire (Prescribed Fire)
Under Alternative B, prescribed fire and other vegetative treatments would be used to restore fire-adapted ecosystems, which would have a long-term beneficial effect on soil resources. With a predicted 3,500 acres (0.4%) of BLM surface to be treated by prescribed fire and mechanical treatments, the beneficial effect of these management actions would be negligible at the planning-area scale.

Biological Resources

Vegetation – Forests and Woodlands
The discussion under Alternative A describes how forest and woodland management activities affect soil resources. Alternative B emphasizes a natural, hands-off, approach to forest and woodland management. Timber harvest and other vegetative treatments would be minimized. Mature and old-growth forests are typically productive plant communities with more ground cover and less surface erosion than early successional forest communities.

Up to 1,000 acres (0.1%) of forest and woodland treatments are predicted under Alternative B. This would have a negligible beneficial effect on soil resources.

Vegetation – Grassland and Shrubland Communities
Under Alternative B, only native species would be authorized for reclamation activities. Native species often have distinct seeding windows and are sometimes slow to establish, which allows invasive species to establish. Initial stabilization and erosion control would be less in the short term. Allowing only native species for reclamation could have a minor adverse effect on soil resources.

Vegetation – Riparian/Wetland Resources
Under Alternative B, surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would be prohibited. Other management actions that would benefit soil resources include managing for DFC in capable communities, and restoring wetland and riparian vegetation supported by (CBNG), produced-water discharge. The 500-foot buffer would protect 3.0 percent, or 23,831 acres, of soils on BLM surface and 4.2 percent, or 144,045 acres, of soils over federal fluid mineral estate. Collectively, these water management actions would have a minor beneficial effect on soil resources.

Invasive Species and Pest Management
The *Impacts Common to All Alternatives* section describes the types of effects on soil resources from invasive species. Alternative B takes an aggressive approach to managing invasive species. Under Alternative B, 15,000 acres (2%) of BLM surface are predicted to be treated, which would have a minor beneficial effect on soil resources.

Fish and Wildlife Resources – Fish and **Special Status Species – Fish**
Alternative B fish and special status fish management actions include maintaining, enhancing,

and restoring fish habitat; managing fish habitat toward DFC; and prohibiting surface-disturbing activities within 0.25 mile of fish-bearing waters. The *Soils* and *Mineral Resources* sections of this soils analysis describe how surface-disturbing activities effect soil resources. There are 261,870 acres (0.4%) of federal mineral estate associated with fish-bearing waters and 818 acres (0.1%) of federal mineral estate associated with special status species fish-bearing waters. Therefore, fisheries management under Alternative B would have a major beneficial effect on soil resources; special status species fish management would have a negligible beneficial effect.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)

There are a number of management actions under Alternative B that prohibit surface-disturbing activities (without provisions) for the protection of wildlife and special status wildlife species; these actions would benefit soil resources locally where soil disturbances are prevented. The timing limitations for various wildlife species would not benefit soil resources because they delay, but do not prevent, surface-disturbing activities.

Under Alternative B, the largest acreages of surface disturbance prohibitions are timber harvest in crucial elk habitat (149,451 acres, or 19%, of BLM surface), disturbance activities in elk security habitat (132,148 acres, or 16.9%, of BLM surface), permanent buffers around active raptor nests (255,129 acres, or 33%, of BLM surface), disturbance activities in reptile and amphibian habitat (176,636 acres, or 23%, of BLM surface), renewable-energy projects in Greater Sage-Grouse habitat (467,897 acres, or 65.1% of BLM surface). Collectively these prohibitions would have a major beneficial effect on the soil resource.

Special Status Species – Plants

Surface-disturbing activities are prohibited within special status plant species habitat under Alternative B. This prohibition effects all programs on BLM surface (126,811 acres [16.21%]). Surface disturbance associated with federal mineral development has the potential to effect the largest acreage (243,929 acres [5.08%]) of the total federal mineral estate. Cumulatively special status plant management would have a major beneficial effect on soil resources.

Heritage and Visual Resources

Cultural Resources

Management actions under Alternative B include a prohibition of surface-disturbing activities in areas with historic properties that retain their historic setting, Traditional Cultural Properties (TCPs), sacred sites, and other culturally sensitive areas. To protect the historic settings of these sites, the prohibition on surface-disturbing activities can extend 5 miles from the sensitive cultural site, which would protect soil resources on 330,592 acres, or 42 percent, of BLM surface, and 1,854,954 acres, or 39 percent, of federal fluid mineral estate. This would have a major beneficial effect on soil resources.

Visual Resources

Under Alternative B, areas inventoried as (VRM) Class II and special emphasis areas would be managed as (VRM) Class II. There are 217,021 acres, or 27.9 percent, of BLM surface classified as (VRM) Class II. This management action could have a major beneficial effect on the soil resource. However, because surface disturbance is reduced but not prohibited, planning level impacts maybe less beneficial thus having a minor beneficial effect on the soil resources.

Land Resources

Forest Products
Management actions under Alternative B include commercial sales of saw timber, limiting timber harvest units to 5 acres, managing sales to keep forests within ecologically sustainable limits, and natural regeneration of harvest areas. The reliance on natural regeneration could increase vegetative recovery time following vegetation removal, which would adversely affect soil resources. A maximum of 1,000 acres, or 0.1 percent, of forest product-related activity is predicted on BLM surface; this would have a negligible adverse effect on soil resources.

Renewable Energy
Management under Alternative B would exclude renewable-energy projects wherever minerals development and other surface-disturbing activities are prohibited and allow renewable-energy development where other surface-disturbing activities are allowed. Approximately 5,000 acres, or 0.6 percent, of disturbance on BLM surface are predicted over the planning period. Renewable-energy development at this scale would have a negligible adverse effect on soil resources.

Rights-of-Way and Corridors
Management under Alternative B would exclude ROW activity from 706,556 acres of BLM surface and restricts communications sites. These actions would reduce additional surface disturbance. The predicted disturbance from ROW actions is 18,011 acres (2.3%) of BLM surface, which would have a minor adverse effect on soil resources.

Travel and Transportation Management
Management actions under Alternative B include closing 625,854 acres to motorized use and limiting motorized vehicle use elsewhere to designated routes, closing and reclaiming roads to protect sensitive resources, and limiting travel off designated routes to permitted activities. These actions would limit the potential adverse effects on soil resources from motorized vehicles to a negligible level.

Recreation
Alternative B would provide for recreation to be intensively managed in and would prohibit mineral leasing within a 0.5 mile buffer of SRMAs. The restriction on mineral leasing would reduce potential surface disturbance from mineral-development facilities and associated infrastructure. These management actions would prohibit surface-disturbing activities on 55,529, acres or 7.1 percent, of BLM surface, which would have a moderate beneficial effect on soil resources.

Lands with Wilderness Characteristics
Alternative B would prohibit most surface-disturbing activities on 12,237 acres, or 1.6 percent, of BLM surface to emphasize primitive recreation and natural values, which would have a minor beneficial effect on soil resources.

Livestock Grazing Management
Management actions under Alternative B include reducing grazing effects following timber harvest, limiting or prohibiting grazing where it would not be compatible with other resources, locating mineral supplements away from sensitive resources, a provision for reserve common allotments, and two years of livestock rest following vegetative treatments. The *Impacts Common to All Alternatives* section above describes effects on soil resources from livestock grazing. Projected surface disturbances are the same across alternatives. At present, livestock grazing is not authorized on approximately 10,000 acres (1.3%) of BLM surface due to rugged topography and steep slopes, and where livestock grazing is determined to be incompatible with other

resource uses or values. Livestock grazing may be further restricted in sensitive areas, increasing protections on the soil resource. This would have a direct beneficial effect on soil resources. Collectively, these management actions would have a moderate beneficial effect on soil resources.

Special Designations

Areas of Critical Environmental Concern
Alternative B would designate eight ACECs encompassing 511,000 acres, or 8.3 percent, of BLM surface and implement limitations and prohibitions on surface-disturbing activities in ACECs. ACEC designation and management would have a moderate beneficial effect on soil resources.

4.1.3.5. Alternative C

Soil
Under Alternative C, allowing surface-disturbing activities on soils with a severe erosion hazard, on slopes equal to or greater than 25 percent, on soils with poor reclamation suitability, and on LRP areas would have a major adverse effect on soil resources. These are the most sensitive soils and the most difficult to reclaim following surface-disturbing activities. Allowing activities on these soils would be inconsistent with Appendix J (p. 2155) and inconsistent with the use of conventional construction equipment. Alternative C would fail to protect 215,496 acres (28%) of BLM surface and 669,739 acres (20%) of federal fluid mineral estate that possess soils with a severe erosion hazard, 170,590 acres (22%) of BLM surface and 412,145 acres (45%) of federal fluid minerals estate with slopes equal to or greater than 25 percent, 455,090 acres (12%) of BLM surface and 1,514,445 acres (48%) of federal fluid minerals estate that possess soils with poor reclamation suitability, and 218,928 acres (28%) of BLM surface and 685,950 acres (20%) of federal fluid mineral estate with badlands, rock outcrops, or slopes susceptible to mass movement.

Physical Resources

Air Quality
Alternative C air quality management actions would not affect soil resources.

Water Resources
There are three water management actions under Alternative C that would affect soil resources — allowing on-channel reservoirs; allowing surface discharge of produced water; and allowing surface-disturbing activities near springs, non-(CBNG), reservoirs, water wells, perennial streams, and within riparian habitats. These management actions would not prevent surface-disturbing activities that would erode stream banks and soils; this would adversely affect soil resources. The absence of a 500-foot buffer would leave 2.5 percent, or 19,861 acres, of the soils on BLM surface and 2.8 percent, or 95,172 acres, of soils over federal fluid mineral estate available for development, therefore leaving soils vulnerable to impacts. Under Alternative C, there would be 32,912 acres (4.2%) of drainage channel on BLM surface and 397,753 acres (8.3%) of drainage channel over federal mineral estate available for on-channel reservoir placement and surface discharge of produced water. Collectively, these water management actions would have a moderate adverse effect on soil resources.

Cave and Karst Resources
Alternative C would allow surface-disturbing activities, including minerals development and timber harvest, in cave and karst areas. Cave and karst resources could be present on

13 percent (101,455 acres) of BLM surface and 4.4 percent (212,626 acres) of federal mineral estate. The potential for surface-disturbing activities in cave and karst areas is relatively low, related both to the difficult topography and limited potential for mineral resources. Although cave and karst resources comprise more than ten percent of BLM surface, due to the limited foreseeable activity, the overall result would be a minor adverse effect on soil resources.

Mineral Resources

The *Impacts Common to All Alternatives* section describes how minerals activities affect soil resources. In general, the amount of area available for mineral exploration and development under Alternative C is comparable to Alternative A, but there would be more development because there are fewer management constraints.

Locatable Minerals
Under Alternative C, 1,455 acres (0.02% of federal locatable minerals) are predicted to be disturbed by locatable minerals development. This would have a negligible adverse effect on soil resources.

Leasable Minerals – Coal
Under Alternative C, the surface disturbance prediction of 195,700 acres of coal development is 4.1 percent of the federal mineral estate. This is a minor adverse effect on soil resources.

Leasable Minerals – Fluids
Alternative C would allow for the development of the federal fluid minerals estate with decreased protections for soils and other resources. Alternative C would place major constraints on fluid minerals development only on what is considered the coal conflict zone, which comprises 303,601 acres (0.9%) of the federal mineral estate. The approximate total acres disturbed associated with the construction of well sites, access roads, and pipelines would be 22,255 acres. This represents 0.6 percent of soil resources over the federal fluid mineral estate. Since soil erosion affects an area larger than the physical disturbance the overall effect would be minor adverse at the planning-area scale.

Salable Minerals
Under Alternative C, 2,090 acres (0.1% of federal salable minerals) are predicted to be disturbed by salable minerals development. This would have a negligible adverse effect on soil resources.

Fire and Fuels Management

The *Impacts Common to All Alternatives* section describes how fire and fuels management generally affects soil resources. The following paragraphs describe more specific effects on soil resources from fire and fuels management actions under Alternative C.

Unplanned Fire (Wildfire)
Under Alternative C, full protection tactics would be used in response to unplanned wildland fire. Heavy equipment usage would not be limited, but would consider other resource values. These actions would do little to limit erosion and would adversely affect soil resources. With an emphasis on suppression, this alternative would increase the probability of large watershed-damaging fires over the long term. Full suppression of wildland fires would result in an accumulation of fuels and an increase in late-seral vegetative communities that are more

prone to soil-damaging catastrophic wildland fires. Greater fire suppression efforts would result in increased disturbance from suppression activities, such as building fire lines, which would increase localized soil erosion. In addition, no active rehabilitation of affected soils is predicted under Alternative C. With a predicted 27,596 acres of BLM surface to be affected by wildfires, the adverse effects of these management actions would be minor at the planning-area scale.

Planned Fire (Prescribed Fire)
Wildland fire and other vegetative treatments would be used to restore fire-adapted ecosystems for commodity production. Long-term benefits to soil resources would be tempered by additional surface-disturbing activities related to commodity production. However, commodity production would be consistent with the required management for soils and other resources to reduce effects. With a predicted 42,000 acres (5.4%) of BLM surface to be treated by prescribed fire and mechanical treatments, the beneficial effects of these management actions would be minor at the planning-area scale.

Biological Resources

Vegetation – Forests and Woodlands
Timber harvest and other vegetative treatments would be designed to maximize forest health through active forest management under Alternative C. Discussion of how forest and woodland management actions affect soil resources is provided under Alternative A.

Under Alternative C, up to 24,000 acres (3.1%) of forest and woodland treatments are predicted on BLM surface. Forest and woodland management under Alternative C would have a minor beneficial effect on soil resources.

Vegetation – Grassland and Shrubland Communities
Allowing desirable non-native plant species for initial reclamation may help stabilize soils in a timely manner, therefore protecting soils and controlling erosion. This alternative would allow for quick-growing species to compete with annual weeds, stabilize the soil, and provide an opportunity for slower-establishing native plants to inhabit the site. Initial soil stabilization for all soil disturbances in the planning area, would result in a moderate beneficial effect on soil resources from this management action.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would be allowed under Alternative C. Wetland and riparian vegetation would be restored only where directly disturbed by (CBNG), activities such as dams and reservoirs. The 500-foot buffer would fail to protect 3 percent, or 23,831 acres, of the soils on BLM surface and 4.2 percent, or 144,045 acres, of soils over federal fluid mineral estate. Collectively, these water management actions would have a minor adverse effect on soil resources.

Invasive Species and Pest Management
The *Impacts Common to All Alternatives* section describes the types of effects to soil resources from invasive species. Alternative C would take a conservative approach to managing invasive species. Under Alternative C, 10,000 acres (1.3%) of BLM surface are predicted to be treated. This would have a minor beneficial effect on soil resources.

Fish and Wildlife – Fish and Special Status Species – Fish
Fish and special status fish management actions under Alternative C include considering all resources when affecting perennial waters; managing fish habitat toward PFC; allowing

surface-disturbing activities near naturally occurring waterbodies except within 500 feet of waters containing special status fish species; and restoring or improving fisheries habitat only for special status fish. The *Soils* and *Mineral Resources* sections of this soils analysis describe how surface-disturbing activities affect soil resources. There are 261,870 acres (0.4%) of federal mineral estate associated with fish-bearing waters and 4,846 acres (0.1%) of federal mineral estate associated with special status species fish-bearing waters. Therefore, allowing surface-disturbing activities under Alternative C would have a negligible adverse effect on soil resources.

Fish and Wildlife – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Most management actions under Alternative C allow surface-disturbing activities with consideration of wildlife and special status wildlife species; therefore, these actions would have little direct benefit to soil resources. Actions that would provide measurable benefits include the designation of a Wildlife Habitat Management Area (WHMA) in the Fortification Creek crucial elk ranges (32,602 acres, or 4.2%, of BLM surface), a restriction on surface-disturbing activities near active Greater Sage-Grouse leks (3,594 acres, or 0.5%, of BLM surface), and a Controlled Surface Use (CSU) limitation on fluid mineral leases near active special status raptor nests (28,437 acres, or 3.6%, of BLM surface). Although a few management actions would affect more than one percent of soil resources, the benefit to soil resources would be negligible.

Special Status Species – Plants
Under Alternative C, surface-disturbing activities would be allowed in special status plant habitat, but not in known populations. Populations are typically only a few acres in size. Special status plant species have narrow habitat requirements and therefore are not widespread in the planning area. Special status plant management under Alternative C would not affect soil resources.

Heritage and Visual Resources

Cultural Resources
Management actions under Alternative C include an allowance for surface-disturbing activities in areas with historic properties that retain their historic settings, TCPs, sacred sites, and other culturally sensitive areas when appropriate mitigation is accomplished. Cultural sites themselves are typically small in size and buffers to protect historic settings are typically less than 0.25 mile wide. These cultural resources management actions would have a negligible adverse effect soil resources.

Visual Resources
Under Alternative C, areas inventoried as (VRM) Class II and special emphasis areas would be managed as (VRM) Class III. The objective of (VRM) Class III areas is to partially retain the existing character of the landscape; management activities should not dominate the view. Class III management would likely not affect the level of surface-disturbing activities. Therefore, Alternative C visual resources management would not affect soil resources.

Land Resources

Forest Products
Management actions under Alternative C include offering an array of forest products to maximize economic returns, no limit on harvest unit size, and the planting and maintenance of trees following harvest. Planting and maintaining trees following harvest would help forest

and woodland vegetation recover and reduce the duration of long-term effects from vegetation removal. A maximum of 24,000 acres, or 3.1 percent, of forest product-related activity is predicted to occur on BLM surface. This would have a minor adverse effect on soil resources.

Renewable Energy
Management under Alternative C would allow renewable-energy development throughout the planning area consistent with other resource values. Approximately 40,000 acres (19.2%) of disturbance are predicted on BLM surface during the planning period. Renewable-energy development at this scale would have a major adverse effect on soil resources.

Rights-of-Way and Corridors
Management under Alternative C would allow for ROW activity unless specifically excluded. The predicted disturbance from ROW actions is 57,083 acres (7.3%) of BLM surface, which would have a moderate adverse effect on soil resources.

Travel and Transportation Management
Management actions under Alternative C include allowing motorized use within stock driveway, retaining all existing roads, closing areas to motorized vehicle use to protect sensitive resources, and allowing travel off designated routes for necessary tasks. Additional allowances for motorized vehicle use would result in more adverse effects on soil resources than under current management. TTM under Alternative C would have a minor adverse effect on soil resources based on the amount of area open to motorized vehicle access 754,102 acres (96.4%).

Recreation
Alternative C would provide for mineral leasing and other surface-disturbing activities. Alternative C designates 30,570 asSRMAs. However, flexible management actions in Alternative C do not necessarily restrict development or surface disturbance in SRMAs. Therefore, the impact of recreation on soils resources is negligible.

Lands with Wilderness Characteristics
There are no areas proposed to be managed for the preservation of wilderness characteristics under Alternative C. Therefore, there would be no effect on soil resources.

Livestock Grazing Management
Management actions under Alternative C soil resources include limiting or prohibiting grazing where it is currently prohibited, locating mineral supplements away from sensitive resources, and two years of livestock deferment following vegetative treatments. The *Impacts Common to All Alternatives* section above describes effects on soil resources from livestock grazing. Projected surface disturbances are the same across alternatives. At present, livestock grazing is not authorized on approximately 10,000 acres (1.3%) of BLM surface due to rugged topography and steep slopes, and where livestock grazing is determined to be incompatible with other resource uses or values. Cumulatively, these management actions would have a minor beneficial effect on soil resources.

Special Designations

Areas of Critical Environmental Concern
Alternative C would not designate any ACECs and there would be no additional limitations or prohibitions on surface-disturbing activities. Therefore, there would be no effect on soil resources.

4.1.3.6. Alternative D

Soil
Under Alternative D, surface-disturbing activities could be allowed on soils with a severe erosion hazard, on slopes equal to greater than 25 percent, and on soils with poor reclamation suitability with an approved construction, stabilization, and reclamation plan(s). Under Alternative D, LRP areas should be avoided, but in limited situations disturbances may be considered with the applicable plan(s). This would allow for surface-disturbing activities on sensitive soil resources while minimizing and mitigating the impacts to soil resources.

A construction plan should include a site evaluation, construction techniques and other practices to be employed by a proponent for surface disturbing activities. The plan is to demonstrate how surface disturbance and the associated effects will be minimized, erosion controlled, and reclamation potential will be maintained. The content of the plan will vary with the complexity of the proposal (i.e., suitability of native materials as construction material, plan and profile, engineered diagram, geotechnical investigation, etc.).

The purpose of a stabilization plan is to control erosion and maintain soil/site stability through erosion control. Soil/site stability characteristics will meet those of the Ecological Site Description (ESD) reference sheet. Erosion will be controlled to prevent irrecoverable soil loss and will be measured using BLM approved methodologies.

For a description of reclamation plans, goals and objectives, refer to Appendix O (p. 2495).

Alternative D could potentially disturb 215,496 acres (28%) of BLM surface and 669,739 acres (20%) of federal fluid mineral estate possessing soils with a severe erosion hazard; 170,590 acres (22%) of BLM surface and 412,145 acres (12%) of federal fluid mineral estate with slopes equal to or greater than 25 percent; 455,090 acres (58%) of BLM surface and 1,514,445 acres (45%) of federal fluid mineral estate possessing soils with poor reclamation suitability; and 218,928 acres (28%) of BLM surface and 685,950 acres (20%) of federal fluid mineral estate potentially containing LRP areas consisting of but not limited to badlands, rock outcrops, or slopes susceptible to mass movement. A construction, stabilization, and reclamation plan does not mean that impacts will be avoided. In the short term impacts are similar to Alternative C (because surface-disturbing activities are not prohibited) and long-term impacts would be less, dependent upon the successful implantation and maintenance of the mitigation measures applied. This management would have a minor beneficial effect on soil resources.

Physical Resources

Air Quality
Alternative D air quality management actions would not affect soil resources.

Water Resources
Under Alternative D, there are three water management actions that would affect soil resources — allowing on-channel reservoirs; allowing surface discharge of produced water; and allowing surface-disturbing activities near springs, non-(CBNG), reservoirs, water wells, perennial streams, and in riparian habitats. These management actions would allow surface-disturbing activities with limited protection in place to prevent stream bank and soil erosion. The 500-foot buffer would encompass 2.5 percent, or 19,861 acres, of the soils on BLM surface and 2.8 percent, or 95,172 acres, of soils over federal fluid mineral estate. There are 32,912 acres (4.2%)

of drainage channel on BLM surface and 397,753 acres (8.3%) of drainage channel over federal mineral estate that would evaluated when considering on-channel reservoir placement and surface discharge. Soils associated with water are typically sensitive and even with some restrictions in place erosion is likely to occur. These areas can be difficult to reclaim. BLM's authority to manage water discharge is limited as it is under the authority of the Wyoming DEQ. Collectively, these water management actions would have a minor adverse effect on soil resources.

Cave and Karst Resources
Under Alternative D, surface-disturbing activities, including minerals development and timber harvest, would be allowed in cave and karst areas with site-specific mitigation. Protections would likely focus on protecting significant caves. The potential for surface-disturbing activities in cave and karst areas is relatively low, related both to the difficult topography and limited potential for mineral resources. Management actions to protect cave and karst resources would have a minor beneficial effect on soil resources due to the site-specific buffer near significant caves, with 13 percent of the BLM surface having a CSU for mineral development.

Mineral Resources

The *Impacts Common to All Alternatives* section above describes how minerals activities affect soil resources. In general, the amount of area available for mineral exploration and development is comparable to Alternative A, as is predicted development. Alternative D incorporates resource protections which allows mineral resources development when impacted resource objectives can be met.

Locatable Minerals
Under Alternative D, 1,252 acres (0.2% of federal locatable minerals) are predicted to be disturbed by locatable minerals development. This would have a negligible adverse effect on soil resources.

Leasable Minerals – Coal
The surface disturbance prediction of 195,700 acres of coal development is 4.1 percent of federal mineral estate. This would have a minor adverse effect on soil resources under Alternative D.

Leasable Minerals – Fluids
Alternative D would allow for the development of federal fluid mineral estate with an approved construction, stabilization, and reclamation plan(s). Development of the federal fluid mineral estate (CBNG, conventional oil vertical and horizontal) within the planning area is predicted to potentially disturb, 14,186 acres, which is 0.42 percent of soil resources over the federal fluid minerals estate. Soil disturbance is site specific and dependent upon topography, as slope increases total disturbance increases. Reasonable Foreseeable Development (RFD) predictions on the amount of disturbance is based on current proposals and activity, most current development activity is located in the southern portion of the planning area. This geographic area is characterized by gently rolling to rolling landscapes.

The RFD predicts development potential into the central portion of the planning area. These landscapes are generally steep and very steep, greatly increasing the soil disturbance associated with fluid mineral development. Soils disturbance would increase significantly from roads and infrastructure that were not included in the RFD for surface disturbance. This RMP predicts increases in initial soil disturbance of 13,164 acres (0.38%) from roads and infrastructure over the federal fluid mineral estate. Horizontal/vertical drilling locations or other large constructed

disturbances have the potential to create areas described in this document as sensitive sites (soils with poor reclamation suitability, highly erodible soils, LRP areas, and steep slopes [25% or greater]). Therefore impact to the soil resource has been elevated to a minor adverse impact.

Salable Minerals
Under Alternative D, 1,193 acres (0.03% of federal salable minerals) are predicted to be disturbed by salable minerals development. This would have a negligible adverse effect on soil resources.

Fire and Fuels Management

The *Impacts Common to All Alternatives* section above describes how fire and fuels management generally affects soil resources. The following paragraphs describe more specific effects on soil resources from management actions under Alternative D.

Unplanned Fire (Wildfire)
Under Alternative D, response to unplanned wildland fire varies from full suppression to monitoring fire as a management tool. The use of heavy equipment would be limited except when human safety is at risk, and fire and suppression damage would be rehabilitated where necessary. These actions would limit erosion and benefit soil resources. However, with a predicted 27,596 acres (3.5%) of BLM surface to be affected by wildfires, the beneficial effects of these management actions would be minor at the planning-area scale.

Planned Fire (Prescribed Fire)
Under Alternative D, wildland fire and other vegetative treatments would be used to meet desired management objectives, which would result in long-term beneficial effects on soil resources. With a predicted 14,000 acres (1.8%) of BLM surface to be treated by prescribed fire and mechanical treatments, the benefit of these management actions would be minor at the planning-area scale.

Biological Resources

Vegetation – Forests and Woodlands
Forest and woodland management under Alternative D would maximize forest health through active forest management similar to Alternative C, except with fewer acres predicted to be treated. Discussion of how forest and woodland management actions effect soil resources is provided under Alternative A.

Under Alternative D, up to 20,000 acres (1.3%) of forest and woodland treatments are predicted on BLM surface. Forest and woodland management under Alternative D would have a minor beneficial effect on soil resources.

Vegetation – Grassland and Shrubland Communities
Allowing desirable non-native plant species for initial reclamation would help stabilize soils in a timely manner, thus protecting soil and controlling erosion. Alternative D would allow for quick-growing species to compete with annual weeds, which would stabilize the soil and provide an opportunity for slower-establishing native plants to inhabit the site. Initial soil stabilization for all soil disturbances in the planning area, would result in a moderate beneficial effect on soil resources from this management action.

Vegetation – Riparian/Wetland Resources
Under Alternative D, surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would be allowed when in accordance with defined criteria. Other management actions that would benefit soil resources include managing for DFC within capable communities and restoring wetland and riparian vegetation supported by (CBNG), produced-water discharge. The 500-foot buffer would protect 3 percent, or 23,831 acres, of the soils on BLM surface and 2.8 percent, or acres, of soils over federal fluid mineral estate. Collectively, these management actions would have a minor beneficial effect on soil resources.

Invasive Species and Pest Management
The *Impacts Common to All Alternatives* section above describes the types of effects on soil resources from invasive species. Under Alternative D, 12,000 acres (1.5%) of BLM surface are predicted to be treated for invasive species, which would have a minor beneficial effect on soil resources.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Fish and special status fish management actions under Alternative D include maintaining, enhancing, and restoring fish habitat; managing fish habitat toward DFC; and allowing surface-disturbing activities within 0.25 mile of fish-bearing water when appropriately mitigated unless special status fish species are present, in which case disturbance would be prohibited.

The *Soils* and *Mineral Resources* sections of this soils analysis describe how surface-disturbing activities affect soil resources. There are 261,870 acres (0.4%) of federal mineral estate associated with fish-bearing waters and 4,846 acres (0.1%) of federal mineral estate associated with special status species fish-bearing waters. Because there are allowances for surface disturbance in sensitive soils, fisheries management under Alternative D would have a moderate beneficial effect on soil resources; special status species fish management would have a negligible beneficial effect.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
There are a number of management actions under Alternative D that would allow surface-disturbing activities where wildlife and special status wildlife species could be adequately protected. These actions would benefit soil resources locally where soil disturbances are prevented.

Some of the management actions with measurable benefits to soil resources include the following: timber harvest would maintain current amounts of crucial elk habitat (149,451 acres, or 19%, of BLM surface), elk security habitat would be retained (132,148 acres, or 16.9%, of BLM surface), surface-disturbing activities would be prohibited near Greater Sage-Grouse leks (9,966 acres, or 1.27%, of BLM surface), removal of sagebrush in Greater Sage-Grouse habitats would be restricted, and surface-disturbing activities may be prohibited near special status species raptor nests (17,417 acres, or 2.2%, of BLM surface). Collectively these prohibitions would have a major beneficial effect on the soil resource.

Special Status Species – Plants
Under Alternative D, surface-disturbing activities would be allowed in special status plant habitat, but not within known populations. Populations are typically only a few acres in size. Special status plant species have narrow habitat requirements and are therefore not widespread in the planning area. Special status plant management would not affect soil resources.

Heritage and Visual Resources

Cultural Resources
Management actions under Alternative D include a prohibition on surface-disturbing activities for specifically identified historic properties that retain their historic settings, and appropriate mitigation for surface-disturbing activities for the protection of TCPs, sacred sites, and other culturally sensitive areas. To protect the settings of the identified historic properties, surface-disturbing activities could be restricted up to three miles from the sensitive cultural site. This would protect soil resources on 221,490 acres, or 28.3 percent, of BLM surface. Because these management actions limit, but do not prohibit, surface-disturbing actions, collectively they would have a moderate beneficial effect on soil resources.

Visual Resources
Under Alternative D, specifically identified areas inventoried as (VRM) Class II or special emphasis areas would be managed as (VRM) Class II. There are 112,329 acres, or 14.5 percent, of BLM surface classified as (VRM) Class II. However, because surface disturbance would be reduced but not prohibited, beneficial effects on soil resources would be minor.

Land Resources

Forest Products
Management actions under Alternative D include offering an array of forest products managed within ecologically sustainable limits, and planting following harvest only when necessary to ensure regeneration. Regeneration standards would help forest and woodland vegetation recover, which would reduce the duration of long-term effects from vegetation removal. A maximum of 20,000 acres, or 2.6 percent, of forest product-related activity is predicted to occur on BLM surface. This would have a minor adverse effect on soil resources.

Renewable Energy
Management under Alternative D would exclude renewable-energy development in specifically identified areas and allow development in the remainder of the planning area. Approximately 75,240 acres (9.6%) of disturbance on BLM surface are predicted over the planning period. Renewable-energy development at this scale would have a moderate adverse effect on soil resources.

Rights-of-Way and Corridors
Management under Alternative D would allows for ROW activity while conserving other resources. The predicted disturbance from ROW actions is 38,762 acres (4.9%) of BLM surface, which would have a minor adverse effect on soil resources.

Travel and Transportation Management
Management actions under Alternative D include limiting the majority of motorized vehicle use to designated routes and within stock driveways, closing and reclaiming areas to protect sensitive resources, and allowing travel off designated routes for identified tasks. TTM under Alternative D would have a minor beneficial effect on soil resources.

Recreation
Alternative D would prohibit or limit mineral leasing and limit surface-disturbing activities in designated SRMAs. Alternative D would protect soils on 54,160 acres (6.9%) of BLM surface by intensively managing recreation in these areas. This management action would have a moderate beneficial effect on soil resources.

Lands with Wilderness Characteristics
Alternative D would prohibit most surface-disturbing activities on BLM surface lands with wilderness characteristics to emphasize ecosystem health, primitive recreation, and natural values. This would have a minor beneficial effect on soil resources.

Livestock Grazing Management
Management actions under Alternative D include managing grazing following timber harvest, developing range improvements in accordance with resource needs, limiting or prohibiting grazing where it would not be compatible with other resources, locating mineral supplements away from sensitive resources, a provision for reserve common allotments, and managing livestock following treatments until resource objectives are met. At present, livestock grazing is not authorized on approximately 10,000 acres (1.3%) of BLM surface. The lands where grazing could also be limited or prohibited may possess key soil features (sensitive soils). Therefore, this management action would have a beneficial effect on soil resources. Collectively, the livestock grazing management actions under Alternative D would have a moderate beneficial effect on soil resources.

Special Designations

Areas of Critical Environmental Concern
Alternative D would designate two ACECs encompassing 2,849 acres, or 0.3 percent, of BLM surface, and implement limitations and prohibitions on surface-disturbing activities in ACECs. ACEC designation and management would have a negligible beneficial effect on soil resources.

4.1.3.7. Cumulative Impacts

Chapter 4 describes effects to soil resources from past and present actions, federal and non-federal as part of the affected environment. Appendix G (p. 1937) lists projections of reasonably foreseeable federal and non-federal actions. Effects from foreseeable federal actions are described by alternative above. Non-federal actions would affect soils similar to federal actions. However, the extent of surface-disturbing activities and mitigation for effects to soil resources would differ between federal and non-federal actions.

The primary non-BLM authorized activities in the planning area relate to energy development, including ROW and livestock grazing. The extent of non-federal locatable minerals development, salable minerals development, renewable-energy development, and ROW activity is several times greater than BLM activities because the BLM administers approximately 11 percent of the surface acreage in the planning area. The coal estate is predominantly federally owned, but intermixed; therefore, coal mining follows federal authorities and mitigation. The level of non-federal coal development predicted is 15 percent of the federal coal development, which directly correlates to the non-federal coal estate. Non-federal fluid minerals development is also proportional to estate ownership; approximately 65 percent federal and 35 percent non-federal. Adverse effects on soil resources would likely be greater with non-federal fluid minerals development, because without BLM responsibility for sustainable resource management, there would be fewer mitigation measures implemented for soil resources.

Because of the intermingled ownership pattern, grazing management and the acres of livestock grazing on BLM surface versus non-federal surface does not change appreciably, and acre for acre, similar effects on soil resources would be anticipated.

4.1.3.8. Conclusion

Allowable uses and management actions described in this section for the various alternatives were used to determine anticipated effects on soil resources. Meaningful differences in long-term disturbance acreage, management tactics, and acreage of lands unavailable for surface disturbance form the basis for conclusion. Alternative B would produce the fewest potential adverse effects on soil resources, because management actions would be the most protective of soil resources and are anticipated to result in the least soil disturbance. Alternative C is the least protective of the soils resource and would produce the most soil disturbance. Alternative D attempts to balance soil protections while allowing minerals and land use activities. The primary difference between alternatives D and A is that Alternative D defines when an activity could be allowed whereas Alternative A does not. The alternatives listed in order from most beneficial to the most adverse in terms of effects on soil resources are alternatives B, D, A, and C.

4.1.4. Water Resources

This section describes effects on the quality and quantity of surface water and groundwater from management actions for other resources. Adverse effects result from actions that degrade surface water or groundwater quality, change surface water flow regimes, or change groundwater quantity. Short-term effects generally last fewer than five years while disturbed areas are reclaimed or impact mitigation measures are established. Long-term effects last more than five years.

This analysis included considerations of actions that affect erosion, sediment transport, and sedimentation processes because sediment in the transport process is a water quality parameter, often measured as turbidity. Deposited sediment (sedimentation) affects channels, which contain water resources.

This analysis also considers pollutants other than sediment, some of the more common of which in the planning area would be petroleum by-products, other chemicals, and bacterial contaminants. Petroleum and chemicals will likely be introduced through spills or oil and gas operations. Bacterial pollutants are most commonly generated by livestock and wildlife, or through improper or ineffective sewage disposal.

4.1.4.1. Methods and Assumptions

This section describes the methods and assumptions used in the water resources effects analysis. Impacts are quantified where possible; in the absence of quantitative data, best professional judgment was used to qualitatively describe effects. Impacts are sometimes described using ranges of potential effects or in qualitative terms, if appropriate, according the definitions provided below.

Analysis of effects to water resources is based on achieving the watershed objectives of managing surface land use and water resources to maintain or improve water quality to comply with the water quality standards for uses and classes as established by the State of Wyoming in the Water Quality Rules and Regulations.

Nonpoint sources of pollution can include, but are not limited to, surface disturbance from construction activities for oil and gas development activities; concentrated livestock operations areas such as holding pens, watering areas, salt-block locations, shade spots, or lambing grounds; roads; and recreation areas. A watershed can experience any or all of these activities and could possess natural features such as poor soils and steep slopes that contribute to effects and could

involve a mixture of private and public land. This means that causes and effects of pollution in waterbodies as a result of nonpoint sources can be difficult to identify. However, the BLM is committed to addressing any nonpoint pollution sources that could be directly or indirectly result from BLM-approved activities. This commitment might mean addressing such effects during activity planning (see Chapter 1). Areas also can be designated for special management (see Chapter 2, Actions for Water Quality, Watersheds, and Soils, and Actions for Special Designation/Management Areas), if new problems arise during the planning period, and if a waterbody with the potential to be added to the state's CWA section 303(d) list of impaired waters is identified. The BLM will address these issues within its legal jurisdiction as they are identified. The watershed approach to evaluating and monitoring Wyoming Standards for Healthy Rangelands will occur on a 10-year rotation schedule, and will allow the BLM to identify areas with potential water-quality problems.

The proposed management of each resource program is discussed in terms of the potential to affect water resources, either beneficially or adversely. Some BLM actions, such as surface mining, could intensively disturb project sites of limited size. In the discussion of such resource management, in instances where there is a possibility of intense disturbance of sites equaling 5 or more acres, the term “local impacts” is used to acknowledge these situations, especially when the total disturbance acreage under an alternative would be relatively small. No watersheds in the planning area are managed entirely by the BLM; therefore, the effects of management of each resource are dispersed according to the layout of public lands and federal mineral estate within the watersheds of the planning area.

Assumptions

Assumptions used in this analysis include, but are not limited to, the following:

- Surface disturbance that could affect water resources during the planning period will result mainly from road, pipeline, impoundment, and well-pad construction associated with oil, gas, and other minerals development including coal mining.
- Surface disturbance, especially in areas with highly erosive soils, can affect surface water quality by increasing sediment transported to small drainages and ultimately to larger streams during runoff events.
- The extent of unsurfaced roads (i.e., those lacking gravel or other surfacing material) is an indicator of the relative quantity of sediment delivery that could affect surface water quality within each watershed (Furniss et al. 2000). New unsurfaced roads will be constructed to access new oil and gas wells; therefore, an increase in oil and gas wells is associated with an increase in roads.
- The State of Wyoming has primacy over water quality and quantity regulations for the state. Activities of parties involved in BLM management actions can affect the quality and timing of affected water flow, but these activities must have appropriate state permits. It is assumed that any water discharged as a result of BLM actions must be permitted by the state and must meet the appropriate water quality standards.
- The BLM will help state agencies ensure that state rules and regulations are met by reviewing permitting information submitted as part of BLM actions, but does not have the authority to enforce state regulations or assume liability in cases where state water standards are not met by parties involved in BLM actions.
- Water production from individual CBNG wells is generally highest during the first year of pumping and decreases relatively rapidly thereafter. Therefore, the rate of water production

follows the pace of mineral development, and water production rates will decrease as development is completed in an area and aquifers are drawn down (BLM 2003c).
- Deep groundwater resources associated with target coal zones could be substantially drawn down or depleted as a result of CBNG development (BLM 2003c).
- Actions that protect soil and vegetative resources will generally minimize effects to water resources.
- Effects conclusions are based largely on the acreage within 500 feet of surface waters that would experience surface disturbance or be protected from surface disturbance by the management actions being analyzed; there are 19,861 acres of BLM surface and 95,172 acres of federal fluid mineral estate within 500 feet of surface waters.

Significance Criteria

In addition to the scale of impacts identified in Methods and Assumptions, an adverse effect on water resources as a result of project actions would be considered potentially significant if the following were to occur:

- Degradation of water quality beyond the designated use of the receiving waters as defined by the Wyoming DEQ, or other violations of federal or state water quality standards, or adversely affecting a waterbody on the state's CWA section 303(d) list of impaired waters.
- Unmitigated loss of wetlands or wetland function (Executive Orders [EOs] 11990 and 11988) or activities that would degrade riparian and wetland areas such that, as a minimum physical state, PFC and Wyoming Standards for Healthy Rangelands (Appendix P (p. 2501)) are not being maintained.
- Streamflow characteristics of streams are altered such that established fisheries, wildlife, livestock, recreation, domestic, municipal, and industrial uses are affected.
- The alteration of stream hydraulic geometry by accelerated runoff and erosion (i.e., undue erosion, sedimentation, or mass wasting) beyond that expected through natural processes.
- The natural flow to or level of groundwater in existing springs, seeps, artesian wells, or permitted water supply wells is reduced to the point where beneficial uses cannot be maintained.
- Groundwater quality in an aquifer is degraded such that it can no longer be classified for its current and potential use(s).

4.1.4.2. Impacts Common to All Alternatives

Water Resources

The BLM will install flow control devices on developed springs and water wells on BLM-administered surface when problems at such sites are identified. This action would minimize waste of the water resources and reduce erosion caused by overflowing water supplies. These facilities would have a beneficial effect on water resources; however, due to the small number and localized areas where this management will apply, benefits would be negligible.

Water rights will be applied for BLM surface when and where the need arises. These could be groundwater rights or surface water rights used primarily for livestock or wildlife watering. This process will allow the BLM to protect legal priority in maintaining long-term water resources. Additionally, the BLM will work to develop offsite water sources for livestock and wildlife where other activities present an opportunity or need. Acquisition of water rights and modifying water sources would have a beneficial effect on water resources; however, due to the small and localized areas where these actions would apply, the beneficial effect would be negligible.

Water resources would be managed to meet the Wyoming Standards for Healthy Rangelands (Appendix P (p. 2501)) to achieve PFC and to meet Wyoming water quality standards established by the Wyoming DEQ. Managing for these conditions in specific projects, and at the project planning stage could preserve proper watershed function and minimize adverse effects on water quantity and quality. Interdisciplinary review is performed for mineral resource development on federal lands and mineral estate. This process would allow detailed analysis of proposed actions for compliance with these goals. Current guidance will be used to assess and monitor water quality to implement Standard 5 as there is presently no BLM program in the planning area to measure water quantity and quality in relation to the Wyoming Standards for Healthy Rangelands, Standard 5.

Land uses and surface-disturbing activities would be managed to reduce channel and bank erosion, sediment transport, and sedimentation in accordance with project-specific reclamation plans and Wyoming DEQ applied SWPPPs. These activities would benefit water resources because they would limit the transport and deposition of sediment and other pollutants into surface waters.

Overall, activities described above for water resources would have a negligible beneficial effect on water resources.

Physical Resources

Air Quality

Air quality management actions common to all alternatives include the implementation of air quality impact mitigation measures such as dust suppression and cooperative efforts to reduce dust emissions. These actions reduce airborne pollutants that could precipitate into surface waters. However, due to the small amount of pollutants that could be introduced into water resources, the actions would have a negligible beneficial effect on water resources.

Soil

Surface-disturbing activities that affect soil resources are evaluated on a case-by-case basis using NRCS soil survey data and interpretations and onsite investigations. Requiring mitigation measures, relocating project disturbance, or denying authorization would reduce adverse effects on water resources by limiting disturbances and the associated deposition of sediment and chemical pollutants in surface waters. Requiring reclamation plans with authorized surface-disturbing activities would minimize long-term effects on water resources, especially in relation to transport and deposition of sediment and chemical pollutants.

Cave and Karst Resources

Management actions common to all alternatives for cave and karst resources would not affect water resources because they are procedural actions (inventories).

Mineral Resources

Locatable Minerals

There are 777,310 acres of BLM surface overlying federal mineral estate available for potential locatable minerals exploration and development, with foreseeable locatable minerals development anticipated to affect a maximum of 1,455 acres (0.2%). Because most of the available area would not be within 500 feet of surface water, the adverse effect on water resources would be negligible.

Potential surface and groundwater issues could arise from the development of In Situ Recovery (ISR) uranium. However, ISR development is under the regulatory authority of the Nuclear Regulatory Commission, and water quality impacts would be under the authority of Wyoming DEQ. In these active mining areas, the ambient groundwater is circulated as mining solution when oxidants are added for dissolving the uranium in the target formation. Mine areas are maintained in an under balanced condition with respect to water quantity, which means that slightly more water is removed than the amount injected to prevent excursion of the solution from the targeted areas. The mined area is ringed with groundwater monitor wells in the target zone as well as above and below to monitor for leakage of the mine solution. Additionally, the mines are required to determine pre-mining baseline water quality which serves to set the goal for groundwater restoration after mining is complete. The Wyoming DEQ Land Quality Division (LQD) and Water Quality Division have authority over the restoration of the groundwater in a mined area, in concert with the requirements of the Nuclear Regulatory Commission. BLM maintains responsibility for the BLM surface lands within the mine boundary.

Leasable Minerals – Coal

The potential acreage available for coal leasing is extensive, but the foreseeable activity has a maximum disturbance of 195,700 acres confined to central Campbell County and north-central Sheridan County. This would have an overall minor adverse effect on surface water resources because of the localized extent in the planning area; only 856 acres (1.3%) of the federal coal likely to be developed (coal administrative zone) is within 500 feet of surface waters. Groundwater quality has been and will be degraded in mined areas; research shows that elevated Total Dissolved Solids (TDS) levels occur until the salts made available by the greater surface area of rock fragments exposed to water draining through the spoil have been flushed out. This process creates significant short-term, if not long-term, impacts. In certain areas the elevated TDS levels are high enough to change the class of use of the groundwater. Combined, the adverse impacts to surface water and groundwater could be elevated to moderate.

Potential Impacts Associated with Surface Coal Mining

1. Reduction in surface water runoff and peak flows
2. Potential acceleration of groundwater recharge (due to replacement of excavated material with unconsolidated material
3. Removal of coal and overburden groundwater aquifers
4. Lowered water levels in aquifers adjacent to mine
5. Increase in groundwater TDS in backfilled areas
6. Disruption of water supply for surface water rights holders
7. Disruption of groundwater wells from reduced levels of aquifers

Surface coal mining requires that any surface water be removed or relocated prior to topsoil removal. Perennial streams are diverted in coordination with the Wyoming DEQ and the U.S. Army Corps of Engineers. Other water bodies, such as impoundments or natural surface playas in the mine area are drained and removed as necessary.

Coal mining would have substantial, short-term effects on surface drainage systems and water runoff characteristics under any action alternative. Erosion and sediment discharge would likely increase in disturbed areas because of vegetation removal, but infiltration rates would likely improve after reclamation because of changes in soil structure and the presence of vegetation and more moderate topography to reduce runoff. Water flow and direction in mine areas would be altered by the removal and reconstruction of drainage channels prior to mining and from

redirected flow through the use of erosion- and sediment-control structures to manage surface water runoff from disturbed areas.

While mining is in progress, surface water quality would be protected by directing surface runoff from affected areas to various sediment-control structures including sediment ponds, traps, ditches, sumps, and mine pits. Wyoming DEQ requires that SWPPP be implemented on all disturbed areas. Any water produced in conjunction with mining operations cannot be discharged to surface waters without a Wyoming Pollutant Discharge Elimination System (WYPDES) permit. After mining and reclamation are complete, surface water flow and quality would approximate pre-mining conditions.

The groundwater quality after reclamation may differ from pre-mining conditions, but would be similar to the quality in previously reclaimed areas. Water quality would remain adequate for current uses such as livestock and wildlife. Wyoming DEQ requires that the water quality in the reclaimed areas of the mines meet the class of use determined for the zones prior to the mining activity.

The coal aquifer and any water-bearing strata in the overburden will be permanently removed and replaced with unconsolidated backfill in the area mined. Mining would also cause a moderate, short-term reduction in groundwater in aquifers beyond the mined area as a result of seepage into and dewatering from mine excavations (i.e., drawdown). The extent of drawdown depends on how long the mine excavations were open, the distance of the aquifers from the mined area, and the extent of dewatering.

Eventually, groundwater is expected to rise to similar levels as observed prior to mining, but it would not have all of the same characteristics because of the more homogeneous nature of the backfill. It is likely that recharged groundwater would be adequate for post-mining land uses such as water sources for livestock and wildlife. Mining would not disturb the aquifers below the coal (Hay Creek II Final EIS p. ES-27).

Alteration of aquifer levels could impact groundwater wells. The Wyoming State Engineer's Office (WSEO) governs the protection of groundwater water rights. Mine operators are required to provide the owner of a water right whose water source is interrupted, discontinued, or diminished by mining with water of equivalent quantity and quality (Hay Creek II Final EIS).

Leasable Minerals – Fluids

Fluid minerals development in the planning area would expose soils to erosive processes. Sediment and other pollutants could subsequently be transported to surface water and groundwater and adversely affect water quality.

Other than erosion and sedimentation, the most visible contributor to water resource impacts from oil and gas operations would be water management during CBNG development. Typical CBNG development requires the production of large quantities of water (compared to conventional gas or oil production). Reinjection of produced water to the subsurface could result in groundwater mounding and increased pressures in the injection zone, potential loss of beneficial uses of produced water, and water quality changes in the receiving aquifer. Treatment and surface discharge of water to perennial surface water systems would result in surface disturbance from the treatment site and pipelines or other infrastructure construction needed to convey the water to discharge points. A variety of treatment methodologies are used to bring the produced water within limits specified by the Wyoming DEQ in WYPDES permits. Additional information can be found in the PRB Final EIS (BLM 2003c) and in Appendix W (p. 2623).

Water produced while dewatering coal formations during CBNG development would deplete groundwater aquifers. CBNG development could lower water levels and hydrostatic pressure in springs geologically connected to the producing formations. Other potential effects on groundwater could include infiltration of poor-quality water stored in impoundments and dewatering of coal zones that could provide usable water. Additional information can be found in the PRB Final EIS (BLM 2003c) and in Appendix W (p. 2623).

Hydraulic fracturing is a process that injects water, sand, and chemicals into the mineral bearing formation to fracture the formation and increase oil and gas recovery by creating passages through which gas and liquids can flow. Additional information on hydraulic fracturing as well as other completion technologies can be found in Appendix V (p. 2599).

Minimizing impacts to groundwater quality and quantity as a management action would help preserve groundwater resources. A maximum of 5,280 new CBNG wells are projected for drilling as a part of BLM projects during the planning period, and effects on groundwater are projected as part of minerals development. Activities associated with CBNG development would be the largest contributors to effects on water resources in the planning area. At least this many additional CBNG wells would be drilled for non-BLM projects, which would affect groundwater resources associated with BLM projects. Dewatering coal zones for the purpose of producing natural gas would reduce the quantity of groundwater available for future use, a major adverse effect under all alternatives. Additional information can be found in the PRB Final EIS (BLM 2003c) and in Appendix W (p. 2623).

Deep groundwater-monitoring wells would continue to be used to assess effects on groundwater from CBNG water production over the planning period. The 2003 PRB Oil and Gas Final EIS (BLM 2003c) projected effects on groundwater quantity and quality. Effects on groundwater quality in the deep groundwater aquifers would likely be minor. Monitoring activities track potential effects to groundwater level, however, minimal monitoring of water quality in deep aquifers is conducted.

Shallow groundwater resources have the potential to be affected by water infiltrating into the subsurface from water storage impoundments, and from CBNG produced water discharged to surface drainages. However, thus far, Wyoming DEQ-required water quality monitoring as part of CBNG development suggests that effects on shallow groundwater aquifers would be minor. Limited BLM implemented shallow groundwater monitoring will continue to monitor effects to both water level and quality.

Water discharged to storage impoundments has the potential to seep or leak beyond the impoundment and affect downstream surface drainages. However, due to the low volume of water that generally resurfaces in the drainages, overall effects would be minor. Localized impacts from individual impoundments could be considered significant when water resurfaces downstream of a CBNG impoundment as a seep with poor water quality, or in areas that exhibit highly erosive conditions. If mitigation measures are not pursued when the problem is identified, there could be longer-term effects on riparian vegetation and bottomland soils.

Water discharged into ephemeral channels could affect the hydrologic characteristics of receiving drainage systems and result in the loss or gain of riparian and wetland features. Many of these systems are formed under an intermittent or ephemeral discharge regime. When the stream hydrology is changed to a perennial flow regime by the introduction of produced water discharges, channel incision, and headward and lateral erosion can occur in many locations. These erosive processes could increase chemical and sediment transport and associated sedimentation in

downstream perennial systems. BLM collects stream channel survey data throughout the PRB to assess changes to channel geometry as a result of these discharges.

Water produced by CBNG and other oil and gas developments is often beneficially used by wildlife and agricultural operations. Sometimes this is accomplished by allowing wildlife and livestock direct access to impoundments used to store produced water. Oftentimes, this beneficial use is facilitated through the use of stock tanks to allow access to the water. Such activities can cause localized erosion and sedimentation in water bodies through concentrated use of the water by livestock. However, proper placement of stock tanks minimizes the impacts by moving the livestock use away from water bodies.

Collectively, adverse effects from management of leasable fluid minerals could result in moderate adverse effects on water resources.

Salable Minerals
Local effects to water resources from salable minerals actions could be noticeable, but due to the small size of potential disturbance (fewer than 2,090 acres), adverse effects would be negligible.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Fire and fuels management actions include fuels reduction projects involving prescribed fires, and chemical, biological, and mechanical treatments. In the short term, fuels reduction projects would reduce canopy and ground cover, thereby potentially increasing surface water runoff and exposing more soil to erosion. In the long term, management actions are successful if they would limit the areal extent and frequency of intense and destructive wildland fires, thus reducing the overall effects on water resources from wildland fires. All prescribed burn projects include provisions for reclamation. This, combined with the fact that acreages projected for treatment under the various alternatives are relatively small (extreme case of 42,000 acres), adverse effects on water resources would be negligible.

Peak runoff and chemical and sediment transport via runoff can increase dramatically after wildland fires. Loss of vegetation and hydrophobic soil conditions developed during intense fires can result in increased runoff and erosion, which could increase pollutants transported to surface waters. Fire and fuels management actions would include wildfire suppression and implementing Emergency Stabilization and Burned Area Rehabilitation Standards; these actions would reduce adverse effects on water resources after wildfires. When necessary, rehabilitation and restoration efforts would reduce erosion after wildfires by using mechanical erosion control techniques and enhancing plant recovery.

Wildland fire suppression activities can result in temporary surface disturbance and soil compaction due to increased vehicle traffic, equipment staging, and fire camps, and result in negligible to minor effects on water resources impacts. Fire line construction can increase runoff and erosion due to vegetation and duff removal. Fire line construction also can provide preferential pathways for surface water runoff that can result in channelization, especially in areas with steep slopes and poor soils. Rehabilitation of fire control lines would occur after most fires, thereby minimizing the effects of runoff and erosion. Fire-retardant chemicals used during suppression activities would not be applied within 300 feet of surface water sources. Fire suppression chemicals that do enter surface waters generally only persist in the aquatic

environments for one to four days. Due to the highly localized areas in which these fires would likely occur, the overall adverse effect on water resources would be negligible.

Biological Resources

Vegetation
Vegetative communities would be managed to achieve and maintain proper ecosystem function and meet resource goals, which would benefit water resources by keeping hillslopes stable and preserving healthy watershed conditions. Vegetation management prescriptions would be implemented to meet the Wyoming Standards for Healthy Rangelands, which would maintain watershed conditions. Improving and diversifying vegetation would have the indirect benefit of improving watershed health by maintaining natural runoff peak flows, stable hillslopes, and functioning channel conditions.

Vegetation – Forests and Woodlands
There are no forests and woodlands management actions common to all alternatives that would affect water resources.

Vegetation – Grassland and Shrubland Communities
In addition to the effects described above for overall vegetation, management of grasslands and shrublands on the uplands would improve watershed health by improving the vigor of native plants and increasing surface cover, which decreases sediment transport and overland flow rates. This would have a negligible beneficial effect on water resources.

Vegetation – Riparian/Wetland Resources
Plans to manage riparian systems to move toward PFC will be implemented. Properly functioning riparian systems beneficially affect water resources by reducing erosion and filtering out sediment before it reaches surface waters. Riparian areas also will provide shaded bank conditions that will help cool water, which will slow the growth of algae that can lead to eutrophic conditions.

The BLM will work to manage loss of riparian and wetland conditions, and evaluate for retention and maintenance riparian and wetland conditions that have developed as a result of produced water discharge associated with oil and gas development. Managing riparian and wetland areas to meet PFC as part of the Wyoming Standards for Healthy Rangelands would ensure wetlands are not declining and would be able to withstand flood events. Healthy riparian and wetland vegetation decreases bank erosion and serves as a filter to remove and recycle nutrients, remove chemical and organic wastes, and reduce sediment loads that reach streams and water sources. Due to the small areas involved, management actions would have a negligible beneficial effect on water resources.

Invasive Species and Pest Management
Effects on water resources from invasive species and pest management would be negligibly beneficial to water resources by helping to maintain or restore natural streamflow characteristics through healthier watershed conditions, as discussed in the *Vegetation* section above.

Fish and Wildlife Resources – Fish
Mitigation of surface-disturbing activities would reduce erosion, sediment transport, and sedimentation. Due to the small areas involved, management actions would have a negligible beneficial effect on water resources.

Harmful non-native riparian vegetation will be managed to improve fish habitat. Some of these species, such as Tamarix (salt cedar), consume large volumes of surface water and shallow

groundwater. Managing this vegetation would reduce the consumptive loss of this water, which would potentially help restore natural flows to some streams. This would have a beneficial effect on water resources.

Barriers to fish passage will be managed under all alternatives. Many of the existing barriers are in the form of culverts that have eroded on the downstream side through improper placement or maintenance. Often this leaves an elevated culvert outlet. Water exiting the culvert can do so with tremendous energy that constitutes a substantial erosive force in the receiving stream channel. Managing these features to enhance fish passage also would alleviate much of the erosive potential of the structure. Any efforts that will minimize stream channel erosion would beneficially affect water resources. However, construction activities in the stream channels necessary to accomplish these actions would have short-term negligible effects from erosion, sediment transport, and sedimentation if effective BMPs were not implemented and until reclamation efforts were complete.

Efforts to improve public access to fish-bearing waters would increase the potential for introduction of pollutants to those waters. This would have a negligible adverse effect on water resources.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Wildlife and special status wildlife management actions common to all alternatives include mitigation for surface-disturbing activities; maintaining or improving wildlife habitats; protecting crucial wildlife habitats; managing, maintaining, and restoring Greater Sage-Grouse habitat; and establishing a permanent disturbance-free buffer for bald eagle nests. Mitigating and prohibiting surface-disturbing activities would reduce erosion, sediment transport, and sedimentation. Any efforts that decrease these processes would have a major beneficial effect on water resources.

Special Status Species – Plants
Effects on water resources from special status plant management are described under the overall vegetation discussion in this section. Due to the small areas involved, management actions would have a negligible beneficial effect on water resources.

Special Status Species – Fish
Supporting the Wyoming Game and Fish Department (WGFD) efforts to obtain water rights for the benefit of special status fish habitat would generally have a beneficial effect on water resources because it would enhance in streamflows. However, often the acquisition of a water right means that it has been taken from an alternative use. If this were the case, it could represent an adverse effect on that previous water use. Overall, the result would be a negligible beneficial effect on water resources.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources
There are no cultural or paleontological resource management actions common to all alternatives that would affect water resources.

Areas with paleontological resources of high quality or importance are typically small (fewer than 40 acres), which would result in the displacement, not prevention, of any surface-disturbing activities. There would be no effect on water resources from any of the paleontological

management actions under any alternative; therefore, paleontological resources are not further discussed in this section.

Visual Resources
The three WSAs and proposed Middle Fork Powder River WSR would be managed as VRM Class I, with an objective to preserve the existing character of the landscape. Most surface-disturbing activities would be prohibited. There are 2,982 acres (15.0%) of BLM surface within 500 feet of surface water in the WSAs (2,300 acres) and Middle Fork Powder River WSR (682 acres). VRM would have a major beneficial effect on water resources.

Land Resources

Lands and Realty
The are no lands and realty management actions common to all alternatives that would affect water resources.

The lands and realty program does not have any management actions that vary by alternative that would affect surface-disturbing activities. Therefore, lands and realty management is not furthered discussed in this section.

Forest Products
Depending on the methodology used for timber harvesting, soils can be exposed to accelerated erosion during the harvesting process. This activity can increase erosion, sediment transport, and sedimentation potential. Under all alternatives, timber harvesting would be prohibited within 200 feet of surface waters. This management action would maintain vegetative buffers adjacent to surface waters that filter out mobilized sediment before it reaches areas of runoff concentration. This would mitigate many of the adverse effects on water quality as a result of timber harvesting. Due to the small areas involved, management actions would have a negligible beneficial effect on water resources.

Rights-of-Way and Corridors
The designation of ROW corridors would create less dispersed disturbance by locating utilities in or adjacent to existing disturbed areas associated with existing ROW, constructed roads, or highways. The BLM would designate ROW corridors to minimize surface disturbance and adverse effects on other resources. Due to the small areas involved, management actions would have a negligible adverse effect on water resources.

Travel and Transportation Management
Management actions common to all alternatives include minimizing surface disturbance and erosion, closing roads temporarily or permanently where resource damage is occurring, reclaiming roads if they are heavily eroded, and prohibiting motorized travel if damage to soils would result. TTM would follow a holistic approach, including the inventory, design, construction, maintenance, and reclamation of roads and trails, which would limit adverse effects on water resources. Road closures and maintenance would reduce erosion, surface runoff, sediment transport, and sedimentation of downstream waters.

Public input would be considered for appropriate motorized vehicle use areas consistent with other resource values. Motor vehicle use could result in localized increases in erosion caused by soil compaction and runoff concentration in tire ruts on roads and routes. Where roads and routes bisect or parallel stream channels and riparian and wetland areas, there could be increased runoff and sedimentation. In areas where resource damage is a concern or where there are risks to

public health or safety, temporary closures to motorized vehicle use would be allowed. Motorized vehicle travel would be prohibited on soils if damage to vegetation, soils, or water quality would result. These management actions would result in localized beneficial, but negligible, impacts to water resources by reducing pollutant transport, including sediment, into surface waters.

Recreation

Recreation management areas (RMAs) would avoid riparian habitat or develop and manage recreational sites, recreation facilities, and recreational access in a manner that minimizes adverse effects on riparian habitat. Dispersed camping and commercial camps would be prohibited within 200 feet of perennial surface waters, and developed recreational sites would be closed to livestock grazing. These actions would reduce erosion, sediment transport, and sedimentation to surface waters in the localized RMAs. Due to the small areas involved, recreation management actions would have a negligible beneficial effect on water resources.

Livestock Grazing Management

Most BLM-administered lands in the planning area would be available for livestock grazing, except for limited areas included in developed recreation sites and areas where livestock grazing would not be compatible with other resource values. Livestock grazing can reduce vegetative cover, cause surface disturbance from hoof action, and compact soils in localized areas. The most noticeable of such impacts would be around waterbodies, salt blocks, fencelines, and other areas where animals frequently congregate. In contrast, dispersed distribution and periodic livestock grazing rotation would be expected to reduce the intensity of localized impacts. This would be expected to decrease the overall adverse effects on water resources, but the potential for adverse effects on water resources could be major. Reducing vegetative cover could result in increased surface runoff, erosion, sediment transport, and sedimentation from affected areas. However, continued implementation of livestock management to achieve the Wyoming Standards for Healthy Rangelands (Appendix P (p. 2501)) would reduce adverse effects on water resources from livestock grazing. Conservation and mitigation measures for livestock operations would be implemented, and where successful, would reduce adverse effects on water resources from livestock grazing.

Livestock grazing on public lands can result in periodic increases of fecal coliform when streamflow rates are low and livestock concentrations are high (e.g., *E. coli* is a bacteria that can be present in animal feces and causes human health problems). Several waterbodies in the planning area are currently listed as “Impaired” or “Not Supporting” on the state's CWA section 303(d) list of impaired waters for E. coli. If a waterbody were found to exceed standards for E. coli due to livestock grazing, adjustments to management would be implemented where appropriate and in coordination with the Wyoming DEQ.

Water storage reservoirs, water wells, water troughs and pipelines would be provided to disperse grazing use. In addition, livestock would be managed to sustain riparian, wetland, and other special habitats. These actions would reduce adverse effects on water resources and would be considered a moderate benefit.

Overall, management actions associated with livestock grazing could result in a minor adverse effect on water resources.

Special Designations

Areas of Critical Environmental Concern and Scenic or Back Country Byways
There are no management actions common to all alternatives for ACECs or Scenic or BCBs that would affect water resources.

Byway designation would not affect other activities; therefore, Scenic or BCBs are not discussed by alternative. WSR and WSA designation is not predicted during the planning period; therefore, such special designations are not anticipated to affect water resources. The only special designation addressed by alternative is ACECs.

Wild and Scenic Rivers
Managing surface waters to maintain WSR characteristics would preclude alternative surface water uses and developments such as reservoir construction for irrigation and recreational use. Because the designation would be limited to the Middle Fork Powder River, and the likelihood of any such projects being completed during the planning period is minimal, beneficial effects from precluding development would be negligible.

Wilderness Study Areas
These areas would be managed to maintain or enhance their natural characteristics, which would protect surface water from the adverse effects of development. Use would emphasize primitive, nonmotorized activities to maintain current natural values. These actions would have a negligible beneficial effect on water resources due to the small size of the affected areas. Public use could increase in these areas, but that is not likely due to limited public access to the WSAs.

Socioeconomic Resources

Social and Economic Conditions
The social and economic management actions have no direct relationship with water resources and therefore there would be no effect. Social and economic resources will not be considered further in this section.

Health and Safety
This resource includes management provisions designed to prevent accidental spills of hazardous materials, which would benefit surface water and groundwater resources. There is a potential for accidental spills of hazardous waste in the planning area because such materials, including oil, drilling fluids, water treatment system chemicals and end products, pesticides, and cleaning solvents, are being produced, used and transported in the planning area. Spills, misuse, or improper disposal of such materials have the potential to adversely affect water resources. There could be locally significant impacts to water quality from accidental spills or inappropriate use and disposal; however, given the large size of the planning area and the sparse concentration of hazardous materials sources, the overall potential adverse effects on water resources would be negligible. Effects on water resources from health and safety management would be the same under all alternatives.

4.1.4.3. Alternative A

Water Resources
Under Alternative A, adverse effects on water resources would continue (the *Impacts Common to All Alternatives* section above describes some of these effects). Many of the issues that came to the forefront with the onset of CBNG development were not considered in the 1985 RMP. Therefore, all management actions under Alternative A had no previous decision except for

the prohibition on surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams unless waived by the authorized officer. Consequently, Alternative A does not include most of the management actions included under other alternatives.

Prohibiting surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams unless waived by the authorized officer would benefit water quality through the filtering effects of buffer strips near surface waters. This action reduces the potential for surface contamination around wells to infiltrate shallow groundwater. In some or many cases, the 500-foot prohibition could be waived, which could result in major effects at localized sites. However, with proper analysis, adverse effects should be negligible. Under the current plan, the 500-foot setback distance has been waived many times because it was judged to be too restrictive. One example of where the setback distance has typically been judged to be too restrictive is around surface water impoundments that were constructed as part of a CBNG development, and their value as a resource to be protected is limited. The option of waiving the setback distance would still be available under Alternative A. In any event, the waiver option can lead to inconsistent decisions and poor management of adverse effects.

Physical Resources

Air Quality

Air quality modeling would have no effect on water resources.

Soil

The Alternative A seasonal prohibition on surface-disturbing activities on soils with severe erosion hazard and year-round prohibition on surface disturbance on slopes equal to or greater than 25 percent unless waived by the authorized officer, could have a major beneficial effect on water resources, especially regarding erosion, sediment transport, and sedimentation associated with surface-disturbing activities. However, the lack of defined criteria and inconsistent use of waivers in the past reduce beneficial effects to moderate.

Cave and Karst Resources

Because there are no cave and karst management actions in the 1985 RMP, management of cave and karst areas is considered on a project specific basis. This has led to inconsistent management of surface-disturbing activities. Karst formations are present on 32 percent (63,171 acres) of BLM surface within 500 feet of water. The potential for surface-disturbing activities in cave and karst areas is low, related both to the difficult topography and limited potential for mineral resources. Although karst formations comprise more than ten percent of BLM surface, due to limited foreseeable activity and the fact that protection would likely be in the form of a buffer limiting surface-disturbing activities around the caves themselves (and not the karst formation), the result would be a negligible beneficial effect on water resources. At present, there are five significant caves identified within 500 feet of surface water.

Mineral Resources

Locatable Minerals

Under Alternative A, 554 acres (0.1% of soils over federal locatable minerals) are predicted to be disturbed by locatable minerals development. Little of this would likely be within 500 feet of surface water resources, and therefore would have a negligible adverse effect on water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Leasable Minerals – Coal
The foreseeable area for coal development could affect 1.3 percent (856 acres) of the federal mineral estate within 500 feet of surface water, which would have a minor adverse effect on water resources under Alternative A. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Leasable Minerals – Fluids
Oil and natural gas exploration and development, both conventional and CBNG would result in almost 31,572 acres of new surface disturbance. This represents 0.9 percent of the federal fluid mineral estate (3,386,530 acres), and therefore would have a negligible adverse effect on water resources. Effects to surface water are expected to be greater due to wells near streams and the effects of produced water discharges into surface waters. This would result in overall minor adverse effects on water resources though processes described under *Impacts Common to All Alternatives*.

Salable Minerals
Alternative A management actions would result in effects similar to those described under *Impacts Common to All Alternatives*. Surface-disturbing activities associated with mineral extraction could result in locally intense disturbance that could have short- and long-term locally adverse effects on water resources near sites through chemical and sediment loading. However, the total acreage predicted for salable minerals development, is relatively low (530 acres, or 0.01% of federal salable minerals). This would have a negligible adverse effect on water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Fire and Fuels Management

Unplanned Fire (Wildfire)
Under Alternative A, response to unplanned wildland fire varies from full suppression to use of fire as a management tool. The use of some types of suppression equipment would be limited in some areas, and fire and suppression damage would be rehabilitated. These actions would limit erosion and benefit water resources. However, with a prediction of 27,596 acres of BLM surface to be affected by wildfires, the benefit of these management actions would be negligible at the planning-area scale.

Planned Fire (Prescribed Fire)
Prescribed fire and chemical, mechanical, and biological treatments would be implemented to support vegetation and wildlife objectives, which would result in long-term benefits to water resources. The use of these processes would reduce canopy cover, disturb the soil surface, and increase erosion in the short term. Over the long term, fire and fuels management actions would improve the health and vigor of the vegetation and improve watershed condition by reducing the chance of widespread vegetation loss through insects, disease, and wildfire. Such a widespread loss of vegetation would contribute to accelerated runoff due to lower vegetation density and increase erosion, sediment transport, and sedimentation by exposing the soils to erosive processes caused by higher overland flow rates. Loss of root mass also would be a long-term factor in hillslope condition. Fire lines built with heavy equipment are more difficult to reclaim, and create more disturbance on the landscape (about 10 feet wide as opposed to 1 foot wide for hand lines), but all disturbances are projected to be reclaimed under this alternative. With a forecast of 14,000 acres (1.8%) of BLM surface to be treated by prescribed fire and mechanical treatments, the benefit of these management actions would be minor at the planning-area scale.

Biological Resources

Vegetation – Forests and Woodlands
Timber harvest and other vegetative treatments would be designed to improve biodiversity and water quality. Disturbance associated with forest treatment activities would reduce canopy cover, disturb the soil surface, and increase erosion in the short term. Reducing the canopy cover would expose the soil surface to rain-splash erosion and could increase rilling and gullying. Forest litter, duff, and organic material forming ground cover are the most important components for protecting the mineral soil from erosion in forested systems (Elliot et al. 1996).

Meeting the DFC in the long term with these vegetative treatments would contribute to properly functioning watersheds that support productive plant communities. Improving the health and vigor of forests would result in increased ground cover and would reduce surface erosion.

Under Alternative A, up to 6,000 acres of forest and woodland treatments are predicted (0.8% of BLM surface). Forest and woodland management under Alternative A would have a negligible beneficial effect on water resources.

Vegetation – Grassland and Shrubland Communities
There is only one grasslands and shrublands management action that varies across the alternatives. This management action relates to whether non-native species can be used during reclamation. There was no decision in the 1985 RMP regarding this management action; therefore, species used for reclamation would need to be consistent with the BLM reclamation policy, which does allow the use of non-native species. A primary goal of reclamation is soil stabilization, and vegetation species used in reclamation are chosen with this goal in mind. Allowing the use of non-native species would be beneficial to water resources by reducing potential erosion. However, because little of the potential surface disturbance would occur within 500 feet of surface waters, this beneficial effect would be negligible.

Vegetation – Riparian/Wetland Resources
Under Alternative A, surface-disturbing activities would be prohibited within 500 feet of springs, water wells, and perennial streams unless waived by the authorized officer. Like many management actions in the 1985 RMP, the prohibition can be waived and waiver criteria were not defined. This has resulted in inconsistent management. *Impacts Common to All Alternatives* describes the benefits to water resources from protecting riparian and wetland communities. This management action would keep most erosion resulting from surface-disturbing activities from reaching surface waters; however, due to the provision for waivers and the resulting reduction in protection, this management would have a moderate beneficial effect on water resources.

Invasive Species and Pest Management
Impacts Common to All Alternatives describes impacts to water resources from invasive species and pest management. The only management action related to invasive species in the 1985 RMP was to control noxious weeds in cooperation with the counties. Under Alternative A, 8,000 acres (1.02%) of BLM surface predicted to be treated. Because most of the treatment areas would be more than 500 feet from surface water, the result would be a negligible beneficial effect on water resources.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Reservoirs are occasionally maintained, and are designed to enhance fisheries. This alternative would generally benefit water resources, but could add to potential erosion, sediment transport,

and sedimentation during maintenance processes. Maintenance actions would cause short-term adverse effects, but long-term beneficial effects. However, due to limited applicability of this action in the planning area, overall beneficial effects on water resources would be negligible.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)

There are a number of management actions under Alternative A that prohibit surface-disturbing activities for the protection of wildlife and special status wildlife species; these actions would benefit water resources locally where surface disturbance is prevented. Typically, these management actions provide the opportunity for waivers without defined criteria, which reduce the benefits to water resources because the waivers have been inconsistently applied. In practice, prohibitions on surface-disturbing activities to protect wildlife rarely prevent surface-disturbing activities; rather, they cause the activities to be relocated outside the protected area, which would not benefit water resources. Timing limitations on surface-disturbing activities for various wildlife species also do not benefit water resources because they simply delay surface-disturbing activities.

The management action affecting the largest acreage is the permanent buffer around active raptor nests (10,686 acres, or 53.8% of BLM surface within 500 feet of surface water). However, despite this large acreage, the benefit to water resources would be minor because of the inconsistent application of waivers.

Special Status Species – Plants

There were no decisions regarding special status plants in the 1985 RMP; therefore, management would be considered on a project-specific basis. Surface disturbance prohibitions would likely be limited to identified plant populations, which are typically widespread and small. Ute-ladies'-tresses orchid is the only riparian-dependent special status plant species, at present there are no documented populations in the planning area. Because there are no documented populations of special status plant species and populations are typically small, the benefit to water resources would be negligible.

Heritage and Visual Resources

Cultural Resources

Protection or preservation of cultural sites would benefit water resources by limiting or excluding surface-disturbing activities on or near specific sites. Surface-disturbing activities would be avoided within 0.25 mile or the visual horizon, whichever is closer, of the Bozeman Trail, Crazy Woman Battle Site, and other sites selected on a project-specific basis. These avoidance areas would reduce activities that cause surface disturbance in these locations. However, it is likely that these avoidance areas would change the individual locations of facilities and not the total acres of surface disturbance. New locations might not necessarily be better sited from a watershed-impact perspective. Impacts to water resources, such as increased local erosion and overland flow, would be considered on the activity-planning and decision level, and impacts would be avoided when possible. Data recovery as a result of cultural site disturbance typically occurs in areas that have already been disturbed. Scientific data recovery projects are extremely rare and protection measures afforded by the NHPA and required reclamation would mitigate any adverse effects to acceptable levels.

Beneficial effects on water resources from the management of cultural resources would be negligible due to the relocation of projects and the small amount of acreage affected (180 acres, 0.9% of the Bozeman Trail within 500 feet of surface water).

Visual Resources

The 1985 RMP manages visual resources in accordance with their VRM classes. VRM Class II is the only class in the 1985 RMP likely to reduce surface-disturbing activities and therefore benefit water resources. The objective of VRM Class II is to retain the existing character of the landscape; management actions can be seen but they should not attract attention. There are 9,891 acres, or 50 percent, of BLM surface classified as VRM Class II within 500 feet of surface water. However, because surface disturbance is reduced and not prohibited and VRM management has been inconsistently applied, benefits to water resources would be moderate.

Land Resources

Forest Products

A maximum of 6,000 acres (0.8%) of BLM surface would be available for commercial wood products harvesting, most of which is in the southern Big Horn Mountains. As roads are upgraded to provide access to commercial products, impacts would include changes in surface hydrology and increased local erosion where runoff would concentrate in ditches and culverts. Reduction of the canopy cover resulting from logging opens the soil surface to erosion processes. Forest litter, duff, and organic material forming ground cover are the most important components for protecting soil from erosion in forested systems (Eiswerth and Shonkwiler 2006). Any harvesting techniques that remove ground cover would contribute more to rain-splash and hillslope erosion processes. Hillslope erosion could increase sediment transport and sedimentation in receiving waters. This is especially true for logging in areas with steep slopes and riparian areas. Therefore, harvesting techniques designed to reduce soil disturbance would be applied where possible during timber cutting activities. Reclamation techniques and erosion and sediment control BMPs would be used on all cutting areas, thus limiting the severity and longevity of adverse effects. Because of the sensitive nature and important function of these potential harvest areas for watershed resources, direct effects to water resources from commercial logging activities would be expected to be locally significant. However, the overall adverse effect on water resources in the planning area be negligible due to the small amount of acreage.

Renewable Energy

The 1985 RMP does not include decisions on renewable energy. Under Alternative A, proposals for renewable-energy development would be considered, and it is expected that several small wind-energy facilities would be proposed. Road construction and use and surface disturbance for facilities related to wind-energy development would increase local erosion. However, due to the small number of acres of BLM surface suitable for wind-energy development, renewable-energy management actions under Alternative A would have a negligible adverse effect on water resources.

Rights-of-Way and Corridors

ROW and corridors management and effects under Alternative A would be the same as described under *Impacts Common to All Alternatives*. In addition, surface-disturbing activities and surface occupancy would not be allowed on slopes equal to or greater than 25 percent. This would result in a negligible beneficial effect on water resources because it would reduce soil erosion, sediment transport, and sedimentation.

Travel and Transportation Management

Under current management, approximately 3,650 acres (4.6%) of BLM-administered lands are Closed to Off-highway Vehicle (OHV) use in specially designated areas, and would continue under this alternative. OHV use would be Limited to existing or designated roads and trails.

Approximately 37,646 acres (16%) of BLM-administered lands would be seasonally Closed to motorized vehicle use.

Under this alternative TTM would be largely unchanged. Therefore, adverse effects to water resources would continue. However, as land use increases, adverse effects on water resources would increase. More vehicle access would contribute to accelerated erosion, sediment transport, and sedimentation. Depending on the rate of land use increases, this alternative could result in a negligible adverse effect on water resources.

Recreation
Effects on water resources from recreation resource management would be similar to those described under *Impacts Common to All Alternatives*, with the addition of a prohibition on surface-disturbing activities associated with oil and gas development within 0.5 mile of certain RMAs. This change would have a negligible beneficial effect on water quality due to the minimal likelihood of oil and gas development in the area.

Lands with Wilderness Characteristics
Parcels that meet the size and naturalness requirements have been evaluated for wilderness characteristics. Newly acquired lands will be evaluated for wilderness characteristics. The likelihood of acquiring any areas meeting the wilderness characteristics requirements is minimal. Therefore, beneficial impacts to water resources from this action would be negligible.

Livestock Grazing Management
Impacts from livestock grazing management would be the same as those described under *Impacts Common to All Alternatives*. With proper planning and effective management of range improvements, any adverse effects on water resources would be minimized. Range improvements would be designed to maintain or improve the distribution of livestock within each allotment and prevent livestock concentration and overuse of forage that leads to increased surface runoff and soil erosion. Adverse effects from range improvement projects would be negligible due to the small number of acres associated with such projects. Grazing systems and range improvements would improve or maintain desired range conditions, which would minimize adverse effects on water resources from livestock grazing. Overall, BLM actions could disturb 225,609 acres, mostly through grazing allotment use. As discussed under *Impacts Common to All Alternatives*, concentrated livestock use of areas near water has the potential to adversely affect water resources. A minor adverse effect on water resources would be expected under Alternative A.

Special Designations

Areas of Critical Environmental Concern
There are no areas proposed for ACEC designation under this alternative; therefore, there would be no effect on water resources.

4.1.4.4. Alternative B

Water Resources
As previously discussed, management of water produced in association with CBNG development can have major adverse effects on water resources. Historically, much of this water has been managed by discharging it into on-channel reservoirs where it was allowed to infiltrate and evaporate. Under Alternative B, development of new on-channel reservoirs for this purpose would no longer be authorized.

On-channel reservoirs have the effect of altering the natural flow characteristics of a drainage. The reservoir captures runoff from upstream precipitation events, and unless the reservoir is full or a drainage gate is open, no water will pass the dam. This phenomenon has the effect of attenuating the natural streamflow hydrograph, resulting in lower peak flows with potentially longer durations. Reducing peak flows would have the beneficial effect of decreasing the erosive forces of elevated streamflow and reducing the effects of flash flooding. However, the same attenuating effects would alter the natural channel characteristics and vegetation that have evolved to rely on these "flashy" systems. In addition, on-channel reservoirs can capture natural runoff that downstream water users rely on for agricultural purposes. This effect is most pronounced when there are multiple reservoirs in a drainage basin. Capturing natural runoff can adversely affect aquatic life, wildlife habitat, and wetland conditions that have formed under a more natural flow regime. Alternative B would likely cause on-channel reservoir development to be relocated outside BLM authority, and therefore would have only a minor to moderate beneficial effect on regional water resources.

There have been a few cases in which on-channel reservoirs have leaked to downstream channels or hillslopes. At times, vegetation exposed to the leakage was killed due to poor water quality or the vegetation was not adapted to the altered soil moisture. In addition, altered vegetative conditions or soil moisture can provide favorable conditions that induce the spread of invasive plant species, such as Tamarix (salt cedar). Therefore, eliminating additional on-channel reservoirs would be have a beneficial effect related to these issues. Adverse effects from prohibiting on-channel reservoirs would include the loss of the potential for shallow aquifer recharge from impounded water, whether that water is from natural runoff or produced from oil and gas operations. In addition, not authorizing on-channel reservoirs could adversely affect the availability of year-round water for livestock use.

Not authorizing surface discharge of CBNG produced water would have multiple beneficial effects. Potential channel degradation as a result of enhanced flows would be eliminated. This channel degradation could be in the form of headward or lateral stream channel erosion, or vegetation changes that could induce stream channel or bank instability. Vegetation changes caused by the addition of CBNG produced water also could alter forage availability for livestock and wildlife. Adverse effects would include the loss of additional water sources for wildlife and livestock. In some cases, this would constitute a loss of artificial irrigation that would reduce available forage for livestock and wildlife. It also could adversely affect the establishment or enhancement of riparian conditions that help stabilize stream channels and provide additional wildlife habitat.

Water users have adapted to plentiful water provided by CBNG development. Not authorizing new on-channel impoundments or surface discharge would force CBNG operators to find alternative methods to manage produced water or cut back on production. Both of these options would reduce or halt water availability to water users, particularly agricultural users. As water production from existing CBNG projects declined, water users would have to find other sources of water or cut back on usage to meet supply. Under Alternative B, abandoned CBNG wells would not be converted to water supply wells to help meet that demand. In localized areas, some landowners would likely develop new water wells to compensate for the loss of CBNG produced water. However, due to cost, this would not be likely to be widespread. In most areas of the PRB, non-federal CBNG development is relatively close by. Because this non-federal development would not be subject to the restrictions under this alternative, that development might be able to compensate for some of the lost water. However, there are areas where all of the development is federally attached. In these areas, there might not be a practical alternative water source available.

Due to the potential availability of non-federal water sources, this alternative would have a minor to moderate effect on water resources.

An NSO restriction within 500 feet of springs, non-CBNG reservoirs, water wells, perennial surface water, and riparian areas would reduce the potential for sediment to be transported to the water feature and subsequent sedimentation in that feature that would contribute to the degradation of water quality. The beneficial effect of this decision are described under Alternative A. Like Alternative A, under Alternative B surface disturbance could be modified or displaced in many cases as a result of this management action. Therefore, the beneficial effect of this action could be moderate. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Overall, these management actions are anticipated to have a moderate beneficial effect on water resources.

Physical Resources

Air Quality

Air quality modeling would have no effect on water resources.

Soil

The effects of this alternative on water resources would be similar to under Alternative A, except that restrictions on surface-disturbing activities in areas with severe erosion hazard, slopes equal to or more than 25 percent, and soils with poor reclamation potential would be year-round. In addition to these restrictions, prohibiting disturbance on badlands, rock outcrops, and slopes prone to mass movement would be applied on highly erodible soils. The prohibition on surface-disturbing activities on soils with poor reclamation potential would protect soils on 455,090 acres (58%) of BLM surface and 1,514,445 acres (45%) of federal fluid mineral estate. It is anticipated that a similar percentage of water resources would benefit from these prohibitions. This would have a major beneficial effect on water resources.

Cave and Karst Resources

Under Alternative B, all surface-disturbing activities, including minerals development and timber harvest, would be prohibited in cave and karst areas. The prohibitions would be absolute, and there would be no exceptions. Karst formations are present on 32 percent (63,171 acres) of BLM surface within 500 feet of water. Management actions to protect cave and karst resources would have a major beneficial effect on water resources.

Mineral Resources

Locatable Minerals

Under Alternative B, 277 acres (0.03% of federal locatable minerals) are predicted to be disturbed by locatable minerals development. It is likely that little of this disturbance would be within 500 feet of surface water resources. Management under Alternative B would have a negligible adverse effect on water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Leasable Minerals – Coal

The foreseeable area for coal development could affect 1.3 percent (856 acres) of the federal mineral estate within 500 feet of surface water. This would result in a minor adverse

effect on water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Leasable Minerals – Fluids
Oil and natural gas (both conventional and CBNG) exploration and development would result in approximately 286 acres of surface disturbance. This would result in the potential for adverse effects on water resources though processes described under Impacts Common to All Alternatives. Reclamation procedures and the application of BMPs would reduce long-term effects, such as increased erosion and surface runoff, on water resources. Even with successful reclamation and full implementation of BMPs, minerals management actions would lead to direct adverse effects on water resources and these effects could be major in local areas and therefore are considered minor at the planning area scale area despite the small acreage affected.

Salable Minerals
Under Alternative B, salable minerals development is predicted to disturb 114 acres (0.003% of federal salable minerals). This would have a negligible adverse effect on water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Fire and Fuels Management

Unplanned Fire (Wildfire)
Under Alternative B, response to unplanned wildland fire would vary from full suppression to monitoring fire as a management tool. The use of heavy equipment would be limited to existing roads and trails, and all fire and suppression damage would be rehabilitated. These actions would limit erosion and be beneficial to water resources. With a forecast of 27,596 acres (3.5% of BLM surface) to be affected by wildfires, the benefit of these management actions would be negligible at the planning-area scale. This alternative would result in a higher accumulation of fuels than Alternative A, and could eventually increase the likelihood of high-intensity watershed-damaging wildfires.

Planned Fire (Prescribed Fire)
Wildland fire and other vegetative treatments would be used to restore fire-adapted ecosystems, which would result in long-term benefits to water resources. With a forecast of 3,500 acres (0.4%) of BLM surface to be treated by planned fire and mechanical treatments, the benefit of these management actions would be negligible at the planning-area scale.

Biological Resources

Vegetation – Forests and Woodlands
Alternative B emphasizes a natural, hands-off, approach to forest and woodland management. Timber harvest and other vegetative treatments would be minimized. Mature and old-growth forests are typically productive plant communities with increased ground cover and reduced surface erosion. Insects, disease, wildland fire, and other stochastic events would be allowed to run their course. Old-growth forest stands would be managed to emphasize old-growth characteristics. This alternative would likely increase fuels availability significantly. In the event of a severe wildfire, this action could have substantial localized adverse effects on water resources. Depending on topography, soils, vegetative characteristics, and fire intensity, a severe wildfire could result in severe erosion and sediment transport if not controlled. In some cases this could result in ecosystem-destroying sedimentation in the surface waters. At the planning area scale the overall effect would be negligible.

Vegetation – Grassland and Shrubland Communities
Under Alternative B, only native species would be authorized for reclamation activities. Native species often have distinct seeding windows and are sometimes slow to establish, allowing invasive species to establish. Allowing only native species for reclamation could have a negligible adverse effect on water resources.

Vegetation – Riparian/Wetland Resources
Under Alternative B, surface-disturbing activities would be prohibited within 500 feet of springs, water wells, and perennial streams. Adverse effects from surface-disturbing activities would be largely avoided, which would be a major benefit to water resources.

Invasive Species and Pest Management
Impacts to water resources from invasive species and pest management are described under Impacts Common to All Alternatives. Alternative B takes an aggressive approach to managing invasive species. Under Alternative B, 15,000 acres (2%) of BLM surface are predicted to be treated. However, because much of the treated areas would be more than 500 feet from surface water, the result would be a negligible beneficial effect on water resources.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Under Alternative B, reservoirs and riparian areas would be managed to enhance fisheries. This management would generally benefit water resources, but could add to potential erosion, sediment transport, and sedimentation during maintenance processes.

Reservoirs would be required to be designed to include fisheries. This management would generally benefit water resources, but could add to potential erosion, sediment transport, and sedimentation during maintenance processes.

Perennial waters that affect fish habitat would be maintained or enhanced. This management would generally benefit water resources.

Surface-disturbing and disruptive activities would be prohibited within 0.25 mile of naturally occurring waterbodies containing native or desirable non-native fish species. This management would minimize the likelihood of sediment being transported to waterbodies that would result in sedimentation of the water. This action would affects 10,529 acres within 500 feet of surface water, or 53 percent of water resources, a major beneficial effect. Yellowstone cutthroat trout could be present in streams associated with 182 acres (0.9%) of BLM surface within 500 feet of water, a negligible beneficial effect.

Restoration of important stream segments for fish habitat would be in accordance with WGFD priorities. This management would generally provide a minor benefit to water resources, but could add to potential erosion, sediment transport, and sedimentation during maintenance processes.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
There are a number of management actions under Alternative B that prohibit surface-disturbing activities, without exception provisions, for the protection of wildlife and special status wildlife species; these actions would benefit water resources locally where soil disturbances are prevented. Timing limitations for surface-disturbing activities for various wildlife species also would not benefit water resources because those restrictions delay, but do not prevent, surface-disturbing activities.

Two of the largest surface disturbance prohibitions in terms of acreage include permanent buffers around active raptor nests (6,415 acres, or 32%, of BLM surface within 500 feet of surface water) and in reptile and amphibian habitat (13,909 acres, or 70%, of BLM surface within 500 feet of surface water).

Special Status Species – Plants
Alternative B would prohibit surface-disturbing activities that could adversely affect special status plant habitat. Ute-ladies'-tresses orchid is the only riparian-dependent special status plant species; therefore, adverse impacts from surface-disturbing activities would be largely avoided within 500 feet of surface water. This would have a major beneficial impact on water resources.

Heritage and Visual Resources

Cultural Resources
Management actions under Alternative B include a prohibition on surface-disturbing activities in areas with historic properties that retain their historic setting, TCPs, sacred sites, and other culturally sensitive areas.

Benefits to water resources from cultural resources management would be major due to the amount of acreage affected (8,671 acres [44%] of BLM surface within 500 feet of surface water).

Visual Resources
Under Alternative B, areas inventoried as VRM Class II and special emphasis areas would be managed as VRM Class II. There are 217,021 acres, or 28 percent, of BLM surface classified as VRM Class II. However, because surface disturbance would be reduced but not prohibited, the benefits to water resources would be moderate.

Land Resources

Forest Products
Forest resources management under Alternative B would emphasize natural processes to achieve forest health goals. Commercial timber harvesting would be limited to 5 acres per select group and to remove timber after catastrophic events for safety reasons. This management would have negligible adverse effects on water resources because of the limited area where harvest, and therefore erosion, would occur.

Renewable Energy
Renewable-energy projects would be excluded in certain otherwise restricted areas. The likelihood of these areas coinciding with areas suitable for renewable-energy development is minimal. Due to these considerations, effects on water resources would be negligible, but would be beneficial if they occurred.

Rights-of-Way and Corridors
Alternative B management of ROW corridors would be as described under *Impacts Common to All Alternatives*. In addition, 706,556 acres would be excluded from ROW, 56,857 acres would be identified for ROW avoidance, and 18,689 acres would have minor ROW constraints. ROW would be excluded on slopes equal to or greater than 25 percent and in areas with highly erodible soils. This would result in a minor beneficial effect on water resources because it will reduce the occurrence of soil erosion, sediment transport, and sedimentation.

Travel and Transportation Management

Under Alternative B, 625,854 acres in selected areas would be closed to motorized vehicle use. Motorized vehicle use would be limited to designated roads on 137,126 acres, and an additional 18,259 acres would have seasonal prohibitions on motor vehicle use. These actions would reduce erosion, sediment transport, and sedimentation associated with motor vehicle activity, thereby providing a minor beneficial effect on water resources.

Recreation
Alternative B effects on water resources from recreation resource management would be similar to those described under *Impacts Common to All Alternatives* and under Alternative A, with the addition of a recommendation to withdraw some appropriations under the mining laws. This alternative also would prohibit minerals leasing within a half mile of designated SRMAs. Designated SRMAs overlap the Tongue River and Middle Fork Powder River. Recreation management alternatives might afford some additional protection for waterways within SRMAs. The Middle Fork is currently protected by the WSR provisions; however, an SRMA may extend additional protection from major surface-disturbing development. These management actions would have a negligible beneficial effect on water quality due to the small areas involved.

Lands with Wilderness Characteristics
Areas with wilderness characteristics would prevent or minimize exposure to motorized vehicle traffic, close areas to mineral leasing, recommend withdrawal from locatable minerals entry, close areas to salable minerals, exclude ROW, prohibit commercial woodcutting, and prohibit all other surface-disturbing activities. Due to the small area involved, 12,237 acres, these actions would have a negligible beneficial effect on water resources.

Livestock Grazing Management
Alternative B livestock grazing management effects would be similar to those under Alternative A, except grazing systems and range improvements would be implemented to enhance wildlife, watershed, and riparian values, instead of designing improvements to achieve livestock management objectives. Actions to enhance watershed and riparian values would reduce erosion and sediment loading to nearby streams, maintain adequate vegetative cover, and enhance soil productivity. Livestock salt or mineral supplements would be placed a minimum of 0.5 mile from water sources and riparian areas. Livestock grazing would be prohibited in areas where it has been determined to be incompatible with other resources. These actions would have a minor beneficial effect on water resources.

Special Designations

Areas of Critical Environmental Concern
If the eight proposed ACECs were designated, local water resources would benefit because ACEC designation would prevent disturbance and potential degradation of surface water quality and protect relatively undisturbed watersheds. The BLM would evaluate authorized activities and develop mitigation measures to protect the integrity of the characteristics for which the ACEC was designated. These areas would be managed for preservation and would minimize potential future development. This management would maintain or improve water resources by limiting surface disturbance that could contribute to erosion and nonpoint sources of sediment and other pollutants. However, the designation of ACECs could increase popularity with recreationists in several of the ACECs, resulting in increased potential for degradation of surface water resources

if overuse or misuse were to occur. Management under Alternative B would have a negligible beneficial effect on water resources because of the small areas involved.

4.1.4.5. Alternative C

Water Resources

The potential effects from on-channel reservoirs are addressed under Alternative B (p. 751). Allowing on-channel reservoirs in consideration of other resource values would contain natural streamflow and storm water runoff, thereby resulting in adverse effects on flow regimes. Alternative C would not cause the on-channel reservoir development to be displaced to locations outside BLM authority, as suggested under Alternative B. Because neither alternative presents a significant difference in scale of reservoir development, just the location of the development, Alternative C would have a minor to moderate adverse effect on water resources.

Reservoir leakage, as described under Alternative B (p. 751), would be more likely to occur under Alternative C. Adverse effects from leaking impoundments would primarily involve impacts to vegetation and soils from altered water quality as well as from accelerated erosion. Beneficial effects of on-channel reservoirs would be the potential for shallow aquifer recharge from CBNG waters and additional artificial water sources for wildlife and livestock. However, because effects would be small and localized, adverse effects on water resources would be minor.

Authorizing surface discharge of CBNG produced water would have multiple adverse effects. There would be potential channel degradation as a result of enhanced flows. This channel degradation could be in the form of headward or lateral stream channel erosion, or vegetation changes that could make stream channels or banks unstable. Vegetation changes caused by the addition of CBNG produced water also could alter forage availability for livestock and wildlife. Beneficial impacts would include the supply of additional water sources for wildlife and livestock. In some cases, this would constitute artificial irrigation that would enhance available forage for livestock and wildlife. It could also promote the establishment or enhancement of riparian conditions that help stabilize stream channels and provide additional wildlife habitat.

Water users have adapted to plentiful water provided by CBNG development. As water production from CBNG projects declines, water users will have to find other sources of water or cut back on usage to meet supply. Under Alternative C, the option of converting abandoned CBNG wells to water supply wells to help meet that demand would be available. Historically, operators have had varying degrees of success at converting these wells for water supplies. The adverse side of taking over these wells on BLM-managed surface is that the BLM assumes all down-hole liability – that is, if problems arise in the future, the BLM could face a substantial costs associated with plugging and abandoning or rehabilitation. This can be minimized if adequate down-hole construction information is available (or can be supported with geophysical logs or video inspection) and the conversion is properly designed and supervised by an experienced geohydrologist or petroleum engineer. Often, problematic well conversions are local issues related to the availability of a suitable water-bearing zone. Other times, the issue is related to the cost of re-completing a well. Because of these and other issues, the likelihood of large numbers of CBNG wells being converted is minimal. Therefore, this alternative would have a minor to moderate adverse effect on water resources.

Allowing surface occupancy within 500 feet of springs, non-CBNG reservoirs, water wells, perennial surface water, and riparian areas would increase the potential for sediment transport to the water feature and subsequent sedimentation in that feature that would contribute to

the degradation of water quality. The beneficial effects of this decision are described under Alternative A. Proper implementation of BMPs would minimize the effects of this management action to negligibly adverse.

Maintaining existing water supply sources and adding new sources would meet current demand and allow for added use. New water sources would have an adverse effect for more locations of concentrated use, but the potential beneficial effect would be the dispersion of existing usage, thereby possibly allowing for some recovery. Not requiring alternative energy sources at new water sources would have a negligible adverse effect on water resources due to the possible erosion and sedimentation involved with the development of conventional power sources.

Allowing surface disturbance and surface occupancy within 500 feet of perennial surface water, springs, non-CBNG reservoirs, and wetland and riparian areas would greatly increase the potential for erosion, sediment loading of runoff, and degradation of water quality. However, since not allowing the disturbance and occupancy would likely merely relocate the disturbance, and the proper implementation of BMPs would minimize the effects, this action would only have a minor adverse effect on water resources

Under Alternative C, unneeded CBNG-related surface water impoundments would be removed and reclaimed. Reclamation of disturbed impoundment sites must follow the Wyoming Reclamation Policy (BLM 2012i) and the BFO Impoundment Reclamation Guidance (BLM 2012 e).This action would provide beneficial effects of restoring channel capacity and stability, and reestablishing natural down-gradient flow regimes. It would also cause short-term adverse impacts by exposing the local area to erosion and sedimentation.

Overall, the management actions under Alternative C would have a moderate adverse effect on water resources.

Physical Resources

Air Quality

There would be no effect on water resources from Alternative C air quality management.

Soil

Alternative C would remove all restrictions on surface disturbance and occupancy in areas with severe erosion hazard, on slopes equal to or more than 25 percent, and on soils with poor reclamation potential. These actions would have a major adverse effect on water resource, because allowing disturbance and occupancy on all soil types would increase the likelihood of soil erosion, sediment transport, and sedimentation in receiving waterbodies.

Cave and Karst Resources

Under Alternative C, surface-disturbing activities, including minerals development and timber harvest, would be allowed in cave and karst areas. Karst formations are present on 32 percent (63,171 acres) of BLM surface within 500 feet of water. The potential for surface-disturbing activities in cave and karst areas would be relatively low, related both to the difficult topography and limited potential for minerals resources. Although cave and karst resources comprise more than ten percent of BLM surface, due to the limited foreseeable minerals activities, the result would be a minor adverse effect on water resources.

Mineral Resources

Locatable Minerals
Under Alternative C, 1,455 acres (0.002% of federal locatable minerals) are predicted to be disturbed by locatable minerals development. It is likely that little of this acreage would be within 500 feet of surface water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*. Therefore, Alternative C would have a negligible adverse effect on water resources.

Leasable Minerals – Coal
Under Alternative C, all lands in the planning area would be open to coal exploration. However, during the planning period, there is minimal likelihood of significant coal development beyond the high-potential development areas previously described in Impacts Common to All Alternatives. New coal development would have a major effect on localized groundwater resources, but due to the low probability of extensive development, the effect would be minor. The foreseeable area for coal development could affect 1.3 percent (856 acres) of the federal mineral estate within 500 feet of surface water. This would have a minor adverse effect on water resources.

In addition, federal coal resources would be available for coal-gasification projects and from methanogenesis. Little data are available on the associated effects because the processes are relatively new. However, it is anticipated that localized aquifer drawdown would be required. This dewatering process would produce water that would need to be managed. Some projects have proposed injecting the produced water on the margins of the project area to control the gasification process. Other water management options will likely resemble methodologies used for CBNG development. Any proposed coal-gasification project would have associated surface disturbance, which would involve erosion and sedimentation issues like all surface-disturbing activities. Any methanogenesis project would be evaluated under project-specific NEPA analysis. Regardless of the water-handling methodologies employed, the effect on water resources would be minimal due to the small, localized areas that would be subjected to the processes.

Leasable Minerals – Fluids
Under Alternative C, no lands would be closed to oil and gas leasing. Oil and natural gas (conventional and CBNG) exploration and development would result in approximately 43,252 acres (1.3% of fluid mineral estate) of surface disturbance. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*. This alternative would have a moderate adverse effect on water resources associated with the level of surface disturbance.

Salable Minerals
The total acreage predicted for salable minerals development under Alternative C is 2,090 acres (0.1% of federal salable minerals). If all development occurred within 500 feet of surface waters, the predicted development represents 1.2 percent of the total federal mineral estate within 500 feet of surface waters. However, the true acreage likely to be developed within 500 feet of surface water would be much less. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*. Therefore, the result would be a negligible adverse effect on water resources.

Fire and Fuels Management

Unplanned Fire (Wildfire)
Under Alternative C, full suppression tactics would be used in response to unplanned wildland fire. Heavy equipment use would not be limited, but would consider other

resource values. These actions would do little to limit erosion and would have adverse effects on water resources. With an emphasis on suppression, this alternative would increase the probability of large watershed-damaging fires over the long term. Full suppression of wildland fires would result in an accumulation of fuels and an increase in late-seral vegetative communities that are more prone to catastrophic wildland fires. Wildland fires reduce canopy and ground cover, thereby exposing soils to erosion and increasing the potential for hillslope runoff. In addition, physical soil properties could be adversely affected, such that infiltration rates are lowered in some cases, thus increasing surface runoff. Wildland fire would increase sediment loading and impact downstream water quality, depending on the severity of the fire and its location within the watershed. Evapotranspiration and other hydrologic properties also would be altered in some locations because of increases in late-seral vegetation resulting from wildland fire suppression.

Greater fire suppression efforts would result in increased disturbance from suppression activities such as building fire lines, which increase localized soil erosion. In addition, no active rehabilitation of affected soils is forecast. This alternative could result in changes to water quality in the form of sedimentation, and increased surface runoff in some locations, if a large wildland fire could not be suppressed. With a forecast of 27,596 acres (3.5% of BLM surface) to be affected by wildfires, the adverse effect of these management actions would be minor at the planning-area scale.

Planned Fire (Prescribed Fire)
Under Alternative C, wildland fire and other vegetative treatments would be used to restore fire-adapted ecosystems for commodity production. Long-term benefits to water resources would be tempered by additional surface-disturbing activities related to commodity production. However, commodity production would be consistent with the required management for water and other resources to reduce impacts. With a forecast of 42,000 acres (5.4%) of BLM surface to be treated by planned fire and mechanical treatments, the benefit of these management actions would be minor at the planning-area scale because not all the treated areas would be near surface water.

Biological Resources

Vegetation – Forests and Woodlands
Intensive management tactics, such as large clear cuts, would be used to manage for desired forest health. If not properly managed, these actions could increase erosion, sediment transport, and sedimentation that would have an adverse effect on water resources. Under Alternative C, up to 24,000 acres (3.1%) of BLM surface of forest and woodland treatments are predicted. Forest and woodland management under Alternative C would have a minor adverse effect on water resources.

Vegetation – Grassland and Shrubland Communities
Allowing desirable non-native plant species for initial reclamation would help stabilize soils in a timely manner, thus controlling erosion. Alternative C would allow for quick-growing species to compete with annual weeds and provide an opportunity for slower-establishing native plants to inhabit the site. Given the amount of potential soil disturbance within 500 feet of surface water, the beneficial effect on water resources from this management action would be negligible.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities would be allowed within 500 feet of springs, water wells, and perennial streams consistent with other resource values. Wetland and riparian vegetation would

be restored only where directly disturbed by CBNG activities such as the construction of dams and reservoirs. These management actions would have a minor adverse effect on water resources.

Invasive Species and Pest Management
Impacts Common to All Alternatives describes effects on water resources from invasive species and pest management. Alternative C would take a conservative approach to managing invasive species. Under Alternative C, 10,000 acres (1.3%) of BLM surface are predicted to be treated; most treatment areas would be more than 500 feet from surface waters. This management would have negligible beneficial effects on water resources.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Reservoir designers would be encouraged to be design reservoirs to enhance fisheries, this would generally benefit water resources in the long term, but could add to potential erosion, sediment transport, and sedimentation during construction and maintenance processes.

Reservoirs and riparian areas would be managed to enhance fisheries as a secondary concern. This alternative would likely add to potential erosion, sediment transport, and sedimentation during construction and maintenance processes.

All resource values would be considered regarding actions that would affect perennial waters. This alternative would increase the likelihood of sediment being transported to waterbodies, which would result in sedimentation of the water. However, consistency with other resource values would temper the effect.

Surface-disturbing and disruptive activities would be allowed within 0.25 mile of naturally occurring waterbodies consistent with other resources. Alternative C would increase the likelihood of sediment being transported to waterbodies that would result in sedimentation of the water. This action allows surface-disturbing activities on 10,529 acres within 500 feet of surface water, or 53 percent of water resources, which would be a major adverse effect.

Important stream segments for fish habitat would be restored on a project-specific basis, resulting in a long-term benefit to water resources, but could add to potential erosion, sediment transport, and sedimentation during maintenance processes.

Overall, the alternative would result in major long-term adverse effects from general fisheries management and negligible adverse effects from special status species fisheries management due to the limited range of Yellowstone cutthroat trout.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Most management actions under Alternative C would allow surface-disturbing activities with consideration of wildlife and special status wildlife species; these actions would provide little direct benefit to water resources. Actions that would still provide a measurable benefit include a restriction on surface-disturbing activities near active Greater Sage-Grouse leks (85 acres, or 0.4%, of BLM surface within 500 feet of surface water) and a disturbance-free buffer zone for bald eagle nest sites and winter roosts (150 acres, or 0.8%, of BLM surface within 500 feet of surface water). Due to the limited area protected by these management actions and allowance for surface disturbance under other management actions, the overall benefit to water resources would be negligible.

Special Status Species – Plants
Alternative C would limit surface disturbance prohibitions to identified plant populations, which are typically rare and small. Ute-ladies'-tresses orchid is the only riparian-dependent special status plant species; at present there are no documented populations in the planning area. Because there are currently no documented populations and populations are typically small, the benefit to water resources would be negligible.

Heritage and Visual Resources

Cultural Resources
Management actions under Alternative C include an allowance for surface-disturbing activities in areas with historic properties that retain their historic settings, TCPs, sacred sites, and other culturally sensitive areas when appropriate mitigation is accomplished. Cultural sites themselves are typically small and buffers to protect historic settings are typically less than 0.25 mile wide. Therefore, minerals activities would likely be displaced, but not prevented. Fewer restrictions on surface disturbance could result in a negligible adverse effect on water resources.

Visual Resources
Under Alternative C, areas inventoried as VRM Class II and special emphasis areas would be managed as VRM Class III. The objective of VRM Class III areas is to partially retain the existing character of the landscape (management activities should not dominate the view). Class III management would likely not affect the level of surface-disturbing activities. Therefore, there would be no effect on water resources.

Land Resources

Forest Products
Forest products management actions under Alternative C would be similar to those under Alternative A, except that Alternative C would focus more on commercial timber harvest instead of natural processes. Effects on water resources would be the same nature as under *Impacts Common to All Alternatives*. 24,000 acres would be harvested during the planning period. Rather than natural processes, commercial treatments would primarily be tool to achieve forest health objectives. This action would require more aggressive management and would likely require the use of more roads and off-road vehicle use. Under Alternative C, there likely would be an increase in human disturbances in remote areas that would undergo natural processes under other alternatives. Therefore, compared to Alternative A, adverse effects from roads and disturbance under Alternative C would likely increase in some locations. Mitigation and BMPs would still be applied to forest management activities to reduce these effects where possible. Adverse impacts on water resources would be negligible from the application of mitigation and due to the limited area of commercial forests within 500 feet of water resources.

Renewable Energy
Alternative C would allow renewable-energy development anywhere in the planning area if consistent with other resource values. However, there is very little likelihood that large areas suitable for renewable-energy development would coincide with areas where management of other resource values would allow such activities. Therefore, this alternative would have a negligible adverse effect on water resources.

Rights-of-Way and Corridors
Alternative C management of ROW corridors would be as described under *Impacts*

Common to All Alternatives. In addition, 28,554 acres would be excluded from ROW, 27,706 acres would be identified for ROW avoidance, and 199,829 acres would have minor ROW constraints. Areas with slopes equal to or greater than 25 percent and highly erodible soils will not be excluded from ROW. This would have a minor adverse effect on water resources.

Travel and Transportation Management
Under Alternative C, motor vehicle access would be allowed in special status species habitat consistent with the travel management plan. This action could have adverse effects on water resources from accelerated erosion, sediment transport, and sedimentation related to vehicular traffic.

Some areas near sensitive resources would be Closed to motor vehicle use. Motor vehicle travel would be Limited to designated roads and trails on 723,497 acres, and there would be seasonal motor vehicle prohibitions in selected areas of the southern Big Horn Mountains. These actions would reduce erosion, sediment transport, and sedimentation associated with motor vehicle activity, which would have a negligible beneficial impact on water resources as motor vehicle use levels would likely not be affected.

Recreation
Alternative C recreation management would have negligible beneficial effects on water resources similar to those described under *Impacts Common to All Alternatives*.

Lands with Wilderness Characteristics
Under Alternative C, areas with wilderness characteristics would be managed the same as the surrounding areas. Due to the small areas involved, these actions would have a negligible adverse effect on water resources.

Livestock Grazing Management
Under Alternative C, livestock grazing management would result in effects to water resources similar to those described for Alternative B, except that livestock salt or mineral supplements would be placed a minimum of 500 feet from water sources and riparian areas, and grazing would be restricted only in areas where it is currently restricted. These actions would have a negligible adverse effect on water resources.

Special Designations

Areas of Critical Environmental Concern
There would be no effects on water resources from ACEC management under Alternative C as no ACECs would be designated.

4.1.4.6. Alternative D

Physical Resources

Water Resources
Alternative D allows for the flexibility to not authorize certain activities when the adverse effects would be excessive. Surface discharge of CBNG produced water, on-channel reservoirs, and surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams would be allowed if the water resources are adequately protected and other resource values warrant the authorization. Appendix W (p. 2623) describes the processes by which projects

would be evaluated for these conditions. In addition, unneeded reservoirs would be evaluated on an individual basis for removal and reclamation. This alternative would provide a moderate benefit to water resources because it gives the BLM authority to mitigate effects on a site-specific basis within established limits as described in Appendix W (p. 2623).

Air Quality
Under Alternative D, mitigating adverse impacts to air quality could have limited effect on water resources by reducing erosion sources. This would be a negligible beneficial effect.

Soil
Under Alternative D, surface-disturbing activities in areas with severe erosion potential, on slopes equal to or greater than 25 percent, and on soils with poor reclamation potential would be allowed on a project-specific basis. The use of stringent criteria would cause these areas to be avoided in most cases. When these areas could not be avoided, specific measures would be applied to mitigate or prevent adverse effects on water resources. This alternative would provide a moderate benefit to water resources because it gives the BLM authority to reduce effects on a site-specific basis.

Cave and Karst Resources
Under Alternative D, surface-disturbing activities, including mineral development and timber harvest, would be allowed in cave and karst areas, with site-specific mitigation. Protections would likely focus on protecting significant caves. At present, there are five identified significant caves within 500 feet of surface water. The potential for surface-disturbing activities in cave and karst areas is relatively low, related both to the difficult topography and limited potential for mineral resources. Management actions to protect cave and karst resources would have a negligible beneficial effect on water resources.

Mineral Resources

Locatable Minerals
Under Alternative D, 1,252 acres (0.2% of federal locatable minerals) are predicted to be disturbed by locatable minerals development. It is likely that little of this be within 500 feet of surface water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*. Therefore, this would have a negligible adverse effect on water resources.

Leasable Minerals – Coal
The foreseeable area for coal development could affect 1.3 percent (856 acres) of federal mineral estate within 500 feet of surface water; this would have a minor adverse effect on water resources. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*.

Federal coal lands would be available for in situ gasification and methanogenesis which also would have a minor adverse effect on water resources. Impacts associated with coal methanogenesis would be similar to those impacts described under Alternative C.

Leasable Minerals – Fluids
Oil and natural gas (conventional and CBNG) exploration and development would result in approximately 35,185 acres (1% of federal fluid mineral estate) of surface disturbance. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*. This would have minor adverse effects on water resources.

Salable Minerals
The total acreage predicted for salable minerals development under Alternative D is 1,193 (0.3% of federal salable minerals) acres. Other potential impacts will be similar to those described in *Impacts Common to All Alternatives*. Due to the small areas involved, adverse effects on water resources would be negligible.

Fire and Fuels Management

Unplanned Fire (Wildfire)
Under Alternative D, response to unplanned wildland fire varies from full suppression to monitoring fire as a management tool. The use of heavy equipment is limited except when human safety is at risk, and fire and suppression damage would be rehabilitated where necessary. These actions would limit erosion and benefit water resources. However, with a predicted 27,596 acres (3.5%) of BLM surface to be affected by wildfires, the benefit of these management actions would be negligible at the planning-area scale as few of these acres are likely to be within 500 feet of water resources.

Planned Fire (Prescribed Fire)
Under Alternative D, wildland fire and other vegetative treatments would be used to meet desired management objectives, which would result in long-term beneficial effects on water resources. With a predicted 14,000 acres (1.8%) of BLM surface to be treated by prescribed fire and mechanical treatments, the benefit of these management actions would be minor at the planning-area scale.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative D, intensive management tactics would be used to manage for desired forest health. If not properly managed, these actions could increase erosion, sediment transport, and sedimentation, which would have an adverse effect on water resources. Under Alternative D, up to 20,000 acres (1.3% of BLM surface) of forest and woodland treatments are predicted. Due to the acreage in the planning area where these treatments would be applied, adverse effects on water resources would be minor.

Vegetation – Grasslands and Shrubland Communities
Allowing desirable non-native plant species for initial reclamation would help stabilize soils in a timely manner, thus controlling erosion. Alternative D would allow for quick-growing species to compete with annual weeds and provide an opportunity for slower-establishing native plants to inhabit the site. Given the amount of potential surface disturbance within 500 feet of surface water, there would be a negligible beneficial effect to water resources.

Vegetation – Riparian/Wetland Resources
Under Alternative D, surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would be allowed when the resources could be protected. Other management actions that would benefit water resources include managing for DFC within capable communities and restoring wetland and riparian vegetation supported by CBNG produced-water discharge. The 500-foot buffer would protect surface waters unless a waiver was granted. The ability to grant waivers would reduce the beneficial effect to moderate.

Invasive Species and Pest Management
The *Impacts Common to All Alternatives* section above describes the types of effects on soil resources from invasive species. Alternative D would take a moderate approach to managing invasive species. Under Alternative D, 12,000 acres (1.5%) of BLM surface are predicted to be treated. Due to the small areas where invasive species management would overlap water resources, the beneficial effect on water resources would be negligible.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Alternative D would maintain or enhance streams and riparian areas associated with Class I and II streams, the Powder River, the Tongue River, and appropriate areas for desired fisheries potential. This management would generally have a beneficial effect on water resources. Fisheries enhancement would be incorporated into reservoir designs consistent with other resource values. This alternative would generally benefit water resources, but could add to potential erosion, sediment transport, and sedimentation during construction and maintenance processes. Perennial waters that affect fish habitat would be maintained or enhanced consistent with other resource values. This would generally benefit water resources.

Surface-disturbing and disruptive activities would be allowed within 0.25 mile of naturally occurring waterbodies that contain native or desirable non-native fish species in accordance with fisheries objectives. This alternative would reduce the likelihood of sediment being transported to waterbodies that would result in sedimentation of the water. This alternative would allow surface-disturbing activities on 10,529 acres within 500 feet of surface water, or 53.0 percent of water resources, when adverse effects on water and other resources are adequately mitigated. Yellowstone cutthroat trout could be present in streams associated with 182 acres (0.9%) of BLM surface within 500 feet of water.

Important stream segments for fish habitat would be restored in accordance with WGFD priorities. Alternative D would generally benefit water resources, but could add to potential erosion, sediment transport, and sedimentation during maintenance processes.

Overall, activities to maintain or enhance fish habitat would benefit water resources. However, due to the provision for waivers under defined conditions, the beneficial effects would be moderate for fish and negligible for special status fish because of their limited distribution.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
There are a number of management actions under Alternative D that allow surface-disturbing activities where wildlife and special status wildlife species could be adequately protected. These actions would benefit water resources locally where surface disturbances are prevented by reducing erosion, sediment transport, and sedimentation. Any efforts that would minimize these processes would beneficially affect water resources. However, because most management actions regulate, but do not prohibit surface disturbance, and the small amount of land in close proximity to water resources, the benefit to water resources would be minor.

Special Status Species – Plants
Alternative D would limit surface disturbance prohibitions mostly to identified populations, which are typically widespread and small. Ute-ladies'-tresses orchid is the only riparian-dependent special status plant species; at present there are no documented populations in the planning area. Because there are documented populations and populations are typically small, beneficial effects on water resources would be negligible.

Heritage and Visual Resources

Cultural Resources

Management actions under Alternative D include a prohibition on surface-disturbing activities for specifically identified sites with historic properties that retain their historic settings, and appropriate mitigation of surface-disturbing activities for the protection of TCPs, sacred sites, and other culturally sensitive areas. To protect the settings of the identified historic properties, surface-disturbing activities could be restricted up to 3 miles from sensitive cultural sites. Water resource would be protected on 627 acres, or 3.2 percent, of BLM surface within 500 feet of surface water. This would have a minor beneficial impact on water resources.

Visual Resources

Under Alternative D, specifically identified areas inventoried as VRM Class II or as special emphasis areas would be managed as VRM Class II. There are 4,825 acres, or 24 percent, of BLM surface within 500 feet of surface water classified as VRM Class II. However, because surface disturbance is reduced but not prohibited, the benefits to water resources would be moderate.

Land Resources

Forest Products

Alternative D would result in effects similar to Alternative B, except that Alternative D provides more latitude to manage forest product sales within ecologically sustainable limits to maximize economic return. It also provides increased flexibility to perform rehabilitation activities to create healthy and economically sustainable forest stands in consideration of other resource values. Due to the limited areas where these actions would correspond to water resources, adverse effects on water resources would be negligible.

Renewable Energy

Alternative D would exclude renewable-energy projects in certain otherwise restricted areas. The likelihood of these areas coinciding with areas suitable for renewable energy is minimal. Therefore, effects on water resources would be negligible, but would be beneficial if they occurred.

Rights-of-Way and Corridors

Alternative D management of ROW corridors would be the same as described under *Impacts Common to All Alternatives*. In addition, Alternative D would exclude 79,777 acres from ROW and identify 321,149 acres for ROW avoidance. Areas with slopes equal to or greater than 25 percent and highly erodible soils would be avoided. This would result in a minor adverse effect on water resources compared to alternatives A and B, but would represent a decrease in adverse effects compared to Alternative C.

Travel and Transportation Management

Alternative D would allow motor vehicle use in special status species habitat consistent with travel management designations and within routes designated to protect habitat. This action would benefit water resources because it would minimize erosion, sediment transport and sedimentation caused by motor vehicle use, but would allow needed flexibility to control catastrophic wildfires that could result in much worse effects on water resources.

Existing routes would be evaluated for closure and reclamation consistent with other resource values. Approximately 37,389 acres in selected areas would be Closed to motorized vehicle use. Motorized vehicle use would be Limited to designated roads on 661,726 acres, and an

additional 18,259 acres would have seasonal motor vehicle prohibitions. These actions would reduce erosion, sediment transport, and sedimentation associated with motor vehicle activity, thereby having a minor beneficial effect on water resources.

Recreation
Alternative D effects on water resources would be similar to those under Alternative B.

Lands with Wilderness Characteristics
Alternative D would manage 6,864 acres to emphasize ecosystem health, natural values, and primitive recreational opportunities. Due to the small areas involved, these actions would have a negligible beneficial effect on water resources.

Livestock Grazing Management
Alternative D would give watershed protection priority over forage and habitat concerns regarding vegetation production. This could have a minor to moderate beneficial effect on water resources because it would restore natural streamflows and reduce adverse effects on water quality. Livestock grazing would be allowed on all public lands except in areas that determined to be incompatible with other resource values. This would have a minor adverse effect on water resources, but would be consistent with existing conditions. Livestock salt or mineral supplements would be placed a minimum of 500 feet from water sources and riparian areas, which would have a minor beneficial effect on water resources.

Special Designations

Areas of Critical Environmental Concern
Alternative D effects from ACEC management would be similar to those under Alternative B but for a reduced acreage. Due to the limited areas where these actions would correspond to water resources, the effects would be beneficial but negligible.

4.1.4.7. Cumulative Impacts

The BLM manages approximately 11 percent of the surface lands in the planning area, but manages approximately 65 percent of the mineral resources (90% of coal resources). In addition, the authority over water resources primarily lies with the WSEO or the Wyoming DEQ. The WSEO has authority over all issues related to water supply, production, and availability, while the Wyoming DEQ has primacy over all issues related to water quality. This leaves the BLM with the ability to manage actions that could subsequently affect water resources, such as surface disturbance that could supply pollutants to water resources. Given that most water resource management decisions lie with the state, effects are relatively consistent throughout the planning area, regardless of land ownership. Therefore, it is reasonable to assume that impacts assessments related to areas where the BLM only has authority over the surface could be multiplied by 0.89 to estimate the total effect on water resources in the planning area. In addition, it would be reasonable to estimate all effects related to minerals development; multiply impacts by 0.35 to account for all effects.

Water resources impacts for CBNG are thoroughly addressed in the PRB Final EIS. Impacts as a result of coal mining are addressed in the Hay Creek II Coal Lease Application Final EIS as well as other coal leasing NEPA documents. Both of these documents assess cumulative impacts associated with overlapping development.

To summarize, most overlapping impacts to water resources would occur near the coal mines in the south eastern part of the planning area. The impact most likely to be observed will be aquifer drawdown where CBNG production is dewatering coal zone aquifers and shallower. Coal mines will simultaneously be dewatering coal production zones and overburden aquifers above the coal. The impacts associated with aquifer drawdown is described above.

Coal developers and CBNG developers are required to manage any surface water discharges in accordance with Wyoming DEQ WYPDES permit requirements. However, coal producers typically use most of the water they produce for mining operations, so there is very little overlapping impacts associated with discharge.

There are few cumulative or overlapping impacts to water resources associated with conventional oil production. Direct impacts with this type of production is discussed above and in Appendix W (p. 2623) and Appendix V (p. 2599).

4.1.4.8. Conclusion

Allowable uses and management actions described in this section were used to determine potential effects on water resources. Meaningful differences in long-term disturbance acreage; acreage of highly erosive soils; number of oil and gas (including CBNG) wells; and produced-water discharge form the basis for the conclusion described here. Alternative B would result in the least adverse effects on water resources because management actions under this alternative would result in the least amount of change to surface water and groundwater quality and quantity. Therefore, Alternative B provides the greatest protection to surface water and groundwater resources. Alternative A is consistent with current management and provides moderate levels of water resource protection and results in somewhat more adverse effects on water resources than Alternative B. Alternative D would result in fewer adverse effects on surface water than Alternative A, and effects similar to Alternative A related to groundwater quality and quantity. In ascending order from the least adverse to the most adverse effects on water resources, the alternatives rank as follows: Alternative B, Alternative D, Alternative A, and Alternative C.

4.1.5. Cave and Karst Resources

This section describes potential effects on cave and karst resources from proposed management of all other resources. Chapter 3 describes existing cave and karst conditions. Actions that disturb or destroy cave and karst resources or disrupt the habitat of flora or fauna that utilize cave and karst areas are considered adverse; actions that avoid or prevent adverse impacts are beneficial.

The Federal Cave Resources Protection Act of 1988 requires inventory and determinations of significance for cave resources under federal management. Cave resources determined to be significant will be protected from all actions that could adversely impact the resources. This could result in the modification or denial of certain proposals. Cave resources are vulnerable to unauthorized uses and vandalism. Significant cave resources damaged or destroyed by unauthorized uses or vandalism might require protective measures, up to and including closing caves.

Cavities in bedrock can occur anywhere in the planning area. However, only caves found in the karst regions of the Big Horn Mountains are likely to be significant. Those in plains areas will be sandstone rock shelters. The only potential element of significance in rock shelters will be cultural resources, which will be protected under the NHPA. Therefore, for purposes of this

analysis, only areas of the Big Horn Mountains likely to contain cave and karst resources are considered in this analysis. This focus area is comprised of 101,455 acres of BLM surface and 212,626 acres of federal fluid mineral estate.

4.1.5.1. Methods and Assumptions

The analyses of impacts to cave and karst resources under the alternatives are the result of coordination with BLM interdisciplinary team members, review of various publications, and information provided by interested cooperators.

Assumptions

The assumptions include, but are not limited to, the following:

- As populations grow and more people recreate, impacts to cave and karst resources of the Buffalo planning area will increase.
- Given the large amount of karst topography in the planning area, it is very likely that more caves will be discovered. Therefore, it is necessary to protect areas with formations likely to contain cave and karst resources.
- It is very likely that there will be additional discoveries of sensitive species in planning area caves. Therefore, protecting areas likely to contain cave and karst resources also will protect habitat for sensitive species.

4.1.5.2. Impacts Common to All Alternatives

Cave and Karst
All alternatives will meet Federal Cave Resources Protection Act of 1988 requirements and will bring the BFO into compliance. Cave and Karst management that protects these sensitive resources will have a major beneficial effect on cave and karst resources.

Physical Resources

Air Quality
Air quality management actions common to all alternatives or unique to each alternative will not effect cave and karst resources. Therefore, the *Cave and Karst Resources* section does not further address air quality management.

Soil
Runoff from destabilized soils can affect not only the water sources that are integral to cave and karst development, but also potentially impact the plant and animal life that inhabit caves. Using soil surveys and onsite investigations would ensure protection of soil resources. Applying appropriate mitigation (including relocation or denial of projects) and requiring an approved reclamation plan would ensure all disturbances were effectively remediated to BLM standards. This would have a major beneficial effect on cave and karst resources.

Water Resources
Cave and Karst formations are created by the hydraulic and chemical processes of water eroding and reacting with sediment and rock. Cave and karst resources often are present near water resources and riparian areas. While cave and karst areas overlap riparian areas by only four percent, the integral relationship between cave and karst resources and water elevates the

potential impacts of any water-related management actions. Water management actions common to all alternatives that would affect cave and karst resources include managing surface-disturbing activities to prevent degradation of water quality and preventing the loss of riparian areas and these actions would have a moderate beneficial effect on cave and karst resources.

Mineral Resources

Mining activities (locatable, leasable, and salable minerals) would have no impact to cave and karst resources. Minerals development in cave and karst areas is not expected. There are no known deposits of leasable minerals in cave and karst areas. Locatable minerals in the form of metallurgical grade limestone has a moderate potential for occurring in the limestone formations that partially make up the cave and karst formation areas; however, the potential for development, if located, is low. Salable mineral deposits overlap with cave and karst formations by one percent; current salable development overlaps with cave and karst areas by 51 acres. It is possible, although unlikely, that deposits of salable, locatable, or leasable minerals could be found in cave and karst areas. However, due to the inherent difficulty of development in these areas, no impacts to cave and karst resources are anticipated. Therefore, the *Cave and Karst Resources* section does not further address management of mineral resources.

Fire and Fuels Management

There are no management actions common to all alternatives or unique to each alternative for fire and fuels management that would affect cave and karst resources. Therefore, the cave and karst section does not further address these resources.

Biological Resources

Management actions for biological resources are designed to protect biological resources, typically by limiting surface-disturbing activities and preventing erosion and degradation of water quality. Limiting these types of disturbances benefits cave and karst resources (see *Water - Impacts Common to All Alternatives*).

There are no management actions common to all alternatives for special status species-plants that affect cave and karst resources.

There are no management actions common to all alternatives or unique to each alternative for **Grassland and Shrubland Communities**, **Invasive Species and Pest Management**, **Special Status Species – Fish**, or **Forest and Woodlands** that would affect cave and karst resources. Therefore, the *Cave and Karst Resources* section does not further address these resources.

Vegetation – Riparian/Wetland Resources
Cave and karst resources often are present near water resources and riparian areas. While cave and karst areas overlap riparian areas by only four percent, the integral relationship between cave and karst resources and water elevates the potential impacts of any water-related management actions. Cave and Karst formations are created by the hydraulic and chemical processes of water eroding and reacting with sediment and rock. Preventing the degradation, loss, or destruction of riparian and wetland habitat would have a moderate beneficial effect on cave and karst resources.

Fish and Wildlife Resources – Fish
Cave and Karst formations are created by the hydraulic and chemical processes of water eroding

and reacting with sediment and rock. Cave and karst resources often are present near water resources and riparian areas. While cave and karst areas overlap riparian areas by only four percent, the integral relationship between cave and karst resources and water elevates the potential impacts of any water-related management actions. Fisheries management actions common to all alternatives that would affect cave and karsts resources include mitigation for surface-disturbing activities. Surface disturbing activities that impact the quality or flow of water in cave and karst areas could impact cave and karst resources. Mitigating surface disturbing activities in cave and karst areas would have a moderate beneficial effect on cave and karst resources.

Fish and Wildlife Resources – Wildlife
Wildlife management actions common to all alternatives that affect cave and karst resources include mitigation for surface-disturbing activities to prevent erosion and degradation of water quality. Preventing erosion and degradation of water quality would moderately benefit cave and karst resources (see above *Fish and Wildlife Resources – Fish*).

Special Status Species – Wildlife (including Greater Sage-Grouse)
Several Greater Sage-Grouse leks, located on the eastern slopes of the southern Big Horns, are in close proximity to the eastern edge of karst formations. Management actions that would prevent degradations to Greater Sage-Grouse habitat could potentially benefit cave and karst resources. However, the formation areas in question are marginal, both in terms of location and quality, and are not expected to produce caves of significance. Therefore any effects to cave and karst resources from Greater Sage-Grouse management would be negligible and will not be discussed further in the *Cave and Karst Resources* section.

There are no other common to all alternatives from Special Status Species that would affect cave and karst resources.

Heritage and Visual Resources

There are no **Cultural Resource**, **Paleontological Resource**, or **Visual Resource Management** actions common to all alternatives or unique to each alternatives that would affect cave and karst resources. Therefore, the *Cave and Karst Resources* section does not further address these resources.

Land Resources

The following programs do not have any management actions common to all alternatives that would affect cave and karst resources: **Renewable Energy** and **Lands with Wilderness Characteristics**.

The following programs do not have any management actions common to all alternatives or unique to each alternative that would affect cave and karst resources: **Lands and Realty** and **Travel and Transportation Management**. Therefore, the *Cave and Karst Resources* section does not further address these resources.

Forest Products
Management actions common to all alternatives include a prohibition on timber harvest within 200 feet of surface waters. Because adverse impacts to water quality in cave and karst areas could adversely impact cave and karst resources (see *Water - Impacts Common to All Alternatives*), this management action would have a moderate beneficial effect on cave and karst resources.

Rights-of-Way and Corridors
Management actions common to all alternatives include the designation of ROW corridors to minimize surface disturbance and impacts to resources. Surface disturbing activities that impact the quality or flow of water in cave and karst areas could impact cave and karst resources. However, the likelihood of significant ROW corridors occurring in cave and karst areas is minimal given the rugged topography where cave and karst resources occur. Minimizing the potential for impacts to water resources near cave and karst areas through ROW management would have a minor beneficial effect on cave and karst resources.

Recreation
Management actions common to all alternatives include opening the planning area to casual, diverse, and dispersed recreation; avoidance of riparian habitat for developed facilities and camping; and managing caves through a cave management plan. Increased human visitation to caves can adversely impact cave resources. Actions such as vandalism, disturbance of plants and animals, and looting of cultural resources are all probable results. Opening the planning area to dispersed recreational opportunities increases theses risks, which would have an adverse effect on cave and karst resources. Protecting cave and karst resources through cave management plans would minimize impacts on cave and karst resources.

Livestock Grazing Management
Under all alternatives, most of the BLM surface acreage within the planning area would be available for livestock grazing. Livestock grazing would be managed in accordance with the *Wyoming Standards for Healthy Rangelands* to sustain vegetative communities and special status species habitats. Multiple special status species inhabit cave and karst areas, however very little of these areas are suitable for grazing. Therefore, while grazing management would sustain special status species habitat, the small overlap would reduce the benefit to minor.

Special Designations

There are no **Areas of Critical Environmental Concern** or **Scenic or Back Country Byways** management actions common to all alternatives or unique to each alternative that would affect cave and karst resources. Therefore, the *Cave and Karst Resources* section does not further address these resources.

Wild and Scenic Rivers
Management actions common to all alternatives include managing the proposed Middle Fork Powder River WSR in accordance with the Middle Fork Interim Management Plan. Many of the known significant caves in the planning area are in the Middle Fork Canyon area. The Interim Management Plan would help protect this important area, which would have a major beneficial effect on cave and karst resources.

Wilderness Study Areas
Management actions common to all alternatives include managing WSAs for natural conditions and primitive recreation. While WSAs only overlap with cave and karst areas by seven percent, these areas are known to have cave and karst formations that could be significant. Protecting the areas through WSA management would have a major beneficial effect on cave and karst resources.

Socioeconomic Resources

There are no social, economic, or health and safety management actions common to all alternatives or unique to each alternative that would affect cave and karst resources. Therefore, the cave and karst resources section does not further address this resource.

4.1.5.3. Alternative A

Cave and Karst Resources
Alternative A does not include management of cave and karst resources. Current management could potentially allow significant cave and karst resources to be impacted without analysis. This would have a major adverse effect on cave and karst resources.

Physical Resources

Soil
Cave and karst resources are associated with steep slopes, rock outcrops, and other sensitive soil types. Under Alternative A, management or prohibition of surface disturbance on soils with severe erosion hazards would have a beneficial effect on cave and karst resources; management or prohibition of surface disturbance on steep slopes and on soils with poor reclamation suitability would have a beneficial effect on cave and karst resources. Alternative A considers surface disturbance on rock outcrops on a project-specific basis. Therefore, it is not possible to determine a level of impact to cave a karst resources from soil resources management on rock outcrops. Overall, management actions under Alternative A for soil will be a major benefit to cave and karst resources.

Water Resources
Cave and karst resources often are present near water resources and riparian areas. While cave and karst areas overlap riparian areas by only four percent, the integral relationship between cave and karst resources and water elevates the potential impacts of any water-related management actions. Under Alternative A, prohibiting surface-disturbing activities within 500 feet of any spring or perennial stream to prevent erosion and degradation of water quality would have a moderate beneficial effect on cave and karst resources (see *Water - Impacts Common to All Alternatives*).

Biological Resources

Vegetation – Riparian/Wetland Resources
Cave and karst resources often are found in or near riparian areas. Under Alternative A, prohibiting surface-disturbing activities to prevent erosion and degradation of water quality would have a moderate beneficial effect on cave and karst resources.

Fish and Wildlife Resources – Fish
Cave and karst resources often are found in or near riparian areas. Under Alternative A, prohibiting surface-disturbing activities to prevent erosion and degradation of water quality would have a moderate beneficial effect on cave and karst resources

Fish and Wildlife Resources – Wildlife
Management actions under Alternative A that prohibit surface-disturbing activities for the protection of wildlife would beneficially impact cave and karst resources by preventing erosion and habitat disruption. A small portion of cave and karst areas are overlapped by big-game wintering areas. Prohibiting development in big game winter ranges would have a minor beneficial effect on cave and karst resources.

Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)
Large portions of cave and karst formation areas are overlapped by limber pine habitat. Amphibians, reptiles, and bats often utilize cave and karst resources. Management of surface-disturbing activities to prevent disruption and degradation of limber pine, amphibian, reptile, and bat habitat would have a major beneficial effect on cave and karst resources. However, Alternative A considers actions on a project-specific basis, so it is not possible to have adverse impacts limiting the benefits to moderate.

Land Resources

Forest Products
Management actions under Alternative A include the sale of minor forest products. The areas of potential harvest overlap cave and karst areas by seven percent. However, most caves in the planning area are in terrain that does not allow for timber harvest. Therefore, adverse effects (e.g., erosion and habitat disruption) on cave and karst resources resulting from timber harvest would be negligible.

Renewable Energy
Alternative A considers renewable-energy development on a project-specific basis. Although there have been no renewable energy projects to date, 20,000 acres (2.6%) of BLM surface are predicted over the planning period. The southern Big Horn Mountains have excellent wind energy potential and contain most of the cave and karst resources in the planning area. Construction of wind farms in the southern Big Horn Mountains would likely impact cave and karst resources. While wind farms would not necessarily physically damage cave and karst areas, they would pose a significant risk to the bats that utilize these resources. Because these actions are considered on a project-specific basis, some caves and bat populations would likely be protected and others would not, so that the level of impact to cave and karst resources would likely be moderate.

Rights-of-Way and Corridors
Cave and karst resources are often found on steep slopes and highly erodible soils. Under Alternative A, prohibiting surface disturbance on slopes equal to or greater than 25 percent and on highly erodible soils would prevent erosion and water degradation and would apply to most cave and karst areas. However, the likelihood of major ROW permits being issued in cave and karst areas due to difficult topography reduces the benefit to minor.

Recreation
Significant cave and karst resources are located in areas being considered for SRMA designation. Designation and management of cave and karst areas as SRMAs would benefit cave and karst resources by preventing erosion and degradation of habitat. However, Alternative A does not include such management and would not result in this beneficial effect on cave and karst resources. Therefore current management results in moderate adverse impacts to cave and karst resources.

Lands with Wilderness Characteristics
Cave and karst resources often are found in areas with wilderness characteristics. Alternative A is implemented on a project-specific basis and does not currently provide cave and karst protection. Therefore current management results in minor adverse impacts to cave and karst resources as 12,237 acres have been determined to have wilderness characteristics.

Livestock Grazing Management
Cave and karst resources often are found in areas not compatible with livestock grazing. While

livestock have a difficult time accessing many cave and karst areas, some animals successfully negotiate the rugged terrain and steep slopes. While the total number of animals are limited, allowing livestock access to cave and karst areas creates erosion and habitat disruption. Under Alternative A, limiting or prohibiting livestock grazing where it is not compatible with other resources would have a minor beneficial effect on cave and karst resources.

Special Designations

Wild and Scenic Rivers
Many of the planning area's known significant caves fall within the proposed WSR. While this action is considered on a project-specific basis, current management is protective of cave and karst resources and is a major benefit.

Wilderness Study Areas
WSAs contain seven percent of total cave and karst area. If Congress does not designate the WSAs as wilderness, they will be opened for oil and gas leasing. While this means that seven percent of cave and karst resource areas would be opened for oil and gas leasing, the fact that there are no known deposits of oil or gas in these areas reduces the potential major impact to negligible.

4.1.5.4. Alternative B

Cave and Karst Resources
Alternative B includes the highest levels of cave and karst protections. Surface- and subsurface-disturbing activities would be prohibited in cave and karst areas. This would include all mineral exploration and development, timber harvest, and ROWs. In addition, each cave containing significant resources would be managed under an individual cave management plan. Caves with significant resources also would be fenced to exclude livestock from entering. These actions would have a major beneficial effect on cave and karst resources.

Physical Resources

Soil
Cave and karst resources are associated with steep slopes, rock outcrops, and other sensitive soil types. The Alternative B prohibition on surface-disturbing activities on soils with a severe erosion hazard would have a beneficial effect on cave and karst resources. Prohibiting surface-disturbing activities on slopes equal to or greater than 25 percent would have a beneficial effect on cave and karst resources. Prohibiting surface-disturbing activities on soils with poor reclamation suitability would have a beneficial effect on cave and karst resources. Prohibiting surface-disturbing activities on badlands, rock outcrops, biologic crusts, and slopes susceptible to mass movement would have a beneficial effect on cave and karst resources. Overall soil alternatives will have a major beneficial effect on cave and karst resources.

Water Resources
Cave and karst resources often are present near water resources and riparian areas. Alternative B management actions that prohibit surface-disturbing activities within 500 feet of springs, perennial streams, and their associated riparian habitat would have a moderate beneficial effect on cave and karst resources.

Biological Resources

Vegetation – Riparian/Wetland Resources
Cave and karst resources often are found in or near riparian areas. Alternative B management actions that prohibit surface-disturbing activities within 500 feet of riparian habitat would have a moderate beneficial effect on cave and karst resources.

Fish and Wildlife Resources – Fish
Cave and karst resources often are found in or near riparian areas. The Alternative B prohibition on surface-disturbing activities within 0.25 mile of naturally occurring waterbodies that contain fish would have a major beneficial effect on cave and karst resources.

Fish and Wildlife Resources – Wildlife
Management actions under Alternative B that prohibit surface-disturbing activities for the protection of wildlife would benefit cave and karst resources by preventing erosion and habitat disruption. Some big game wintering areas overlap cave and karst resources. Prohibiting development in big game winter ranges would have a minor beneficial effect on cave and karst resources.

Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)
Management actions under Alternative B that prohibit surface-disturbing activities for the protection of special status plant and wildlife species would beneficially impact cave and karst resources. Large portions of cave and karst formation areas are overlapped by limber pine habitat. Prohibiting development in limber pine habitat would have a major beneficial effect on cave and karst resources. Amphibians, reptiles, and bats often utilize cave and karst resources. Management of surface-disturbing activities to prevent disruption and degradation of amphibian, reptile, and bat habitat would have a major beneficial effect on cave and karst resources.

Land Resources

Forest Products
Management actions under Alternative B include the sale of saw timber. The areas of potential harvest overlap with cave and karst areas by seven percent. However, most caves in the planning area are in terrain that does not allow for timber harvest. Therefore, adverse effects (erosion and habitat disruption) on cave and karst resources resulting from timber harvest would be negligible.

Renewable Energy
Alternative B would avoid development of renewable-energy projects in cave and karst areas. This would have a major beneficial effect on cave and karst resources.

Rights-of-Way and Corridors
Cave and karst resources are often found on steep slopes and highly erodible soils.
Under Alternative A, prohibiting surface disturbance on slopes equal to or greater than 25 percent and on highly erodible soils would prevent erosion and water degradation and would apply to most cave and karst areas. However, the likelihood of major ROW permits being issued in cave and karst areas due to difficult topography is slim.

Recreation
Cave and karst resources often are found in areas with recreation potential. Designation and management of cave and karst areas as SRMAs would benefit cave and karst resources.

Alternative B would provide for recreation to be intensively managed and not allow mineral leasing throughout most of the proposed SRMAs. The restriction on mineral leasing would reduce potential surface disturbance from facilities and associated infrastructure of mineral development. Although the proposed SRMAs only overlap cave and karst areas by three percent, that three percent contains many of the planning area's significant caves. Designating the Middle Fork Powder River as an SRMA would have a moderate beneficial effect on cave and karst resources.

Lands with Wilderness Characteristics
Cave and karst resources often are found in areas with wilderness characteristics. Alternative B would prohibit most surface-disturbing activities on five percent of cave and karst areas to emphasize primitive recreation and natural values and would also prevent erosion and habitat degradation. This would have a moderate beneficial effect on cave and karst resources.

Livestock Grazing Management
Cave and karst resources often are found in areas not compatible with livestock grazing. While livestock have a difficult time accessing many cave and karst areas, some animals successfully negotiate the rugged terrain and steep slopes. While the total number of animals are limited, allowing livestock access to cave and karst areas creates erosion and habitat disruption. Alternative B would limit or prohibit livestock grazing where it would not be compatible with other resources. This would have a minor beneficial effect on cave and karst resources.

Special Designations

Wild and Scenic Rivers
Many of the planning area's known significant caves fall within the proposed WSR. If Congress denies the WSR nomination, management will retain current characteristics. Current management benefits cave resources by precluding development that has the potential to create erosion and habitat disruption.

Wilderness Study Areas
If Congress does not designate the WSAs as Wilderness, Alternative B WSA management would likely include prohibiting most surface-disturbing development. While the WSAs include seven percent of cave and karst formations, major surface- and subsurface-disturbing activities are not expected to occur in these areas. Therefore surface disturbance prohibitions in these areas would be a negligible benefit.

4.1.5.5. Alternative C

Cave and Karst Resources
Alternative C would include medium levels of protections for cave and karst resources. All surface- and subsurface-disturbing activities would be required to maintain buffers around significant cave entrances and passages. This would include all mineral exploration and development, timber harvest, and ROWs. Caves containing significant resources would be managed under a planning area cave management plan. Grazing would not be restricted in areas with cave and karst resources except in areas restricted under current management. These management actions would have a major beneficial effect on cave and karst resources by preventing erosion and habitat degradation.

Physical Resources

Soil
Cave and karst resources are associated with steep slopes, rock outcrops, and other sensitive soil types. Allowing activities that may cause erosion and habitat degradation in these areas would adversely impact cave and karst resources to a major degree.

Water Resources
Cave and karst resources often are present near water resources and riparian areas. While cave and karst areas overlap riparian areas by only four percent, the integral relationship between cave and karst resources and water elevates the potential impacts of any water-related management actions. Alternative C management actions allowing surface-disturbing activities within 500 feet of springs, perennial streams, and their associated riparian habitat would have a moderate adverse effect on cave and karst resources (e.g., erosion and habitat disruption).

Biological Resources

Vegetation – Riparian/Wetland Resources
Alternative C would allow surface-disturbing activities within 500 feet of springs and perennial streams. These actions would have a moderate adverse effect on cave and karst resources (see Water above).

Fish and Wildlife Resources – Fish
Cave and karst formations are created by the hydraulic and chemical processes of water eroding and reacting with sediment and rock. Cave and karst resources often are present near water resources and riparian areas. Surface-disturbing activities that impact the quality or flow of water in cave and karst areas could impact cave and karst resources. Allowing surface-disturbing activities near naturally occurring waterbodies would have a major adverse effect on cave and karst resources.

Fish and Wildlife Resources – Wildlife
A small portion of cave and karst areas are overlapped by big-game wintering areas. Management actions under Alternative C that allow surface-disturbing activities in big-game winter ranges would adversely impact cave and karst resources by potentially allowing erosion and habitat disruption. Allowing development in big-game winter ranges would have a minor adverse effect on cave and karst resources.

Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)
Large portions of cave and karst formation areas are overlapped by limber pine habitat. Amphibians, reptiles, and bats often utilize cave and karst resources. Allowing surface-disturbing activities may cause erosion and disruption and degradation of limber pine, amphibian, reptile, and bat habitat. Allowing surface-disturbing activities in limber pine, reptile, and bat habitat would result in major adverse effects.

Land Resources

Forest Products
Management actions under Alternative C include the sale of multiple forest products. The areas of potential harvest overlap with cave and karst areas by seven percent. However, most caves in the planning area are in terrain that does not allow for timber harvest. Therefore, adverse effects (erosion and habitat disruption) to cave and karst resources resulting from timber harvest would be negligible.

Renewable Energy
The southern Big Horn Mountains have excellent wind energy potential and contain most of the cave and karst resources in the planning area. Construction of wind farms in the southern Big Horn Mountains would likely impact cave and karst resources. While wind farms would not necessarily physically damage cave and karst areas, they would pose a significant risk to the bats that utilize these resources. Management under Alternative C would allow renewable-energy development throughout the planning area consistent with other resource values. This would have a major adverse effect on cave and karst resources.

Rights-of-Way and Corridors
Cave and karst resources are often found on steep slopes and highly erodible soils.
Any surface disturbance in these areas could potentially cause erosion and habitat disruption. Management under Alternative C would allow for ROW activity unless it is specifically excluded. However, the likelihood of significant ROW corridors occurring in cave and karst areas is minimal given the rugged topography where cave and karst resources occur. This would have a minor adverse effect on cave and karst resources.

Recreation
Alternative C provides for mineral leasing and other surface-disturbing activities in SRMAs. Any surface disturbance in these areas could potentially cause erosion and habitat disruption. Although the proposed SRMAs under Alternative C overlap cave and karst areas by only 0.5 percent, that 0.5 percent contains some of the planning area's significant caves. Designating the Middle Fork Powder River as a SRMA, but allowing surface-disturbing activities in the SRMA would have moderate adverse effect on cave and karst resources.

Lands with Wilderness Characteristics
Alternative C would follow management recommendations outlined in other resource areas in the RMP. Because lands with wilderness characteristics are completely included within a large and contiguous cave and karst formation area, Alternative C recommendations for cave and karst would be followed; this would result in moderate beneficial effects by reducing surface disturbance and habitat disruption.

Livestock Grazing Management
Under Alternative C, limiting or prohibiting livestock grazing where it is currently prohibited would have a minor beneficial effect on cave and karst resources by reducing surface disturbance and habitat disruption.

Special Designations

Wild and Scenic Rivers
If Congress denies the WSR nomination, management will follow the prescriptions outlined in Alternative C of this RMP. No special provisions will be made for the management of the river's free flowing characteristics or primitive values. If selected, Alternative C will potentially allow for the construction of a dam in Middle Fork Canyon, creating a large reservoir and destroying numerous significant caves. While Alternative C could remove major protections for the Middle Fork Canyon, the likelihood of Congress denying the WSR and development being proposed are low, therefore the adverse impacts are minor.

Wilderness Study Areas
If Congress does not designate the WSAs as Wilderness, Alternative C WSA

management would include allowing surface-disturbing development. While the WSAs include seven percent of cave and karst formations, major surface and subsurface disturbing activities are not expected to occur in these areas. Therefore allowing surface disturbance in these areas would be a negligible adverse effect.

4.1.5.6. Alternative D

Cave and Karst Resources
Alternative D includes adequate levels of protections for cave and karst resources.
Under Alternative D, all surface- and subsurface-disturbing activities would be required to maintain buffers around significant cave entrances and passages. This would include all mineral exploration and development, timber harvest, and ROWs. Caves with significant resources would be managed under a planning area cave management plan with cave-specific components. Grazing would only be restricted from the entrances to significant caves. These management actions would have a major beneficial effect on cave and karst resources.

Physical Resources

Soil
Under Alternative D, allowing surface-disturbing activities on soils with a severe erosion hazard; on slopes equal to or greater than 25 percent; and on miscellaneous soil types with approved reclamation and stabilization plans when soil resources objectives can be met would have minor beneficial effects.

Water Resources
Alternative D would allow surface-disturbing activities near springs, near perennial streams, and in riparian habitats when adequate protection is in place to prevent stream bank and soil erosion. While cave and karst areas overlap riparian areas by only four percent, the integral relationship between cave and karst resources and water elevates the potential impacts of any water-related management actions; the anticipated benefit of these actions is moderate.

Biological Resources

Vegetation – Riparian/Wetland Resources
Alternative D would allow surface-disturbing activities within 500 feet of springs and perennial streams when resource objectives can be met. While cave and karst areas overlap riparian areas by only four percent, the integral relationship between cave and karst resources and water elevates the potential impacts of any water-related management actions; the anticipated benefit of these actions is moderate.

Fish and Wildlife Resources – Fish
Fish management actions under Alternative D include allowing surface-disturbing activities within 0.25 mile of fish-bearing waterbodies when appropriately mitigated. Any disturbance that potentially allows erosion and habitat disruption will adversely impact cave and karst resources. However, if the surface disturbances are carefully mitigated no adverse impacts should occur. This would have a major beneficial effect on cave and karst resources.

Fish and Wildlife Resources – Wildlife
Management actions under Alternative D that prohibit surface-disturbing activities for the protection of wildlife would benefit cave and karst resources by preventing erosion and habitat

disruption. Some big game wintering areas overlap cave and karst resources. Prohibiting development in big game winter ranges would have a minor beneficial effect on cave and karst resources.

Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)
Large portions of cave and karst formation areas are overlapped by limber pine habitat. Amphibians, reptiles, and bats often utilize cave and karst resources. Allowing surface-disturbing activities in limber pine, reptile, and bat habitat would result in adverse effects to cave and karst resources by potentially causing erosion and habitat disruption. However, requiring site specific surveys to locate existing populations of special status species would also identify and protect cave and karst resources in the proposed project locations. These mitigating factors result in a minor beneficial effect under Alternative D.

Land Resources

Forest Products
Under Alternative D, the harvest of forest products in accordance with cave and karst resources protection would not disrupt habitat or cause erosion and will be a negligible benefit.

Renewable Energy
The southern Big Horn Mountains have excellent wind energy potential and contain most of the cave and karst resources in the planning area. Prohibiting development of renewable-energy projects in the southern Big Horn Mountains would have a major beneficial effect on cave and karst resources.

Rights-of-Way and Corridors
Cave and karst resources are often found on steep slopes and highly erodible soils.
Under Alternative D, avoiding surface disturbance on slopes equal to or greater than 25 percent and on highly erodible soils would prevent erosion and water degradation and would apply to most cave and karst areas. However, the likelihood of major ROW permits being issued in cave and karst areas due to difficult topography reduces the benefit to minor.

Recreation
Designation and management of cave and karst areas as SRMAs and not allowing surface-disturbing activities in those areas would have a major beneficial effect on cave and karst resources by preventing erosion and habitat disruption.

Lands with Wilderness Characteristics
Alternative D would prohibit most surface-disturbing activities on 6,864 acres of cave and karst areas to emphasize primitive recreation and natural values and would prevent erosion and habitat disruption. This would have a minor beneficial effect on cave and karst resources.

Livestock Grazing Management
Alternative D proposes limiting or prohibiting livestock grazing where it would not be compatible with other resources. This would have a minor beneficial effect by keeping livestock away from significant caves.

Special Designations

Wild and Scenic Rivers
If Congress denies the WSR nomination, management under Alternative D would continue to prohibit surface disturbing activities, a major beneficial effect.

Wilderness Study Areas
If Congress does not designate the WSAs as Wilderness, Alternative D WSA management would likely be the same as surrounding areas and allow most surface-disturbing development. While the WSAs include seven percent of cave and karst formations, major surface- and subsurface-disturbing activities are not expected to occur in these areas. Therefore surface disturbance prohibitions in these areas would be a negligible adverse effect.

4.1.5.7. Cumulative Impacts

A lack of past management decisions has adversely affected cave and karst resources. This RMP will provide management actions that will result in major beneficial effects on cave and karst resources. Little is known about cave and karst resources on private property in the planning area. The few known caves on private surface are strictly protected by the surface owners. Cave and karst resources across the planning area, on both public and private surface, are well protected through private regulation, future RMP management actions, and general difficulty of access.

4.1.5.8. Conclusion

Allowable uses and management actions described in this section for the alternatives A, B, C, and D were used to determine potential impacts to cave and karst resources. Alternative B would result in the fewest adverse effects on cave and karst resources because management actions under that alternative would result in the least amount of direct and indirect change to the quality and quantity of cave and karst resources. Therefore, Alternative B provides the greatest protection to cave and karst resources. Alternative A is largely consistent with current management, provides moderate levels of cave and karst resources protection, and would result in more adverse effects on cave and karst resources than Alternative B. Alternative D would result in fewer adverse effects on cave and karst resources than Alternative A, and significantly fewer than Alternative C. In ascending order from the least adverse to the most adverse impacts to cave and karst resources, the alternatives rank as follows: Alternative B, Alternative D, Alternative A, and Alternative C.

4.2. Mineral Resources

4.2.1. Locatable Minerals

The BLM manages locatable minerals, which are made available by the various mineral laws, such as the General Mining Law of 1872, as amended. Locatable minerals tend to be the uncommon varieties of minerals, including many metals (such as gold, silver, platinum, copper, and uranium), gemstones, and certain clays, among many others. All the historic and current locatable minerals mining development projects in the planning area are comprised of sodium bentonite (also called Wyoming-type bentonite, a very special clay) and uranium. This section describes potential effects on the locatable minerals resource and/or activities from management actions for other resources and other management programs. The *Locatable Minerals* section of Chapter 3 describes existing locatable minerals resource conditions, and likely trends during the planning period.

The Chapter 3 *Mineral Resources* section presents a discussion regarding the various mineral estate types, and which mineral classifications (Leasable, Locatable, and/or Salable) BLM administers for each major mineral estate type present in the planning area. That section also discusses how split estate lands, which are lands with different ownerships for the surface estate and mineral estate, are administered by BLM, and for which mineral classifications. The total federal locatable minerals resource in the planning area is comprised of all lands in which the federal government owns all minerals (on the Master Title Plats this is shown as "All Mins"), except those areas under the administration of USFS. However, BLM has surface management authority over only those lands containing both all federally owned mineral estate and BLM-administered surface estate. Therefore, although the total federal locatable minerals resource in the planning area is quite large, approximately 3,348,121 acres, the federal locatable minerals resource that BLM administers is much smaller, 777,310 acres. It is this smaller acreage that is analyzed below, as these are the only acres of the total federal locatable minerals resource in the planning area that BLM administers (see the *Mineral Resources* section in Chapter 3).

An unsuitability review was conducted at the planning area level. This review involved identifying areas within the planning area that may best serve the multiple resource use mission of the BLM by being designated as unsuitable for(and recommended for withdrawal from)mineral entry, in order to conserve or protect other resource values. Closure to (withdrawal from) or segregation from mineral entry for these areas is being (recommended).in lieu of designation of unsuitability. After an RMP or plan amendment in which lands are designated unsuitable for mineral entry (and/or closure to or segregation from mineral entry) is approved, the authorized officer shall take all necessary steps to implement the results of this review as it applies to locatable minerals. This would involve recommending the proposed withdrawals to the Secretary of the Interior for appropriate action pursuant to Section 204(a) of Federal Land Policy and Management Act (FLPMA). Withdrawals of 5,000 acres or more would necessitate compliance with the congressional notice provisions of Section 204(c) of FLPMA (43 United States Code [U.S.C.] 1714(c)). Areas that are petitioned for designation as unsuitable for mineral entry (or withdrawal/closure or segregation) shall receive public review and hearings as appropriate. The areas in the planning area identified in this RMP as unsuitable for mineral entry are listed in Table 4.30, "Current Areas Withdrawn From or Containing Restrictions On Mineral Entry under All Alternatives" (p. 820). The areas listed in Table 4.31, " Areas Recommended for Withdrawal from Mineral Entry under All Alternatives" (p. 820) are recommended for withdrawal from mineral entry on behalf of a number of other resources: Wildlife Resources, Cultural Resources, Paleontological Resources, Recreation (SRMAs), Lands with Wilderness Characteristics, and Special Designations (ACECs, WSAs, and WSRs). Each of these areas was recommended for withdrawal from mineral entry after careful consideration of all resource values known to be present in that area. Although these areas were recommended for withdrawal to conserve or protect more than one resource, a number of additional resources may also benefit from closure of these areas. For more information, see the main resource on whose behalf a given withdrawal from mineral entry was recommended, as listed in Table 4.31, " Areas Recommended for Withdrawal from Mineral Entry under All Alternatives" (p. 820).

4.2.1.1. Methods and Assumptions

This section describes the methods and assumptions used in the effects analysis for the locatable minerals resource. The *Locatable Minerals* section of Chapter 3 describes existing locatable minerals resource conditions. In general, the greater the number of acres affected, the greater the effect on the resource. Actions that limit, or impose restrictions upon, the acres of locatable

minerals resource open to mineral entry are considered adverse. Other actions may affect the accessibility to the locatable minerals resource, and these will likely lead to increased project costs by delaying operations or production, or making operations inaccessible during certain times of the year. However, these actions would not affect the locatable minerals resource itself, and are not discussed in detail. Actions that increase the acres of locatable minerals resource (those open to mineral entry) are considered beneficial. Also considered beneficial would be actions that would lead to a reduction in the number of acres currently under restrictions, reduced locatable minerals activities costs, increased opportunities for locatable minerals activities, and/or increased health and safety of workers and/or the general public in/near areas where these activities are occurring or are likely to occur.

Assumptions

The assumptions may include, but are not limited to:

- The occurrence of a locatable mineral does not imply that the mineral can be economically developed.
- Mineral occurrence potential includes both exploitable and potentially exploitable occurrences.
- The potential development activity for the locatable minerals uranium and Wyoming-type bentonite is moderate to high during the planning period.
- The potential development activity for other locatable minerals (e.g., gypsum, metallurgical-grade limestone, many metals and non-metals, gemstones, and Rare Earth Elements (REEs), among others) is low during the planning period.
- The development potential for the locatable mineral Wyoming-type bentonite is high in southwestern Johnson County.
- The development potential for the locatable mineral uranium is moderate to high in southwestern Campbell County and southeastern Johnson County.
- The potential for occurrence in commercial quantities of other locatable minerals (e.g., gypsum, metallurgical-grade limestone, gemstones, and many other metals and non-metals, including REEs and others) across the planning area is low.
- The administration of locatable minerals and related surface-disturbing activities would involve BLM cooperation with the Wyoming DEQ, as outlined in the current BLM Wyoming DEQ MOU for locatable minerals. This MOU (dated November 19, 2003) is entitled "Supplement to MOU No. WY-19 between the DOI, BLM, and the Wyoming DEQ, LQD, for Management of Surface Mining and Exploration for Locatable Minerals on Public Lands" (DOI and State of Wyoming 2003).
- The locatable minerals resource discussed and analyzed in this document consists of only those acres of mineral ownership type "All Mins" for only those lands also having BLM surface ownership (see the *Mineral Resources* section in Chapter 3). Not included are lands in the Bighorn National Forest and the Thunder Basin National Grasslands, as the USFS administers the locatable minerals resource on those lands. Also not included are lands under Department of Defense jurisdiction (e.g., the lands attached to the Veteran's Hospital northwest of Sheridan), as the mineral estate of those lands was transferred to the Department of Defense.
- Notice-level operations do not require approval from the BLM (i.e., no federal action is required). However, such operations are still bound by statutory requirements, including the ESA, the NHPA, and the requirement under the FLPMA and 43 CFR 3809.5 to prevent unnecessary and undue degradation of public lands.
- Development of locatable minerals resources may or may not involve BLM, but must involve only active mining claims. Federally owned locatable minerals resource in lands with BLM surface (the resource analyzed here) is developed through BLM-approved actions

(see the *Mineral Resources* section in Chapter 3). Development of federally owned locatable minerals resources in lands with private or state surface are approved and handled by those entities. However, if an operator cannot obtain the private surface owner's written consent on Stock Raising Homestead Act or certain other lands, BLM will administer the surface estate according to regulations in 43 CFR 3809 for surface-disturbing activities (in accordance with 43 CFR 3809.31). The administration of mineral estate in other lands, including those that have been sold, transferred, or acquired by the federal government, may operate differently (see 43 CFR 3800). For lands where BLM owns the surface estate but not the mineral estate, the mineral estate owner would administer the locatable minerals on those lands; this is extremely uncommon in the planning area, and no projects involving this type of situation are known to currently exist here. Operations not involving BLM are still subject to all appropriate statutory and regulatory requirements.

- Any alternative that restricts locatable minerals activities (mining claim location, exploration, and development) would have some adverse effect on the potential use of the locatable minerals resource.
- Restrictions on the locatable minerals resource (acres open to activities) and/or activities (mining claim location, exploration, and development) apply for the duration of the planning period. However, there could be changes through RMP amendments or changes in regulations.
- Only a few management actions under the alternatives could affect the locatable minerals resource (acres open to locatable minerals activities). These would involve either withdrawing or segregating areas from mineral entry (operation under the mining laws). These actions (withdrawal or segregation) would close those areas to all locatable minerals activities (mining claim location, exploration, and development), subject to valid existing rights.
- Numerous management actions could place restrictions (e.g., timing limitations on certain activities to decrease effects to wildlife) or requirements (e.g., management of topsoil or reclamation activities) on surface-disturbing activities, therefore possibly affecting locatable minerals projects (exploration and development). These restrictions or requirements might increase project costs, but would not affect the available (open) acres of locatable minerals resource, as restrictions can only be imposed to meet the performance standards at 43 CFR 3809.420 for avoiding unnecessary and undue degradation. The WSAs are managed to maintain the suitability of these areas while still under review by Congress regarding their formal designation. They are open to mineral entry, but such activities must be performed so as to not impair their suitability (per 43 CFR 3802), and thus have certain restrictions on locatable minerals activities.
- Except in areas withdrawn or segregated from mineral entry, mining claimants (as defined in 43 CFR 3830.3 and 3830.5) have an inherent right to locate claims, explore, and mine. The BLM cannot revoke this right.

Significance Criteria

In addition to the scale of effects identified above, an adverse effect on the locatable minerals resource as a result of management actions would be considered potentially significant if any of the following were to occur:

- An action would violate objectives associated with locatable minerals resource management (including the *General Mining Law of 1872*, as amended), and its magnitude would be such that special mitigation would be warranted.
- An action would violate the decisions, resolutions, and goals outlined in the current BLM Wyoming DEQ MOU for locatable minerals activities, and its magnitude would be such that special mitigation would be warranted.

- An approved locatable minerals project (an accepted Notice or approved Plan of Operations (POO)) became restricted to the point it would not be feasible to continue operations.
- An approved locatable minerals project (an accepted Notice or approved POO) became restricted to the point it would not be feasible to begin operations.
- New opportunities for locatable minerals exploration and/or development on BLM-administered lands would be substantially reduced.

4.2.1.2. Impacts Common to All Alternatives

This section summarizes management actions common to all alternatives and the likely resulting effects on the federal locatable minerals resource and activities during the planning period due to their implementation. The acres of locatable minerals resource that could be affected, and the percent of the locatable minerals resource those acres represent, indicate the likely possible maximum that would be affected by the given management actions; the actual acres affected could be fewer.

Locatable Minerals
All lands in the planning area not formally withdrawn or segregated from mineral entry (locatable minerals activities) are open to the location of mining claims, and the exploration and development of locatable minerals. The entire resource remains open (777,310 acres, 100%). These acres do not include the three areas already withdrawn from mineral entry (the three WHMAs totalling 11,373 acres, see Table 4.30, "Current Areas Withdrawn From or Containing Restrictions On Mineral Entry under All Alternatives" (p. 820), which were withdrawn on behalf of wildlife resources (see *Wildlife*, below).

Physical Resources

Air Quality
Air quality management actions include implementing mitigation measures, such as dust suppression and cooperative efforts, to reduce dust emissions. These actions could require ongoing monitoring for compliance, which would have a negligible adverse effect on locatable minerals projects through increased costs.

Soil
Soils management actions include an onsite evaluation of proposed projects, mitigation of possible adverse effects on soils, and site-specific reclamation plans. These actions would have a negligible adverse effect on locatable minerals projects through increased costs, for potential additional soil-handling and reclamation steps, and/or amending project site areas or access routes.

Water Resources
Water management actions include managing surface-disturbing activities to prevent degradation of water quality, managing water to meet Wyoming Standards for Healthy Rangelands, and reducing channel and bank erosion. Similar types of mitigation measures are already required for Wyoming DEQ LQD Mine Permits, which are required for locatable minerals development projects. Increased project costs may occur; an overall negligible adverse effect.

Cave and Karst Resources
The cave and karst resources management actions common to all alternatives will not affect the locatable minerals resource or activities.

Mineral Resources

Nearly the entire planning area is available for exploration and development of locatable, leasable, and salable minerals. Existing and future mining of minerals in areas currently open and to become open to those activities could affect the locatable minerals resource by increasing the acres where conflicts with other minerals projects might occur. However, multiple mineral resource uses in the same area are not always physically incompatible. Most potential incompatibility issues would likely result from differences in timing between the projects. This would likely result in increased project costs for one or both projects, due to delays in approval as timing issues are worked out between proponents. If timing cannot be worked out satisfactorily, it is likely one or more proponents would pursue similar projects in another or nearby area, depending on the particular projects they are pursuing.

Leasable Minerals – Coal
Federal coal lands identified as acceptable for further coal leasing consideration, via the April 2001 RMP Revision (BLM 2001a), are available for Lease by Applications (LBAs), lease modifications, emergency leases, and exchanges; potential effect is major adverse (115,372 acres, 15%). However, very little of these acres contain known potentially exploitable occurrences of locatable minerals; the potential effect is likely to be much smaller. Also, coal exploration, leasing, and development do not close any of these lands to mineral entry. Most impacts would likely consist of increased projects costs due to delays and temporary inaccessibility to some sites; effect is likely to be negligible adverse.

Leasable Minerals – Fluids
Effects on locatable minerals projects could be up to minor adverse (20,955 acres, 2.7%) by opening all unleased federal fluid mineral estate to leasing. However, the areas where locatable minerals development would most likely occur during the planning period have moderate to low development potential for oil and gas. Geothermal energy development potential in the planning area is low; therefore, conflicts with this resource are not likely during the planning period. Overall, negligible adverse effects are likely.

Salable Minerals
All lands are open to salable minerals activities except those closed to them. The two main areas where locatable minerals projects are currently developed also contain potentially exploitable salable minerals. However, it's unlikely salable minerals will be sought to be developed in these areas during the planning period as they are plentiful elsewhere. Therefore, the potential effect is likely to be negligible adverse.

Fire and Fuels Management

Fire and fuels management actions could result in increased costs for some locatable minerals projects by temporarily limiting access to certain areas. However, these effects will likely be of short duration, small in areal extent, occur only occasionally, and affect very few projects (negligible adverse).

Biological Resources

Vegetation – Forests and Woodlands
There are no management actions common to all alternatives for forests and woodlands.

Vegetation – Grassland and Shrubland Communities
To reduce effects on grasslands and shrublands, which cover most of the planning area, locatable minerals projects and access roads may need to be sited or redesigned to reduce adverse effects to vegetation. This would increase project costs; a negligible adverse effect.

Vegetation – Riparian/Wetland Resources
To reduce effects on riparian and wetlands areas, which are not uncommon in the planning area, locatable minerals projects and access roads may need to be sited or redesigned to prevent the degradation, loss, or reduction of these resources. Similar types of mitigation measures are already required for Wyoming DEQ Mine Permits, which are required for locatable minerals development projects. Increased project costs likely to result; an overall negligible adverse effect.

Invasive Species and Pest Management
Locatable minerals projects would be recommended to limit surface disturbance to prevent weed spread, required to use certified weed seed-free products during reclamation, and treat reclaimed areas for invasive species, all likely to increase project costs. However, as these treatments should limit the spread of undesirable species, and assist in achieving more successful reclamation, proponents could see decreased overall project costs through avoidance of some planned or additional expenses, resulting in an overall negligible beneficial effect.

Fish and Wildlife Resources – Fish
Barriers to fish passage and activities potentially affecting native and desirable non-native fish species are to be managed with WGFD and other stakeholders. Increased project costs through redesign of water crossings are possible; negligible adverse.

Fish and Wildlife Resources – Wildlife
A number of management actions may lead to temporary inaccessibility to, and/or increase project costs in, certain areas: maintain or improve important wildlife habitats through various treatments and methods; consult with WGFD when applying mitigation, and before waiving, allowing exceptions to, or modifying wildlife-related land use restrictions and mitigation; provide, to the extent possible, suitable habitat and forage to support WGFD (and sometimes BLM modified) wildlife population objectives; manage access to protect crucial habitats; utilize current research, management and conservation plans, and other documents to guide wildlife habitat management; construct new fences to avoid adverse effects to wildlife; work with the WGFD in augmentation and/or reintroduction programs for acceptable wildlife species in suitable habitats; promote maintenance and improvement of habitat for migratory birds of conservation concern consistent with national, regional, and statewide conservation priorities. Overall negligible adverse.

Special Status Species – Plants
Implement actions in recovery plans, conservation measures, terms and conditions, and BMPs, and reasonable and prudent measures within biological opinions for threatened and endangered (T&E) plant species. Allow treatments within habitat and known populations proven to benefit the species. These management actions may temporarily or permanently affect access to, and/or increase project costs in, certain areas. Overall likely negligible adverse effect.

Special Status Species – Fish
A number of management actions may lead to temporary or permanent inaccessibility to, and/or increase project costs in, certain areas: Require modification of projects that may affect Special Status Species (SSS) fish; require the BLM to assist in the restoration, reintroduction, augmentation, or reestablishment of SSS fish populations and habitats; implement actions in recovery plans, conservation measures, terms and conditions, and BMPs, and

reasonable and prudent measures within biological opinions for T&E fish species. Overall likely negligible adverse effect.

Special Status Species – Wildlife (including Greater Sage-Grouse)
A number of management actions may lead to temporary or permanent inaccessibility to, and/or increase project costs in, certain areas: utilize current research, management, and conservation plans and similar related documents to guide SSS wildlife habitat management; implement actions in recovery plans, conservation measures, terms and conditions, protection measures, and appropriate BMPs, and reasonable and prudent measures within biological opinions for T&E wildlife species; maintain seeps, springs, wet meadows, and riparian vegetation in a functional diverse condition for young Greater Sage-Grouse and other species that depend on forbs and insects associated with these areas; restore Greater Sage-Grouse brood-rearing habitats in wetland/riparian areas; manage vegetation composition, diversity, and structure to achieve Greater Sage-Grouse habitat management objectives; minimize disturbance that would alter springs and riparian Greater Sage-Grouse habitat, and develop water sources to replace affected or destroyed natural sources; and design water facilities and fences to reduce effects to Greater Sage-Grouse and habitat. Year-round disturbance-free buffer of known active bald eagle nests (329 acres, 0.04%), and seasonal limited access buffer of known active nests (1,366 acres, 0.18%). Some of these areas fall within areas likely to be developed for locatable minerals. Likely overall negligible adverse effect.

Heritage and Visual Resources

Cultural Resources
Maintain and develop relationships with tribes to identify resources important to them and manage these resources to minimize disturbance are the common to all management actions that would affect locatable mineral development. The likely effect would be negligible adverse, as some projects may have increased costs for some projects due to needing to adjust project areas, and also due to some temporary inaccessibility to some project areas.

Paleontological Resources
Retaining public lands with significant paleontological resources would also mean retention of locatable minerals acres. However, as these lands would likely be recommended to be avoided to conserve the paleontological resource, this may result in amending of some project areas; likely overall negligible adverse effect.

Visual Resources
Locatable minerals activities in areas with established VRM classifications would need to conform to the facility siting and design criteria for that classification, thereby blending with the surrounding landscape. Areas with no previously-established visual resource inventory (VRI) rating would be managed to match surrounding VRM classification. Mitigation for adverse effects on visual resources would increase costs for some locatable minerals projects in areas of certain VRM classifications (mostly II, and sometimes III); a likely negligible adverse effect.

Land Resources

Forest Products and Renewable Energy
There are no management actions common to all alternatives for Forest Products or Renewable Energy that would affect the locatable minerals resource or activities.

Lands and Realty
Management actions include the prohibiting of subsequent uses of Recreation and Public Purpose (R&PP) lands if not compatible with that authorization, withdrawals or segregations of surface and/or mineral lands, disposing of lands meeting certain criteria, and modifying, revoking, or terminating certain withdrawals and segregations. Many of these actions could effect the acres of, or restrictions on certain acres of, the locatable minerals resource. Certain withdrawals would result in permanent decreases in the acres of locatable minerals resource. It is likely that more lands will become closed (withdrawn or segregated) to locatable minerals activities due to such actions; minor adverse effect is likely.

Rights-of-Way and Corridors
Management actions include siting new ROWs adjacent to existing disturbances to minimize surface disturbance, which may necessitate modifying the siting of some roads and access routes. ROW for locatable minerals projects are very uncommon: most locatable minerals project-related uses of many areas of BLM surface in/near areas being explored or mined would qualify as legitimate occupancy under 43 CFR 3809 and 3715, making the need for a ROW for those projects unnecessary. Likely a negligible adverse effect, due to possible increased costs for extremely few projects.

Travel and Transportation Management
Management actions include minimizing surface disturbance and erosion, closing roads temporarily or permanently where resource damage is occurring, reclaiming roads if they are heavily eroded, and prohibiting motorized travel if soils would be damaged. These actions may necessitate redesigning and/or reconstructing all or portions of certain roads, and restricting use of certain roads during certain time periods. All these actions would result in increased costs for some projects; as this is not likely to be common, an overall negligible adverse effect is likely.

Recreation
Recreation management actions include allowing dispersed recreation and casual use of public lands throughout the planning area, and minimizing noise and light pollution. More dispersed recreation will result in more vehicles and people travelling across and/or temporarily occupying public lands. This would increase potential hazards to the safety of the public in general, and some project operators. Approximately 20–25 percent of the lands in current authorized locatable minerals projects are BLM surface lands, and several operators must cross other BLM surface lands to access their project sites. This potential increased traffic at some project sites may lead to increased soil compaction, erosion, and/or trash and waste, also leading to increased operational and reclamation costs for these project proponents. Minimization of noise and light pollution near recreation facilities will likely lead to increased costs for some locatable minerals projects. Not likely to affect more than a few projects; overall effect likely to be minor adverse.

Lands with Wilderness Characteristics
Evaluating newly acquired lands and other parcels meeting size and naturalness requirements for wilderness characteristics could temporarily preclude these lands from experiencing locatable minerals activities. This restriction may be become permanent for any such designated lands that become officially withdrawn from mineral entry. However, as all lands in the planning area have already been evaluated (see Alternative B), and acquired lands are not open to mineral entry, the likelihood of any further lands (existing or newly acquired) in the planning area meeting such characteristics is extremely low; negligible adverse effect likely.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock, possibly resulting in short-term loss of grazing resources in relatively small areas. This loss will likely be very small, and will be reversed upon completion of reclamation. Costs for some locatable minerals projects will increase due to fencing costs; an overall negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
Currently, there are no designated ACECs in the planning area. However, should any ACECs be designated with the implementation of this RMP revision, management actions common to all include evaluating BLM-authorized activities and developing mitigation to protect the integrity of the characteristics for which the ACECs were designated. As approximately half the authorized and pending locatable minerals projects occur in or near potential ACECs, this management will likely increase costs or restrict certain activities for those projects. However, until particular ACECs are designated, it is difficult to accurately predict the likely impact. Potentially up to a major adverse effect.

Scenic or Back Country Byways
Currently, there are no designated byways in the planning area. However, should any byways be designated after this RMP revision is approved, management actions common to all include managing byways with the objective of protecting the resource values of the area. Such designation likely will not involve instituting any restrictions to size, frequency, or timing of large truck traffic, or the institution of a viewshed buffer along the byway within which few or very select disturbances may occur. Although approximately 50 percent of current authorized and pending locatable minerals projects utilize, or are near, the roads that have been identified as potentially being designated as byways, there will likely be no effect.

Wild and Scenic Rivers
Currently, there are no designated WSRs in the planning area. Management actions common to all include continuing to implement the Manual 6400 – *Wild and Scenic Rivers* for the one proposed WSR (2,664 acres, 0.34%), which involves restricting surface disturbance within that area until Congress acts on the designation. Although some metallurgical-grade limestone is known to occur in this area, it is not likely to be an exploration or development target due the rugged terrain and long distance to market; such material can be found in other areas much easier to access and/or closer to market. In addition, Congress is not expected to act during the planning period. Negligible adverse effect.

Wilderness Study Areas
Currently, there are three WSAs in the planning area (28,931 acres, 3.72%). Management actions common to all include continuing to implement the *BLM Manual 6330 - Management of Wilderness Study Areas* for these WSAs, which includes restriction on certain locatable minerals activities in these areas (per 43 CFR 3802) until Congress acts on these proposals. As Congress is not expected to act during the planning period, and the BLM's recommendation is to not officially designate these areas, these areas will remain restricted from only certain locatable minerals activities, not closed to mineral entry. None of these areas are known to contain commercial amounts of locatable minerals, and are therefore unlikely targets for exploration or development activities. The effect is likely negligible adverse.

Socioeconomic Resources

Social and Economic Conditions
The BLM will utilize local and state socioeconomic plans, quantify socioeconomic effects where possible, and manage in consideration of the fact that BLM actions are integrally connected with the socioeconomic and cultural health of the planning area. Effects on locatable minerals projects would likely be increased costs; negligible adverse.

Health and Safety
Health and safety management actions seek primarily to ensure proper health and safety measures are included in mine plans, including proper procedures for handling spills and releases of hazardous substances. Waste minimization practices are encouraged, including reusing, recycling, and substituting when appropriate. Effects to locatable minerals projects would likely be increased costs; however, many of these measures are already included in their Wyoming DEQ Mine Permits, so few additional expenses would be likely. The resulting increases to the health and safety of the public, and those very few affected operators, is incalculable though. Overall negligible beneficial.

4.2.1.3. Alternative A

This section summarizes management actions under Alternative A, which is the continuation of current management, and the likely resulting effects on the federal locatable minerals resource and/or activities during the planning period due to their implementation.

Locatable Minerals
Currently, there are three WSAs, totaling 28,931 acres (3.72%), in the planning area where certain locatable minerals activities are allowed while these areas are under Congressional review. This leaves 748,379 acres (96%) open to mineral entry with certain restrictions, per 43 CFR 3802. See *Special Designations – Wilderness Study Areas* below for discussion of their impact.

Physical Resources

Air Quality
The requirement for analysis of anticipated effects of proposed activities on air quality, and modeling on a project-specific basis, would likely increase locatable minerals project costs; a negligible adverse effect.

Soil
Soils management actions include prohibitions on surface-disturbing activities on slopes equal to or greater than 25 percent (170,590 acres, 22%), in areas with poor reclamation suitability (455,090 acres, 58%), and seasonally in areas of severe erosion hazard (215,496 acres, 28%); all these prohibitions have provision for waivers, however. Prohibitions also on surface-disturbing activities have been applied on a project-specific basis for areas of LRP, such as badlands, rock outcrops, biologic crusts, and slopes susceptible to mass wasting (218,928 acres, 28%). Topsoil is to be salvaged during project activities and reapplied during reclamation. Approximately 50 percent of BLM surface lands within currently authorized and pending locatable minerals projects occur in areas containing rock outcrops and/or steep slopes. Rock outcrops and steep slopes are typical targets for location of mining claims, and exploration and development activities, as these areas tend to reveal and expose geology that is often hidden elsewhere (sometimes close by) under overlying soil and/or rock layers. As the RFA for locatable minerals is that 556 acres of the federal locatable mineral resource that BLM administers are expected to be disturbed during the planning period (0.07%), the effect will likely be higher, and due almost

entirely to increased costs associated with potential additional topsoil handling and reclamation requirements; likely effects are negligible adverse.

Water Resources
Prohibition on surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams may have up to a minor adverse effect (19,861 acres, 2.5%). However, some mitigation measures regarding these features are already required for Wyoming DEQ Mine Permits. In addition, as these areas are usually undesirable for locatable minerals projects due to such areas' inherent issues, and other considerations (such as grazing), much of this restriction is actually already taken into account when sites are selected. In addition locatable minerals RFA is 554 acres of disturbance (0.07%); a negligible adverse effect is likely.

Cave and Karst Resources
Prohibitions on surface disturbance within a buffer around significant cave entrances may be applied on a project-specific basis (up to 11 acres, less than 0.01%); however, none have affected locatable minerals projects. No locatable minerals projects exist in these areas, and the likelihood of any being proposed here is quite low; although some metallurgical-grade limestone is known to occur in these areas, the terrain is generally rugged, and these areas are some distance from where the materials might be used or sold. These factors would very likely increase mining and transportation costs beyond economic feasibility, and this resource can be mined in many other areas economically. Low probability of projects and possible increased project costs from redesigning or amending project sites. In addition, locatable minerals RFA is for 554 acres (0.07%); negligible adverse.

Mineral Resources

Leasable Minerals – Coal
The RFA for coal projects is 195,700 acres, and 554 acres for locatable. If these two resources conflicted over all 554 acres, which is unlikely as commercial quantities of locatable minerals are typically found elsewhere in the planning area, none of these lands would be closed, withdrawn, or segregated from mineral entry; negligible adverse.

Leasable Minerals – Fluids
Although fluid mineral development could conflict with a large percentage of the locatable minerals resource, those areas most likely to experience exploration and development for locatable minerals have mostly moderate to low potential for oil and gas development. The RFA for oil and gas projects is that 10,575 acres will be developed; 554 acres for locatable minerals projects. Even if there were conflicts between the two resources over all 554 acres, none of these lands would be closed, withdrawn, or segregated from mineral entry; negligible adverse. Geothermal energy development potential in the planning area is low, therefore, conflicts with this resource are not likely during the planning period.

Salable Minerals
The RFA for salable minerals is 530 acres, and locatables is 554. Even if there were conflicts between the two resources over all 530 acres, no lands would be closed, withdrawn, or segregated from mineral entry; negligible adverse effect.

Fire and Fuels Management

Inadvertent damage to property and facilities or temporary access limitations to locatable minerals project sites could occur during fire suppression or prescribed fire activities. Such effects likely would be of short duration, small in areal extent, and occur only occasionally. These limitations may increase project costs for a relatively few projects.

Biological Resources

Vegetation – Forests and Woodlands
Timber harvest and other vegetative treatments may temporarily limit access to certain locatable minerals project sites. However, such limitations would likely be of relatively short duration, small in areal extent, and occur only occasionally, and relatively few areas with known commercial quantities of locatable minerals occur in or near wooded areas. Project costs would likely increase, but for relatively few projects; negligible adverse.

Vegetation – Grassland and Shrubland Communities
Use of non-native species in reclamation seed mixtures has been approved on a project-specific basis. The BLM reclamation policy allows the use of non-native species; a primary goal of reclamation is soil stabilization, and vegetation species are chosen towards that end. Changes in seed mix may increase project costs; however, more successful reclamation would likely lead to minimization of reclamation costs. Overall, the effect may likely be negligible beneficial.

Vegetation – Riparian/Wetland Resources
Prohibitions on surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams may affect up to 23,831 acres (3.07%); however, this prohibition can be waived. In addition, some mitigation and avoidance measures for such areas are already required for Wyoming DEQ Mine Permits, and many of these areas are already avoided due to their inherent issues. Negligible adverse effect likely.

Invasive Species and Pest Management
Invasive species and pest management actions could include areas treated and/or species-specific treatment strategies, applied on a project-specific basis to public lands. These treatments may increase locatable minerals project costs due to temporary access delays to project sites. However, successful treatments will likely also decrease the spread of undesirable species, resulting in likely lower planned project expenses or avoidance of additional project costs; negligible beneficial.

Fish and Wildlife Resources – Fish
Project-specific prohibitions on surface-disturbing and disruptive activities within 0.25 mile of naturally occurring water bodies containing acceptable fish species could result in an adverse effect to locatable mineral development (51,745 acres, 6.66%). Maintenance of reservoirs and riparian areas to enhance potential fisheries could have a negligible adverse effect. Other restrictions may also apply which will likely increase project costs. However, these areas will likely be avoided for locatable minerals development; Wyoming DEQ Mine Permits should already include mitigation to avoid some of these areas. Overall negligible adverse, due to likely increased project costs.

Fish and Wildlife Resources – Wildlife
Wildlife management actions include a number of distance and/or timing limitations or prohibitions on surface disturbance and occupancy in certain areas and habitats, and all will have adverse effects: year-round within the three big game WHMAs (4,583 acres, 0.59%); within 0.5 mile of big game migration corridors (9,587 acres, 2.00%), within 750 feet of sharp-tailed grouse

leks (940 acres, 0.12%), and within the biologic buffer of active raptor nests (255,129 acres, 33%); seasonally within elk crucial winter range and calving areas (75,175 acres, 9.67%), and, within 0.64 mile of sharp-tailed grouse leks (7,607 acres, 0.98%). Other restrictions may also apply which will likely increase project costs, such as no removal of elk security habitat (132,148 acres, 17%). Approximately 25 percent of BLM surface lands within locatable minerals projects occur in/near these areas. The likely effect will be negligible adverse, from increased project costs due to amending project designs and/or areas and delays.

Special Status Species – Plants
Project-specific restrictions to protect SSS plants would have an adverse effect on the locatable minerals resource (126,811 acres of suitable habitat on BLM surface, 16%). Surface-disturbing activities would avoid SSS plant populations, leading to adjustments of some project sites and/or access roads, or temporary inaccessibility to sites. SSS plants have very specific habitat requirements and therefore tend to occur in small areas, and with an RFA of 554 acres for locatable minerals, overall likely effect is negligible adverse.

Special Status Species – Fish
Year-round project-specific restrictions to protect SSS fish (within 0.25 mile of any waters containing SSS fish) may have a negligible adverse effect (818 acres, 0.10%). Other restrictions may also apply which will likely increase project costs. Overall negligible adverse.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Measures to protect SSS wildlife include a number of distance and/or timing restrictions or prohibitions for certain areas and habitats, and all will have an adverse effect on the locatable minerals resource: within prairie dog colonies (6,156 acres, 0.79%); near Greater Sage-Grouse strutting grounds (year-round restricted [0.25 mile] – 3,594 acres, 0.46%; seasonally prohibited [2 miles] – 203,724 acres, 26%); near bald eagle winter roosts, hunting, and concentration areas (year-round – 402 acres, less than 0.05%; seasonally – 3,013 acres, 0.4%); near raptor nesting areas (17,345 acres, 2.2%). Other restrictions may also apply which will likely increase project costs. Approximately 25 percent of locatable minerals projects occur in or near these areas, and with an RFA of 554 acres for locatable minerals projects, the likely effect will be negligible adverse.

Heritage and Visual Resources

Cultural Resources
Prohibitions of surface-disturbing activities within 0.25 mile or visual horizon of portions of the Bozeman Trail and Crazy Woman Battle Site could affect the locatable minerals resource (3,588 acres, 0.46%). Project-specific prohibitions on surface-disturbing activities in certain areas containing historic properties or sensitive or sacred sites (such as TCPs, which includes the Pumpkin Buttes TCP) may adversely affect locatable minerals development. Other project-specific requirements (such as archeological and/or Native American monitors) would likely increase locatable minerals project costs. Many of these areas are already protected to a certain degree by other means; however, many will only be discovered through surface-disturbing activities. Also, locatable mineral deposits are plentiful in other areas, and some projects can be mitigated or redesigned to reduce impacts. The likely up to minor beneficial effect to Cultural Resources (due to new discoveries of Cultural Resources) will mostly offset the likely negligible adverse effect to locatable minerals activities.

Paleontological Resources
Project-specific prohibitions in areas identified as containing paleontological resources of high quality or importance may have a negligible adverse effect (860 acres, 0.11%). Other project-specific requirements (such as paleontological field surveys) would likely increase locatable minerals project costs. Similar to Cultural Resources, the up to negligible beneficial effect to Paleontological Resources (due to new discoveries through surface-disturbing activities), will be mostly offset by the negligible adverse effect to the Locatable Minerals Resource (due to prohibitions); negligible adverse effect likely.

Visual Resources
Locatable minerals activities in areas with established VRM classifications would be required to conform to the objectives and characteristics of that classification, especially regarding the siting and design of facilities. Areas with BLM surface not rated will be managed to conform to the surrounding classification. Other project-specific requirements (such as visual simulation and mitigation design) may be applied. These limitations and requirements would likely increase project costs, with likely a negligible adverse effect.

Land Resources

Forest Products
Management actions include the sale of forest products, and fencing of regeneration areas. Some portion of the forest product-related activity is predicted to occur on BLM-managed woodlands and noncommercial forestlands. These activities may temporarily limit access to certain locatable minerals projects; such limitations would likely be temporary, small, and occasional. As relatively few locatable minerals projects occur in/near wooded areas, and with an RFA of 554 acres, the likely effect would be negligible adverse.

Lands and Realty
Land tenure adjustments may occur on behalf of other resources and even other agencies, and these could increase or decrease BLM surface and/or federal mineral acres. Neither increasing BLM surface acres nor federal mineral acres would increase the locatable minerals resource, (both the total resource, and the BLM-administered portion of there source), as acquired lands are not open to mineral entry (locatable minerals activities). Decreasing BLM surface acres or federal mineral acres might decrease the locatable mineral resource (total resource, and BLM-administered portion), depending on the types of mineral ownerships of the lands involved. Lands identified for acquisition are those adjacent to large blocks of BLM surface and in areas of high recreational potential (118,254 acres, 15%), while lands identified for disposal include those with agricultural potential or water (76,223 acres, 9.81%) and small isolated parcels (totaling 120,722 acres, 15%). It is extremely difficult to predict exactly which land tenure adjustments will occur during the planning period: exchanges and sales are usually initiated by those parties interested in obtaining those lands; donations are typically initiated by the donors; and, acquisitions are often initiated by the sellers, or by BLM in response to an eminent need. In addition, such land tenure adjustments can take a number of years to complete. The identified acquisitions and disposals, should they all occur during the planning period, would lead to an overall decrease in the locatable minerals resource (78,691 acres, 10%). As discussed, it is much more likely that much fewer acres will be affected, however; overall, likely up to minor adverse effect.

Renewable Energy
Approved renewable-energy projects on public lands would result in segregations of those

acres from mineral entry, removing those acres from the locatable minerals resource. Some renewable-energy projects will be long-lived, and others not as long lived, and some may not be incompatible with certain locatable minerals activities. Those lands segregated would be made open again after the renewable-energy site is released from the segregation. Although no renewable-energy projects on public lands in the planning area have been received to date, it is predicted that 20,000 acres (2.57%) of BLM surface will be disturbed during the planning period for these projects. Only approximately 15-25 percent of the acres currently identified as most likely to be developed for renewable energy projects are in areas likely to be developed for locatable minerals projects, in/near the Southern Big Horn Mountains. Renewable energy projects are not likely to be approved in these areas, however (see Chapter 3, *Renewable Energy* section). Although the locatable minerals RFA is just 1,256 acres (0.16%), the level of impact from renewable energy could be up to that total amount (20,000 acres, 2.57%). However, it is more likely that much fewer acres will be affected; minor adverse effect.

Rights-of-Way and Corridors

Some proposed ROW (for roads, access routes, and/or facilities) may need to be modified to be placed within existing ROW, and away from major transportation routes. The RFA for ROWs is 38,762 acres, and that for locatable minerals is 556 acres, and conflict over all 556 acres would be a negligible adverse impact (0.07%). In addition, ROWs for locatable minerals projects are extremely rare (see *Impacts Common to All Alternatives*), so any ROWs issued for such uses would likely be very few and likely only to increase costs for very few projects. No CCS projects have been received for public lands in the planning area to date. It is likely that some will be, as the current political climate appears to favor this type of action for managing GHGs, and much of the planning area contains geological formations currently believed to be amenable to these projects. Current management direction is to approve these as Land Use Application Permits (see the *Geological Resources* section in Chapter 3). Impacts from these types of permits could be up to the total locatable minerals resource (777,310 acres, 100%). However, as these projects will likely take some time to approve due to their complexity and the current financial climate, it is much more likely that the effect will be minor adverse.

Travel and Transportation Management

A number of area-specific restrictions to motor vehicle use, seasonally or year-round, may increase locatable minerals project costs for project proponents. However, these areas would not be completely inaccessible for exploration as a number of activities can be performed without motorized vehicles, a negligible adverse effect is likely.

Recreation

No SRMAs are proposed under Alternative A, although surface disturbance would be prohibited within 0.5 mile of the Dry Creek Petrified Tree EEA. However, there are no known commercial deposits of locatable minerals within the EEA, and given an RFA of 554 acres (0.07%) for locatable minerals, an overall negligible adverse effect is expected.

Lands with Wilderness Characteristics

Acquired lands would be evaluated for wilderness characteristics. It is unlikely any acquisitions would contain wilderness characteristics, and acquired lands are not open to mineral entry. No effect.

Livestock Grazing Management

Temporarily fencing off of some areas being explored and/or mined might be needed to protect livestock. Locatable minerals project costs may increase; an overall negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
There are presently no ACECs or Byways designated, and none are proposed under Alternative A; therefore, no effect.

Wild and Scenic Rivers
There are no Alternative A management actions for WSR that would result in an effect.

Wilderness Study Areas
Currently, there are three areas in the planning area where locatable minerals activities are restricted while under Congressional review: the WSAs, totaling 28,931 acres, (3.72%). As Congress is not expected to act during the planning period, and the BLM's recommendation is to not officially designate these areas, these areas will remain open to certain locatable minerals activities. However, such activities must comply with the regulations at 43 CFR 3802, which have stringent requirements. No effect.

Socioeconomic Resources

Social and Economic Conditions
The BLM will recognize and consider local and regional economic development and land use plans. BLM management could further restrict or limit certain lands, or not limit or restrict others, as a result of the implementation of this action. The effect is difficult to predict, but may result in slightly more area placed under restrictions; negligible adverse.

4.2.1.4. Alternative B

This section summarizes management actions under Alternative B, which emphasizes resource conservation, and the likely resulting effects on the federal locatable minerals resource and/or activities during the planning period due to their implementation.

Locatable Minerals
The three WSAs (totaling 28,931 acres, 3.72%) are open to certain locatable minerals activities, per 43 CFR 3802, which outlines stringent requirements. Conservation measures implemented for other resources under Alternative B would result in a total of 717,741 acres (92%) being recommended for withdrawal from mineral entry (includes the three WSAs). If all these acres were to become withdrawn, this would leave just 59,569 acres open to mineral entry (7.66% of the resource). However, as all these withdrawals are proposed on behalf of other resources (Wildlife Resources, Cultural Resources, Paleontological Resources, Recreation, Lands with Wilderness Characteristics, ACECs, WSRs, and WSAs), the impacts of these withdrawals are discussed under those resources, below.

Physical Resources

Air Quality
Quantitative air quality modeling, and mitigation to ensure project emissions would approach or exceed emissions standards, are required. This would likely increase project costs; negligible adverse.

Soil
Management actions for soils include prohibitions on surface-disturbing activities in areas with severe erosion hazard (215,496 acres, 28%), on slopes equal to or greater than 25 percent (170,590 acres, 22%), in areas with poor reclamation suitability (455,090 acres, 58%), and on areas with LRP (218,928 acres, 28%). Approximately 25 percent of BLM surface lands within currently authorized and pending locatable minerals projects occur in such areas; also, locatable minerals RFA is 277 acres, (0.04%). Likely negligible adverse effect, due to increased costs for certain projects; these lands are not closed to locatable minerals activities.

Water Resources
Surface disturbance is prohibited within 500 feet of springs, reservoirs, water wells, and perennial streams (19,861 acres, 2.56%). These areas are usually undesirable and avoided due to their related inherent problems, and other considerations; the effect will likely be negligible adverse.

Cave and Karst Resources
Surface disturbance is prohibited within cave and karst areas (101,455 acres, 13%).
The likelihood of locatable minerals projects being proposed in cave and karst areas is quite low, due to rugged terrain, and long distance to market. The impact to locatable minerals projects is likely negligible adverse, from increased project costs due to redesigning or amending very few project sites to avoid these areas, and these areas are not closed to locatable minerals activities.

Mineral Resources

Leasable Minerals – Coal
The RFA for coal projects is 186,600 acres and 278 for locatable minerals. Even if there are conflicts between these two resources over all 278 acres, that is 0.04 percent of the locatable minerals resource. Conflict in those areas is unlikely though, as known commercial deposits of locatable minerals are mined outside areas most likely to be developed for coal. Also coal projects do not result in closures of such areas to mineral entry. Negligible adverse effects are anticipated due to increased project costs from delays due to possible conflicts.

Leasable Minerals – Fluids
Conflict with oil and gas projects could potentially affect up to 332,931 acres of the locatable minerals resource, 42.83 percent. However, the RFA for oil and gas projects is 286 acres; 277 for locatable minerals. Even if there are conflicts between these two resources over all 277 acres, that is 0.04 percent of the locatable minerals resource. Conflict in those areas is unlikely, though, as locatable minerals in commercial quantities are not known to occur in most areas likely to be developed for oil and gas projects. Negligible adverse effects are expected due to increased project costs from delays due to possible conflicts.

Salable Minerals
A total of 3,218,690 acres will be closed to salable minerals activities under Alternative B, leaving 129,431 acres open. Conflicts between these two minerals could affect up to 24,232 acres of the locatable minerals resource (3.12%). However, the RFA for salables is 114 acres, and locatables 277. It is unlikely salable minerals will be sought to be developed in the two known areas where locatable minerals occur in commercial quantities, as they are plentiful elsewhere. Therefore, the potential effect is likely to be much smaller; negligible adverse, due to increased project costs from possible delays.

Fire and Fuels Management

Not all fires will be suppressed, likely resulting in types and extents of effects similar overall to those under Alternative A. Most affected locatable minerals projects, not likely to be many, may experience lesser extents, and a few greater, if in an area that experiences a larger burn due to non-suppression. Overall negligible adverse, due to increased project costs.

Biological Resources

Vegetation – Forests and Woodlands
Types of effects are similar to, but likely of lesser extent than, those under Alternative A, as silviculture and pest control treatments, techniques, and methods will be less extensively used (negligible adverse).

Vegetation – Grassland and Shrubland Communities
Requiring use of only native species for all reclamation activities may lead to increased project costs due to higher costs for some native seed species. Overall, likely negligible adverse effect.

Vegetation – Riparian/Wetland Resources
Prohibitions on surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams may effect up to 23,831 acres (3.07%); however, an RFA of 278 acres for locatable minerals (0.04%) and little of this development would be likely in riparian or wetland areas. Negligible adverse effect.

Invasive Species and Pest Management
Invasive species and pest management actions could include area- and/or species-specific treatment strategies, applied on a project-specific basis to public lands. These treatments may increase locatable minerals project costs due to temporary access delays to project sites. However, successful treatments will likely also decrease the spread of undesirable species to project sites, resulting in likely lower planned project expenses or avoidance of additional project costs; beneficial effect likely.

Fish and Wildlife Resources – Fish
Surface-disturbing and disruptive activities are prohibited within 0.25 mile of naturally occurring water bodies containing acceptable fish species (51,745 acres, 6.66%). Reservoirs and riparian areas are managed to enhance potential fisheries. Other actions will likely increase project costs. These areas are already mostly avoided due to mitigation on Wyoming DEQ Mine Permits, and given the locatable minerals RFA is 277 acres, an overall negligible adverse effect is likely, from increased project costs.

Fish and Wildlife Resources – Wildlife
All distance and/or timing limitations or prohibitions are required in Alternative B, and all will adversely affect the locatable minerals resource or projects. These are within: big-game WHMAs (11,373 acres, 1.46%); 0.5 mile of big game migration corridors (9,587 acres, 2.00%); Elk crucial winter range and calving areas (75,175 acres, 9.67%); within 750 feet of sharp-tailed grouse leks year-round (940 acres, 0.12%) and 0.64 mile seasonally (7,607 acres, 0.98%); biologic buffers of active raptor nests (255,129 acres, 33%), and species of conservation concern (171,859 acres, 22.11%). Also, removal of elk security habitat is restricted (132,148 acres, 17%). Other restrictions also apply which will likely increase project costs, including applying seasonal restrictions on existing projects (approximately 530 acres, 0.07%). With approximately 25 percent of locatable minerals projects occurring in/near these areas, and an RFA of 277 acres, the likely effect will be negligible adverse, from increased project costs due to amending relatively few

project designs and/or areas and delays. However, a WHMA is recommended to be designated for the Fortification Creek area elk herd's crucial and yearlong ranges, with these areas recommended for withdrawal from mineral entry (12,419 acres, 1.60%); minor adverse impact.

Special Status Species – Plants
Surface-disturbing activities are required to avoid SSS plant habitat (126,811 acres, 16%), necessitating possible modifications of some project sites and/or access roads. These habitat areas are quite small, and given an RFA of 277 acres for locatable minerals, likely effect is negligible adverse.

Special Status Species – Fish
Surface-disturbing and disruptive activities are prohibited 0.25 mile of any waters containing SSS fish (818 acres, 0.11%). Other prohibitions and requirements apply, likely increasing project costs. Overall negligible adverse.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Restricted and prohibited for all projects are surface-disturbing, disruptive, and/or occupancy activities, and other management actions, to conserve SSS wildlife within the following areas: prairie dog colonies (6,156 acres, 0.79%, minor adverse); Greater Sage-Grouse areas (4.0-mile perimeter around occupied and undetermined leks and winter concentration areas, regardless of habitat suitability – 510,100 acres, 65.62%; greater than 4.0 miles of occupied and undetermined leks in nesting and brood-rearing habitat seasonally – 91,528 acres, 12%; 4.0 miles of winter concentration areas seasonally – 346,987 acres, 45%; habitat greater than 4.0 miles of winter concentration areas seasonally – 79,547 acres, 10%); seasonally within 1.5 miles of SSS raptor nests (183,269 acres, 24%); biologic buffer of special status raptors (113,784 acres, 15%); and habitats of SSS amphibians and reptiles (246,201 acres, 32%). Other requirements also apply which will likely increase project costs: restoration of disturbed sagebrush communities, increasing visibility of existing fencing in Greater Sage-Grouse habitat, and anti-perching devices on powerlines. Some projects may not be approved if they would result in more than one disturbance or 3 percent of total surface disturbance per 640 acres within 4.0 miles of Greater Sage-Grouse leks or winter concentration areas. Approximately 50 percent of locatables minerals projects occur in these areas (approximately 265 acres); and an RFA of 277 acres for locatable minerals projects (0.04%). Likely effect will be negligible adverse, from increased costs for certain projects.

Heritage and Visual Resources

Cultural Resources
Surface-disturbing activities are prohibited within 5 miles or visual horizon of portions of historic properties that retain their integrity of setting (222,978 acres, 29%). Withdrawal from mineral entry is recommended for areas containing historic properties that retain their historic setting (totaling 128,338 acres, 17%); withdrawal of all these acres will result in a major adverse impact. Other requirements will likely increase locatable minerals project costs: archeological monitors for all surface-disturbing activities, and Native American monitors when requested by tribes.

Paleontological Resources
Areas containing paleontological resources of high quality or importance are prohibited to locatable minerals activities (860 acres, 0.11%); these areas would be designated for special management, as they are identified. Withdrawal from mineral entry is recommended for certain areas containing paleontological resources of high quality or importance (40 acres,

less than 0.01%); withdrawal of these acres will result in a negligible adverse impact. Other requirements would likely increase locatable minerals project costs: paleontological field surveys for all Potential Fossil Yield Classification (PFYC) Class 3, 4, and 5 formations; monitoring of surface-disturbing activities on all PFYC Class 4 and 5 formations, and Class 3 as needed.

Visual Resources
Areas will be managed according to their VRM classes. Visual simulation and mitigation design is required within or viewable from areas of VRM Classes I to III; this will likely increase project costs. Likely negligible adverse.

Land Resources

Forest Products
Required temporary fencing of regeneration areas increase costs to certain locatable minerals projects, although relatively few locatable minerals projects occur in/near wooded areas. The likely effect is negligible adverse due to increased project costs from temporary inaccessibility to certain sites.

Lands and Realty
Land tenure adjustments could increase or decrease BLM surface and/or federal mineral estate (see Alternative A). Lands having resource value will be retained (76,223 acres, 9.81%). Lands identified for disposal (120,722 acres, 15%) will be disposed of, with longest retention of those with higher resource values. Lands will be acquired as willing sellers make them available, with no priority to those adjacent to large blocks of BLM surface or areas of high recreational potential. Although it is difficult to predict which land tenure adjustments will occur during the planning period, if all those currently identified were to occur, the locatable minerals resource would decrease (44,449 acres, 5.72%). It is more likely that much fewer acres will be disposed of (see Alternative A). Overall, likely up to negligible adverse impact.

Renewable Energy
Approved renewable-energy projects on public lands would result in segregations of those acres from mineral entry, closing those acres to locatable minerals activities until they are released from those segregations. Some renewable-energy projects may not be incompatible with certain salable minerals activities; see Alternative A. It is predicted that 5,000 acres of BLM surface (0.64% of BLM-administered locatable minerals resource) will be disturbed during the planning period for these projects. Effect could potentially be up to that total amount, negligible adverse.

Rights-of-Way and Corridors
ROWs will need to be placed within identified corridors, and away from major transportation routes. The RFA for ROWs is 18,011 acres (2.32% of BLM-administered locatable minerals resource), and that for locatables is 278; conflict over all 278 acres would be negligible adverse impacts (0.04%), due to increased costs for few projects. Carbon Capture and Storage (CCS) research and projects would be prohibited. In addition, ROWs for locatable minerals projects are extremely rare (see *Impacts Common to All Alternatives*). Overall negligible adverse effect.

Travel and Transportation Management
A number of area-specific restrictions to motor vehicle use may increase locatable minerals project costs for certain project proponents. However, these areas might not be completely inaccessible as a number of exploration activities can be performed without motorized vehicles.

Projects in these areas are not likely to be common as locatable minerals are plentiful elsewhere, likely negligible adverse effect, from increased costs for relatively few projects.

Recreation
A total of two Extensive Recreation Management Areas (ERMAs) (totaling 726,573 acres, 93%) and eight SRMAs (totaling 54,590 acres, 7.02%) are proposed for designation, with withdrawal from mineral entry recommended for all SRMAs designated via this RMP. This could result in up to a moderate adverse effect, if all eight SRMAs are designated and withdrawn from mineral entry. Some of these potential SRMAs are already under some restrictions, and some are in areas not likely to be sought for locatable mineral activities due to ruggedness of terrain and distance to likely markets.

Lands with Wilderness Characteristics
One area of lands with wilderness characteristics (12,237 acres, 1.57%) is recommended to be managed to emphasize primitive recreational opportunities and natural values, which includes recommendation for withdrawal from mineral entry; up to minor adverse impact. Much of the lands with wilderness characteristics area is not likely to be sought for locatable minerals activities, however, due to rugged terrain and long distance to markets.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock. Locatable minerals project costs may increase; an overall negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
A total of eight ACECs are proposed for designation (totaling 511,000 acres, 69%). Withdrawal from mineral entry is recommended for ACECs designated, resulting in up to a major adverse impact. One of these eight ACECs, the Sagebrush Ecosystem ACEC, was proposed to help protect sagebrush habitat, which would help protect the Greater Sage-Grouse (467,897 acres, 60%). However, some of these potential ACECs are already under some restrictions, and some are in areas not likely to be sought for locatable mineral activities due to ruggedness of terrain and distance to markets.

Scenic or Back Country Byways
A number of roads (up to 89 miles or more) will be evaluated during the planning period for their eligibility to be proposed as National Back Country or Scenic Byways. No effect is anticipated, as designation would not preclude locatable mineral activities.

Wild and Scenic Rivers
One WSR (2,664 acres, 0.34%) is under Congressional review, and is managed according to Manual 6400 - *Wild and Scenic Rivers*, which includes surface disturbance restrictions. This area is also recommended for withdrawal from mineral entry. If Congress does not designate this WSR, the present restrictions would likely continue until Congress acts on the designation. Although Congress is not expected to act during the planning period, these restrictions result in negligible adverse impact to the locatable minerals resource; withdrawal would permanently remove these acres, the same type and degree of impact. However, this area is not a likely target for locatable minerals activities, given its remote location and rugged terrain.

Wilderness Study Areas
Currently, there are three areas in the planning area where locatable minerals activities are restricted while under Congressional review: the WSAs, totaling 28,931 acres (3.72%). As Congress is not expected to act during the planning period, and the BLM recommends not officially designating these areas; however, they are recommended for withdrawal from mineral entry. These areas are currently open to certain locatable minerals activities under the regulations at 43 CFR 3802, which includes stringent requirements for retaining the areas' characteristics. If these areas are withdrawn, these areas become closed to all locatable minerals activities; up to minor adverse impact.

Socioeconomic Resources

Social and Economic Conditions
The BLM will consider local and regional economic development and land use plans. BLM management could further restrict or limit certain lands, or not limit or restrict others, as a result of the implementation of this action. In addition, mitigation strategies will be developed as needed to resolve conflicts that have detrimental effects to multiple resources. Effect is difficult to predict, but may result in slightly more area placed under restrictions; negligible adverse.

4.2.1.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource utilization, and the likely resulting effects on the federal locatable minerals resource and/or activities during the planning period due to their implementation.

Locatable Minerals
The three WSAs (totaling 28,931 acres, 3.72%) are open to certain locatable minerals activities, per 43 CFR 3802, which includes stringent requirements. Conservation measures implemented for other resources under Alternative C would result in these 28,931 acres continuing to be closed to certain locatable minerals activities; this would leave 748,379 acres open to all locatable mineral activities, 96.3% of the current resource. As this restriction is on behalf of WSAs, see that resource below for this impact.

Physical Resources

Air Quality
Quantitative air quality modeling is not required. No effect.

Soil
Surface-disturbing activities are allowed, as consistent with other resource values. These include in areas with severe erosion hazard, poor reclamation suitability, LRP, and on slopes equal to or greater than 25 percent. There will be no effect to the locatable mineral resource.

Water Resources
Surface disturbance is allowed within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams. No effect.

Cave and Karst Resources
A buffer is required around significant cave entrances (10 acres, less than 0.01%), negligible adverse.

Mineral Resources

Leasable Minerals – Coal
The RFA for coal projects is 195,700 acres and 1,460 for locatable minerals. Even if there are conflicts between these two resources over all 1,460 acres, that is 0.19 percent of the locatable minerals resource. Conflict in those areas is unlikely though, as known commercial deposits of locatable minerals are mined outside areas most likely to be developed for coal. Also coal projects do not close those areas to mineral entry. Negligible adverse effects are anticipated due to increased project costs from delays due to possible conflicts.

Leasable Minerals – Fluids
A total of 30,520 acres will be closed to fluid mineral leasing, leaving 3,356,010 acres open to oil and gas projects. Conflict with oil and gas projects could potentially effect up to the entire locatable minerals resource. However, the RFA for oil and gas projects is 22,255 acres, 1,455 acres for locatable minerals. Even if there are conflicts between these two resources over all 1,455 acres, that is 0.19 percent of the locatable minerals resource. Conflict in those areas is unlikely, though, as locatable minerals are not known to occur in commercial quantities in most areas likely to be developed for oil and gas projects.

Salable Minerals
A total of 57,213 acres will be closed to salable minerals activities under Alternative C, leaving 3,290,908 acres open. Conflicts between these two minerals could affect up to 24,232 acres of the locatable minerals resource, 3.12 percent. The RFA of salable is 2,090 acres, and locatables is 1,455 acres. It's unlikely salable minerals will be sought to be developed in the two known areas where locatable minerals occur in commercial quantities, as they are plentiful elsewhere. Therefore, the potential effect is likely to be much smaller; negligible adverse, due to potentially increased project costs from possible project delays.

Fire and Fuels Management

Full protection strategies and tactics will be used across the entire planning area, likely resulting in types and extents of effects similar, to those discussed under Alternative A. Not likely to be many locatable minerals projects affected due to temporary inaccessibility to project areas, and those effects would likely be increased project costs due to delays.

Biological Resources

Vegetation – Forests and Woodlands
Types of effects are similar to, but likely of greater extent than those under Alternative A, as silviculture and pest control treatments, techniques, and methods will be more extensively used. A negligible adverse effect to locatable minerals activities, due to potentially increased costs.

Vegetation – Grassland and Shrubland Communities
Desirable non-native species will be allowed for initial reclamation activities, likely leading to possible decreased project costs (see Alternative A); likely negligible beneficial effect.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities are allowed within 500 feet of riparian/wetland systems, aquatic habitats, and floodplains, as consistent with other resource values. The required Wyoming DEQ LQD Mine Permits already include avoidance, or minimization/mitigation for such areas,

although most of these types of areas would be avoided due to problems inherent to them. There would be no effect to the locatable mineral resource.

Invasive Species and Pest Management
Invasive species and pest management actions could include species-specific treatment strategies, applied either in specific areas or across the planning area. These treatments may increase locatable minerals project costs due to temporary access delays to project sites. However, successful treatments will likely also decrease the spread of undesirable species, resulting in likely lower planned project expenses or avoidance of additional project costs; negligible beneficial effect likely.

Fish & Wildlife Resources – Fish
Surface-disturbing activities are allowed within 0.25 mile of naturally occurring water bodies containing acceptable fish species. Reservoirs and riparian areas are managed to improve or enhance other resources first and potential fisheries second. Other actions may also increase project costs, a negligible adverse effect is likely.

Fish & Wildlife Resources – Wildlife
Only two seasonal restrictions occur under Alternative C: a WHMA is proposed to be designated for the Fortification Creek elk herd's crucial range (12,419 acres, 1.60%); and a seasonal prohibition within 0.5 mile of active raptor nests (4,855 acres, 0.62%). With few locatable minerals projects occurring in/near these areas, the likely effect will be negligible adverse due to increased costs for few projects.

Special Status Species – Plants
Surface-disturbing activities that could adversely affect SSS plant habitat are allowed, but not within known populations (126,811 acres, 16%). These habitat areas are quite small, leading to a relatively small amount of lands to avoid; the likely effect is negligible adverse.

Special Status Species – Fish
Surface-disturbing and disruptive activities are prohibited are within 0.25 mile of any waters containing SSS fish, when their effects cannot be mitigated (818 acres, 0.11%). Negligible adverse.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Restrictions occurring under Alternative C include: maintain current habitat utilized by SSS; manage traditional wildlife migration and travel corridors consistent with other resources; manage surface-disturbing and disruptive activities consistent with other resources; require anti-perching devices on new powerlines within occupied Greater Sage-Grouse habitat; restrictions/prohibitions on surface-disturbing and disruptive activities and sometimes occupancy within 0.25 mile of the perimeter of occupied leks (3,594 acres, 0.46%), seasonally within two miles of occupied leks (203,724 acres, 26%), seasonally in identified nesting and early brood-rearing habitat outside the 2-mile lek buffer, and seasonally within Greater Sage-Grouse winter concentration areas; and a year-round disturbance-free buffer of at least 0.5 mile around known bald eagle winter roosts (402 acres, 0.05%), a seasonal limited activity zone within 1 mile of known roosts (3,013 acres, 0.39%), and seasonal species-specific prohibitions for SSS raptor nests (4,855 acres, 0.6%). Approximately 50 percent of locatables minerals projects occur in/near these areas so a fair number of such projects might need to be modified the likely effect will be negligible adverse due to increased project costs.

Heritage and Visual Resources

Cultural Resources
Surface disturbances are allowed in areas containing historic properties when appropriate mitigation is accomplished. Archeological monitors are required on a project-specific basis, increasing project costs; Native American monitors are not required. Overall a negligible adverse effect.

Paleontological Resources
Paleontological field surveys are required for all projects potentially affecting PFYC Class 4 and 5 formations, increasing costs for some projects. Identification and designation of casual collection areas for common invertebrate, plant, and petrified wood fossils. Negligible adverse effect likely.

Visual Resources
Visual simulation may be utilized on a project-specific basis, increasing some projects' costs; overall, a negligible adverse effect likely.

Land Resources

Forest Products
An array of forest products will be available from across the entire planning area; a negligible adverse effect is likely due to increased likelihood of temporary lack of access to certain sites.

Lands and Realty
Land tenure adjustments could increase or decrease BLM surface and/or federal mineral estate. Lands having agricultural potential or water are identified for disposal (76,223 acres, 9.81%). Other lands identified for disposal (120,722 acres, 15%) will be disposed of, with longest retention of those with higher resource values. It is difficult to predict which land tenure adjustments will occur during the planning period (see Alternative A). If all these lands are disposed of (totaling 196,945 acres, 25%), the locatable minerals resource could decrease by up to that amount, depending on the surface and mineral estate ownerships of the various lands. It is much more likely that much fewer acres will be disposed of (see Alternative A). Likely up to minor adverse effect.

Renewable Energy
Although no renewable energy projects for public lands have been received to date, it is predicted that 40,000 acres (5.15%) of BLM surface will be disturbed for these projects during the planning period. Although renewable-energy projects are not necessarily incompatible with locatable minerals activities, these lands will be segregated from mineral entry (see Alternative A), thus decreasing the locatable minerals resource by up to that amount; overall likely up to minor adverse impact, though.

Rights-of-Way and Corridors
Above-ground facilities such as powerlines are to be placed along major transportation routes; as few current or historic locatable minerals projects utilize powerlines, this will likely only increase costs for few projects. ROWs for locatable minerals projects are extremely rare (see *Impacts Common to All Alternatives*). The RFA for ROWs for other uses (such as for oil/gas roads and facilities) is 57,083 acres (7.34%). However, ROWs are not necessarily incompatible with locatable minerals projects (see *Impacts Common to All Alternatives*). CCS research and projects are allowed, where consistent with other resource values; this could occur over up to the entire locatable minerals resource (777,310 acres, 100%, see Alternative A), although it

is more likely that fewer acres will be affected. However, CCS projects are not necessarily incompatible with locatable minerals projects (see *Impacts Common to All Alternatives*). Overall effect likely up to minor adverse.

Travel and Transportation Management
Some areas are restricted or closed to motorized travel, seasonally or year-round. These areas are not completely inaccessible to locatable minerals activities, but these restrictions would make exploration and development activities more challenging and increase costs. A negligible adverse effect is likely.

Recreation
A total of six SRMAs are recommended for designation (totaling 30,570 acres, 3.93%), and none designated would be pursued for withdrawal from mineral entry. No effect.

Lands with Wilderness Characteristics
No lands will be managed for wilderness characteristics, no effect.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock, thereby increasing some locatable minerals project costs may increase; an overall negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
No ACECs are recommended for designation, no effect.

Scenic or Back Country Byways
No roads will be evaluated during the planning period for their eligibility to be proposed as National Back Country or Scenic Byways; no effect.

Wild and Scenic Rivers
One WSR is under Congressional review, and is managed according to Manual 6400 - *Management of Wild and Scenic Rivers*, which includes surface disturbance restrictions. If Congress does not designate the WSR (and Congress is not expected to act during the planning period), these restrictions will be lifted. This area is not a likely target for locatable minerals activities, however, given its' remote location and rugged terrain. No effect.

Wilderness Study Areas
Currently, there are three areas in the planning area where locatable minerals activities are restricted while under Congressional review: the WSAs, totaling 28,931 acres (3.72%). In addition, all motorized and mechanized equipment will be prohibited in these areas. Congress is not expected to act during the planning period, and the BLM's recommendation is to not officially designate these areas. However, any WSAs released by Congress would be subject to consideration for lands with wilderness characteristics. The current surface disturbance restrictions will continue to apply until Congress acts, after which a plan amendment would be completed.

Socioeconomic Resources

Social and Economic Conditions
The BLM is to develop management strategies to recognize and point out conflicts expected to affect multiple resource use, and to incorporate to the extent possible local and regional economic development and land use plans. Effect is difficult to predict, but may result in slightly more area placed under restrictions; negligible adverse.

4.2.1.6. Alternative D

This section describes management actions under Alternative D, the Proposed RMP which strikes a balance between resource use and resource conservation, and the likely resulting effects on the federal locatable minerals resource and/or activities during the planning period due to their implementation.

Locatable Minerals
The three WSAs (totaling 28,931 acres, 3.72%) are open to certain locatable minerals activities, per 43 CFR 3802, which includes stringent requirements. Conservation measures implemented for other resources under Alternative D would result in a total of 61,818 acres (7.95%) being recommended for withdrawal from mineral entry (includes the three WSAs). If all these acres were to become withdrawn, this would leave 715,492 acres open to certain locatable mineral activities; 92 percent of the current resource. As these withdrawals are recommended on behalf of various resources (Recreation, Lands with Wilderness Characteristics, and ACECs), these impacts are discussed under those resources.

Physical Resources

Air Quality
Quantitative air quality modeling, and mitigation to ensure project emissions would approach or exceed emissions standards, are required. This would likely increase project costs; negligible adverse.

Soil
Surface-disturbing activities in areas with severe erosion hazard, poor reclamation suitability, LRP, and on slopes equal to or greater than 25 percent are not prohibited unless the soil resource cannot be conserved. Less than 10 percent of current locatable minerals projects are in such areas on BLM surface, and soils are conserved during project operations. Likely negligible adverse effect.

Water Resources
Surface disturbance within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams is allowed where resource objectives are met. As these areas are already avoided due to their related inherent problems, and other locatable minerals projects can avoid surface water resources. The effect will likely be negligible adverse.

Cave and Karst Resources
Surface-disturbing activities are prohibited are within a site-specific buffer around significant cave entrances (11 acres, less than 0.01%). Locatable minerals projects are not likely in these areas due to the rugged terrain and long distance to markets. The effect to locatable minerals projects is likely to be negligible adverse, from increased costs for some projects.

Mineral Resources

Leasable Minerals – Coal
The RFA for coal projects is 195,700 acres and 1,256 for locatable minerals. Even if there are conflicts between these two resources over all 1,256 acres, that is 0.16 percent of the locatable minerals resource. Conflict in areas of likely coal development are unlikely though, as known commercial deposits of locatable minerals are mined outside these areas. Also coal projects do not close those areas to mineral entry. Negligible adverse effects are anticipated due to increased project costs from delays due to possible timing/location conflicts.

Leasable Minerals – Fluids
A total of 72,276 acres will be closed to fluid mineral leasing, leaving 3,314,254 acres open to oil and gas projects. Conflict with oil and gas projects could potentially affect up to that number of acres of the locatable minerals resource. However, the RFA for oil and gas projects is 14,869 acres and 1,256 for locatable minerals. Even if there are conflicts over all 1,256 acres, that is 0.16 percent of the locatable minerals resource; a negligible adverse effect. Conflict in those areas is unlikely, as locatable minerals are plentiful outside the areas likely to be developed for oil and gas projects; overall effect is likely negligible adverse, due to delays and increased costs for certain projects.

Salable Minerals
A total of 623,061 acres will be closed to salable minerals activities under Alternative D, leaving 2,725,060 acres open. However, the RFA for salable is 1,198 acres, and locatable 1,256. It is unlikely salable minerals will be sought to be developed in the two known areas where locatable minerals occur in commercial quantities, as they are plentiful elsewhere. Therefore, the potential effect is likely to be much smaller; a negligible adverse effect, due to increased project costs from possible delays.

Fire and Fuels Management

Fire response and treatment will vary to meet other resource objectives; likely types and extents of effects will be similar overall to those under Alternative A. Relatively few locatable minerals projects might be effected through temporary restriction of access to sites.

Biological Resources

Vegetation – Forests and Woodlands
Types of effects are similar to, but likely of slightly lesser extent than, those under Alternative A; some silviculture and pest control treatments, techniques, and methods will be less extensively used and some more. Few locatable minerals projects occur in/near forests and woodlands; negligible adverse effect likely from increased costs for few projects.

Vegetation – Grassland and Shrubland Communities
Desirable non-native species are allowed for short-term reclamation activities, but only with native species during final reclamation. Increased project costs are possible with requirements for native seed species, a negligible adverse effect.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities are allowed within 500 feet of riparian/wetland systems and aquatic habitats where other resource objectives are met. These ares are usually avoided for locatable mineral development; likely negligible adverse effect.

Invasive Species and Pest Management
Planning and actions would be required to manage invasive species, these would increase project costs but decrease the spread and of invasive species; negligible beneficial effect.

Fish and Wildlife Resources – Fish
Surface-disturbing activities are allowed within 0.25 mile of naturally occurring water bodies containing acceptable fish species where fish resource objectives can be met (51,745 acres, 6.66%). Fisheries enhancement in reservoir design is utilized consistent with other resources. Other actions will likely increase project costs. These areas are already mostly avoided due to mitigation on Wyoming DEQ Mine Permits; negligible adverse effect likely, due to increased costs for few projects.

Fish and Wildlife Resources – Wildlife
Distance and/or timing limitations will adversely affect the locatable minerals resource. These are within: big-game WHMA (totaling 11,373 acres, 1.46%); 0.5 mile of big game priority travel corridors (9,587 acres, 2.00%); big game crucial winter range and elk calving areas (98,411 acres, 13%); 0.25 mile year-round of occupied sharp-tailed grouse leks (940 acres, 0.12%), and seasonally within two miles of occupied leks in potential nesting and early brood-rearing habitat (48,127 acres, 6.19%); and within either year-round or seasonally within U.S. Fish and Wildlife Service (USFWS) Wyoming Ecological Services' recommended spatial buffers for breeding raptors (255,129 acres, 33%). In addition, retention of 85 percent of existing elk security habitat is required (existing acreage 132,148 acres, 17%). A WHMA is not recommended to be designated for the Fortification elk herd; instead, the current management (BLM 2011c) is to be retained. Other restrictions also apply which will likely increase project costs, including applying seasonal restrictions on existing projects when wildlife resources are not met (approximately 530 acres, 0.07%). With approximately 25 percent of locatable minerals projects occurring in/near these areas, the likely effect will be negligible adverse due to increased costs for few projects.

Special Status Species – Plants
Surface-disturbing activities are prohibited within SSS plant habitat when the populations would not be conserved (126,811 acres, 16%). Also, predisturbance flowering season surveys are required prior to project approval. These habitat areas are typically quite small, and few projects are likely in these areas. Likely effect is negligible adverse.

Special Status Species – Fish
Surface-disturbing activities are prohibited within 0.25 mile of any waters containing SSS fish species, unless it benefits the species (818 acres, 0.11%). Other prohibitions and requirements apply, likely increasing project costs. Overall negligible adverse.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Restricted and prohibited for all projects are surface-disturbing, disruptive, and/or occupancy activities, and other management actions, to conserve SSS wildlife within following areas: prairie dog colonies, unless suitable habitat for SSS dependent upon prairie dogs is not affected (6,156 acres, 0.79%); year-round within at least 0.5 mile (adjusted based on site-specific USFWS information) of bald eagle riparian corridors; seasonally within USFWS recommended buffer and year-round within species-specific biologic buffer of active SSS raptor nests (17,417 acres, 2.24%); and habitats of SSS amphibians, reptiles, and bats, unless populations and habitat can be conserved (176,636 acres, 23%). Powerlines are to be designed to minimize wildlife-related impacts, are to avoid certain areas of high avian use, and are prohibited within certain distances of Greater Sage-Grouse leks, areas, or habitat; this will likely lead to increased project costs.

The prohibitions, restrictions, and other requirements that will be instituted under Alternative D to prevent unnecessary or undue degradation in Greater Sage-Grouse populations and habitat (below) do not apply to locatable minerals activities, as the Greater Sage-Grouse is not a proposed or listed T&E species (per 43 CFR 3809.11(c)(6), and 3809.420(b)(3)(iii)(7)); see also Instruction Memorandum [IM] Washington Office [WO]-2012-043, dated December 22, 2011). BLM can request for project proponents to follow these measures, however, compliance is not mandatory.

- Greater Sage-Grouse Core Population Areas:

  Prohibit surface disturbing activities, disruptive activities, and occupancy within 0.6 mile of the perimeter of occupied Greater Sage-Grouse leks (independent of habitat suitability). Allow no more than one oil and gas or mining location and no more than 5 percent disturbance per 640 acres within the Disturbance Density Calculation Tool (DDCT) analysis area (4 mile buffer of occupied leks within 4 miles of proposed surface disturbance restricted to Core Population Area and Connectivity Corridor). Design and manage facilities to prevent West Nile Virus (WNv) transmission. Avoid overhead electric transmission lines and bury electrical distribution lines where possible; if not possible, then locate overhead lines at least 0.6 miles from the perimeter of occupied Greater Sage-Grouse leks and install raptor perch guards. Prohibit electric overhead transmission lines unless within one-half mile either side of existing 115 kV or larger transmission lines creating a corridor no wider than one mile. Limit noise sources to 10 A-weighted decibels (dBA) above ambient noise measured at the perimeter of occupied Greater Sage-Grouse leks from March 1 to May 15, 6 PM to 8 AM, unless scientific findings indicate a different noise level is appropriate. In addition, limit noise sources in other important Greater Sage-Grouse habitats if research and/or policy indicate the need. Locate new roads, used to transport products or waste, greater than 1.9 miles and other new roads, such as roads for site access, greater than 0.6 miles from the perimeter of occupied Greater Sage-Grouse leks. Construct roads to minimum design standards needed. Restore disturbed sagebrush communities on BLM surface to meet the Wyoming DEQ community-specific full shrub density standard (Chapter 4 Rules and Regulations, option III) for all predisturbance shrub species and 5 percent minimum canopy cover of sagebrush. A 90 percent confidence interval is required to demonstrate achievement of the standard. The standard must be demonstrated the last year of the responsibility period, and all planted shrubs shall have been in place for at least two years. Prohibit surface disturbing and disruptive activities from March 15 to June 30 (independent of habitat suitability). Prohibit surface disturbing and disruptive activities within Greater Sage-Grouse winter concentration areas from December 1 to March 14.

- Greater Sage-Grouse Core Population Connectivity Corridors:

  Prohibit surface-disturbing activities, disruptive activities and occupancy within 0.6 mile of the perimeter of occupied Greater Sage-Grouse leks (independent of habitat suitability). Allow no more than 5 percent total surface disturbance per 640 acres within the DDCT analysis area (4 mile buffer of occupied leks within 4 miles of proposed surface disturbance, restricted to Core Population and Core Population Connectivity Corridors. Design and manage facilities to prevent WNv transmission. Avoid overhead electric transmission lines and bury electric distribution lines where possible; if not possible, locate overhead lines at least 0.6 miles from the perimeter of occupied Greater Sage-Grouse leks and install raptor perch guards. Locate new roads, used to transport products or waste, greater than 1.9 miles and other, new such as site access, greater than 0.6 mile from the perimeter of the occupied Greater Sage-Grouse leks. Construct roads to minimum design standards needed, and facilities with motion, light sources, noise (10 decibels above ambient), with a height greater than 4.5 feet. Restore disturbed

sagebrush communities on BLM surface to meet the Wyoming DEQ community-specific full shrub density standard (Chapter 4 Rules and Regulations, option III) for all predisturbance shrub species and 5 percent minimum canopy cover of sagebrush. A 90 percent confidence interval is required to demonstrate achievement of the standard. The standard must be demonstrated the last year of the responsibility period, and all planted shrubs shall have been in place for at least two years. Prohibit surface disturbing and disruptive activities within 4 miles of occupied Greater Sage-Grouse leks from March 15 to June 30 (independent of habitat suitability, restricted to within Core Population Connectivity Corridors). Prohibit surface disturbing and disruptive activities within Greater Sage-Grouse winter concentration areas, from December 1 to March 14.

- Occupied Greater Sage-Grouse habitat outside of Core Population Areas and Core Population Connectivity Corridors:

  Prohibit or restrict surface-disturbing and disruptive activities within 0.25 mile of the perimeter of occupied Greater Sage-Grouse leks. Reduce surface disturbance for authorizations within 0.25 mile of occupied Greater Sage-Grouse leks. Design and manage facilities to prevent WNv transmission. Bury electric distribution lines where possible; if not possible, then locate overhead lines at least 0.5 mile from the perimeter of occupied Greater Sage-Grouse leks and install raptor perch guards. Restore disturbed sagebrush communities on BLM surface to meet the Wyoming DEQ community-specific full shrub density standard (Chapter 4 Rules and Regulations, option III) for all predisturbance shrub species and 5 percent minimum canopy cover of sagebrush. A 90 percent confidence interval is required to demonstrate achievement of the standard. The standard must be demonstrated the last year of the responsibility period, and all planted shrubs shall have been in place for at least two years. Recommend for all surface-disturbing activities on BLM surface adjacent to priority habitat, within or adjacent to lands involved in Greater Sage-Grouse conservation projects, or support an 85 percent Greater Sage-Grouse population density. BLM parcels less than 640 acres that only meet the population density factor may be excluded. Prohibit surface disturbing and disruptive activities within 2.0 miles of occupied Greater Sage-Grouse leks, from March 15 to June 30 (independent of habitat suitability), and within Greater Sage-Grouse winter concentration areas from December 1 to March 14.

Approximately 50 percent of locatable minerals projects occur in or near SSS habitat; likely effect will be to increase project costs for some projects — negligible adverse effect likely.

Heritage and Visual Resources

Cultural Resources

Surface disturbance is prohibited within Pumpkin Buttes, Cantonment Reno, Dull Knife Battle, Crazy Woman Battle, contributing and unevaluated segments of the Bozeman Trail, all rock art sites, rock shelter sites, and Native American burials. Surface disturbance is allowed in within three miles of those areas, if the development is not visible or will result in a weak contrast rating to the setting (154,697 acres, 20%). Prohibitions and other measures will be used to mitigate adverse effects to sensitive sites such as TCPs and or sacred sites (1,105 acres, 0.14%). Other requirements include: requiring archeological monitors for projects according to established strategy; establishing agreements to provide tribal access to Pumpkin Buttes, other TCPs, and sacred sites on BLM surface, and requiring Native American monitoring for surface-disturbing projects in accordance with agreements or on a project-specific basis. Cultural Resources Project Plans (CRPPs) will be developed for Pumpkin Buttes, sites associated with Red Cloud's War

and the Great Sioux War, and the South Big Horn Mountains; it is uncertain at this time what restrictions or requirements might be included in these CRPP. Many of such areas are already protected to a certain degree by other means, locatable minerals are plentiful in other areas; effect will most likely be negligible adverse.

Paleontological Resources
Areas containing paleontological resources of high quality or importance would be designated for special management as they are identified (860 acres, 0.11%); these areas are to be avoided by locatable minerals activities. Requiring paleontological field surveys for all PFYC Class 4 and 5 formations, and Class 3 as needed, with monitoring of surface-disturbing activities in such areas as based on the survey results, would increase project costs. Overall, a negligible adverse effect.

Visual Resources
Areas will be managed according to their VRM classes, except certain areas (such as SRMAs, ACECs, lands with wilderness characteristics, Powder River Breaks, Fortification Creek); some of these areas will be managed according to more scenic management. Required within VRM Class II areas is completion of visual simulation and mitigation design; these may be required on a project-specific basis within VRM Class III areas with high visual sensitivity. These will likely increase project costs; effect is likely negligible adverse.

Land Resources

Forest Products
Temporarily fencing off of regeneration or treatment areas may be needed, and may temporarily limit access to certain locatable minerals projects. Relatively few locatable minerals projects occur in/near wooded areas; likely effect negligible adverse.

Lands and Realty
Land tenure adjustments could increase or decrease BLM surface and/or federal mineral estate (see Alternative A). Lands will be acquired and disposed of based on resource values, including but not limited to, disposals of lands with agricultural potential and water (76,223 acres, 9.81%). Other management actions include: disposal of BLM surface lands identified for disposal (120,722 acres, 16%), and other lands not identified but meeting appropriate disposal criteria, would be available for disposal. Acquisition of lands from willing sellers would occur consistent with other resource values, with priority given to those lands adjacent to large blocks of BLM surface (before those in other areas). It is difficult to predict which land tenure adjustments will occur during the planning period. Although currently identified disposals total 196,945 acres (25%), it is much more likely that fewer acres will be affected (see Alternative A). Overall more likely up to minor adverse effect.

Renewable Energy
Although no renewable energy projects for public lands in the planning area have been received to date, it is predicted that 75,240 acres of BLM surface will be disturbed for these projects during the planning period (9.68%). Although not all renewable-energy projects are incompatible with locatable minerals activities, these lands would be segregated from mineral entry (see Alternative A), thereby reducing the locatable minerals resource by that amount. It is much more likely that fewer acres will be affected, however (see Alternative A); effect is likely to be up to minor adverse.

Rights-of-Way and Corridors
Transmission lines and above-ground facilities will be placed within existing ROW and other disturbed areas. ROW for locatable minerals projects are uncommon (see *Impacts Common to All Alternatives*); these actions would likely have an overall negligible adverse effect, due to possible increased costs for extremely few projects. The predicted disturbance from other ROWs is 38,762 acres of BLM surface (4.99%). However, ROWs are not necessarily incompatible with locatable minerals projects (see Alternative A). It is more likely that fewer acres will be affected; likely up to minor adverse effect. CCS proposals will be evaluated; assessing the likely level of effect on the locatable minerals resource from these opportunities is difficult, as no projects for public lands in the planning area have been received to date. However, up to the entire locatable minerals resource (777,310 acres, 100%) could be affected (see Alternative A), although CCS projects are not necessarily incompatible with locatable minerals projects.

Travel and Transportation Management
A number of area-specific restrictions to motor vehicle and OHV use, seasonally or year-round, may increase locatable minerals project costs for certain project proponents, but these areas might not be completely inaccessible as a number of locatable minerals activities can be performed without motorized vehicles. These actions may require redesigning and/or reconstructing certain roads, and restricting use of certain roads during certain time periods, increasing project costs. Projects in these areas are not likely to be common as locatable minerals are plentiful elsewhere, but will have increased costs; negligible adverse effect is likely.

Recreation
The planning area is proposed to be divided into eight ERMAs (349,663 acres, 45%), and seven SRMAs (53,221 acres, 6.85%). Designation of ERMAs would not close those areas to locatable mineral activities, but would likely add some requirements for analysis and/or mitigation, increasing project costs. All designated SRMAs are recommended for withdrawal from mineral entry, so if all seven SRMAs are withdrawn, the locatable minerals resource would be moderately adversely affected through loss of those acres. The effect could be up to moderate adverse.

Lands with Wilderness Characteristics
One area of lands with wilderness characteristics is recommended for withdrawal from mineral entry. Although this area is not likely to be sought for locatable minerals activities, due to rugged terrain and long distance to markets, if it is withdrawn, the locatable minerals resource would decrease by these acres (6,864 acres, 0.88%); negligible adverse effect.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock. Locatable minerals project costs may increase; an overall negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
A total of two ACECs are recommended for designation, totaling 2,849 acres, (0.3%). These areas would be managed under site-specific management plans, which includes recommending them for withdrawal from mineral entry. Some of these potential ACECs are already under some restrictions, and some are in areas not likely to be sought for locatable mineral activities due to ruggedness of terrain and distance to markets. Negligible adverse effect likely.

Scenic or Back Country Byways
A number of roads will be evaluated during the planning period for their eligibility to be proposed as National Back Country or Scenic Byways. No effect.

Wild and Scenic Rivers
One WSR is under Congressional review, and is managed according to Manual 6400 - *Wild and Scenic Rivers*, which includes surface disturbance restrictions. If Congress denies its designation, these restrictions will continue to retain the areas' characteristics. Congress is not expected to act during the planning period, however. These restrictions result in negligible adverse effect to the locatable minerals resource (2,664 acres, 0.34%). This area is not a likely target for locatable minerals activities, however, given its remote location and rugged terrain.

Wilderness Study Areas
Currently, there are three areas in the planning area where locatable minerals activities are restricted while under Congressional review: the WSAs, (totalling 28,931 acres, 3.72%). In addition, all motorized and mechanized equipment will be prohibited in these areas. Congress is not expected to act during the planning period, and the BLM's recommendation is to not officially designate these areas. However, any WSAs released by Congress would be subject to consideration for lands with wilderness characteristics. The current surface disturbance restrictions will continue to apply until Congress acts, after which a plan amendment would be completed; effect is up to minor adverse.

Socioeconomic Resources

Social and Economic Conditions
The BLM is to work with other entities (local, state, federal, private) to develop mitigation strategies for promoting a healthy and sustainable social and economic environment. The BLM is to work with all stakeholders to identify socioeconomic effects of BLM actions and develop strategies to mitigate those effects where possible to promote sustainability in a multiple resource use environment. Effect is difficult to predict, but may result in slightly more area being restricted, or more requirements that would increase project costs; negligible adverse.

4.2.1.7. Cumulative Impacts

The current total available federal locatable minerals resource that BLM administers is comprised of BLM-administered surface and all minerals; this amounts to 777,310 acres. The current total available locatable minerals resource that BLM does not administer comprises the remainder of the planning area, 6,567,691 acres (7,356,374 total acres in the planning area, less 777,310 acres that are BLM-administered locatable minerals, and less the 11,373 acres already withdrawn from mineral entry). The existence of federal mineral estate does not imply the presence of locatable minerals of sufficient quality and/or quantity to make them economically viable to develop in those lands (see Chapter 3). Alternative A forecasts that approximately 554 acres of federal mineral estate will be disturbed during federally-authorized exploration and development activities ("BLM"), and approximately 7,989 acres of non-federal mineral estate during similar activities not involving or requiring BLM authorization ("non-BLM"); see Appendix G (p. 1937). Under the other alternatives, these acres are: Alternative B – 277 acres BLM, 23,968 acres non-BLM; Alternative C – 1,455 acres BLM, 11,984 acres non-BLM; Alternative D – 1,256 acres BLM, 17,975 acres non-BLM. Under all alternatives, the actual current acres (Alternative A) and projected potential acres (alternatives B through D) of the BLM-administered portion of the

federal locatable minerals resource explored and/or developed are all less than 2 percent of this resource; the equivalent non-BLM acres (given above, and in Appendix G (p. 1937)) are less than 1 percent of that resource.

The current acres under exploration/development were obtained from BLM's LR2000 database (BLM acres) and Wyoming DEQ LQD's files (non-BLM acres). The projected acres under alternatives B through D were obtained by approximating how much locatable minerals mining might occur under each of those scenarios: Alternative B is the most restrictive for BLM-administered lands, while Alternative C is the least restrictive, and Alternative D is anticipated to lie between those two extremes. Alternative B's BLM acres were approximated to be 50 percent of that for Alternative A — this approximation takes into account the actual number of BLM-administered acres that are already authorized to continue to be mined and yet to be mined, as well as those actual and approximated acres that will be reclaimed during the planning period. Alternative B Non-BLM acres were approximated to be quite large, taking two important factors into account: (1) as BLM-administered lands are greatly restricted under Alternative B (and a large percentage of the resource is proposed to be withdrawn from mineral entry (92%), this likely will result in more non-BLM acres being mined to make up for the decrease in BLM-administered lands available for mining and/or mineral entry, and (2) the additional very likely potential for mining to increase in the planning area overall. Alternatives B through D, for both types of acres, take into account the very real likelihood that mining will continue to increase in the planning area due to the nation's and world's continually increasing populations and technological advances: our needs for minerals are likely to increase, and continue increasing, into the future. In addition, for those 2 locatable minerals currently mined in the planning area (Wyoming-type bentonite, and uranium), there are currently few substances that can be used in their stead, given their special characteristics. Alternative C's BLM acres were approximated to be roughly 260 percent of that for Alternative A (an increase of roughly 160% over what is currently occurring) – this approximation takes into account the likelihood that more BLM-administered acres will be mined, given the lesser restrictions on these lands; non-BLM acres are also projected to increase, though not as greatly as under Alternative B. Alternative D's BLM and non-BLM acres were both approximated to be roughly 225 percent of that for Alternative A (an increase of roughly 125% over what is currently occurring) – this approximation takes into account the likelihood that all lands will likely experience more mining into the future, and that much fewer acres are proposed to be withdrawn (8% of the resource).

In general, BLM-authorized locatable minerals activities disturb far fewer acres in the planning area than do BLM-authorized oil and gas or coal activities (see Appendix G (p. 1937)), and that such BLM-authorized activities disturb fewer acres in the planning area than do non-BLM activities. Locatable minerals demand and production has been increasing over the last several years. Bentonite production has been steadily increasing, while uranium production has made a comeback in the planning area with more growth yet to come. Uranium demand has been somewhat stagnant somewhat recently, as the price also stagnated. However, nuclear power generation is one of the key components for meeting modern power generation needs, and the importance of this role very likely will increase over time (see Chapter 3). Overall, the forecast is that locatable minerals demand will rise during the planning period. Table 4.30, "Current Areas Withdrawn From or Containing Restrictions On Mineral Entry under All Alternatives" (p. 820) identifies the current areas withdrawn or restricted from mineral entry under all alternatives. Table 4.31, " Areas Recommended for Withdrawal from Mineral Entry under All Alternatives" (p. 820) identifies areas recommended for withdrawal from mineral entry by resource and by alternative.

Table 4.30. Current Areas Withdrawn From or Containing Restrictions On Mineral Entry under All Alternatives

Area Withdrawn or Restricted From Mineral Entry	Acreage
Existing Withdrawals from Mineral Entry (acres)	
Amsden Creek WHMA	523
Kerns WHMA	155
Middle Fork Canyon (aka Ed O. Taylor) WHMA	10,695
Total Acres Withdrawn	**11,373**
Existing Restrictions from Mineral Entry (acres)	
Fortification Creek WSA	12,419
Gardner Mountain WSA	6,423
North Fork WSA	10,089
Total Acres Restricted	**28,931**
Total Acres Withdrawn or Restricted from Locatable Mineral Activities	**43,089**
Source: BLM 2012f WHMA Wildlife Habitat Management Area WSA Wilderness Study Area	

Table 4.31. Areas Recommended for Withdrawal from Mineral Entry under All Alternatives

	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
For Wildlife Resources:				
Elk crucial range within Fortification Creek WHMA	N/A	12,419	N/A	N/A
Total Acres	**N/A**	**12,419**	**N/A**	**N/A**
For Cultural Resources:				
Bozeman Trail, Crazy Woman Battle Site, and other areas containing sensitive sites (such as TCPs and/or sacred sites)	N/A	128,338	N/A	N/A
Total Acres	**N/A**	**128,338**	**N/A**	**N/A**
For Paleontological Resources:				
Areas containing paleontological resources of high quality or importance	N/A	40	N/A	N/A
Total Acres	**N/A**	**40**	**N/A**	**N/A**
For Recreation:				
Burnt Hollow SRMA	N/A	17,280	N/A	17,280
Cabin Canyon SRMA	N/A	1,369	N/A	N/A
Dry Creek Petrified Tree EEA SRMA	N/A	2,567	N/A	2,567
Hole-in-the-Wall SRMA	N/A	11,952	N/A	11,952
Middle Fork Powder River SRMA	N/A	10,083	N/A	10,083
Mosier Gulch SRMA	N/A	1,026	N/A	1,026
Welch Ranch SRMA	N/A	809	N/A	809

	Alternative A (acres)	Alternative B (acres)	Alternative C (acres)	Alternative D (acres)
Weston Hills SRMA	N/A	9,504	N/A	9,504
Total Acres	**N/A**	**54,590**	**N/A**	**53,221**
For Wilderness Characteristics:				
Lands with Wilderness Characteristics Consideration	N/A	12,237	N/A	6,864
Total Acres	**N/A**	**12,237**	**N/A**	**6,864**
For ACECs:				
Burnt Hollow ACEC	N/A	17,280	N/A	N/A
Cantonment Reno ACEC	N/A	523	N/A	N/A
Dry Creek Petrified Tree EEA ACEC	N/A	2,567	N/A	N/A
Fortification Creek Elk Area ACEC	N/A	32,602	N/A	32,602
Hole-in-the-Wall ACEC	N/A	11,952	N/A	N/A
Pumpkin Buttes ACEC	N/A	1,731	N/A	1,731
Sagebrush Ecosystem ACEC	N/A	467,897	N/A	N/A
Welch Ranch ACEC	N/A	809	N/A	809
Total Acres	**N/A**	**535,365**	**N/A**	**2,542**
For WSR:				
Middle Fork Powder River WSR	N/A	2,664	N/A	N/A
Total Acres	**N/A**	**2,664**	**N/A**	**N/A**
For WSAs:				
Fortification Creek WSA	N/A	12,419	N/A	N/A
Gardner Mountain WSA	N/A	6,423	N/A	N/A
North Fork WSA	N/A	10,089	N/A	N/A
Total Acres	**N/A**	**28,931**	**N/A**	**N/A**
Total Acres Recommended for Withdrawal (summed Totals by Resource, less those acres for areas recommended under more than one Resource)	**N/A**	**717,741**	**N/A**	**61,818**

Source: BLM 2012f

ACEC Area of Critical Environmental Concern
EEA Environmental Education Area
N/A Not Applicable
SRMA Special Recreation Management Area
TCP Traditional Cultural Property
WSA Wilderness Study Area
WSR Wild and Scenic Rivers

4.2.1.8. Conclusion

The alternatives listed in ascending order from least to most adverse in terms of effects on the locatable minerals resource are alternatives A, C, D, and B.

Alternative A is the continuation of current management. Alternative B emphasizes resource conservation, and therefore generally places the most constraints on, and is the most restrictive to, development. Alternative C emphasizes resource use, and therefore places the least constraints on, and is the least restrictive to, development. Alternative D is the Proposed RMP, which strikes a middle ground between resource conservation and resource use, and therefore places a more moderate amount of constraints on development.

4.2.2. Leasable Minerals – Coal

This section estimates the effects on coal resources from management actions under each alternative. The effects on coal exploration, leasing, and development under each alternative can be direct, indirect, short-term, and long-term. As appropriate, effects are described as beneficial or adverse. Direct effects result from actions that either specifically prohibit or allow coal exploration and development. An example of a direct effect would be when an area is identified as unsuitable for coal mining so as to protect another resource value. An example of an indirect effect would be a timing restriction on exploration activity in a certain area, which would delay, but not prohibit, exploration in that location. Short-term effects are limited in time, while long-term effects would generally extend over the entire planning period.

4.2.2.1. Methods and Assumptions

Methods and assumptions used in this analysis include the following:

- The coal screening process has been completed for all coal lands categorized as having high potential for coal development. These are in two defined areas, one in Campbell County and one in Sheridan County. Upon receipt of a lease-by-application, the BLM will review previous coal planning decisions using current, site-specific data, and reapplying the coal screens as necessary, before determining if those lands would be acceptable for further consideration for leasing.
- For coal lands determined acceptable for further consideration in the two defined areas, leasing could occur under LBA, lease modification, emergency lease, or exchange. At present, there are 12 pending LBAs in the Campbell County area with high potential for coal development.
- Coal lands outside the two high-potential areas are not being evaluated for acceptability for further consideration for coal leasing in this RMP. The BLM assumes interest in leasing these lands would not be likely during the planning period based on the lack of a response to the call for coal development interest during the scoping of this RMP, as well as forecasting and active management of resource depletion and replacement over the last two decades.
- Coal lands outside the two high-potential areas would be considered open for coal exploration; however, the BLM also assumes that interest in exploration would not be likely during the planning period. However, exploration for coal suitable for *in situ* production methods (gasification) may be more likely.
- Exploration operations use several pieces of equipment including one or two pickup trucks, a water truck, and a rubber-tired drill rig with a 1,000 or 1,500-foot depth rating. These vehicles travel to the drill site along existing roads, trails, or along routes that have been surveyed for archeological resources and aligned to avoid cultural sites. The rig sets up at the drill location

and is not moved until drilling is completed. The water truck could make one trip out of the site and the pickup trucks several trips. Drilling of most holes can be completed in half a day or less. Four core holes are generally drilled per section, unless more detailed information is needed, such as to define an outcrop.

- Major restrictions on coal exploration include areas with occupancy prohibitions or overlapping timing requirements that leave insufficient open times to perform exploration operations.
- Moderate restrictions on coal exploration include seasonal restrictions or surface use restrictions.
- Restrictions for other resources apply to the entire planning period, but can be changed through RMP amendments.

Exploration, leasing, and development activity was estimated for the entire planning period. An analysis was performed using production forecasts for the Wyoming PRB, reserves available to current operators, and the amount of leasing necessary to replace depleted reserves during the planning period. In addition, acres of disturbance and reclamation were estimated based on production forecasts. The PRB Coal Review, Task 2 report (ENSR 2009a) was used for data to 2020, and the BLM projected these data to 2030 for this RMP. The BLM is currently updating the Task 2 report to 2030, and the report is expected to be complete at about the same time as the Buffalo RMP.

The BLM has estimated that it would issue 60 exploration licenses in the two high-potential areas over the next 20 years (the planning period). The BLM also estimates that approximately five licenses could result from interest in coal leasing outside those two areas, likely as a result of new coal conversion technologies. Exploration activity is estimated to disturb 600 acres in the two high-potential areas, and 100 acres outside those areas. This disturbance would be very short-term (1 to 2 days), with immediate reclamation.

The BLM has estimated that it would issue 28 coal leases encompassing 106,400 acres with approximately 10.2 billion tons of coal and encompassing 106,400 acres in the two high-potential areas over the next 20 years. The majority, if not all, of these leases would be to provide reserves so that the already operating mines can continue to operate. This is the ongoing production maintenance leasing program currently in effect for the PRB Coal Production Region (see the Chapter 3 *Leasable Minerals – Coal* section).

The 28 leases issued in the two high-potential areas are expected to be needed to maintain production at operating mines in the Buffalo planning area.

Exploration outside the areas identified as acceptable for further coal leasing consideration is expected to be associated with new coal recovery ventures. Such ventures include the possibility of technologies to convert coal, in situ, to either natural gas or liquid hydrocarbons (gasification or liquefaction) or technology that would commercially and beneficially develop deeper or currently uneconomical coals.

The BLM also is aware of a potential commercial technology that employs a biogenic process that would use a portion of the coal to manufacture natural gas. This process has been called methanogenesis, but is referred to as CH_4 farming in this section. The manufacture of the natural gas would be accomplished by injecting materials into the coal to stimulate organisms that are naturally occurring in PRB coal. These organisms biogenically consume hydrogen and carbon in the coal to manufacture hydrocarbons. These hydrocarbons would be produced or extracted for commercial use through existing wellbores. The result would be that depleted CBNG wells can be caused to yield hydrocarbons. It is likely that if this process is viable, the CBNG wells

would stay active longer before being plugged and reclaimed. Another result is that the coal in place would be partially altered, primarily in terms of chemical changes that could lower the coal's commercial value.

Significance Criteria

In addition to a major effect based on the scale of effect, an adverse effect on coal resources as a result of multiple-use constraints would be considered potentially significant if the following were to occur (Table 4.32, "Coal Resources Affected" (p. 824)):

Table 4.32. Coal Resources Affected

Percent of coal resource affected	Areas with high potential for coal development	Coals presently not economical to develop by surface mining methods
Less than 1		
1 to 5	X	
5 to 10		
More than 10		X

4.2.2.2. Impacts Common to All Alternatives

Leasable Minerals – Coal

Processing and consideration of LBAs and other leasing actions allowed in a decertified federal coal production region would continue in the two areas of coal lands with high potential for coal development. At present, there are seven LBAs being processed. The impacts associated with leasing have been or will be addressed in EISs, combining leases similarly located in space and application timing. Separate Records of Decision (RODs) will be issued for each LBA, with a decision of whether each LBA tract would be offered for competitive sale. At the time of this writing, four RODs have been issued. Two sales have been held (Maysdorf II North and Hay Creek II). No bids were received for the Maysdorf II North sale; the other tract associated with this LBA, Maysdorf II South, has not been scheduled for sale. One bid was received for the Hay Creek II sale that did not meet the BLM's estimation of fair market value. It is anticipated that the Hay Creek II tract will be reoffered at a later date. The seven LBAs total approximately 27,000 acres and contain approximately 3.5 billion tons of coal reserves. It is expected that these LBAs will be completed during the period 2013 to 2022. If leased, the reserves currently under LBA would meet coal production demand for the respective applicant mines for approximately ten to twelve years.

At this time, no other leasing is being considered. It is expected that additional leasing will be requested for surface coal mining in the areas identified as acceptable for further coal leasing consideration during the planning period. Assuming the existing LBAs are offered and leases issued, it is estimated that approximately five to six billion tons of recoverable reserves (approximately 68,000 to 81,600 acres) in addition to the existing LBAs would need to be leased during the planning period to replace depleted reserves at operating mines.

Coal lands outside the two high-potential areas have not been screened under the requirements of the coal regulations. If a coal leasing action was proposed outside the established areas with high-potential for coal development, the four coal planning screens will be applied to those lands and prior to leasing an amendment to this RMP will be required. Based on screening, only coal lands found acceptable for further consideration for leasing would be considered for potential lease. Given the conditions under which the decertified PRB federal coal production region

operates, it would not be likely that leasing for surface mining would occur outside the two high-potential areas. There has been interest shown in non-conventional coal utilization, such as *in situ* (in place) conversion of coal to hydrocarbons. Although commercial production of in situ coal gasification has not occurred in the PRB, there were two test sites for this technology in the 1970s near Gillette, Wyoming, and Linc Energy operates a pilot gasification project in the PRB on State of Wyoming surface and minerals. Upon receipt of an application for in situ coal gasification or conversion outside of the areas identified for further coal leasing consideration, a land use plan amendment would be initiated and the four coal screens would be applied to the area of interest.

Physical Resources

Air Quality, Soil, and Water Resources

Air management actions common to all alternatives include the implementation of mitigation measures to reduce emissions and to work cooperatively to reduce dust emissions. The coal mines are a primary emissions source within the planning area. A reclamation plan is required for the authorization of all surface-disturbing activities for the protection of soil, water and other resources. Surface-disturbing activities are managed to prevent degradation of water quality. These management actions would increase costs but would not prevent any coal operations; therefore, their effect is minor adverse.

Cave and Karst Resources

Karst formations are limited to the Big Horn Mountains portion of the planning area, outside of the PRB coal deposits. There would be no effect from cave and karst management on the coal program; therefore, cave and karst will not be discussed further in this section.

Mineral Resources

Locatable Minerals and Salable Minerals

The predominant locatable minerals within the planning area are uranium and bentonite. Uranium deposits are found primarily in south western Campbell County and south eastern Johnson County. Bentonite is found primarily in south western Johnson County. Commercial quantities of locatable minerals do not overlap with the high coal development potential areas. Salable mineral deposits are widespread throughout the planning area. Sufficient salable mineral deposits are available outside of foreseeable coal LBA areas. Neither locatable or salable minerals management would affect coal management; they will not be discussed further in this section.

Leasable Minerals – Fluids

Oil and gas fields underlie the coal lands in the Buffalo planning area. The development and production of these fields could affect the timing of leasing and development of federal coal lands. WO IM 2006-153, Policy and Guidance on Conflicts between CBNG and Surface Coal Mine Development in the PRB, dated May 11, 2006, provides updated direction on resolving conflicts between surface coal mining and CBNG operations on federal oil and gas leases (BLM 2006c). Conflict Administration Zones (CAZ) have been defined in areas where federal oil and gas leases are in effect on federal coal lands in the path of projected mining. Conflict resolution to optimize the production of both coal and oil and gas resources in the CAZ is the same under all alternatives. Coal leasing in producing conventional oil and gas fields could be deferred unless or until coal development would not interfere with the economic recovery of the oil and gas resource. This is determined on a project-specific (case-by-case) basis during coal lease tract processing. The effect is moderate adverse as coal mining could be delayed several years.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Fire and fuels management actions common to all alternatives would not effect coal exploration or development. Fire management within active coal mining areas would not differ across the alternatives and therefore will not be discussed in this section.

Biological Resources

Vegetation – Forests and Woodlands
There are no management actions common to all alternatives for the forest and woodland resources, there would be no effect on the coal program. Forest and woodland management actions by alternative predominantly relate to forest (old-growth, aspen, etc.) and mixed-shrubland management. These vegetation communities are present only within the northern Sheridan County high coal areas identified as acceptable for further coal leasing consideration. The presence of forest and woodland communities would not affect a potential coal lease or exploration activities; therefore, there would be no effect on the coal program and forest and woodland management will not be discussed further in this section.

Vegetation – Grassland and Shrubland Communities
Coal operations would be required to reestablish disturbed sites to healthy plant communities, and to manage the reclaimed lands for sustainable forage levels in accordance with the Wyoming Standards for Healthy Rangelands. These management actions would not prevent or restrict mining activities but would increase operational costs, the effect is minor.

There is only one management action which varies by alternative, regarding non-native species use in reclamation efforts. Seed requirements would not effect coal exploration or development activities; therefore, grassland and shrubland communities are not discussed further in this section.

Vegetation – Riparian/Wetland Resources
Management actions common to all alternatives would require coal operators to restore riparian/wetland habitats to enhance forage conditions and improve water quality as part of mine reclamation in order to achieve the Wyoming Standards for Healthy Rangelands. These actions would increase the cost of coal activities but would not prohibit coal exploration or development, the effect would be minor adverse.

Invasive Species and Pest Management
Coal operations would be required to revegetate and treat invasive species on disturbed areas through an Integrated Pest Management (IPM) program using certified weed seed-free products. These management actions would not prevent or restrict mining activities but would increase operational costs, the effect is minor.

Management actions that vary by alternative further regulate invasive species and pest management but would not restrict coal exploration or development or vary substantially in their effect; therefore, invasive species and pest management will not be discussed further in this section.

Fish and Wildlife Resources – Fish and Special Status Species – Plants and Fish
There are no potential fisheries or SSS plant habitat within the high coal development potential areas identified as acceptable for further coal leasing consideration, there will be no effect from

fish or SSS plant management on coal exploration or development. These resources will not be discussed any further in this section.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Management actions common to all alternatives would require coal operators to restore wildlife habitats as part of mine reclamation. New fences would be constructed to avoid adverse wildlife impacts. These actions would increase the cost of coal activities but would not prohibit coal exploration or development, the effect would be minor adverse.

Heritage and Visual Resources

Cultural Resources
Management actions common to all alternatives do not restrict coal exploration or development and therefore would have no effect on the coal resource.

Paleontological Resources
Paleontological management actions common to all alternatives and management actions which vary by alternative regulate the management of important and high-quality paleontological resources. High-quality resources would most likely be found within PFYC Class 4 or 5 areas which do not overlap with the areas identified as acceptable for further coal leasing consideration, there would be no effect on coal exploration or development from paleontological resource management and it will not be discussed further in this section.

Visual Resources
VRM actions, common to all alternatives would not effect coal exploration or development, there are no WSAs or WSRs in the areas identified as acceptable for further coal leasing consideration.

Land Resources

Forest Products, Renewable Energy, Rights-of-Way and Corridors, Travel and Transportation Management, and Lands with Wilderness Characteristics
The areas identified as acceptable for further coal leasing consideration do not include the commercial forest areas, areas with wind potential of good or higher, or lands with wilderness characteristics; there will be no effect from forest product, renewable energy, or wilderness characteristics management on the coal resource. ROWs and corridors, and TTM actions, common to all alternatives and by alternative, would not effect the coal resource. Established coal leases and foreseeable leases do not require ROWs, utilities are managed with the lease. Transportation management regulates public access to BLM surface and does not pertain to coal management. The public is typically excluded from active mining areas. None of these resources will be discussed further in this section.

Lands and Realty
The common to all management actions do not direct land acquisitions or disposals, only that they will be considered on a project specific basis. Since the management actions do not direct land tenure change proposals there would not be a discernible effect on the coal resource.

Recreation
The recreation common to all management actions do not regulate other land uses and therefore would not effect coal management.

Livestock Grazing Management
Livestock grazing is authorized on BLM surface within the areas identified as acceptable for further coal leasing consideration. The livestock grazing management actions common to all alternatives, and by alternative, do not regulate other land uses and therefore would not effect coal management. Livestock grazing will not be discussed further in this section.

Special Designations

Areas of Critical Environmental Concern
The Welch Ranch ACEC evaluation area is within the northern Sheridan County area identified as acceptable for further coal leasing consideration and the Burnt Hollow ACEC evaluation area is adjacent to the Campbell County area identified as acceptable for further coal leasing consideration. ACEC management actions common to all alternatives do not effect the on-the-ground management of the potential ACECs and therefore would not effect the coal resource.

Scenic or Back Country Byways, Wild and Scenic Rivers, and Wilderness Study Areas
None of the areas evaluated for these special designations are within an area identified as acceptable for further coal leasing consideration. There will be no effect from management actions, common to all alternatives or by alternative, for these special designations that would effect the coal resource, these special designations will not be discussed further in this section.

Socioeconomic Resources

Social and Economic Conditions
Social and economic management actions, common to all alternatives and by alternative, do not effect the on-the-ground exploration or development of coal and therefore would not effect the coal resource. Social and economic resources will not be discussed further in this section.

Health and Safety
Health and safety management actions common to all alternatives would increase the cost of coal operations but would not prohibit exploration or development activities. The impact of increased operational costs is minor adverse. There are no health and safety management actions which vary by alternative.

4.2.2.3. Alternative A

Leasable Minerals – Coal
Alternative A would continue management in accordance with the 1985 RMP as amended and maintained. This alternative would allow for coal exploration on all federal coal lands, subject to license stipulations necessary to protect other resource values. Coal exploration involves the use of truck-mounted drill rigs and support vehicles to drill shallow core holes. Historically, exploration has been active, averaging six licenses open (active) at any time, with three new licenses approved annually. This trend is expected to continue through the planning period. Restrictions on coal exploration are consistent with resource protection requirements for other short-term surface-disturbing activities. It is estimated that 65 exploration licenses would be issued during the planning period. The average license is assumed to authorize 20 exploration locations (wells), each disturbing 0.5 acre and each reclaimed within 1 year of drilling.

Sixty licenses are expected in the two areas identified as acceptable for further coal leasing consideration, with 600 acres disturbed and reclaimed during the planning period.

Although possible, new exploration on unleased lands outside the areas identified as acceptable for further coal leasing consideration would be unlikely during the planning period. It is assumed that coal demand for non-conventional conversion to liquid or gas hydrocarbons will increase during the planning period. Therefore, it is assumed five exploration licenses would be applied for on coal lands outside high-potential areas during the planning period. These licenses would likely cover a larger area because of the relative scarcity of data about coal outside the high-potential areas, with 100 acres disturbed and reclaimed during the planning period.

Leasing in the two areas identified as acceptable for further coal leasing consideration is expected to continue. Leasing would continue at a rate necessary to replace depleted reserves at the rates predicted in the PRB coal review study. From 2020 to 2030, the rate of production increase is conservatively forecast at one percent per year, approximately half the rate of the present electric power demand forecast. The reduced rate of coal demand is predicated on an increased emphasis on non-fossil fuels and a corresponding reduction in coal's participation in the portfolio of electric generation sources, and conservation of electricity as a result of electricity costs.

Under Alternative A, it is estimated that 28 new leases would be issued to existing operators during the planning period. It is assumed that surface-disturbing activities would lag leasing by five years to allow for Wyoming DEQ and Office of Surface Mining Reclamation and Enforcement (OSM) permitting timeframes. Surface disturbance estimates assume roughly contemporaneous reclamation at existing mines, with reclamation assumptions accounting for long-term mine facilities, and a ten percent increase in mine disturbance footprints to account for larger laybacks as coal depth increases.

Table 4.33, "Cumulative Disturbance and Reclamation from Coal Mining at Existing Mines under All Alternatives" (p. 843) lists estimates of disturbance and reclamation during the planning period. Under Alternative A, by 2030, it is expected that mining in the two areas identified as acceptable for further coal leasing consideration would have disturbed a total of 195,700 acres. These 195,700 acres comprise 120,700 acres that have been reclaimed, 45,500 acres in active mining areas and areas not yet recontoured or reseeded, and 75,000 acres occupied by facilities, stockpiles, ponds, haul roads, and other long-term structures.

There is developing interest in leasing coal lands for *in situ* coal gasification. This is a process that consumes coal that is in place underground and converts that coal by a physical process to hydrocarbons that can be recovered using wellbores. This process has been tested but not implemented commercially in the PRB; however, it has been implemented internationally. To have a project of this type on federal coal lands, a coal lease would be required.

It is assumed that coal demand for non-conventional conversion to liquid or gas hydrocarbons would increase during the planning period, and such interest would likely focus on coal outside of those areas already identified as acceptable for further coal leasing consideration. If a coal leasing action was proposed outside the established high-potential areas, the four coal planning screens will be applied to those lands, and prior to leasing an amendment to this RMP will be required.

At present, there is no management or specific policy guidance for managing CH_4 farming, the commercial manufacture of natural or hydrocarbon gases or liquids through physical or biological processes that convert coal *in situ*. Until there is such a policy, interim or permanent, the coal resource could be adversely affected if such processes are employed on federal coal

lands. For federal coal lands that also have federal oil and gas leases, there would be a minor effect from CH_4 farming. On these lands, if a federal well's productive life is extended by CH_4 farming, it might not be depleted and abandoned as normally occurs as coal mining approaches and available gas is depleted. However, the public could receive a royalty on the manufactured gas where a federal oil and gas lease is in effect. For federal coal lands where the oil and gas rights are non-federal, the effect of CH_4 farming could be significant because there would be no authorization to provide a mechanism for addressing conflicts between CH_4 farming and federal coal leases. Furthermore, if coal value is diminished, there is no mechanism to recover this lost value for the public benefit, except to pursue damages through trespass or similar actions. The BLM is expected to pursue policy resolution during the development of this RMP.

Physical Resources

Air Quality

There is one management action that varies by alternative regarding air quality modeling. Alternative A would require air quality monitoring on a project specific basis, typically when there could be an air quality standard exceedance. Modeling has regularly been performed for the PRB coal mines collectively and this holistic approach is anticipated to continue throughout the planning period. Modeling increases the cost for coal operations but it does not prohibit coal activities. Mitigation resulting from air quality modeling may also increase operational costs but is not anticipated to prevent coal mining. The modeling and costs would be a minor adverse effect to coal exploration and development. Since air quality monitoring for coal development is anticipated to occur in all alternatives there is no difference between alternatives in regards to coal and therefore air quality will not be discussed further in this section.

Soil and Water Resources

Current management prohibits surface-disturbing activities on sensitive soils and near water resources with exception provisions. These management actions would not effect coal mine siting but would regulate the location of exploration and non-conventional conversion operations. Project proponents can likely avoid sensitive soils and water resources when planning their projects therefore the effect of these management actions would be minor adverse.

Mineral Resources

Leasable Minerals – Fluids

Under Alternative A, coal development experiences a minor beneficial effect from lease stipulations on oil and gas leases for leased coal lands that are permitted for mining. Oil and gas operations that interfere with permitted mining do not adversely affect coal production as a result of these lease stipulations. However, this alternative does not provide for placing similar stipulations on oil and gas leases in areas not yet leased for coal development but that have high potential for coal leasing.

Under this alternative, the PRB CAZ would remain in effect. The CAZ is a defined area established by the BLM and based on the area that is expected to be mined over the next ten years. In that area, oil and gas lessees are notified of the expected mining and offered royalty incentives to expedite CBNG recovery in advance of mining. The CAZ is modified annually to reflect the progress of mining activities.

Biological Resources

Vegetation – Riparian/Wetland Resources
Current management prohibits surface-disturbing activities near riparian and wetland resources with exception provisions. These management actions would likely not effect coal mine siting but would regulate the location of exploration and non-conventional conversion operations. Project proponents can avoid riparian and wetland resources when planning their projects therefore the effect of these management actions would be minor adverse.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Current management prohibits surface-disturbing activities near important wildlife sites (WGFD WHMAs, grouse breeding sites, raptor nests, bald eagle nest and communal roost sites) and seasonally within sensitive habitats (big-game crucial winter range and calving areas, raptor nests, grouse nesting habitat, bald eagle nest and communal roost sites). Exceptions are provided for a portion of one Greater Sage-Grouse Core Population Area is within the area identified as acceptable for further coal leasing consideration in Campbell County and bald eagle nest and roost sites are present within the area identified as acceptable for further coal leasing consideration in Sheridan County. The presence of sensitive wildlife habitats is unlikely to effect coal mine siting as the areas identified as acceptable for further coal leasing consideration have already been screened accounting for these wildlife resources. These management actions would regulate the location of exploration and non-conventional conversion operations. Project proponents may not be able to avoid all wildlife protection areas when planning their projects therefore the effect of these management actions would be moderate adverse.

Heritage and Visual Resources

Cultural Resources
Current management stipulates fluid mineral leases for the protection of the Bozeman Trail and the Crazy Woman Battle Site. The Bozeman Trail passes through the identified as acceptable for further coal leasing consideration in Sheridan County. Although the current management action is fluid mineral specific, exploration and non-conventional coal conversion operations would likely be mitigated on a project specific basis for the protection of cultural resources. Cultural sites can typically be avoided or mitigated so that the effect on coal operations would be negligible.

Visual Resources
The high coal areas identified as acceptable for further coal leasing consideration contain VRM Classes II, III, IV, and V. The objective of VRM Class II is to retain the existing character of the landscape, management activities may be seen but should not attract attention. VRM Class III provides for moderate landscape change, activities may attract attention but should not dominate the view. Management activities may dominate the view in VRM Classes IV and V. Coal exploration and development activities particularly within VRM Classes II and III would be affected as projects would be required to include design features to comply with the appropriate VRM objectives. This could include limiting the size and placement of pits and infrastructure. The level of impact would be minor as there is little VRM Class II in the Campbell County area identified as acceptable for further coal leasing consideration and although VRM Class II makes up a large component of the Sheridan County area identified as acceptable for further coal leasing consideration less development is forecasted and the rough topography could be used to screen coal activities.

Land Resources

Lands and Realty
The current program for land tenure adjustments is proponent driven, the BLM is not actively pursuing potential acquisitions or disposals. There are parcels of BLM surface within both areas identified as acceptable for further coal leasing consideration identified for disposal and BLM surface within the Campbell County area identified for acquisition. It is most likely that realty actions would include only the surface estate and not the mineral estate; therefore, there would be no effect to the coal resource.

Recreation
Welch Ranch in northern Sheridan County is the only recreation site completely within an area identified as acceptable for further coal leasing consideration. Burnt Hollow is adjacent to, and Weston Hills lies in close proximity to, the Campbell County area identified as acceptable for further coal leasing consideration. Mineral activities would be managed on a project-specific basis within the recreation areas, which could include prohibiting coal exploration and development. Because a coal proposal is unlikely at Welch Ranch, the effect of recreation management on coal activities would be negligible adverse.

Special Designations

Areas of Critical Environmental Concern
The Welch Ranch ACEC evaluation area is within the northern Sheridan County area identified as acceptable for further coal leasing consideration and the Burnt Hollow ACEC evaluation area is adjacent to the Campbell County area identified as acceptable for further coal leasing consideration. There presently are no ACECs within the planning area therefore ACEC management would not affect the coal resource.

4.2.2.4. Alternative B

Leasable Minerals – Coal
Alternative B emphasizes resource conservation, and would allow for coal exploration only on federal coal lands in the two high-potential areas, subject to license stipulations necessary to protect other resource values. Coal exploration involves the use of truck-mounted drill rigs and support vehicles to drill shallow core holes. Historically, exploration has been active, averaging six licenses open (active) at any time, with three new licenses approved annually. This trend is expected to continue during the planning period. Restrictions on coal exploration are consistent with resource protection requirements for other short-term surface-disturbing activities. Under Alternative B, it is estimated that 60 exploration licenses would be issued during the planning period. The average license is assumed to authorize 20 exploration locations (wells), each disturbing 0.5 acre, and each reclaimed within one year of drilling, with 600 acres disturbed and reclaimed during the planning period.

Leasing in the two areas identified as acceptable for further coal leasing consideration is expected to continue under this alternative. Leasing would continue at a rate necessary to replace depleted reserves at the rates predicted in the PRB coal review study through 2020. From 2020 to 2030, the rate of production increase is conservatively forecast at one percent per year, approximately half the rate of the present electric power demand forecast. The reduced rate of coal demand is predicated on an increased emphasis on non-fossil fuels and a corresponding reduction of coal participation as a generation fuel, and conservation of electricity as a result of electricity costs.

Under Alternative B, it is estimated that 28 new leases would be issued to existing operators during the planning period. It is assumed that surface-disturbing activities would lag leasing by five years to allow for Wyoming DEQ and OSM permitting timeframes. Surface disturbance estimates assume roughly contemporaneous reclamation at existing mines, with reclamation assumptions accounting for long-term mine facilities, and a ten percent increase in mine disturbance footprints to account for larger laybacks as coal depth increases.

Table 4.33, "Cumulative Disturbance and Reclamation from Coal Mining at Existing Mines under All Alternatives" (p. 843) lists estimates of disturbance and reclamation during the planning period. Under this alternative, by 2030 it is expected that mining in the two areas identified as acceptable for further coal leasing consideration could disturb a total of 186,600 acres. These 186,600 acres comprise 120,600 acres that have been reclaimed, 36,500 acres in active mining areas, and 66,000 acres occupied by facilities, stockpiles, ponds, haul roads, and other long-term structures.

It is assumed that coal demand for non-conventional conversion to liquid or gas hydrocarbons will increase during the planning period. Under Alternative B, lands outside the two high-potential areas would be closed to exploration. As a result of these constraints, no exploration for new coal recovery ventures would be expected during the planning period. This is considered a major effect, because it would remove an extensive portion of the national coal resource from non-conventional conversion. However the commercial feasibility of this technology is uncertain.

As noted under Alternative A, there is no existing management or specific policy guidance for managing CH_4 farming. Under Alternative B, all coal lands in the Buffalo planning area would be closed to CH_4 farming. For federal coal lands that also have federal oil and gas leases, there would be a major effect as these lands become closed to potential gas manufacture. For federal coal lands where the oil and gas rights are non-federal, the effect of CH_4 farming could be significant because there would be no authorization to provide a mechanism for addressing conflicts between CH_4 farming and federal coal leases. Furthermore, if coal value is diminished, there is no mechanism to recover this lost value for the public benefit, except to pursue damages through trespass or similar actions.

Physical Resources

Soil and Water Resources

Alternative B prohibits surface-disturbing activities on sensitive soils and near water resources. These management actions could influence the siting of new coal mines but is unlikely to prevent their authorization. Exploration and non-conventional conversion operations would be prohibited for the protection of soil and water resources. Proponents of exploration and non-conventional conversion operations should be able to avoid sensitive soils and water resources when planning their projects. The effect of these management actions would be moderate adverse as the siting of coal exploration and development activities would be affected on more than ten percent of the planning area but proponents would be able to find suitable project locations.

Mineral Resources

Leasable Minerals – Fluids

Under Alternative B, new leases would be delineated to avoid active oil and gas operations in cases where it is demonstrated that reasonably foreseeable coal operations would interfere with economic recovery of conventional oil and gas resources, and new leases would

be stipulated with a requirement that coal development would accommodate preexisting oil and gas recovery operations. Existing coal leases would not be adversely affected under this alternative, unless these leases are stipulated with a requirement that coal development would accommodate preexisting oil and gas recovery operations when the existing leases are readjusted. The requirement to avoid oil and gas operations would have a major effect on coal recovery because there would be extensive areas of coal left in place to avoid oil and gas activity.

Under this alternative, the BLM policy established for the PRB that provides for a CAZ would remain in effect.

Biological Resources

Vegetation Resources – Riparian/Wetland
Alternative B prohibits surface-disturbing activities near riparian and wetland areas. These management actions could influence the siting of new coal mines but is unlikely to prevent their authorization. Exploration and non-conventional conversion operations would be prohibited for the protection of riparian and wetland resources. Proponents of exploration and non-conventional conversion operations would be able to avoid riparian and wetland communities when planning their projects. The effect of these management actions would be moderate adverse as the siting of coal exploration and development activities would be affected on more than ten percent of the planning area but proponents would be able to find suitable project locations.

Fish and Wildlife Resources – Wildlife and **Special Status Species – Wildlife (including Greater Sage-Grouse)**
Alternative B prohibits surface-disturbing activities near important wildlife sites (WGFD WHMA, grouse breeding sites, raptor nests, bald eagle nest and communal roost sites) and seasonally within sensitive habitats (big-game crucial winter range and calving areas, raptor nests, grouse nesting habitat, bald eagle nest and communal roost sites). Greater Sage-Grouse nesting habitat and herptile breeding habitat are present within both areas identified as acceptable for further coal leasing and bald eagle nest and roost sites are present within the Sheridan County potential area identified as acceptable for further coal leasing consideration. The presence of SSS wildlife habitats could influence coal mine leasing and siting. These management actions would regulate the location of exploration and non-conventional conversion operations. Project proponents would be unable to avoid all wildlife protection areas when planning their projects and projects or certain activities could be prohibited therefore the effect of these management actions would be major adverse.

Heritage and Visual Resources

Cultural Resources
Areas containing historic properties that retain their historic setting would be closed to mineral leasing, including coal. This management actions would prohibit coal leasing within five miles of the Bozeman Trail and other historic sites and would effect both areas identified as acceptable for further coal leasing consideration. This management action would prohibit coal mine leasing, exploration, and non-conventional coal operations in more than ten percent of the areas identified as acceptable for further coal leasing consideration, a major adverse effect.

Visual Resources
The Sheridan County areas identified as acceptable for further coal leasing consideration contains VRM Classes II, III, and IV; the Campbell County area identified as acceptable for further coal

leasing consideration is largely comprised of VRM Class IV with some VRM Class III. The objective of VRM Class II is to retain the existing character of the landscape, management activities may be seen but should not attract attention. VRM Class III provides for moderate landscape change, activities may attract attention but should not dominate the view. Management activities may dominate the view in VRM Class IV. Coal exploration and development activities particularly within VRM Classes II and III would be affected as projects would be required to include design features to comply with the appropriate VRM objectives. This could include limiting the size and placement of mine pits and infrastructure. The level of impact would be minor as there is no VRM Class II in the Campbell County high coal development potential area and although VRM Class II makes up approximately one-third of the Sheridan County area identified as acceptable for further coal leasing consideration little development is forecasted and the rough topography could be used to screen coal activities.

Land Resources

Lands and Realty

Alternative B would retain all lands identified for disposal having resource value, mineral estate would be considered a resource value. The parcels identified for disposal within both areas identified as acceptable for further coal leasing consideration would be retained. Acquisition actions would likely include acquisition of the mineral estate. Retaining all federal coal and the acquisition of additional federal coal lands would be a major benefit to the coal program.

Recreation

Welch Ranch in northern Sheridan County is the only SRMA completely within an area identified as acceptable for further coal leasing consideration. Three SRMAs lie partially within (Cabin Canyon), adjacent to (Burnt Hollow), or in close proximity to (Weston Hills) the Campbell County area identified as acceptable for further coal leasing consideration. Mineral leasing and exploration activities would be prohibited within and one-half mile surrounding the SRMAs. The effect of the prohibition would be minor as the Campbell County SRMAs are along the eastern edge of the area identified as acceptable for further coal leasing consideration and would likely impact few proposals. Coal activities are even less likely near the Welch Ranch SRMA in Sheridan County.

Special Designations

Areas of Critical Environmental Concern

The Welch Ranch ACEC is within the northern Sheridan County area identified as acceptable for further coal leasing consideration and the Burnt Hollow ACEC is adjacent to the Campbell County area identified as acceptable for further coal leasing consideration. Mineral activities would be prohibited within the ACECs. There is no management buffer surrounding the ACECs. Coal activity is not likely at the Welch Ranch therefore the prohibition effect would be negligible.

4.2.2.5. Alternative C

Leasable Minerals – Coal

Alternative C would emphasize resource use. This alternative would allow for coal exploration on all federal coal lands. Coal exploration involves the use of truck-mounted drill rigs and support vehicles to drill shallow core holes. Historically, exploration has been active, averaging six licenses open (active) at any time, with three new licenses approved annually. This

trend is expected to continue during the planning period. Restrictions on coal exploration are consistent with resource protection requirements for other short-term surface-disturbing activities. It is estimated that 65 exploration licenses would be issued during the planning period. The average license is assumed to authorize 20 exploration locations (wells), each disturbing 0.5 acre and each reclaimed within one year of drilling. Sixty licenses are expected in the two areas identified as acceptable for further coal leasing consideration, with 600 acres disturbed and reclaimed over the life of the plan.

New exploration on unleased lands outside the areas identified as acceptable for further coal leasing consideration is possible, but unlikely, during the planning period. It is assumed that coal demand for non-conventional conversion to liquid or gas hydrocarbons would increase during the planning period. Therefore, during the planning period, it is assumed that five new licenses would be submitted on coal lands outside the areas identified as acceptable for further coal leasing consideration. It is assumed these licenses would cover a larger area, due to the relative scarcity of coal data outside the areas identified as acceptable for further coal leasing consideration, with 100 acres disturbed and reclaimed during the planning period.

Leasing in the two areas identified as acceptable for further coal leasing consideration is expected to continue. Leasing would continue at a rate necessary to replace depleted reserves at the rates predicted in the PRB coal review study. From 2020 to 2030, the rate of production increase is conservatively forecast at one percent per year, approximately half the rate of the present electric power demand forecast. The reduced rate of coal demand is predicated on an increased emphasis on non-fossil fuels and a corresponding reduction of coal participation as a generation fuel, and conservation of electricity as a result of electricity costs.

Under Alternative C, it is estimated that 28 new leases would be issued to existing operators during the planning period. It is assumed that surface-disturbing activities would lag leasing by five years to allow for Wyoming DEQ and OSM permitting timeframes. Surface disturbance estimates assume roughly contemporaneous reclamation at existing mines, with reclamation assumptions accounting for long-term mine facilities, and a 10 percent increase in mine disturbance footprints to account for larger laybacks as coal depth increases.

Table 4.33, "Cumulative Disturbance and Reclamation from Coal Mining at Existing Mines under All Alternatives" (p. 843) lists estimates of disturbance and reclamation during the planning period. Under this alternative, by 2030 it is expected that mining in the two areas identified as acceptable for further coal leasing consideration would have disturbed a total of 195,700 acres. These 195,700 acres comprise 120,700 acres that have been reclaimed, 45,500 acres in active mining areas, and 75,000 acres occupied by facilities, stockpiles, ponds, haul roads, and other long-term structures.

There is developing interest in leasing coal lands for *in situ* coal gasification. This is a process that consumes coal in place underground and converts that coal by a physical process to hydrocarbons that can be recovered using wellbores. This process has not been implemented commercially in the PRB; however, it has been implemented internationally. To have a project of this type on federal coal lands, a coal lease would be required.

It is assumed that coal demand for non-conventional conversion to liquid or gas hydrocarbons would increase during the planning period, and such interest would likely focus on coal outside of the areas identified as acceptable for further coal leasing consideration. If a coal leasing action was proposed outside those areas, the four coal planning screens will be applied to those lands, and prior to leasing an amendment to this RMP will be required.

Under this alternative, the BLM would implement a policy or mechanism designed to authorize CH_4 farming on federal coal lands, regardless of the ownership of the oil and gas estate. The authorization could be an agreement, contract, or lease that would provide for compensation to the public for the use, production and/or reduced value of the federal coal or for the royalty value of the manufactured hydrocarbons produced. In addition, under this alternative, these authorizations would be stipulated to provide a requirement to CH_4 farm operators to cease their operations when the coal is leased for conventional mining. This policy would have a major beneficial effect on coal resource management by establishing a mechanism to manage conflicts between CH_4 farming and mining, by ensuring some return to the public for use of the coal resource, and by establishing an authorization process requiring appropriate NEPA analyses and mitigation measures.

Physical Resources

Soil and Water Resources

Alternative C provides for surface-disturbing activities on sensitive soils and near water resources with adequate consideration of all resources. These management actions would not effect active coal mines but would regulate the location of exploration and non-conventional conversion operations. Project proponents can likely avoid sensitive soils and water resources, but would not necessarily be required to, when planning their projects therefore the effect of these management actions would be negligible adverse.

Mineral Resources

Leasable Minerals – Fluids

Under Alternative C, coal development would experience a major beneficial effect from lease stipulations on oil and gas leases for coal lands that are permitted for mining. Oil and gas operations that interfere with permitted mining would not adversely affect coal production as a result of these lease stipulations. Furthermore, this alternative provides for similar stipulations on oil and gas leases in areas not yet leased for coal development but that have high potential for coal leasing. This has a beneficial effect on the coal resource by increasing the bonus value of the coal resource through reductions in future mining costs that would be required as compensation to operators that had established oil and gas operations. Under this alternative, the BLM policy established for the PRB that provides for a CAZ would remain in effect.

Biological Resources

Vegetation Resources – Riparian/Wetlands

Alternative C provides for surface-disturbing activities within and near riparian and wetland habitats with adequate consideration of all resources. These management actions would not effect active coal mines but would regulate the location of exploration and non-conventional conversion operations. Project proponents can likely avoid riparian and wetland communities, but would not necessarily be required to, when planning their projects therefore the effect of these management actions would be negligible adverse.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)

Alternative C allows surface-disturbing activities near important wildlife sites (WGFD WHMA, grouse breeding sites, raptor nests, bald eagle nest and communal roost sites) and within sensitive habitats (big-game crucial winter range and calving areas, raptor nests, grouse nesting habitat,

bald eagle nest and communal roost sites) when all resources are adequately considered. Greater Sage-Grouse leks are present within both areas identified as acceptable for further coal leasing consideration and bald eagle nest and roost sites are present within the Sheridan County area identified as acceptable for further coal leasing consideration. The presence of sensitive wildlife habitats is unlikely to effect coal mine siting. These management actions would regulate the location of exploration and non-conventional conversion operations. Project proponents may not be able to avoid all wildlife protection areas when planning their projects but wildlife can be considered and mitigated in project designs, and no projects would likely be prohibited, so that the effect of these management actions on coal activities would be minor adverse.

Heritage and Visual Resources

Cultural Resources

Alternative C allows surface-disturbing activities near historic sites that retain their historic setting. Coal mine siting would not be effected by this management action. Exploration and non-conventional coal conversion operations would be mitigated on a project specific basis. Cultural sites can typically be avoided or mitigated so that the effect on coal operations would be negligible.

Visual Resources

The Sheridan County area identified as acceptable for further coal leasing consideration contains VRM Classes III, and IV; the Campbell County area identified as acceptable for further coal leasing consideration is entirely VRM Class IV. VRM Class III provides for moderate landscape change, activities may attract attention but should not dominate the view. Management activities may dominate the view in VRM Class IV. Coal exploration and development activities particularly within VRM Class III would be affected as projects would be required to include design features to comply with the VRM objectives. This could include limiting the size and placement of pits and infrastructure. The level of impact would be negligible as there is no VRM Class III in the Campbell County area identified as acceptable for further coal leasing consideration. Although VRM Class III makes up approximately one-fourth of the Sheridan County area identified as acceptable for further coal leasing consideration, activities can be seen but they should not dominate the view. Rough topography can also be used to screen coal activities. It is anticipated that all proposals could be modified to meet VRM objectives.

Land Resources

Lands and Realty

Alternative C would seek to dispose of all lands identified for disposal, realty actions would also seek to dispose of the mineral estate. Additional federal acreage, surface or mineral, would not be acquired. Disposing of federal coal without the acquisition of additional federal coal lands would have a major adverse effect on the coal program.

Recreation

Welch Ranch in northern Sheridan County is the only SRMA completely within an area identified as acceptable for further coal leasing consideration. Burnt Hollow is adjacent to, and Weston Hills lies in close proximity to, the Campbell County area identified as acceptable for further coal leasing consideration. Mineral activities would be managed within, and adjacent to, SRMAs in consideration of other resource values. Such management would be unlikely to prohibit any

coal activities. Because a coal proposal is unlikely at Welch Ranch, the effect of recreation management on coal activities would be negligible adverse.

Special Designations

Areas of Critical Environmental Concern
The Welch Ranch ACEC evaluation area is within the northern Sheridan County area identified as acceptable for further coal leasing consideration and the Burnt Hollow ACEC evaluation area is adjacent to the Campbell County area identified as acceptable for further coal leasing consideration. No ACECs would be designated under Alternative C therefore ACEC management would not affect the coal resource.

4.2.2.6. Alternative D

Leasable Minerals – Coal
Alternative D would generally allow resource use if the activity can be conducted in a manner that conserves physical, biological, and heritage and visual resources, and would emphasize moderate constraints on resource uses to reduce adverse effects on resource values. Alternative D is the Proposed RMP.

This alternative would allow for coal exploration on all federal coal lands, subject to license stipulations necessary to protect other resource values. Coal exploration involves the use of truck-mounted drill rigs and support vehicles to drill shallow core holes. Historically, exploration has been active, averaging six licenses open (active) at any time, with three new licenses approved annually. This trend is expected to continue during the planning period. Restrictions on coal exploration are consistent with resource protection requirements for other short-term surface-disturbing activities. It is estimated that 65 exploration licenses would be issued during the planning period. The average license is assumed to authorize 20 exploration locations (wells), each disturbing 0.5 acre, and each reclaimed within 1 year of drilling. Sixty licenses are expected in the two areas identified as acceptable for further coal leasing consideration, with 600 acres disturbed and reclaimed during the planning period.

New exploration on unleased lands outside the high-potential areas is possible, but unlikely, during the planning period. It is assumed that coal demand for non-conventional conversion to liquid or gas hydrocarbons would increase during the planning period. Therefore, 5 exploration licenses during the planning period would be on coal lands outside the areas identified as acceptable for further coal leasing consideration. These licenses would likely cover a larger area, due to the relative scarcity of coal data outside the areas identified as acceptable for further coal leasing consideration with 100 acres disturbed and reclaimed during the planning period.

Leasing in the two areas identified as acceptable for further coal leasing consideration is expected to continue. Leasing would continue at a rate necessary to replace depleted reserves at the rates predicted in the PRB coal review study. From 2020 to 2030, the rate of production increase is conservatively forecast at one percent per year, approximately half the rate of the present electric power demand forecast. The reduced rate of coal demand is predicated on an increased emphasis on non-fossil fuels and a corresponding reduction of coal participation as a generation fuel, and conservation of electricity as a result of electricity costs.

Under Alternative D, it is estimated that 28 new leases would be issued to existing operators during the planning period. It is assumed that initiation of surface-disturbing activities would lag

coal lease issuance by five years to allow for Wyoming DEQ and OSM permitting timeframes. Surface disturbance estimates assume roughly contemporaneous reclamation at existing mines, with reclamation assumptions accounting for long-term mine facilities, and a ten percent increase in mine disturbance footprints to account for larger laybacks as coal depth increases.

Table 4.33, "Cumulative Disturbance and Reclamation from Coal Mining at Existing Mines under All Alternatives" (p. 843) lists estimates of disturbance and reclamation during the planning period. Under this alternative, by 2030 it is expected that mining in the two high-potential areas would have disturbed a total of 195,700 acres. These 195,700 acres comprise 120,700 acres that have been reclaimed, 45,500 acres in active mining areas and not yet recontoured or reseeded, and 75,000 acres occupied by facilities, stockpiles, ponds, haul roads, and other long-term structures.

There is developing interest in leasing coal lands for *in situ* coal gasification. This is a process that consumes coal in place underground and converts that coal by a physical process to hydrocarbons that can be recovered using wellbores. This process has not been implemented commercially in the PRB; however, it has been implemented internationally. To have a project of this type on federal coal lands, a coal lease would be required.

It is assumed that coal demand for non-conventional conversion to liquid or gas hydrocarbons would increase during the planning period, and such interest would likely focus on coal outside of the areas identified as acceptable for further coal leasing consideration. If a coal leasing action was proposed outside the established high-potential areas, the four coal planning screens will be applied to those lands, and prior to leasing an amendment to this RMP will be required.

At present, there is no management or specific policy guidance for managing CH_4 farming. Under Alternative D, until such specific management or policy guidance becomes available, the BLM would implement an authorization requirement when federal coal lands are requested for CH_4 farming. This coal use authorization would likely not be an exclusive use of the coal resource, but would allow for concurrent coal leasing with a condition in the authorization that would provide a mechanism for CH_4 farming cessation when necessary for coal mining operations. The authorization also would provide public compensation for the reduction in coal value resulting from CH_4 farming, especially on those lands where the coal and oil and gas mineral estate have been severed. If specific management or policy guidance becomes available that requires a coal lease for CH_4 farming, and a coal leasing action for CH_4 farming was proposed outside the established high-potential areas, the four coal planning screens will be applied to those lands, and prior to leasing an amendment to this RMP will be required.

Physical Resources

Soil and Water Resources

Alternative D provides for surface-disturbing activities on sensitive soils and near water resources when these resources are adequately protected. These management actions would likely not effect coal mine siting but would regulate the location of exploration and non-conventional conversion operations. Project proponents can avoid or mitigate sensitive soils and water resources when planning their projects therefore the effect of these management actions would be minor adverse.

Mineral Resources

Leasable Minerals – Fluids
Under Alternative D, during the planning period, new fluid mineral leases in areas identified as highly likely to be considered for LBAs would stipulate that oil and gas operations defer to coal development. The stipulation would serve to regulate fluid mineral operations that would interfere with potential coal mining. Lease stipulations in oil and gas leases in effect on leased, permitted coal lands would have a major beneficial effect on coal development. Oil and gas operations that interfere with permitted mining would not adversely affect coal production as a result of these lease stipulations. This provides a further beneficial effect on the coal resource by increasing the bonus value of the coal resource through reductions in future mining costs that would be required as compensation to operators that had established oil and gas operations. Under this alternative, the BLM policy established for the PRB that provides for a CAZ would remain in effect.

Biological Resources

Vegetation Resources – Riparian/Wetlands
Alternative D provides for surface-disturbing activities near riparian and wetland areas when these resources are adequately protected. These management actions would likely not effect coal mine siting but would regulate the location of exploration and non-conventional conversion operations. Project proponents can avoid or mitigate riparian and wetland communities when planning their projects therefore the effect of these management actions would be minor adverse.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative C allows surface-disturbing activities near important wildlife sites (WGFD WHMA, grouse breeding sites, raptor nests, bald eagle nest and communal roost sites) and within sensitive habitats (big-game crucial winter range and calving areas, raptor nests, grouse nesting habitat, bald eagle nest and communal roost sites) when the wildlife resources are adequately protected. A portion of one Greater Sage-Grouse Core Population Area is within the Campbell County area identified as acceptable for further coal leasing consideration and bald eagle nest and roost sites are present within the Sheridan County area identified as acceptable for further coal leasing consideration. The presence of sensitive wildlife habitats is unlikely to effect coal mine siting as the areas identified as acceptable for further coal leasing consideration have already been screened accounting for these wildlife resources. These management actions would regulate the location of exploration and non-conventional conversion operations. Project proponents may not be able to avoid all wildlife protection areas when planning their projects therefore the effect of these management actions would be moderate adverse.

Heritage and Visual Resources

Cultural Resources
Alternative D allows surface-disturbing activities within three miles of identified historic sites that retain their historic setting with adequate mitigation. Coal mine siting would likely not be affected by this management action. Exploration and non-conventional coal conversion operations would be mitigated and potentially prohibited for the protection of historic sites. Because few coal proposals are likely to be prohibited, most can be adequately mitigated, the effect on coal operations would be minor adverse.

Visual Resources
The Sheridan County area identified as acceptable for further coal leasing consideration contains VRM Classes II, III, and IV; the Campbell County area identified as acceptable for further coal leasing consideration is largely comprised of VRM class IV with some VRM Class III. The objective of VRM Class II is to retain the existing character of the landscape, management activities may be seen but should not attract attention. VRM Class III provides for moderate landscape change, activities may attract attention but should not dominate the view. Management activities may dominate the view in VRM Class IV. Coal exploration and development activities particularly within VRM Classes II and III would be affected as projects would be required to include design features to comply with the appropriate VRM objectives. This could include limiting the size and placement of mine pits and infrastructure. The level of impact would be minor as there is no VRM Class II in the Campbell County area identified as acceptable for further coal leasing consideration. Although VRM Class II makes up approximately one-third of the Sheridan County area identified as acceptable for further coal leasing consideration, little development is forecasted and the rough topography could be used to screen coal activities.

Land Resources

Lands and Realty
Alternative D would pursue land acquisitions and disposals for the public benefit. There are parcels identified for disposal within both areas identified as acceptable for further coal leasing consideration and parcels identified for acquisition in the Campbell County area identified as acceptable for further coal leasing consideration. Realty actions would seek to include the mineral estate in order to simplify management, prevent the creation of split estate. An active program to consolidate federal estate and dispose of small difficult to manage parcels would be a moderate benefit to the coal program.

Recreation
Welch Ranch in northern Sheridan County is the only SRMA completely within an area identified as acceptable for further coal leasing consideration. Three SRMAs lie partially within (Cabin Canyon), adjacent to (Burnt Hollow), or in close proximity to (Weston Hills) the Campbell County area identified as acceptable for further coal leasing consideration. Mineral leasing and exploration activities would be prohibited within, but not adjacent to, Burnt Hollow and Welch Ranch. Mineral leasing and activities would be allowed but managed to protect the recreation resources at Cabin Canyon and Weston Hills. The effect of the prohibition would be negligible as mineral activities would not be regulated outside of the SRMAs, Cabin Canyon would be available for coal leasing, and coal activities are unlikely to be proposed at Welch Ranch.

Special Designations

Areas of Critical Environmental Concern
The Welch Ranch ACEC lies within the northern Sheridan County area identified as acceptable for further coal leasing consideration. Burnt Hollow, located adjacent to the Campbell County area identified as acceptable for further coal leasing consideration, would not be designated. Mineral activities would managed under ACEC specific management plans which could include a prohibition on mineral exploration and development. Coal activity is not likely at the Welch Ranch therefore the prohibition effect would be negligible.

4.2.2.7. Cumulative Impacts

During the planning period, under any of the alternatives, it is expected that approximately 9 to 12 billion tons of coal will be produced by existing mines. This production will be in response to a national demand and a national preference for PRB coal due to lower mining costs, more environmentally compliant use, and demonstrated successful reclamation. The BLM preliminary work on the 2030 forecast for the PRB Coal Review indicates a slower rate of increase in PRB coal demand than occurred from 1990 through 2010, primarily due to new natural gas discoveries, a greater national priority on nuclear and renewable-energy generation, and potential effects on coal-fired electric generation as a result of possible regulation of GHGs. A more realistic annual growth rate in PRB coal production through 2030 is between 0.25 percent and two percent. This forecast is consistent with the Energy Information Administration's 2010 Energy Outlook Report (Energy Information Administration 2010). Therefore, by 2030, the BLM would expect PRB coal production to be between 500 and 700 million tons annually.

Coal produced is expected to be used almost entirely as steam coal for electric generation and other industrial applications. This coal will be used across the entire United States and internationally as demand and prices dictate.

Table 4.33, "Cumulative Disturbance and Reclamation from Coal Mining at Existing Mines under All Alternatives" (p. 843) lists cumulative disturbance and reclamation as a result of continuing production at existing mines under all alternatives. Approximately five percent of this cumulative disturbance and reclamation is estimated to occur on non-federal coal lands. Because the fee and state lands are scattered, it is not likely that these lands would be disturbed if the federal coal lands are not leased and permitted.

Table 4.33. Cumulative Disturbance and Reclamation from Coal Mining at Existing Mines under All Alternatives

Year	Total Cumulative Disturbance	=	Total Cumulative Reclamation	+	Area Available to Reclaim[1]	+	Area Unavailable to Reclaim[2]
2010	102,500		46,800		30,000		25,700
2020	148,800		86,200		34,400		28,200
2030	195,700		120,700		45,500		75,000

Source: ENSR 2005b

[1]Includes active mining area
[2]Includes facilities, stockpiles, ponds, haul roads, etc.

A small amount of acreage would be disturbed by exploration activity each year under all alternatives (600 acres), with slightly more exploration (100 acres) allowed under Alternative D in response to expected interest in *in situ* gasification of deeper PRB coals. All exploration disturbances would be reclaimed immediately following exploration. Because the United States retained most of coal lands in the PRB, an insignificant amount (up to 100 acres) of exploration could occur off of federal coal lands.

Coal leasing in advance of existing mining is expected under all alternatives. The BLM will manage the pace of leasing to ensure a fair return to the public, through bonus bids, for those coal reserves leased. The BLM paces individual lease offerings to coincide with leased reserve depletion. This avoids potential private speculation in federal coal reserves, while providing existing coal mines with adequate reserves to compete for coal sales. If a lease

application is received for areas outside of those areas currently acceptable for further coal leasing consideration, a RMP amendment will be required.

Under Alternative D, the BLM expects that interest in *in situ* coal gasification would result in coal leasing in the deeper PRB coals outside of the areas identified as acceptable for further coal leasing consideration. If a lease application is received for areas outside of those areas currently acceptable for further coal leasing consideration, a RMP amendment will be required.

Under Alternative D, the BLM expects to manage CH_4 farming on federal coal lands. The activity will occur on lands already disturbed for conventional CBNG recovery. CH_4 farming, while it would not cause new disturbance, would result in a delay in reclaiming these disturbed lands.

4.2.2.8. Conclusion

Federal coal resources will be managed under all alternatives consistent with the specific coal planning criteria as required at 43 CFR 3420.1 and 43 CFR 3460. These requirements include identifying federal coal lands as unsuitable for coal leasing that fall under any of the coal unsuitability criteria, managing multiple use conflicts, and not leasing federal coal lands where there is a qualified surface owner that denies consent to lease.

All alternatives provide for replacing reserves depleted by existing mines. Leasing would be for production maintenance. Production at existing mines is in response to demand, and leasing would be in response to production. All exploration activities under any alternative are subject to development restrictions in place under that alternative.

Alternative B would restrict coal exploration and development to the two designated high-potential areas, potentially restricting *in situ* gasification, underground mining, and long-term future surface coal mining. This i would remove an extensive portion of the national coal resource from non-conventional conversion. However, the commercial feasibility of these technologies in the PRB is uncertain. All other alternatives would allow coal exploration throughout the planning area, with leasing subject to a land use plan amendment during which all of the coal planning requirements would be applied.

CH_4 farming is seen to be a beneficial use of federal coal resources when properly managed. CH_4 farming would provide for a possible use of coals at depths where coal mining is cost prohibitive. However, many unanswered operational and legal questions persist. Pilot projects to test this process will be considered on a case-by-case basis; however, the operational and legal questions must be answered before CH_4 farming projects can proceed to commercial development in the BFO area.

4.2.3. Leasable Minerals – Fluids

Management actions to protect other resource values could directly and indirectly impact new oil and gas leases, exploration, and development. A direct impact is one that specifically prohibits or allows oil and gas leasing, exploration, or development. An example of a direct impact is the decision to identify areas as closed to new oil and gas leasing. Management actions that do not explicitly allow or prohibit oil and gas exploration and development activity, but could influence a company's decision whether to proceed with a given project, are considered an indirect impact on oil and gas leasing, exploration, or development. Indirect impacts are the result of management actions that place restrictions on oil and gas exploration and development. An example of an

indirect impact is a CSU stipulation restricting certain activities to protect a wildlife habitat area. Short-term impacts have a duration of fewer than five years. For example, a Timing Limitation Stipulation (TLS) or other seasonal restriction could result in short-term impacts. Long-term impacts have a duration of at least five years and perhaps for the duration of the planning period. Decisions to identify areas as closed to oil and gas leasing result in long-term impacts when the decision covers more than five years. Refer to Maps 13 through 16 for leasable fluid minerals alternatives.

4.2.3.1. Methods and Assumptions

Impacts analysis and conclusions are based on interdisciplinary team knowledge of resources and the project area, review of existing literature, and information provided by other agencies. Impacts are quantified where possible. Spatial analysis was performed using the ESRI ArcGIS computer software. In the absence of quantitative data, best professional judgment was used. Impacts are sometimes described using ranges or are described in qualitative terms, if appropriate. Reductions in the number of well locations (and potential surface disturbance) from the baseline RFD scenario for each alternative are a result of proposed management actions, mitigation measures, and BMPs presented in Chapter 2 and various appendices. Those measures can affect oil and gas development activities by not allowing leasing, restricting surface occupancy, controlling surface use, or adding restrictive mitigation to Conditions of Approval (COAs) on federal Applications for Permit to Drill (APDs). After the acres of federal oil and gas resources were calculated for each classification by alternative, the percent reduction in well numbers for each classification by alternative was estimated. This estimate is a percentage of the well numbers and surface disturbance that may not occur under each alternative. The impacts of the various restrictions are shown using the change in oil and gas production that results from all management actions.

The number of wells projected to be drilled under each alternative is used to estimate potential effects on other resources. These well numbers provide an easy, but incomplete, basis for estimating effects because multiple wells can be drilled from the same surface location. Well locations (as opposed to well numbers) are an indicator of human presence or disruptive activities and related impacts. The other major component of the fluid minerals RFD scenario is surface disturbance related to the construction of exploration and development wells and associated infrastructure. Surface disturbance associated with oil and gas development activity is the primary indicator of effects on other resources. Surface disturbance varies by type of well (conventional versus CBNG) because well pad size can vary and multiple wells can be drilled from one surface location. The estimate of surface disturbance by alternative is included in the BFO final RFD report; these estimates are included in Appendix G (p. 1937). Many variables may increase or decrease the level of drilling activity and associated surface disturbance acreage during the planning period. If the projections in the RFD prove to be inaccurate, the BLM will evaluate the RMP when the well numbers or surface disturbances in the RFD are approached to determine if a plan amendment or revision is warranted. Every subsequent action must be consistent with the RMP, and that consistency is checked in every NEPA document the BLM completes.

In addition to the number of oil and gas wells and the surface disturbance estimated for each alternative, the locations of the oil and gas activity are important to the analysis of effects on other resources. Most of the oil and gas exploration and development is projected to occur in areas currently experiencing oil and gas development, based on high and moderate oil and gas potential (Map 23). Map 23 identifies the areas in the Buffalo planning area most likely to experience future oil and gas development activity.

Oil and gas leasing, exploration, and development can occur throughout the entire Buffalo planning area, except where it is restricted.

The RFD and RFA tables can be found in Appendix G (p. 1937).

Assumptions

- The analysis began with the baseline total unconstrained oil and gas development potential taken from the RFD scenario for oil and gas (Stilwell et al. 2012) as summarized in Chapter 3, and applied the constraints from the other resource programs in Chapter 2. Constraints under each resource may affect oil and gas development.
- Most of the planning area has a high potential for the occurrence of oil and gas (Stilwell et al. 2012).
- There will be low or no potential interest in developing geothermal resources during the planning period.
- The RFD was updated in 2012 to reflect the increased interest in horizontal drilling.
- The CBNG potential is 51.8 percent federal fluid minerals.
- The conventional potential is 51.5 percent federal fluid minerals.
- Constraints greater than 160 acres are not reachable by CBNG technologies.
- Constraints greater than 1,300 acres are not reachable by conventional technologies.

The following terms are used to define the extent of environmental consequences:

- Negligible – The impact on the resource is barely detectable; less than 1 percent of the resource is affected. This level of impact is not considered to be significant to the fluid mineral resource.
- Minor – The impact on the resource is slight but detectable; there is a small change in the resource. This includes impacts on 1 percent to 5 percent of the resource. This level of impact is not considered to be significant to the fluid mineral resource.
- Moderate – The impact on the resource is readily apparent; there is a measurable change in the resource. This includes impacts to between 5 and 10 percent of the resource.
- Major – The impact on the resource is great; there is a highly noticeable, long-term, or permanent measurable change in the resource. This includes impacts on more than 10 percent of the resource.
- In this section impact is used instead of effect for describing what may happen to the fluid mineral resource. The reason for this is that impact describes an action that has an adverse effect on the fluid minerals resource. The impact can be described as anything that would cause the fluid minerals resource to not be developed or would add time and cost to the project.

Significance Criteria

Impacts on leasable fluid minerals are considered significant if management actions affects 250 or more CBNG wells and 50 or more conventional wells.

4.2.3.2. Impacts Common to All Alternatives

Leasable Minerals – Fluids

Geothermal leasing and geophysical exploration would be allowed in the same areas as oil and gas leasing under all alternatives; this action would treat all fluid mineral activities equally. The deferral of fluid mineral leasing in areas with leased coal would impact the availability of fluid mineral resources. This would be a minor impact as the fluid mineral

resources would still be present but their availability would be delayed until the coal operation is completed. The remaining management actions common to all alternatives are incorporated into policy or Oil and Gas Onshore Order #1.

Physical Resources

Air Quality

The air quality management actions common to all alternatives have no impact on the fluid minerals resource.

Soil

Authorized surface-disturbing activities will include plans for reclamation; site-specific reclamation actions should reflect the complexity of the project, environmental concerns, and the reclamation potential of the site. This management action is already a requirement of Oil and Gas Onshore Order #1. Therefore, it has no additional impact to the fluid minerals resource.

Water Resources

The water management actions common to all alternatives have no impact on the fluid minerals resource.

Cave and Karst Resources

The cave and karst management actions common to all alternatives have no impact on the fluid minerals resource.

Mineral (other than Fluid Mineral) Resources

Under all alternatives, the development of other mineral resources may have a negligible impact on fluid mineral resources. In these situations, conflicts between fluid minerals development and other minerals development would generally be addressed on a case-by-case basis. Regulations preclude the waste of any public resource, and in most situations compromises are reached that affirm the ability of minerals developers to produce the mineral resources.

Fire and Fuels Management

Fire and fuels management prioritizes fire suppression in areas with high resource values and high values to humans, including oil and gas development areas and infrastructure. Wildland fires generally have little impact on the development and production of oil and gas resources, but they can be devastating when they occur. Health and safety impacts for oil and gas personnel can be significant. Fuel treatments designed to reduce fuels and meet other multiple-use resource objectives may benefit oil and gas production by reducing the sizes and intensities of wildland fires, thereby reducing the threat of loss of oil and gas facilities to wildland fire. The individual alternatives have no impact on the federal minerals resource and are therefore not discussed further in the fluid minerals section.

Biological Resources

Vegetation – Forest and Woodlands

There are no impacts common to all alternatives for forest and woodlands management actions.

There are no impacts to the oil and gas resource from forest and woodlands and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Vegetation – Grassland and Shrubland Communities
Grassland and shrubland communities management may influence the location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. These are the only impacts to the oil and gas resource from grassland and shrubland communities and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Vegetation – Riparian/Wetland Resources
Riparian/wetland resources management actions common to all alternatives may influence the location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. However, the management actions for each alternative have a varying degree of impact and are discussed in depth in their respective sections.

Invasive Species and Pest Management
There are no impacts common to all alternatives for invasive species and pest management actions. There are no impacts to the oil and gas resource from invasive species and pest management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Fish and Wildlife Resources – Fish
Fish resource management actions common to all alternatives may influence the timing, location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. However, the management actions for each alternative have a varying degree of impact and are discussed in depth in their respective sections.

Fish and Wildlife Resources – Wildlife
Wildlife resource management actions common to all alternatives may influence the timing, location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. However, the management actions for each alternative have a varying degree of impact and are discussed in depth in their respective sections.

Special Status Species – Plants
SSS plants resource management actions common to all alternatives may influence the location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. However, the management actions for each alternative have a varying degree of impact and are discussed in depth in their respective sections.

Special Status Species – Fish
SSS fish resource management actions common to all alternatives may influence the timing, location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. However, the management actions for each alternative have a varying degree of impact and are discussed in depth in their respective sections.

Special Status Species – Wildlife (including Greater Sage-Grouse)
SSS wildlife resource management actions common to all alternatives may influence the timing, location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. However, the management actions for each alternative have a varying degree of impact and are discussed in depth in their respective sections.

Upland game birds management actions common to all alternatives may influence the timing, location and size of oil and gas facilities, but would not preclude the development or completion of oil and gas activities. However, the management actions for each alternative have a varying degree of impact and are discussed in depth in their respective sections.

Raptors resource management actions common to all alternatives may influence the timing, location and size of oil and gas facilities. Surface disturbance is prohibited within 0.5 mile for known active bald eagle nests, and would have a negligible impact because this affects 7,710 acres or 0.22 percent of the fluid mineral resource. This impact may affect 32 CBNG wells and may preclude them from being drilled. In some cases the surface disturbance prohibition and the addition of the 1 mile CSU from February 1 to August 15 could lead to the fluid minerals resource not being developed.

Heritage Resources

Cultural Resources

The cultural resources management actions common to all alternatives have no impact on the fluid minerals resource.

Paleontological Resource

The paleontological resources management actions common to all alternatives have no impact on the fluid minerals resource.

Visual Resources

Visual resources manage WSAs under VRM Class I objectives. Any facilities or structures proposed in WSAs will be designed so as not to impair wilderness suitability. As fluid mineral development would be largely precluded within a WSA, there would be no effect from VRM Class I management. Elsewhere, visual resources management would require non-temporary facilities and structures to be screened, painted, and designed to blend with the surrounding landscape except where safety indicates otherwise. These management actions may influence the timing, location, size, and coloration of oil and gas facilities, but rarely preclude the development or completion of oil and gas activities. Visual resources management may have a minor to moderate impact on the fluid minerals resource depending on the location and intensity of the oil and gas activity.

Land Resources

Forest Products

There are no impacts to the fluid minerals resource from common to all alternatives for forest products management actions. There are no impacts from each alternative to the fluid minerals resource from forest products management and are therefore not discussed further in *Leasable Minerals–Fluids* section.

Lands and Realty

There are no impacts to the fluid minerals resource common to all alternatives for lands and realty management actions. There are no impacts from each alternative to the fluid minerals resource from lands and realty management and are therefore not discussed further in *Leasable Minerals–Fluids* section.

Renewable Energy
There are no impacts to the fluid minerals resource common to all alternatives for renewable energy management actions. There are no impacts from each alternative to the fluid minerals resource from renewable energy management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Rights-of-Way and Corridors
There are no impacts to the fluid minerals resource common to all alternatives for ROW and corridors management actions. There are no impacts from each alternative to the fluid minerals resource from ROW and corridors management and are therefore not discussed further in *Leasable Minerals–Fluids* section.

Travel and Transportation Management
TTM actions for maintenance of the public land transportation system would provide for public safety and adequate access for minerals development tasks. In most cases, developers would use the existing state, county, or BLM transportation network for initial access to potential oil and gas exploration sites, access for geophysical exploration, and similar activities. Once the BLM approves oil and gas exploration and development activities, developers may be required to improve and maintain existing BLM roads or develop new roads and remove them when they are no longer needed. There are no impacts to the fluid minerals resource common to all alternatives for TTM actions. There are no impacts from each alternative to the fluid minerals resource from transportation access management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Recreation
Recreation management actions may utilize the best available technology to minimize noise and light pollution potentially affecting recreation facilities and sites, and may have a negligible impact on the fluid minerals resource. This management action would not preclude the development or completion of oil and gas activities but it could influence the size, color and equipment of oil and gas facilities.

Lands with Wilderness Characteristics
There is no development forecasted for CBNG or conventional development within the southern Big Horn Mountains, the region of the planning area that includes the area possessing wilderness characteristics. Therefore there will be no impact on fluid minerals management and wilderness characteristics will not be discussed further in the *Leasable Minerals–Fluids* section.

Livestock Grazing Management
There are no impacts to the fluid minerals resource common to all alternatives for livestock grazing management actions. There are no impacts from each alternative to the fluid minerals resource from livestock grazing management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Special Designations

Areas of Critical Environmental Concern
ACEC management actions common to all alternatives will have no impact on the fluid minerals resource. However, the management actions within each alternative may have varying degrees of impact on the fluid minerals resource.

Scenic or Back Country Byways
There are no impacts to the fluid minerals resource common to all alternatives for scenic or national BCBs management actions. There are no impacts from each alternative to the fluid minerals resource from scenic or national BCBs management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Wild and Scenic Rivers
There are no impacts to the fluid minerals resource common to all alternatives for WSRs management actions. There are no impacts from each alternative to the fluid minerals resource from WSRs management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Wilderness Study Areas
If Congress acts on the WSAs (Fortification Creek, Gardner Mountain, and North Fork) (Map 75), the RMP will be amended. BLM Manual 6330 – Management of Wilderness Study Areas guidelines would continue to be followed during the RMP amendment. The BLM manages WSAs for the preservation of natural conditions and processes, and to provide opportunities for solitude or a primitive and unconfined type of recreation. Under the guidance of BLM Manual 6330 – Management of Wilderness Study Areas, the BLM manages WSAs to emphasize primitive, nonmotorized activities to maintain the current natural values. These actions may have a minor impact on fluid minerals development, because the total area of the WSAs is small compared to the area of potential oil and gas development.

Socioeconomic Resources

Social and Economic Conditions
There are no impacts to the fluid minerals resource common to all alternatives for socioeconomics management actions. There are no impacts from each alternative to the fluid minerals resource from socioeconomics management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

Health and Safety
There are no impacts to the fluid minerals resource common to all alternatives for health and safety management actions. There are no impacts from each alternative to the fluid minerals resource from health and safety management and are therefore not discussed further in the *Leasable Minerals–Fluids* section.

4.2.3.3. Alternative A

Leasable Minerals – Fluids
Stipulating fluid mineral leases in areas with leased coal would impact the availability of fluid mineral resources. This would be a minor impact as it affects 1.3 percent of the fluid minerals resource which would still be present but the availability would be delayed until the coal operation is completed.

Physical Resources

Air Quality
The air management action, modeling on a project specific basis, will have no effect on the fluid minerals resource.

Soil
Alternative A applies an NSO stipulation for minerals leases on slopes equal to or greater than 25 percent. This covers 412,145 acres and may have a major impact because it affects 12 percent of the fluid minerals resource and may affect 416 CBNG wells and 23 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells.

Surface-disturbing activities are restricted on soils with poor reclamation suitability. This covers 1,514,445 acres and may have a major impact because it affects 45 percent of the fluid minerals resource and may affect 3,598 CBNG wells and 599 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Applying an NSO stipulation for minerals leases in areas with severe erosion hazard covers 669,739 acres. This may have a major impact because it affects 20 percent of the fluid minerals resource and may affect 3,780 CBNG wells and 383 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Under Alternative A, surface-disturbing activities on badlands, rock outcrops, and slopes susceptible to mass movement are restricted on a project-specific basis. This management action has been inconsistently applied. This management approach may have a moderate impact on the fluid minerals resource, depending on how much area may be affected and how prevalent the action may be.

Overall the management actions for soil for Alternative A would have a major impact on the fluid minerals resource.

Water Resources
Alternative A prohibits surface-disturbing activities within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams. This applies to 95,172 acres and may have a minor impact because it affects 2.8 percent of the fluid minerals resource and may affect 777 CBNG wells and 59 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Cave and Karst Resources
The cave and karst management action will have no effect on the fluid minerals resource.

Mineral Resources

Leasable Minerals – Coal
On coal leases for which mining and reclamation plans have been approved, oil and gas leases under Alternative A would stipulate that oil and gas operations not interfere with approved coal mining. There are 45,500 acres closed to leasing due to coal mining activity. This may have a minor impact because it affects 1.3 percent of the fluid minerals resource.

Biological Resources

Vegetation – Riparian/Wetland Resources
Alternative A prohibits surface-disturbing activities within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams. This applies to 144,045 acres and may have a minor impact because it affects 4.2 percent of the fluid minerals resource and may affect 777 CBNG wells and 59 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Fish and Wildlife Resources – Fish
Under Alternative A, mineral leasing activities near fish-bearing waters may be considered on a case-by-case basis. This management action has been inconsistently applied. This may have a minor impact on the fluid minerals resource, depending on how much area may be affected and how prevalent the action may be.

Fish and Wildlife Resources – Wildlife
Under Alternative A, surface disturbance and occupancy are prohibited unless waived by the authorized officer within Ed O. Taylor, Kerns, Bud Love and Amsden Creek big game winter ranges. This applies to 14,216 acres and may have a negligible impact because it affects 0.4 percent of the fluid minerals resource and may affect one CBNG well and one conventional well.

Alternative A prohibits surface disturbance and disruptive activities in crucial elk winter range between November 15 and April 30 and in elk calving areas from May 1 to June 30, when necessary, a total of 173,512 acres). This may have a minor impact on fluid minerals development because activities would be allowed during other periods.

Alternative A prohibits surface disturbance and occupancy within 750 feet of sharp-tailed grouse leks at any time. This applies to 2,200 acres and may have a negligible impact because it affects less than 0.1 percent of the fluid minerals resource and may affect one CBNG well and one conventional well.

Alternative A prohibits surface disturbance within an additional 0.64-mile radius of sharp-tailed grouse leks from April 1 through May 30 unless the authorized officer waives the prohibition (35,736 acres). This may have minor impacts on fluid minerals development because the duration of the constraint is less than six months.

Alternative A prohibits surface disturbance or occupancy within a biologic buffer zone around active nests of raptor species of high federal interest unless the authorized officer waives the prohibition. This applies to 1,195,815 acres and may have a major impact because it would affect 35 percent of the fluid minerals resource and may affect 5,040 CBNG wells and 1,327 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Alternative A precludes new surface-disturbing activities within 0.5 mile of raptor nests during critical periods from February 1 to July 31 (2,298,687 acres). This may have a major impact on fluid minerals development due to the size and duration of the timing stipulation.

Overall the management actions for Fish and Wildlife Resources – Wildlife would have a major impact on the fluid minerals resource.

Special Status Species – Plants
Under Alternative A, minerals leasing in habitat for special status plant species is

considered on a case-by-case basis. This management action has been inconsistently applied. This may have a minor impact on fluid minerals development, depending on how much area may be affected and how prevalent the action may be.

Special Status Species – Fish
Under Alternative A, surface-disturbing activities near waters with special status fish are considered on a case-by-case basis. This management action has been inconsistently applied. This may have a minor impact on fluid minerals development, depending on how much area would be affected and how prevalent the action may be.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative A manages SSS wildlife on a case-by-case basis. This management action has been inconsistently applied. This management may have a minor impact on oil and gas development, depending on how much area is affected and how prevalent the action may be.

Alternative A prohibits or restricts surface-disturbing activities or surface occupancy within a 0.25-mile radius of the perimeter of occupied Greater Sage-Grouse leks. This covers 22,777 acres and may have a negligible impact on fluid minerals development because it affects 0.7 percent of the fluid minerals resource and may affect 8 CBNG wells and 1 conventional well.

This alternative prohibits surface disturbance within Greater Sage-Grouse nesting habitat from March 1 to June 15, unless the authorized officer waives the prohibition, and affects 1,685,563 acres of the fluid minerals resource. This may have a moderate impact due to the size and duration of the timing stipulation.

Alternative A requires a 0.5-mile year-round disturbance free buffer zone for known active bald eagle nests and bald eagle winter roosts. This applies to 7,710 acres, and may have a negligible impact because it affects 0.23 percent of the fluid minerals resource and may affect 32 CBNG wells and 1 conventional well.

Applying a TLS within 1 mile of known active bald eagle nests and bald eagle winter roosts covers 24,171 acres and may have a negligible impact because it affects 0.5 percent of the fluid minerals resource.

Alternative A prohibits surface disturbance or occupancy within a biological buffer zone around active nests of special status raptor species unless waived by the authorized officer. This covers 433,635 acres, and may have a major impact because it affects 13 percent of the fluid minerals resource and may affect 5,040 CBNG wells and 1,327 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Alternative A manages SSS amphibians, reptiles, and bats on a case-by-case basis. This management action has been inconsistently applied. This management may have a minor impact on oil and gas development, depending on how much area is affected and how prevalent the action may be.

Overall the management actions for SSS – Wildlife would have a major impact on the fluid minerals resource.

Heritage and Visual Resources

Cultural Resources
Alternative A applies NSO stipulations on mineral leases for the Crazy Woman Battle Site and potentially eligible or significant segments of the Bozeman Trail (0.25 mile or the visual horizon, whichever is closer). This applies to 27,233 acres, and may have a negligible impact because it affects 0.6 percent of the fluid minerals resource, and may affect 61 CBNG wells and 20 conventional wells.

Minerals activities in areas with sensitive or sacred sites are considered on a case-by-case basis. This management action has been inconsistently applied. This management action may have a minor impact on oil and gas development, depending on how much area is affected and how prevalent the action may be.

Overall the management actions for cultural resources would have a minor impact on the fluid minerals resource.

Paleontological Resources
Minerals activities in areas with paleontological sites are considered on a case-by-case basis. This management action has been inconsistently applied. This management action may have a negligible impact on oil and gas development, depending on how much area is affected and how prevalent the action may be.

Visual Resources
Visual resources are managed in accordance with objectives for VRM classes that have been assigned to the planning area. This may have a negligible impact on the fluid minerals resource as it influences the timing, location, size, and coloration of oil and gas facilities, but rarely precludes the development or completion of oil and gas activities.

Land Resources

Recreation
Under Alternative A, oil and gas leasing and development are not allowed in the Mosier Gulch Recreation Area and surface disturbance or occupancy is prohibited within 0.5 mile of the site unless waived by the authorized officer. This action may have a negligible impact because it affects less than 0.01 percent of the fluid minerals resource and may not affect oil and gas development since it is outside the RFD scenario.

Prohibiting surface disturbance or occupancy within 0.5 mile of Dry Creek Petrified Tree EEA, unless waived by the authorized officer, may have a negligible impact because it affects less than 0.01 percent of the fluid minerals resource and may affect 6 CBNG wells and 1 conventional well.

Overall the management actions for Recreation would have a negligible impact on the fluid minerals resource.

Special Designations

Areas of Critical Environmental Concern
There are presently no ACECs within the planning area; ACEC management actions will have no impact on the fluid minerals resource.

Wilderness Study Areas
Under Alternative A WSAs will continue to be unavailable for fluid mineral leasing and development. The Fortification Creek WSA has high potential for CBNG resources and as high as moderate potential for conventional resources. Gardner Mountain and North Fork WSAs have no fluid mineral potential. WSA management may have a negligible adverse impact on oil and gas development.

4.2.3.4. Alternative B

Leasable Minerals – Fluids
Suspending fluid mineral leases in areas with leased coal would impact the availability of fluid mineral resources. This would be a minor impact as it affects 1.3 percent of the fluid minerals resource which would still be present but the availability would be delayed until the coal operation is completed.

Physical Resources

Air Quality
Alternative B's requirement for air quality modeling may have a negligible impact on the fluid minerals resource as it would increase operator costs.

Soil
Under Alternative B, NSO stipulations for mineral leases in areas with severe erosion hazard covers 669,739 acres. This may have a major impact because it affects 20 percent of the fluid minerals resource and may affect 1,958 CBNG wells and 168 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Applying an NSO stipulation for mineral leases on slopes equal to or greater than 25 percent covers 412,145 acres. This may have a major impact because it affects 12 percent of the fluid minerals resource and may affect 280 CBNG wells and 15 conventional wells.

Applying an NSO stipulation on surface-disturbing activities on soils with poor reclamation suitability covers 1,514,445 acres. This may have a major impact because it affects 45 percent of the fluid minerals resource and may affect 3,598 CBNG wells and 600 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Applying an NSO stipulation on badlands, rock outcrops, biological crusts, and slopes susceptible to mass movement covers 685,950 acres and may have a major impact because it affects 20 percent of the fluid minerals resource and may affect 1,280 CBNG wells and 108 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Overall the management actions for soil would have a major impact on the fluid minerals resource.

Water Resources
Alternative B prohibits surface-disturbing activities within 500 feet of springs, reservoirs, water wells, perennial streams, and associated riparian habitat to prevent stream bank and soil erosion. The 500-foot buffer covers 95,172 acres of the soils in the planning area, which may

have a minor impact because it affects 2.8 percent of the fluid minerals resource and may affect 778 CBNG wells and 59 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Prohibiting on-channel reservoirs covers 397,753 acres, and may have a negligible impact because it may not preclude oil and gas development, rather it limits one option of water disposal.

Overall the management actions for water resources would have a minor impact on the fluid minerals resource.

Cave and Karst Resources
Alternative B prohibits all surface- and subsurface-disturbing activities in cave and karst areas. This covers 212,626 acres and may have a negligible impact because the cave and karst resources do not overlap the RFD for CBNG or conventional wells, but it may affect whether or not a lease for fluid minerals is leased and what the bid for that lease might be.

Mineral Resources

Leasable Minerals – Coal
Under Alternative B, when a coal lease-by-application is filed over existing oil and gas leases, the coal lease applicant will be required to develop a mitigation plan acceptable to the oil and gas lessee allowing maximum recovery of both resources. Implementation of this mitigation plan must be accepted by any successful lease-by-application bidder and will become a stipulation on the coal lease. If a mitigation plan cannot be agreed upon prior to offering the coal lease sale, then BLM will delineate coal tracts to avoid oil and gas operations or will delay leasing of the coal tract. This may have a moderate beneficial effect on the fluid mineral estate.

Biological Resources

Vegetation – Riparian/Wetland Resources
Alternative B applies an NSO stipulation and prohibits surface-disturbing activities for mineral leasing within 500 feet of riparian/wetland systems, aquatic habitats, and floodplains. This covers 144,045 acres and may have a moderate impact because it affects 4.2 percent of the fluid minerals resource and may affect 1,218 CBNG wells and 233 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Fish and Wildlife Resources – Fish
Alternative B applies an NSO stipulation to fluid minerals leases within 0.25 mile of naturally occurring waterbodies containing native and desirable non-native fish species. This covers 261,869 acres and may have a moderate impact because it affects 7.7 percent of the fluid minerals resource and may affect 1,263 CBNG wells and 308 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Fish and Wildlife Resources – Wildlife
Under Alternative B, surface disturbance and occupancy are prohibited within Ed O. Taylor, Kerns, Bud Love and Amsden Creek winter ranges for big game. This applies to 14,216 acres and

may have a negligible impact because it affects 0.4 percent of the fluid minerals resource and may affect one CBNG well and one conventional well.

Alternative B applies a CSU stipulation to leases in elk crucial winter range and calving areas. This may have a minor impact because the CSU is more than 40 acres.

Requiring fluid minerals production and by-products to be piped out of crucial elk winter range and calving areas may have a minor impact because it may add cost to the oil and gas project.

Prohibiting surface-disturbing and disruptive activities with 0.5 mile of big-game migration and travel corridors covers 85,462 acres. This may have a minor impact because it affects 2.5 percent of the fluid minerals resource and may affect 102 CBNG wells and 20 conventional wells.

Applying an NSO stipulation to mineral leases within 0.25 mile of sharp-tailed grouse leks covers 3,601 acres. This may have a negligible impact because it affects 0.05 percent of the fluid minerals resource and may affect 14 CBNG wells and one conventional well.

Applying a TLSto minerals leases within an additional 2-mile radius of sharp-tailed grouse leks from April 1 through July 15 may have a minor impact due to the size and duration of the timing restriction.

Applying an NSO stipulation to mineral leases within a biologic buffer zone around active nests of raptor species of high federal interest covers 1,195,815 acres. This may have a major impact because it affects 35 percent of the fluid minerals resource and may affect 5,040 CBNG wells and 1,327 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Applying a TLS to mineral leases with 1.5 miles of active raptor nests may have a moderate impact due to the size and duration of the timing restriction.

Overall the management actions for Fish and Wildlife Resources – Wildlife would have a major impact on the fluid minerals resource.

Special Status Species – Plants
Alternative B applies an NSO stipulation on mineral leases in habitat for special status plant species. This covers 243,929 acres and may have a minor impact because the plant habitat is mostly outside the area of the RFD, even though it affects five percent of the fluid minerals resource and may affect 5 CBNG wells and 5 conventional wells.

Special Status Species – Fish
Alternative B applies an NSO stipulation on mineral leases within 0.25 mile of any waters containing special status fish species. This covers 2,481 acres and may have a negligible impact on the fluid minerals resource because it affects less than 0.01 percent of the fluid minerals resource and is outside the area of the RFD.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative B locates and manages facilities to minimize noise impacts on SSS. This rarely precludes the development or completion of oil and gas activities and may have a minor impact to the fluid minerals resource.

Managing surface-disturbing and disruptive activities to minimize impacts on special status wildlife species and their habitats rarely precludes the development or completion of oil and gas activities and may have a minor impact to the fluid minerals resource.

Applying an NSO stipulation to mineral leases containing prairie dog habitat covers 47,702 acres and may have a minor impact because it affects 1.4 percent of the fluid minerals resource and may affect 142 CBNG wells and 16 conventional wells.

Alternative B leases minerals in Greater Sage-Grouse habitat dependent upon Greater Sage-Grouse habitat suitability, population density, and development density. Leasing is closed within 4.0 miles of Greater Sage-Grouse leks and winter concentration areas and covers 2,248,685 acres. This may have a major impact because it affects 66 percent of the fluid minerals resource and may eliminate 4,468 CBNG wells and 1,294 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Applying an NSO prohibiting surface disturbing activities, disruptive activities, and occupancy within 4 miles of the perimeter of occupied or undetermined Greater Sage-Grouse leks covers 2,248,685 acres. This may have a major impact because it affects 66 percent of the fluid minerals resource and may affect 4,468 CBNG wells and 1,294 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Applying a TLS prohibiting surface disturbance and disruptive activities within nesting and early brood-rearing habitat greater than 4 miles of an occupied or undetermined Greater Sage-Grouse lek, from March 1 to July 15, may have a major impact due to the size and duration of the timing stipulation.

Applying a TLS prohibiting surface disturbance and disruptive activities, from November 15 to March 14, for Greater Sage-Grouse winter concentration areas may have a major impact due to the size and duration of the timing stipulation.

Applying a CSU that allows no more than one disturbance and three percent total surface disturbance per 640 acres within the DDCT analysis area covers 3,117,708 acres or 92 percent of the fluid minerals resource. This may have a major impact on CBNG because the restrictions effectively eliminate CBNG development since CBNG is developed on 80 acre spacing and is shallow enough geologically that directional drilling techniques may not allow full development of this resource. This same CSU may also have a major impact on conventional development because of the size of the pads and access roads along with the existing disturbance that would exceed the 3 percent disturbance cap which may severely restrict conventional development on federal minerals.

Alternative B applies an NSO stipulation to mineral leases within 0.5 mile of the following riparian corridors consistently used by bald eagles: Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River. This covers 58,902 acres and may have a minor impact because it affects 1.6 percent of the fluid minerals resource and may affect 536 CBNG wells and 69 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells. This buffer may be adjusted to 1.0 mile or greater based on topographic features, visibility, disturbance and human activity levels, and other factors, which covers 147,321 acres. This may have a minor impact because it affects 4.3 percent of the fluid minerals resource and may

affect 1,447 CBNG wells and 186 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Prohibiting surface-disturbing and disruptive activities within 1.5 miles of a SSS raptor nest may be a major impact because of the size and duration of the management action.

Applying an NSO stipulation to mineral leases within a biologic buffer zone around active nests of special status raptor species covers 433,635 acres. This may have a major impact because it affects 13 percent of the fluid minerals resource and may affect 1,580 CBNG wells and 687 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Alternative B prohibits surface-disturbing and disruptive activities for the protection of special status amphibian and reptile species and their habitats in the following areas: identified 100-year floodplains, areas within 1,640 feet (500 meters) of perennial waters, springs, playas, wells, and wetlands, areas within 100 feet of ephemeral channels, and areas within 1,640 feet (500 meters) of south-facing rock outcrops. This covers 1,217,959 acres and may have a major impact because it affects 36 percent of the fluid minerals resource and may affect 3,956 CBNG wells and 1,265 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Overall the management actions for SSS – Wildlife would have a major impact on the fluid minerals resource.

Heritage and Visual Resources

Cultural Resources

Alternative B recommends withdrawals from minerals leasing and closes fluid minerals leasing in areas with historic properties that retain their historic settings. This covers 759,449 acres and may have a major impact because it affects 22 percent of the federal mineral estate and may eliminate 1,440 CBNG wells and 519 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Prohibiting surface disturbance in areas containing historic properties, within 5 miles or the visual horizon (whichever is closer) of historic properties that retain their integrity of setting covers 1,854,954 acres and may have a major impact because it affects 55 percent of the fluid minerals resource and may affect 2,246 CBNG wells and 888 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Recommending withdrawals and closing mineral leasing in areas with sensitive sites such as TCPs and sacred sites to protect their settings covers 4,642 acres. This may have a negligible impact because it affects only 0.14 percent of the federal mineral estate and may affect 30 CBNG wells and 4 conventional wells.

Overall the management actions for cultural resources would have a major impact on the fluid minerals resource.

Paleontological Resources
Alternative B closes mineral leasing in areas containing paleontological resources of high importance and affects 860 acres. This may have a negligible impact because it would affect 0.02 percent of the fluid minerals resource and may eliminate six CBNG wells and one conventional well.

Visual Resources
Visual resources manages all VRI Class II areas and special emphasis areas as VRM Class II. All VRI Class III areas outside special emphasis areas are managed as VRM Class III. This may have a minor impact on the fluid minerals resource as it influences the timing, location, size, and coloration of oil and gas facilities, but rarely precludes the development or completion of oil and gas activities.

Land Resources

Recreation
Under Alternative B, closing areas to leasing and prohibiting surface disturbance in SRMAs and within a 0.5-mile buffer around SRMAs covers 55,529 acres. This may have a minor impact because it affects 1.6 percent of the fluid minerals resource and may eliminate 17 CBNG wells and 11 conventional wells.

Special Designations

Areas of Critical Environmental Concern
Closures to mineral leasing in the Cantonment Reno, Burnt Hollow, Dry Creek Petrified Tree, Fortification Creek, Hole-in-the-Wall, Pumpkin Buttes, and Welch Ranch ACECs covers 511,000 acres. This may have a minor impact because it affects 1.9 percent of the fluid minerals resource and may eliminate 193 CBNG wells and 29 conventional wells.

Wilderness Study Areas
Alternative B prohibits all motorized and mechanized equipment in WSAs. WSAs are closed to oil and gas leasing under Manual 6330. The Fortification Creek WSA has high potential for CBNG resources and low to moderate potential for conventional resources. Gardner Mountain and North Fork WSAs have no fluid mineral potential. This covers 28,931 acres, and may have a negligible impact because it affects 0.6 percent of the fluid minerals resource.

4.2.3.5. Alternative C

Leasable Minerals – Fluids
Stipulating coal leases in areas with leased fluids would benefit the fluid mineral resources, as the fluid mineral development would take preference over the coal lease on 1.3 percent of the fluid minerals resource.

Physical Resources

Air Quality
Air quality monitoring is not required, the air management action will have no effect on the fluid minerals resource.

Soil
The soils management actions will have no effect on the fluid minerals resource.

Water Resources
The water management action will have no effect on the fluid minerals resource.

Cave and Karst Resources
Under Alternative C, cave and karst management actions may have a negligible impact on the fluid minerals resource. A CSU stipulation in cave and karst areas covers 11 acres and affects less than 0.01 percent of the fluid minerals resource and may not affect any wells.

Mineral Resources

Leasable Minerals – Coal
Under Alternative C, stipulate fluid mineral leases when nominated within the areas identified acceptable for further consideration for coal leasing (BLM 2001a) to require a mitigation plan allowing for maximization of both coal and oil and gas resources. Since oil and gas leasing would still be possible in these areas and the oil and gas resources would not be destroyed, the acreage is irrelevant and any additional constraint on the lease may be a minor impact.

Biological Resources

Vegetation – Riparian/Wetland Resources
The riparian and wetland communities management action will have no effect on the fluid minerals resource.

Fish and Wildlife Resources – Fish
The fish management actions will have no effect on the fluid minerals resource.

Fish and Wildlife Resources – Wildlife
The big game and upland game birds management actions will have no effect on the fluid minerals resource.

Under Alternative C, a TLS is applied within 0.5 mile of active raptor nest. This affects 757,733 acres and may have a moderate impact due to the size of the timing stipulation.

Special Status Species – Plants
Alternative C applies an NSO stipulation to mineral leases in areas with known populations of special status plant species. This may have no effect on the fluid minerals resource since there are no special status plant species that currently overlay the RFD.

Special Status Species – Fish
Alternative C applies an NSO stipulation within 500 feet of any waters containing special status fish species. This covers 821 acres, and may have a negligible impact because it affects 0.02 percent of the fluid minerals resource and may affect 11 CBNG wells and 1 conventional well.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative C manages as follows within occupied Greater Sage-Grouse habitat:

- CSU prohibiting surface-disturbing and disruptive activities and occupancy within 0.25 mile of the perimeter of occupied or undetermined Greater Sage-Grouse leks. This affects 22,777 acres

and may have a negligible impact because it affects 0.7 percent of the fluid minerals resource and may affect 7 CBNG wells and one conventional well.
- Prohibit surface-disturbing and disruptive activities in all areas within 2 miles of occupied leks from March 1 to July 15. This may have a moderate impact due to the size and duration of the timing stipulation.
- Prohibit surface-disturbing and disruptive activities and occupancy within Greater Sage-Grouse winter concentration areas from November 15 to March 14. This may have a moderate impact due to the size and duration of the timing stipulation.

Alternative C requires a 0.5 mile year round disturbance free buffer zone for known bald eagle winter roosts. This applies to 7,710 acres, and may have a negligible impact because it affects 0.22 percent of the fluid minerals resource and may affect 32 CBNG wells and 1 conventional well.

Applying a TLS within 1 mile of known bald eagle winter roosts covers 24,171 acres and may have a negligible impact because it affects 0.5 percent of the fluid minerals resource.

Applying a TLS within 0.25 mile of a special status raptor nest affects 75,276 acres. This may have a minor impact due to the size and duration of the timing stipulation.

Applying a CSU stipulation to mineral leases within a biologic buffer around active nests of special status raptor species year-round covers 433,635 acres. This may have a major impact because it affects 13 percent of the fluid minerals resource and may affect 1580 CBNG wells and 687 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Alternative C special status amphibians, reptiles, and bats species management actions will have no effect on the fluid minerals resource.

Overall the management actions for SSS – Wildlife would have a major impact on the fluid minerals resource.

Heritage and Visual Resources

Cultural Resources

Alternative C allows mineral leasing in areas containing historic properties that retain their historic setting, when appropriate mitigation is accomplished. Mitigate through appropriate stipulations such as NSO or CSU to protect the setting. This covers 759,449 acres and may have a major impact because it affects 22 percent of the fluid minerals resource and may affect 1,440 CBNG wells and 519 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Alternative C allows mineral leasing in areas with sensitive sites such as TCPs and sacred sites, and may apply mitigation through appropriate stipulations such as NSO or CSU to protect the settings of such sites. This covers 92,494 acres, and may have a minor impact because it affects 2.7 percent of the fluid minerals resource and may affect 641 CBNG wells and 214 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Overall the management actions for Cultural Resources would have a major impact on the fluid minerals resource.

Paleontological Resources
Alternative C paleontologic resource management actions will have no effect on the fluid minerals resource.

Visual Resources
Alternative C visual resources manage all VRI Class II areas as VRM Class III. All VRI Class III areas are managed as VRM Class IV. This may have a negligible impact on the fluid minerals resource as it influences the timing, location, size, and coloration of oil and gas facilities, but rarely precludes the development or completion of oil and gas activities.

Land Resources

Recreation
Alternative C allows leasing in the Burnt Hollow, Petrified Tree, Middle Fork, Mosier Gulch, Welch Ranch, and Weston Hills SRMAs in accordance with the surrounding management, which covers 30,896 acres. This may have a negligible impact because it affects only 0.6 percent of the fluid minerals resource.

Special Designations

Areas of Critical Environmental Concern
The ACEC management action will have no effect on the fluid minerals resource.

Wilderness Study Areas
Alternative C prohibits all motorized equipment in WSAs. This covers 28,931 acres, and may have a negligible impact because it affects 0.6 percent of the fluid minerals resource. The Fortification Creek WSA has high potential for CBNG resources and as high as moderate potential for conventional resources. Gardner Mountain and North Fork WSAs have no fluid mineral potential.

4.2.3.6. Alternative D

Leasable Minerals – Fluids
Suspending fluid mineral leases in areas with leased coal would impact the availability of fluid mineral resources. This would be a minor impact as it affects 1.3 percent of the fluid minerals resource which would still be present but the availability would be delayed until the coal operation is completed.

Physical Resources

Air Quality
The air quality management actions will have no effect on the fluid minerals resource.

Soil
Alternative D applies a CSU stipulation on soils with a severe erosion hazard with an approved reclamation and stabilization plan. This covers 669,739 acres and may have a major impact because it affects 20 percent of the fluid minerals resource and may affect 1,959 CBNG wells and 168 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Applying a CSU on all slopes 25 percent or greater covers 412,145 acres. This may have a major impact because it affects 12 percent of the fluid minerals resource and may affect 280 CBNG wells and 15 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells.

Applying a CSU stipulation on LRP areas such as badlands, rock outcrops, biological crusts, and slopes susceptible to mass movement covers 685,950 acres. This may have a major impact because it affects 20 percent of the fluid minerals resource and may affect 1,280 CBNG wells and 108 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Overall the management actions for soil would have a major impact on the fluid minerals resource.

Water Resources
Alternative D applies a CSU stipulation to any fluid mineral lease within 500 feet of any spring, non-CBNG reservoir, water well, or perennial stream based on other resource values, including, but not limited to soil, slope, and vegetation. This covers 95,172 acres and may have a minor impact because it affects 2.8 percent of the fluid minerals resource and may affect 778 CBNG wells and 59 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Cave and Karst Resources
Alternative D applies a CSU stipulation within cave and karst areas. This covers 212,626 acres (4.4%) and may have a negligible impact because the cave and karst resources do not overlap the RFD for CBNG or conventional wells.

Mineral Resources

Leasable Minerals – Coal
Stipulate fluid mineral leases when nominated over existing coal leases to allow maximum recover of the coal resources. When an oil and gas parcel is nominated over a coal lease application or coal lease modification application, the parcel will be pulled from the oil and gas sale list and deferred until such time a coal lease is issued. Once a coal leased is issued or the sale cancelled and the case closed, the deferred parcel nomination may be added to the oil and gas lease sale list with stipulations. This may have a moderate impact on the fluid minerals resource and could affect the resources throughout the planning period.

Biological Resources

Vegetation – Riparian/Wetland Resources
Alternative D applies a CSU stipulation to any fluid mineral lease within 500 feet of riparian/wetlands systems, and aquatic habitats. This covers 144,045 acres and may have a moderate impact because it affects 4.2 percent of the fluid minerals resource and may affect 1,216 CBNG wells and 233 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Fish and Wildlife Resources – Fish
Alternative D applies a CSU stipulation within 0.25 mile of naturally occurring waterbodies

containing native and desirable non-native fish species. This covers 261,870 acres and may have a moderate impact because it affects 5.5 percent of the fluid minerals resource and may affect 1,263 CBNG wells and 308 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Fish and Wildlife Resources – Wildlife

Alternative D prohibits surface disturbance and occupancy in the Ed O. Taylor, Kerns, Bud Love, and Amsden Creek winter ranges for big game. This covers 14,216 acres and may have a negligible impact because it affects 0.3 percent of the fluid minerals resource and no CBNG wells or conventional wells as these area are located outside the RFD.

Applying a CSU and TLS stipulation to leases within big game crucial winter range and elk calving areas covers 334,366 acres. This may have a minor impact because it affects 9.8 percent of the fluid minerals resource and may affect 253 CBNG wells and 43 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells.

Requiring fluid mineral production and byproducts to be piped out of crucial elk winter range and calving areas unless operator proposes and acceptable alternative may have a minor to moderate effect based on the type of production and the additional equipment required to pipe the fluids. This requirement does not grant approval for off-lease measurement and/or commingling.

Applying a CSU stipulation to mineral leases within 0.25 mile of sharp-tailed grouse leks covers 3,601 acres. This may have a negligible impact because it affects 0.05 percent of the fluid minerals resource and may affect 14 CBNG wells and 1 conventional well.

Applying a TLS to minerals leases within an additional 2-mile radius of sharp-tailed grouse leks from April 1 through July 15 may have a minor impact due to the size and duration of the timing restriction.

Alternative D applies a CSU stipulation to fluid mineral leases within the USFWS recommended biologic buffer zone around active nests of raptor species of conservation concern. This covers 1,195,815 acres and may have a major impact because it affects 35 percent of the fluid minerals resource and may affect 5,040 CBNG wells and 1,327 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Alternative D applies a TLS to fluid mineral leases within USFWS recommended spatial buffer of an active raptor nest for the following time periods:

- February 1 to July 15 for golden eagles, barn owls, and great horned owls. This covers 111,962 acres and affects 3.3 percent of the fluid minerals resource.
- April 1 to July 31 for ospreys, merlins, sharp-shinned hawks, kestrels, prairie falcons, northern harriers, Swainson's hawks, and Cooper's hawks. This covers 19,708 acres and affects 0.6 percent of the fluid minerals resource.
- March 1 to July 31 for red tailed hawks, short eared owls, long eared owls, and screech owls. This covers 79,644 acres and affects 2.4 percent of the fluid minerals resource.
- Overall the TLS may have a moderate impact due to the size and durations of the stipulations.

Overall the management actions for Fish and Wildlife Species – Wildlife would have a major impact on the fluid minerals resource.

Special Status Species – Plants
Alternative D applies a CSU stipulation to mineral leases in habitat for special status plant species. This covers 243,929 acres and may have a minor impact because it affects 7.2 percent of the fluid minerals resource and may affect 15 CBNG wells 5 conventional wells.

Applying an NSO stipulation to fluid mineral leases within known special status plant populations may have a negligible impact because the current populations are outside the RFD.

Special Status Species – Fish
Alternative D prohibits surface-disturbing activities within 0.25 mile of fish-bearing waters when special status fish species are present. This covers 2,481 acres, and may have a negligible impact because it affects 0.1 percent of the fluid minerals resource and may affect 15 CBNG wells and 2 conventional wells.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative D locates and manages facilities to mitigate noise impacts on special status wildlife species. This rarely precludes the development or completion of oil and gas activities and may have a minor impact on the fluid minerals resource.

Managing surface-disturbing and disruptive activities to minimize impacts on special status wildlife species and their habitats rarely precludes the development or completion of oil and gas activities and may have a minor impact on the fluid minerals resource.

Applying a CSU stipulation to mineral leases in areas with active prairie dog colonies to provide suitable habitat to SSS that depend on prairie dog colonies covers 47,702 acres. This may have a minor impact because it affects 1.4 percent of the fluid minerals resource and may affect 143 CBNG wells and 16 conventional wells.

Greater Sage-Grouse Core Population Area

Alternative D applies an NSO prohibiting surface-disturbing activities, disruptive activities, and occupancy within 0.6 mile of the perimeter of occupied Greater Sage-Grouse leks. This covers 30,754 acres and may have a negligible impact because it affects 0.9 percent of the fluid minerals resource and may affect 84 CBNG wells and 1 conventional well.

Applying a CSU that allows on average no more than one disturbance and no more than five percent total disturbance per 640 acres within the DDCT analysis area and, where technologically feasible, prohibits facilities with motion, light sources, noise (10 decibels above ambient), and heights greater than 4.5 feet covers 519,945 acres. This may have a major impact because it affects 15.3 percent of the fluid minerals resource and may eliminate 803 CBNG wells and affect 150 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells. CBNG resources need to be developed on 80 acre spacing which cannot be accomplished with only 1 disturbance per 640 acres and current technology. Due to directional and horizontal technologies, the conventional oil and gas resource may be accessed up to 1 mile under the Core Population Area boundary without the surface location being within Core Population Area. This may cause an increased density of conventional wells on the boundary of the Core Population Area.

Applying a TLS prohibiting surface-disturbing and disruptive activities within Core Population Area from March 15 to June 30, covers 440,114 acres. This may have a major impact due to the size and duration of the stipulation.

Applying a TLS prohibiting surface-disturbing and disruptive activities within Greater Sage-Grouse winter concentration areas, from December 1 to March 14, may have a minor to moderate impact due to the size and duration of the stipulation.

Greater Sage-Grouse Core Population Connectivity Corridor

Alternative D applies an NSO prohibiting surface-disturbing activities, disruptive activities, and occupancy within 0.6 mile of the perimeter of occupied Greater Sage-Grouse leks. This covers 7,359 acres and may have a negligible impact because it affects 0.2 percent of the fluid minerals resource and may affect 45 CBNG wells and 15 conventional wells.

Applying a CSU stipulation that allows no more than five percent total surface disturbance per 640 acres within the DDCT analysis area and avoids facilities with motion, light sources, noise (10 decibels above ambient), and height greater than 4.5 feet covers 150,006 acres. This may have a moderate impact because it affects 4.4 percent of the fluid minerals resource and may affect 763 CBNG wells and 70 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells. The management for Core Population Connectivity Corridors (Connectivity Corridors) is significantly different from the management of Core Population Areas. Within Connectivity Corridors the disturbance is not limited to 1 per 640 acres. This allows for the possibility of CBNG and conventional oil and gas development within Connectivity Corridors dependant on existing surface disturbance. While it is more likely that development will occur in Connectivity Corridors than in Core Population Areas, because of the restrictions, CBNG development will probably not happen within Connectivity Corridors.

Applying a TLS prohibiting surface-disturbing and disruptive activities within 4 miles of an occupied Greater Sage-Grouse lek, from March 15 to June 30, covers 131,849 acres. This may have a minor impact due to the size and duration of the timing stipulation.

Applying a TLS prohibiting surface-disturbing and disruptive activities within Greater Sage-Grouse winter concentration areas, from December 1 to March 14, may have a minor to moderate impact due to the size and duration of the stipulation.

Greater Sage-Grouse Habitat Outside Core Population Areas and Core Population Connectivity Corridors

Alternative D applies an NSO prohibiting surface-disturbing activities, disruptive activities, and occupancy within 0.25 mile of the perimeter of occupied Greater Sage-Grouse leks. This covers 16,103 acres and may have a negligible impact because it affects 0.5 percent of the fluid minerals resource and may affect 8 CBNG wells and 1 conventional well.

Applying a TLS prohibiting surface-disturbing and disruptive activities within 2 miles of occupied Greater Sage-Grouse leks, from March 15 to July 30, covers 779,734 acres. This may have a major impact due to the size and duration of the timing stipulation.

Applying a TLS prohibiting surface-disturbing and disruptive activities within Greater Sage-Grouse winter concentration areas, from December 1 to March 14, may have a minor to moderate impact due to the size and duration of the stipulation.

Alternative D requires a 0.5 mile year round disturbance free buffer zone for known active bald eagle winter roosts. This applies to 11,848 acres, and may have a negligible impact because

it affects 0.28 percent of the fluid minerals resource and may affect 32 CBNG wells and 1 conventional well.

Alternative D applies a CSU stipulation to mineral leases within 0.5 mile of the following riparian corridors consistently used by bald eagles: Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River. This covers 58,902 acres and may have a minor impact because it affects 1.6 percent of the fluid minerals resource and may affect 536 CBNG wells and 69 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells. This buffer may be adjusted to 1 mile or greater based on topographic features, visibility, disturbance and human activity levels, and other factors, which covers 147,321 acres. This may have a moderate impact because it affects 4.3 percent of the fluid minerals resource and may affect 1,447 CBNG wells and 186 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Alternative D applies a TLS to mineral leases within a species specific spatial buffer using USFWS recommendations containing nests for an active SSS raptor nest for the following time periods:

- March 1 to July 31 for ferruginous hawks and peregrine falcons. This covers 670,652 acres and may have a major impact due to the size and duration of the timing stipulation.
- April 15 to September 15 for burrowing owls. This covers 11,316 acres and may have a minor impact due to the size and duration of the timing stipulation.
- April 1 to August 31 for northern goshawk. Currently there are no mapped nests for this species though they would likely be found in the area. Therefore, the impact may be none.

Applying an NSO stipulation to mineral leases within a biologic buffer zone using USFWS recommendations around active nests of special status raptor species covers 433,635 acres. This may have a major impact because it affects 12.8 percent of the fluid minerals resource and may affect 1,606 CBNG wells and 626 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Under Alternative D, a CSU stipulation is applied to mineral leases for the protection of special status amphibian, reptile, and bat species and their habitats where SSS occur in areas within 1,640 feet (500 meters) of perennial waters, vernal pools, playas, and wetlands, and within 1,640 feet of south-facing rock outcrops. This covers 1,217,959 acres, and may have a major impact because it affects 36 percent of the fluid minerals resource and may affect 3,956 CBNG wells and 1,265 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Overall the management actions for SSS – Wildlife would have a major impact on the fluid minerals resource.

Heritage and Visual Resources

Cultural Resources

Alternative D applies an NSO stipulation to fluid mineral leases for Pumpkin Buttes, Cantonment Reno, Dull Knife Battle Site, Crazy Woman Battle Site, contributing and unevaluated segments of the Bozeman Trail, all rock art sites, all rock shelter sites, and all Native American burial sites.

This covers 24,461 acres, and may have a negligible impact because it affects 0.7 percent of the fluid minerals resource and may affect 58 CBNG wells and 15 conventional wells.

Applying a CSU stipulation to protect the setting within three miles of the above sites covers 613,601 acres. This may have a major impact on the fluid minerals resource because it affects 16 percent of the fluid minerals resource and may affect 1,440 CBNG wells and 519 conventional wells. This management action is considered a significant impact on leasable fluid minerals because it affects 250 or more CBNG wells and 50 or more conventional wells.

Overall the management actions for Cultural Resources would have a major impact on the fluid minerals resource.

Paleontological Resources
Alternative D applies an NSO stipulation to mineral leases in areas containing paleontological resources of high quality or importance. This covers 860 acres and may have a negligible impact because it affects 0.02 percent of the fluid minerals resource and may affect 6 CBNG wells and 1 conventional well.

Visual Resources
Visual resources manage all VRI Class II areas (except Powder River Breaks and Fortification Creek) and special emphasis areas as VRM Class II. All VRI Class III areas, plus Powder River Breaks and Fortification Creek, outside special emphasis areas are managed as VRM Class III. This may have a minor impact on the fluid minerals resource as it influences the timing, location, size, and coloration of oil and gas facilities, but rarely precludes the development or completion of oil and gas activities.

Land Resources

Recreation
Alternative D does not allow fluid mineral leasing within the boundary of Burnt Hollow, Dry Creek Petrified Tree, Middle Fork Powder River, Mosier Gulch, Hole in the Wall, and Welch Ranch SRMAs. This may have a minor impact because it affects 1.5 percent of the fluid mineral resource and may eliminate 22 CBNG wells and 10 conventional wells.

Applying a CSU stipulation to Weston Hills SRMA covers 9,504 acres. This may have a negligible impact because it affects 0.3 percent of the fluid minerals resource and may affect six CBNG wells and nine conventional wells.

Overall the recreation management actions for recreation would have a minor impact on the fluid minerals resource.

Special Designations

Areas of Critical Environmental Concern
Alternative D designates two ACECs (2,849 acres) and manages them under site specific management plans. This may have a negligible impact because it affects less than 0.1 percent of the fluid minerals resource and may affect 18 CBNG wells and 5 conventional wells.

Wilderness Study Areas
Alternative D prohibits all motorized and mechanized equipment in WSAs. This

covers 28,931 acres, and may have a negligible impact because it affects 0.6 percent of the fluid minerals resource.

4.2.3.7. Cumulative Impacts

Oil and gas leasing, exploration and production continue under all alternatives in this RMP. The extent of the activity will be limited by each of the alternatives, with Alternative B imposing the most restrictions and Alternative C imposing the least, the prices of oil and gas commodities and the available technology for extraction of the fluid minerals. However, restrictions imposed on the resource can preclude the resource from being developed regardless of how valuable the oil and gas may be. For instance, where overlapping timing stipulations are present the operation window for drilling for oil and gas may be 3 months. Typically CBNG wells are drilled, completed and producing with 45 days. For the deeper conventional wells the drilling alone may take 30-60 days with another 30 days for completion and production activities. If anything occurs to extend these timeframes the operator may have to postpone the activities until the following year thereby increasing the cost of the well. Other restrictions, such as VRM, may not prohibit the project but may add to the cost of the project. These costs may cause a marginally economic project to be tabled until the future or may cause it to be dropped altogether.

4.2.4. Leasable Minerals – Other

The likelihood of other leasable minerals (i.e., leasable minerals other than coal, crude oil, natural gas, and geothermal energy) being explored for, or developed, in the planning areas is remote (see Chapter 3, *Other Leasable Minerals* section). Therefore, these minerals are not discussed further, and potential effects on other leasable minerals due to management actions for other resources are not analyzed. To date, the BFO has not received applications to lease a leasable mineral other than coal, oil, or gas in the planning area. If the office receives a lease application for leasing of another leasable mineral, the BLM solid minerals team in the High Plains District Office likely would process the application.

4.2.5. Salable Minerals

The BLM manages salable minerals to make them available for the mineral consumption needs of the nation. Salable minerals are the most common varieties of minerals, and include aggregate (such as sand and gravel), clinker (locally called “scoria”), common clay, stone, decorative rock, rip rap, and boulders; other minerals may also fall under this category. Clinker and sand and gravel comprise nearly all salable minerals disposals in the planning area. This section describes potential effects on the salable minerals resource from management actions for other resources and other management programs. The *Salable Minerals* section of Chapter 3 describes existing salable minerals resource conditions and likely trends during the planning period.

The Chapter 3 *Mineral Resources* section presents a discussion regarding the various mineral estate types and which mineral classifications (Leasable, Locatable, and/or Salable) BLM administers for each major mineral estate type present in the planning area. That section also discusses how split estate lands, which are lands with different surface estate and mineral estate ownership, are administered by the BLM, and for which mineral classifications. The total federal salable minerals resource in the planning area is comprised of all lands in which the federal government owns all minerals (on the Master Title Plats this is shown as “All Mins”) for all surface ownership types. The only exception is lands under the administration of USFS, which

may or may not have USFS surface. The total federal locatable minerals resource is quite large, approximately 3,357,586 acres. It is this acreage that is analyzed below, as these are the acres of the total federal salable minerals resource in the planning area that the BLM administers (see the *Mineral Resources* section of Chapter 3).

4.2.5.1. Methods and Assumptions

This section describes the methods and assumptions used in the effects analysis for the salable minerals resource. The *Salable Minerals* section of Chapter 3 describes existing salable minerals resource conditions. In general, the greater the number of acres affected, the greater the effect on the resource. Actions that limit, or impose restrictions upon, the acres of salable minerals resource open to mineral entry are considered adverse. Other actions may affect the accessibility to the salable minerals resource, and these will likely lead to increased project costs by delaying operations or production, or making operations inaccessible during certain times of the year. However, these actions would not affect the salable minerals resource itself, and are not discussed in detail. Even in the extreme example that a number of such limitations would result in such high costs that a given project became uneconomic, those acres of salable minerals resource would still be considered available or open to mineral materials disposals. Actions that increase the acres of salable minerals resource (those open or available) are considered beneficial. Also considered beneficial would be actions that would lead to a reduction in the number of acres currently under restrictions, reduced salable minerals activities costs, increased opportunities for salable minerals activities, and/or increased health and safety of workers and/or the general public in/near areas where these activities are occurring.

Assumptions

The assumptions may include, but are not limited to:

- The occurrence of a salable mineral does not imply that the mineral can be economically developed.
- Mineral occurrence potential includes both exploitable and potentially exploitable occurrences.
- The potential for occurrence of salable minerals exists across almost the entire planning area.
- A number of common variety minerals, such as sand, gravel, decorative stone, common clay, shale, borrow material, and clinker, occur in the planning area. Some varieties (such as sand, gravel, and clinker) have a high potential for development.
- The potential for development of sand, gravel, and clinker is expected to continue to be high throughout the planning period.
- Current demand for and production of decorative stone (e.g., building stone and moss rock) is low and expected to remain low throughout the planning period.
- The administration of salable minerals and related surface-disturbing activities would involve BLM cooperation with the Wyoming DEQ, as outlined in the current BLM/Wyoming DEQ MOU for salable minerals. The latest version of this MOU was signed on September 11, 2013, and is titled "Supplement to MOU No. WY-19 between the US DOI, BLM, Wyoming State Office, and the State of Wyoming DEQ, LQD, for Management of Surface Mining and Exploration for Mineral Materials (Salable Minerals) on Public Lands" (DOI and State of Wyoming 2013).
- The salable minerals resource discussed and analyzed in this document consists of only those acres of mineral ownership type "All Mins" with BLM, private, or State of Wyoming surface ownership (not USFS surface; see Chapter 3). Not included are lands in the Bighorn National Forest and the Thunder Basin National Grasslands, as the USFS administers the salable minerals

resource on those lands, even those without USFS surface. Also not included are lands under Department of Defense jurisdiction (e.g., the lands attached to the Veteran's Hospital northwest of Sheridan), as the mineral estate of those lands was transferred to the Department of Defense.
- Any alternative that limits salable minerals activities or acres would have an adverse effect on the potential exploration and development of salable minerals.
- Restrictions on salable minerals activities apply for the duration of the planning period. However, there could be changes through RMP amendments or changes in regulations.
- The disposal of salable mineral resources is discretionary.

Significance Criteria

In addition to the scale of effects identified at the beginning of Chapter 4, an adverse effect on the salable minerals resource as a result of management actions would be considered potentially significant if any of the following were to occur:
- An action would violate objectives associated with salable minerals resource management (including the *Materials Act of 1947*, as amended), and its magnitude would be such that special mitigation would be warranted.
- An action would violate the decisions, resolutions, and goals outlined in the BLM/Wyoming DEQ MOU for salable minerals activities, and its magnitude would be such that special mitigation would be warranted.
- An approved salable minerals project (exploration or development) became restricted to the point it would not be feasible to continue operations.
- An approved salable minerals project (exploration or development) became restricted to the point it would not be feasible to begin operations.
- New opportunities for salable minerals exploration and/or development on BLM-administered lands would be substantially reduced.

4.2.5.2. Impacts Common to All Alternatives

This section summarizes management actions common to all alternatives and the likely resulting effects on the federal salable minerals resource during the planning period due to their implementation. The acres of salable minerals resource that could be effected, and the percent of the salable minerals resource those acres represent, indicate the likely possible maximum number of acres that would be affected by the given management actions; the actual acres effected could be fewer.

Salable Minerals
All lands in the planning area not restricted (prohibited or closed) from salable minerals activities are open for the exploration and development of salable minerals. Currently, there are three areas in the planning area where salable minerals activities are restricted while under Congressional review: the WSAs, totaling 28,931 acres. This leaves 3,348,121 acres open to salable minerals activities, which is the entire resource (100%).

Physical Resources

Air Quality
Air quality management actions include implementing mitigation measures, such as dust suppression and cooperative efforts, to reduce dust emissions. These actions could require

ongoing monitoring for compliance, which would have a negligible adverse effect on salable minerals projects through increased costs.

Soil
Soils management actions include an onsite evaluation of proposed projects, mitigation of possible adverse effects on soils, and site-specific reclamation plans. These actions would have a negligible adverse effect on salable minerals projects through increased costs for additional soil-handling and reclamation steps and/or amending project site areas or access routes.

Water Resources
Water management actions include managing surface-disturbing activities to prevent degradation of water quality, managing water to meet Wyoming Standards for Healthy Rangelands, and reducing channel and bank erosion. Similar types of mitigation measures are already required for Wyoming DEQ Mine Permits, which are required for nearly all salable minerals development projects. The very occasional project that needs all these measures added, plus any additional measures the BLM would require for other Wyoming DEQ approved projects, would increase those projects costs; an overall negligible adverse effect.

Cave and Karst Resources
The cave and karst resources management actions common to all alternatives will not affect the salable minerals resource or activities.

Mineral Resources

Nearly the entire planning area is available for exploration and development of locatable, leasable, and salable minerals. Existing and future mining of other minerals in areas currently open and to become open to those activities could affect the salable minerals resource by increasing the acres where conflicts with other minerals projects might occur. In addition, multiple mineral resource uses in the same area are not always physically incompatible. Most potential incompatibility issues would likely result from differences in timing between the projects. This would likely result in increased project costs for one or both projects, due to delays in approval as timing issues are worked out between proponents. If timing cannot be worked out satisfactorily, it is likely one or more proponents would pursue similar projects in another or nearby area, depending on the particular projects they are pursuing.

Locatable Minerals
All lands except those formally withdrawn are open to locatable minerals projects. A total of 11,373 acres were withdrawn, leaving 777,310 acres of BLM-administered surface/all federally owned mineral lands open. Conflicts with locatable minerals projects could affect up to that entire acreage of the salable minerals resource (3,348,121 acres, 23%). The two main areas where locatable minerals projects are currently developed also contain potentially exploitable salable minerals. However, it is unlikely salable minerals will be developed in these areas during the planning period, as they are plentiful elsewhere. Therefore, the potential effect is likely to be much smaller; minor adverse.

Leasable Minerals - Coal
Federal coal lands identified as acceptable for further coal leasing consideration, via the April 2001 RMP Revision (BLM 2001a), are available for LBAs, lease modifications, emergency leases, and exchanges; the potential effect is minor adverse (115,372 acres, 3.45%). Some of these acres contain potentially exploitable occurrences of salable minerals. However,

such projects would likely not be pursued by proponents other than the nearby coal mines due to the related timing and safety issues. In addition, although coal mining does not close areas to salable minerals activities, if the exploitable salables deposits in these areas are not used by the coal mines, they will likely become unusable as coal mining proceeds through a given area. Unused salable minerals (typically surficial or near-surface) will become part of the overburden removed and stockpiled prior to coal mining, and placed back in the open pit after coal mining. This would tend to essentially destroy the value of such deposits, as their quality would most likely be compromised during the overburden removal, stockpiling, and replacing activities. This would result in some potentially exploitable salable minerals deposits in the areas of coal mines becoming unusable, though perhaps not many. This impact, plus possibly increased projects costs due to delays and temporary inaccessibility to some sites, would likely result in up to a minor adverse effect.

Leasable Minerals - Fluids
Effects to the salable minerals resource could be minor adverse (90,261 acres, 2.7%) by opening all unleased federal fluid mineral estate to leasing, but this does not close these areas to salable minerals activities; and the various projects might or might not be incompatible. In addition, some salable mineral deposits at well sites may be affected in quality, thickness, and areal extent as the oil/gas operators would move surficial materials around to attain a flat well site. When a well site is reclaimed, it will be recontoured to blend with surrounding topography; this may result in further loss of the quality of some potentially exploitable salable minerals deposits. The overall effect is likely minor adverse. Geothermal energy development potential in the planning area is low; therefore, conflicts with this resource are not likely during the planning period.

Fire and Fuels Management

Fire and fuels management actions could result in increased costs for some salable minerals projects by temporarily limiting access to certain areas. However, these effects will likely be of short duration, small in areal extent, occur only occasionally, and impact very few projects.

Biological Resources

Vegetation – Forests and Woodlands
There are no management actions common to all alternatives for forests and woodlands.

Vegetation – Grassland and Shrubland Communities
To reduce effects on grasslands and shrublands, which cover most of the planning area, salable minerals projects and access roads may need to be sited or redesigned to reduce adverse effects to vegetation. This would increase project costs and cause a negligible adverse effect.

Vegetation – Riparian/Wetland Resources
To reduce effects on riparian and wetlands areas, which are not uncommon in the planning area, salable minerals projects and access roads may need to be sited or redesigned to prevent the degradation, loss, or reduction of these resources. Similar types of mitigation measures are already required for Wyoming DEQ Mine Permits, which are required for nearly all salable minerals development projects. The very occasional project that needs all these measures added, plus any additional measures the BLM would require, would increase those projects' costs and likely result in an overall negligible adverse effect.

Invasive Species and Pest Management
Salable minerals projects would be required to limit surface disturbance to prevent weed spread, use certified weed seed-free products during reclamation, and treat reclaimed areas for invasive species, which are all likely to increase project costs. However, as these treatments should limit the spread of undesirable species and assist in achieving more successful reclamation, proponents may more likely see decreased overall project costs through avoidance of some planned or additional expenses. An overall negligible beneficial effect is expected.

Fish and Wildlife – Fish
Barriers to fish passage and activities potentially affecting native and desirable non-native fish species are to be managed with the WGFD and other stakeholders. These actions would possibly increase project costs through redesign of water crossings and result in a negligible adverse effect.

Fish and Wildlife – Wildlife
A number of management actions may lead to temporary or permanent inaccessibility to, and/or increase project costs in, certain areas and include: maintain or improve important wildlife habitats through various treatments and methods; consult with the WGFD when applying mitigation, and before allowing exceptions to, or modifying wildlife-related land use restrictions; provide suitable habitat to support WGFD wildlife population objectives; manage access to protect crucial habitats; construct new fences to avoid adverse effects to wildlife; and promote maintenance and improvement of habitat for migratory birds of conservation concern consistent with national, regional, and statewide conservation priorities. Overall a negligible adverse effect is anticipated.

Special Status Species – Plants
Management actions common to all alternatives include the following: implement actions in recovery plans, conservation measures, terms and conditions, BMPs, and reasonable and prudent measures within biological opinions for T&E plant species; and allow treatments within habitat and known populations proven to benefit the species. These management actions may temporarily or permanently affect access to, and/or increase project costs in, certain areas. Overall the likely effect is negligible adverse as SSS plants are typically rare and their populations are small and can therefore be easily avoided.

Special Status Species – Fish
A number of management actions may lead to temporary or permanent inaccessibility to, and/or increase project costs in, certain areas: require modification of projects that may affect SSS fish; require the BLM to assist in the restoration, reintroduction, augmentation, or reestablishment of SSS fish populations and habitats; and implement actions in recovery plans, conservation measures, terms and conditions, BMPs, and reasonable and prudent measures within biological opinions for special status fish species. Overall, these actions would likely result in a negligible adverse effect.

Special Status Species – Wildlife (including Greater Sage-Grouse)
A number of management actions may lead to temporary or permanent inaccessibility to, and/or increase project costs in, certain areas: utilize current research, management, and conservation plans and similar related documents to guide SSS wildlife habitat management; implement actions in recovery plans, conservation measures, terms and conditions, protection measures, and appropriate BMPs, and reasonable and prudent measures within biological opinions for T&E wildlife species; maintain seeps, springs, wet meadows, and riparian vegetation in a functional

condition; restore Greater Sage-Grouse brood-rearing habitats; manage vegetation composition, diversity, and structure to achieve Greater Sage-Grouse habitat management objectives; minimize disturbance that would alter springs and riparian Greater Sage-Grouse habitat, and develop water sources to replace affected or destroyed natural sources; and design water facilities and fences to reduce effects to Greater Sage-Grouse and habitat. Year-round disturbance-free buffer of at least 0.5 mile of known active bald eagle nests (329 acres, less than 0.01%), and seasonal limited access buffer of known active nests (1,366 acres, 0.2%). Some of these areas fall within areas likely to be developed for salable minerals, but are not expected to prohibit development. Overall the effect is likely negligible adverse.

Heritage and Visual Resources

Cultural Resources

Management actions common to all alternatives include: maintain and develop relationships with tribes to identify important sites, incorporate this information in planning documents, and manage these sites to minimize disturbance. A negligible adverse effect to salable minerals activities is likely from increased costs for some projects due to needing to adjust project areas, and also some temporary inaccessibility to some project areas.

Paleontological Resources

Retaining public lands with significant paleontological resources would also mean retention of salable minerals acres. However, as these lands would likely be restricted from salable minerals activities to conserve the paleontological resources, this would decrease the acres available for these activities. These actions would likely be a negligible adverse effect.

Visual Resources

Salable minerals activities in areas with established VRM classifications would be required to conform to the facility siting and design criteria for that classification, such as blending with the surrounding landscape. Areas with no previously-established VRI rating would be managed to match surrounding VRM classification. Mitigation for adverse effects on visual resources would increase costs for some salable minerals projects in areas of certain VRM classifications (mostly II, and sometimes III) and result in a likely negligible adverse effect.

Land Resources

Forest Products and Renewable Energy

There are no management actions common to all alternatives for forest products or renewable energy that would effect the salable minerals resource or activities.

Lands and Realty

Management actions include the prohibiting of subsequent uses of R&PP lands if not compatible with that authorization, withdrawals or segregations of surface and/or mineral lands, disposing of lands meeting certain criteria, and modifying, revoking, or terminating certain withdrawals and segregations. Any of these actions could result in decreasing or increasing the acres of, or restrictions on certain acres of the salable minerals resource. It is difficult to predict precisely what cumulative effects all these actions will have on the salable minerals resource, as many of the aspects of such projects are unknown at this time. However, it is likely that more lands will become unavailable or restricted from salable minerals activities due to such actions, which would result in a likely minor adverse effect.

Rights-of-Way and Corridors
Management actions include the siting of new ROWs adjacent to existing disturbances to minimize surface disturbance, which may necessitate modifying the siting of some roads and access routes. ROWs for salable minerals projects are uncommon: most salable minerals project-related uses of many areas of BLM surface in/near areas being explored or mined would qualify as legitimate occupancy of these lands under 43 CFR 3600 and 3715, making the need for a ROW for those projects unnecessary. ROWs would likely have a negligible adverse effect, due to possible increased costs for very few projects.

Travel and Transportation Management
Management actions include minimizing surface disturbance and erosion, closing roads temporarily or permanently where resource damage is occurring, reclaiming roads if they are heavily eroded, and prohibiting motorized travel if soils would be damaged. These actions may require redesigning and/or reconstructing all or certain portions of roads, and restricting use of certain roads during certain time periods. All these actions would result in increased costs for certain projects; as this likely would not be common, an overall negligible adverse effect is likely.

Recreation
Recreation management actions include allowing dispersed recreation and casual use of public lands throughout the planning area and minimizing noise and light pollution potentially affecting recreation facilities and sites. More dispersed recreation will result in more vehicles and people travelling across and/or temporarily occupying public lands. Approximately 20 percent of current authorized salable minerals projects are on BLM surface, and several other operators must cross BLM surface to access their project sites. This potential increased traffic at some project sites may lead to increased soil compaction, erosion, and/or trash and waste, also leading to increased operational and reclamation costs for these project proponents. Requiring minimization of noise and light pollution near recreation facilities will likely lead to increased costs for some salable minerals projects; this is not likely to affect more than a few projects, however. The overall effect is likely to be minor adverse.

Lands with Wilderness Characteristics
Evaluating newly acquired lands and other parcels meeting size and naturalness requirements for wilderness characteristics would temporarily restrict these lands from experiencing salable minerals activities. However, as all lands in the planning area have already been evaluated (see Alternative B), and the low likelihood of BLM acquiring any lands that might meet such characteristics, a negligible adverse effect is likely.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock, possibly resulting in a short-term loss of grazing resources in relatively small areas. This loss will likely be very small and will be reversed upon completion of reclamation. Costs for some salable minerals projects will increase due to fencing costs, resulting in an overall negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
Currently, there are no designated ACECs in the planning area. However, should any ACECs be designated with the implementation of this RMP revision, management actions common to all include evaluating BLM-authorized activities and developing mitigation to protect the integrity of

the characteristics for which the ACECs were designated. As approximately 25 percent of salable minerals projects occur in/near potential ACECs, this management will likely increase costs for certain projects. However, until the particular ACECs are designated, it is difficult to accurately predict the likely impact. These actions would potentially result in a major adverse effect.

Scenic or Back Country Byways
Currently, there are no designated byways in the planning area. However, should any byways be designated after this RMP revision is approved, management actions common to all include managing byways with the objective of protecting the resource values of the area. Such designation likely will not involve instituting any restrictions to size, frequency, or timing of large truck traffic or the institution of a viewshed buffer along the byway within which few or very select disturbances may occur. Although approximately 40 percent of current salable minerals projects utilize and/or are near the roads that have been identified as potentially being designated as byways, there will likely be no effect.

Wild and Scenic Rivers
Currently, there are no designated WSRs in the planning area. Management actions common to all include continuing to implement Manual 6400 - *Wild and Scenic Rivers* for the one proposed WSR (2,664 acres, 0.08%), which involves restricting surface disturbance within that area until Congress acts on the designation. This area is unlikely to be explored or developed for salable minerals due to its' rugged terrain and long distance to points of use. Congress is not expected to act during the planning period; this restriction results in a negligible adverse impact to the salable minerals resource.

Wilderness Study Areas
Currently, there are three WSAs (28,931 acres, 0.86%) in the planning area. Management actions common to all include continuing to implement the BLM Manual 6330 - *Management of Wilderness Study Areas* for these WSAs, which includes restriction on salable minerals activities in these areas until Congress acts on these proposals. As Congress is not expected to act during the planning period, and the BLM recommends not officially designating these areas, these areas will remain restricted from salable minerals activities. The effect on the salable minerals resource is likely negligible adverse.

Socioeconomic Resources

Social and Economic Conditions
The BLM will utilize local and state socioeconomic plans, quantify socioeconomic effects where possible, and manage in consideration of the fact that BLM actions are integrally connected with the socioeconomic and cultural health of the planning area. The effect on salable minerals projects would likely be increased costs, and would be negligible adverse.

Health and Safety
Health and safety management actions seek primarily to ensure proper health and safety measures are included in mine plans, including proper procedures for handling spills and releases of hazardous substances, and mitigation for coal seam fires. The PRB is well-known for coal seam fires, and one salable minerals project occurs adjacent to such an area; risks were minimized to the operator and his personnel through education and discussions of risks and safety prior to approval. Waste minimization practices are encouraged, including reusing, recycling, and substituting when appropriate. Effects to salable minerals projects would likely be increased costs; however, many of these measures are already included in their Wyoming DEQ Mine

Permits. The resulting increases to the health and safety of the public, and a very few operators, is incalculable, though. Overall these actions would likely result in a negligible beneficial effect.

4.2.5.3. Alternative A

This section summarizes management actions under Alternative A, which is the continuation of current management, and the likely resulting effects on the federal salable minerals resource during the planning period due to their implementation.

Salable Minerals
Currently, there are three areas in the planning area where salable minerals activities are restricted while under Congressional review: the WSAs, totaling 28,931 acres. This leaves 3,348,121 acres open to salable minerals activities; these are the total acres of this federal resource analyzed below for all alternatives. As Congress is not expected to act during the planning period, and the BLM recommends to not officially designate these areas, these areas will remain restricted from salable minerals activities. Since these areas have already been prohibited from development, there is no effect on the salable minerals resource.

Physical Resources

Air Quality
The requirement for analysis of anticipated effects of proposed activities on air quality, and modeling on a project-specific basis, would likely increase salable minerals project costs and result in a negligible adverse effect.

Soil
Soils management actions include prohibitions on surface-disturbing activities on slopes equal to or greater than 25 percent (170,590 acres, 5.09%), in areas with poor reclamation suitability (455,090 acres 14%), and seasonally in areas of severe erosion hazard (215,496 acres, 6.44%); all these prohibitions have provisions for waivers, however. Prohibitions also on surface-disturbing activities have been applied on a project-specific basis for areas of LRP, such as badlands, rock outcrops, biologic crusts, and slopes susceptible to mass wasting (218,928 acres, 6.54%). Topsoil is to be salvaged during project activities and reapplied during reclamation. Less than 10 percent of salable minerals projects are currently authorized in such areas with BLM surface; that percentage is not likely to increase, as such areas tend to be avoided due to their inherent problems. However, some salable minerals sites are selected specifically because they have little topsoil or overburden covering the deposit, which leads to lower removal and replacement costs; mineral materials are typically low-price and have highly variable mining and transport costs. Although the RFA for salable minerals is that 532 acres are expected to be disturbed during the planning period (0.02%), and the effect to the resource from these types of restrictions will likely be higher; resulting in a minor adverse effect.

Water Resources
Prohibition on surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams may affect the salable minerals resource (19,861 acres, 0.59%). However, some mitigation measures regarding these features are already required for Wyoming DEQ Mine Permits, which are required for nearly all salable minerals projects. In addition, as these areas are usually undesirable for salable minerals projects due to such areas' inherent issues, and other considerations, much of this restriction is actually already taken into account when sites are selected. These actions would likely result in a negligible adverse effect.

Cave and Karst Resources
Prohibitions on surface disturbance within a buffer around significant cave entrances could be applied on a project-specific basis (11 acres, less than 0.01%); however, none have affected salable minerals projects so far. No salable minerals projects exist in these areas, and the likelihood of any being proposed here is quite low; the terrain is generally rugged, and these areas tend to be some distance from where the materials might be used. These factors would increase mining and transportation costs beyond economic feasibility, and these minerals are plentiful in other areas. The likely effect is negligible adverse.

Mineral Resources

Locatable Minerals
All lands except those formally withdrawn are open to locatable minerals projects. A total of 11,373 acres were withdrawn, leaving 777,310 acres of BLM surface open (100% of that resource). The two main areas where locatable minerals projects are currently developed also contain potentially exploitable salable minerals. It is unlikely though that salable minerals will be developed in these areas during the planning period, as they are plentiful elsewhere. The RFA for locatable minerals projects is that 554 acres will be developed, and 530 acres for salable minerals. Even if these two resources conflicted over all 530 acres, none of these lands would be closed to salable mineral activities; the likely effect is negligible adverse.

Leasable Minerals - Coal
The RFAfor coal projects is 195,700 acres, and 532 acres for salable. If these two resources conflicted over all 532 acres, which is unlikely as salable minerals are plentiful elsewhere in the planning area, none of these lands would be closed to salable minerals activities; the effect is likely negligible adverse.

Leasable Minerals - Fluids
Although fluid mineral development could conflict with nearly the entire salable minerals resource, exploration and development for oil and gas would occur mostly in areas with high and moderate potential for those minerals. The maximum RFA for oil and gas projects is that 10,575 acres will be developed; 532 acres for salable minerals projects. Even if there were conflicts between the two resources over those entire 532 acres, none of these lands are closed to salable minerals activities. This amount of conflict is unlikely, as salable minerals are plentiful elsewhere, and some fluid and salable minerals projects in close proximity may not be incompatible; the effect is likely negligible adverse. Geothermal energy development potential in the planning area is low, therefore, conflicts with this resource are not likely during the planning period.

Fire and Fuels Resources

Inadvertent damage to property and facilities or temporary access limitations to salable minerals project sites could occur during fire suppression or prescribed fire activities. Such effects likely would be of short duration, small in areal extent, and occur only occasionally. These limitations may increase project costs for only a relatively few projects, at most resulting in a negligible adverse effect.

Biological Resources

Vegetation – Forests and Woodlands
Timber harvest and other vegetative treatments may temporarily limit access to certain salable minerals project sites. However, such limitations would likely be of relatively short duration, small in areal extent, and occur only occasionally, and relatively few salable mineral projects occur in or near wooded areas. Project costs would likely increase, but for relatively few projects; the effect would be negligible adverse.

Vegetation – Grassland and Shrubland Communities
Use of non-native species in reclamation seed mixtures has been approved on a project-specific basis. BLM reclamation policy allows the use of non-native species; a primary goal of reclamation is soil stabilization, and vegetation species are chosen towards that end. Changes in seed mix may increase project costs; however, more successful reclamation would likely lead to minimization of reclamation time and costs. Overall, the effect would be negligible beneficial.

Vegetation – Riparian/Wetland Resources
Prohibitions on surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams may effect up to 23,831 acres (0.71%); however, this prohibition can be waived. In addition, some mitigation and avoidance measures for such areas are already required for Wyoming DEQ Mine Permits, which are required for nearly all salable minerals projects. In addition, many of these areas are already avoided, due to their inherent issues. Prohibiting such activities in these areas essentially closes these areas to salable minerals activities; the effect would be negligible adverse.

Invasive Species and Pest Management
Invasive species and pest management actions could include area- and/or species-specific treatment strategies, applied on a project-specific basis to public lands. These treatments may increase salable minerals project costs due to temporary access delays to project sites. However, successful treatments will likely also decrease the spread of undesirable species from project sites, resulting in likely lower planned project expenses or avoidance of additional project costs, which would result in a negligible beneficial effect.

Fish and Wildlife Resources – Fish
Project-specific prohibitions on surface-disturbing and disruptive activities within 0.25 mile of naturally occurring water bodies containing acceptable fish species could result in an adverse effect to the salable minerals resource (51,745 acres, 1.55%). Project- and/or site-specific maintenance of reservoirs and riparian areas to improve potential fisheries could have a negligible adverse effect (13,102 acres, 0.39%). Other restrictions may also apply which will likely increase project costs. However, these areas will likely be avoided for salable minerals development; Wyoming DEQ Mine Permits should already include mitigation to avoid some of these areas. However, prohibiting such activities essentially closes these areas to salable minerals activities. The effect would be up to minor adverse.

Fish and Wildlife Resources – Wildlife
Wildlife management actions include a number of project- and non-project-specific distance and/or timing limitations or prohibitions on surface disturbance and occupancy in certain areas and habitats, and all will have adverse effects: year-round within the three big game WHMAs (4,583 acres, 0.14%); within 0.5 mile of big game migration corridors (9,587 acres, 0.46%), within 750 feet of sharp-tailed grouse leks (940 acres, 0.03%), and within a biologic buffer of active raptor nests (255,129 acres, 7.62%); seasonally within elk crucial winter range and calving areas (75,175 acres, 2.25%), and within 0.64 mile of sharp-tailed grouse leks (7,607 acres, 0.23%). Other

restrictions may also apply which will likely increase project costs, such as no removal of elk security habitat (132,148 acres, 3.95%). Approximately 25 percent of salable minerals projects occur in/near these areas. However, as year-round prohibitions and restrictions essentially close these areas to salable minerals activities, the likely effect will be up to moderate adverse.

Special Status Species – Plants
Year-round project-specific restrictions to protect SSS plants would have an adverse effect on the salable minerals resource (126,811 acres of suitable habitat on BLM surface, 3.79%). Surface-disturbing activities would avoid SSS plant populations, leading to adjustments of some project sites and/or access roads, or temporary inaccessibility to sites. SSS plants have very specific habitat requirements and therefore tend to occur in small areas, and the salable minerals RFA is 530 acres. The effect is up to minor adverse.

Special Status Species – Fish
Year-round project-specific restrictions to protect SSS fish (within 0.25 mile of any waters containing SSS fish) may have a negligible adverse effect (818 acres, 0.02%). Other restrictions may also apply which will likely increase project costs.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Measures to protect SSS wildlife include a number of distance and/or timing restrictions or prohibitions within certain areas and habitats, and all will have an adverse effect on the salable minerals resource: within prairie dog colonies (6,156 acres, 0.18%); within Greater Sage-Grouse strutting grounds (year-round restricted – 3,594 acres, 0.11%, seasonally prohibited – 203,724 acres, 6.08%); near bald eagle nests, winter roosts, hunting, and concentration areas (year-round – 402 acres, 0.01%; seasonally – 3,013, 0.09%); near raptor nesting areas (17,345 acres, 0.52%); and within habitats of SSS amphibians and reptiles (176,636 acres, 5.28%). Other restrictions may also apply that will likely increase project costs. Approximately 25 percent of salable minerals projects occur in/near these areas, and their RFA is 530 acres. The likely effect is up to moderate adverse.

Heritage and Visual Resources

Cultural Resources
Prohibitions of surface-disturbing activities within 0.25 mile or visual horizon of portions of the Bozeman Trail and Crazy Woman Battle Site could affect the salable minerals resource (3,588 acres, 0.11%). Project-specific prohibitions on surface-disturbing activities in or near certain areas containing historic properties or sensitive or sacred sites (such as TCPs, including the Pumpkin Buttes TCP) have an adverse effect to the salable minerals resource. Other project-specific requirements (such as archeological and/or Native American monitors) would likely increase salable minerals project costs. Many of these areas are already protected to a certain degree by other means; however, many will only be discovered through surface-disturbing activities. Also, salable mineral deposits are plentiful in other areas, and some projects can be mitigated or redesigned to reduce impacts. The likely up to minor beneficial effect to Cultural Resources (due to new discoveries of Cultural Resources) will mostly offset the minor adverse effect to the salable minerals resource and such activities (due to prohibitions at these sites, both currently known and future discoveries); the effect would likely be minor adverse.

Paleontological Resources
Project-specific prohibitions in areas identified as containing paleontological resources of high quality or importance may have a negligible adverse effect (860 acres, 0.03%).

Other project-specific requirements (such as paleontological field surveys) would likely increase salable minerals project costs. Similar to Cultural Resources, the up to negligible beneficial effect to Paleontological Resources (due to new discoveries through surface-disturbing activities), will be mostly offset by the negligible adverse effect to the Salable Minerals Resource (due to prohibitions); the effect would likely be negligible adverse effect.

Visual Resources

Salable minerals activities in areas with established VRM classifications would be required to conform to the objectives and characteristics of that classification, especially regarding the siting and design of facilities. Areas with BLM surface not rated will be managed to conform to the surrounding classification. Other project-specific requirements (such as visual simulation and mitigation design) may be applied. These limitations and requirements would likely increase project costs, with a negligible adverse effect.

Land Resources

Forest Products

Management actions include the sale of minor forest products from woodlands and noncommercial forestlands on BLM surface throughout the planning area, and fencing of regeneration areas. These activities may temporarily limit access to certain salable minerals projects; such limitations would likely be temporary, small, and occasional. As relatively few salable minerals projects occur in/near wooded areas, and with an RFA of 530 acres, the likely effect would be negligible adverse.

Lands and Realty

Land tenure adjustments may occur often on behalf of other resources and even other agencies, and these could increase or decrease BLM surface and/or federal mineral estate. Increasing or decreasing federal mineral acres would affect the salable minerals resource, depending on the type of mineral ownership of the lands involved. Neither increasing or decreasing acres of BLM surface would affect the salable minerals resource. Lands identified for acquisition are those adjacent to large blocks of BLM surface and in areas of high recreational potential (118,254 acres, 3.53%), while lands identified for disposal include those with agricultural potential or water (76,223 acres, 2.28%), and small isolated parcels (totaling 120,722 acres, 3.61%). It is extremely difficult to predict exactly which land tenure adjustments will occur during the planning period: exchanges and sales are usually initiated by those parties interested in obtaining those lands; donations are typically initiated by the donors; and acquisitions are often initiated by the sellers, or by the BLM in response to an eminent need. In addition, such land tenure adjustments can take a number of years to complete. The identified acquisitions and disposals, should they all occur during the planning period, would lead to an overall decrease in the salable minerals resource (78,691 acres, 2.35%). As discussed, it is much more likely that much fewer acres will be affected, however.

Renewable Energy

Approved renewable-energy projects on public lands would result in segregations of those acres from mineral entry, removing those acres from the salable minerals resource. Some renewable-energy projects will be long-lived, and others not as long lived, and some may not be incompatible with certain salable minerals activities. Those lands segregated would be made open again after the renewable-energy site is released from the segregation. Although no renewable-energy projects on public lands in the planning area have been received to date, it is predicted that 20,000 acres (2.57%) of BLM surface will be disturbed during the planning period

for these projects. Only approximately 15–25 percent of the acres currently identified as most likely to be developed for renewable energy projects are in areas likely to be developed for salable minerals projects, in/near the Southern Big Horn Mountains. Renewable energy projects are not likely to be approved in these areas, however (see Chapter 3, *Renewable Energy* section). Although the salable minerals RFA is just 532 acres (0.02%), the level of impact from renewable energy could be up to that total amount (20,000 acres, 0.60%). However, it is more likely that fewer acres will be affected, and the effect would be up to minor adverse.

Rights-of-Way and Corridors

Some proposed ROWs (for roads, access routes, and/or facilities) may need to be modified to be placed within existing ROWs, and away from major transportation routes. The RFA for ROWs is 38,762 acres, and that for salable minerals is 532 acres, and conflict over all 532 acres would be negligible adverse impact (0.02%). In addition, ROWs for salable minerals projects are relatively rare (see Impacts Common to All Alternatives), so any ROWs issued for such use would likely be very few and likely only to increase costs for very few projects. No CCS projects have been received for public lands in the planning area to date. It is likely that some will be, as the current political climate appears to favor this type of action for managing GHGs, and much of the planning area contains geological formations currently believed to be amenable to these projects. Current management direction is to approve these as Land Use Applications/Permits (see the *Geological Resources* section of Chapter 3). Impacts from these types of Permits could be up to the total amount of BLM surface lands (777,310 acres, 23%). However, these projects will likely take some time to approve due to their complexity and the current financial climate. It is much more likely that the overall effect will be minor adverse.

Travel and Transportation Management

A number of area-specific restrictions to motor vehicle and OHV use, seasonally or year-round, may increase salable minerals project costs for certain project proponents. However, these areas might not be completely inaccessible as a number of exploration activities can be performed without motorized vehicles; mining and transportation of product would be challenging, though, at best. If a project proceeds, motorized vehicle access might be granted; but for designated Recreation Areas, WHMA, or other special management areas, motorized access likely would not be granted. These actions may require redesigning and/or reconstructing certain roads, and restricting use of certain roads during certain time periods, increasing project costs. Projects in these areas are not likely to be common as salable minerals are plentiful elsewhere, and given an RFA of 530 acres for salable minerals (0.02%), a negligible adverse effect is likely.

Recreation

No SRMAs are proposed under Alternative A, although surface disturbance would be prohibited within 0.5 mile of the Dry Creek Petrified Tree EEA. However, there are no known commercial deposits of salable minerals within the EEA, but are plentiful outside developed recreation areas. Also, given an RFAof 532 acres (0.02%) for salable minerals, an overall negligible adverse effect is expected.

Lands with Wilderness Characteristics

Acquired lands would be evaluated for wilderness characteristics. It is unlikely any acquisitions would contain wilderness characteristics; the effect is likely negligible adverse.

Livestock Grazing Management

Temporarily fencing off areas being explored and/or mined might be needed to protect livestock. Salable minerals project costs may increase; the overall effect would be negligible adverse.

Special Designations

Areas of Critical Environmental Concern and **Scenic or Back Country Byways**
There are presently no ACECs or Byways are designated, and none are proposed under Alternative A; therefore, there would be no effect.

Wild and Scenic Rivers
There are no Alternative A management actions for WSR that would result in an effect.

Wilderness Study Areas
Currently, there are three areas in the planning area where salable minerals activities are restricted while under Congressional review: the WSAs, totaling 28,931 acres (0.86%). Congress is not expected to act during the planning period, and the BLM recommends not officially designating these areas. These areas will remain restricted from salable minerals activities until Congress acts; whether these areas are designated or not, they will remain restricted from salable minerals activities, and there would be no effect.

Socioeconomic Resources

Social and Economic Conditions
The BLM will recognize and consider local and regional economic development and land use plans. The BLM management could further restrict or limit certain lands, or not limit or restrict others, as a result of the implementation of this action. The effect is difficult to predict, but may result in slightly more area being restricted; the effect would be negligible adverse.

4.2.5.4. Alternative B

This section summarizes management actions under Alternative B, which emphasizes resource conservation, and the likely resulting effects on the federal salable minerals resource during the planning period due to their implementation.

Salable Minerals
The three WSAs (totalling 28,931 acres) are already restricted from salable minerals activities. Conservation measures implemented for other resources under Alternative B would result in a total of 1,684,699 acres (50%) being closed to or restricted from salable minerals activities. This would leave 1,663,422 acres (50% of the resource) open to salable mineral activities.

Physical Resources

Air Quality
Quantitative air quality modeling, and mitigation to ensure project emissions would approach or exceed emissions standards, are required. This would likely increase project costs, and the effect would be negligible adverse.

Soil
Management actions for soils include prohibitions on surface-disturbing activities in areas with severe erosion hazard (215,496 acres, 6.44%), on slopes equal to or greater than 25 percent (170,590 acres, 5.10%), in areas with poor reclamation suitability (455,090 acres 14%), and on areas with LRP (218,928 acres, 6.54%). Less than 10 percent of salable minerals projects are

currently authorized in such areas on BLM surface. Salable minerals RFA is 114 acres, less than 0.01 percent. The effect on the salable minerals resource will likely be major adverse, as these prohibitions essentially remove those acres from potential use.

Water Resources
Surface disturbance is prohibited within 500 feet of springs, water wells, and perennial streams (19,861 acres, 0.59%). These areas are typically avoided due to their related inherent problems, and other considerations. The effect on the salable minerals resource will likely be negligible adverse, as these acres are essentially removed from potential use.

Cave and Karst Resources
Prohibited is surface disturbance within cave and karst areas (101,455 acres, 3.03%). Salable minerals projects proposed in these areas are not likely, due to the rugged terrain and long distance to where the materials would likely be used. The effect to salable minerals projects is likely to be minor adverse, as these acres are essentially removed from potential use.

Mineral Resources

Locatable Minerals
A total of 11,373 acres were withdrawn for three WHMAs, and this acreage remains withdrawn. A total of 717,741 acres (this total includes the three WSAs) are recommended for withdrawal under various management actions for other resources. Should all these acres be withdrawn from mineral entry (these are Congressional actions), this would leave 59,569 acres open to locatable minerals activities. Conflict with locatable minerals projects could potentially occur over up to all 59,569 acres of the salable minerals resource. However, the RFA for locatable minerals is 277 acres and 114 for salable minerals. Even if there are conflicts between these two resources over all 114 acres, that is less than 0.01 percent of the salable minerals resource. Conflict in those areas is unlikely, as salable minerals are plentiful on lands outside the areas likely to be developed for locatable minerals; some projects may be delayed, however. The likely effect would be negligible adverse from potentially increased project costs for few projects, due to delays or changing project sites.

Leasable Minerals - Coal
The RFA for coal projects is 186,600 acres and 114 for salable minerals. Even if there are conflicts between these two resources over all 114 acres, that is less than 0.01 percent of the salable minerals resource. Conflict in those areas is unlikely though, as salable minerals are plentiful outside areas most likely to be developed for coal. No lands are prohibited from use, but may be temporarily restricted from use; the effect would be negligible adverse.

Leasable Minerals - Fluids
A total of 2,612,920 acres will be closed to fluid mineral leasing, leaving 773,610 acres open to oil and gas projects. Conflict with oil and gas projects could potentially affect up to that number of acres of the salable minerals resource. However, the RFA for oil and gas projects is 286 acres and 114 acres for salable mineral. Even if there are conflicts between these two resources over all 114 acres, that is less than 0.01 percent of the salable minerals resource. Conflict in those areas is unlikely, though, as salable minerals are plentiful outside the areas likely to be developed for oil and gas projects. And, no lands are prohibited from salable minerals activities, but may be temporarily restricted from such uses.

Fire and Fuels Resources

Not all fires will be suppressed, likely resulting in types and extents of effects similar overall to those under Alternative A. Most affected salable minerals projects, which is likely to be not many, may experience adverse effects if in an area experiences a larger burn due to non-suppression. Overall the effect would be negligible adverse.

Biological Resources

Vegetation – Forests and Woodlands
Types of effects are similar to, but likely of lesser extent than, those under Alternative A, as silviculture and pest control treatments, techniques, and methods will be less extensively used (negligible adverse).

Vegetation – Grassland and Shrubland Communities
Requiring use of only native species for all reclamation activities may lead to increased project costs due to higher costs for some native seed species. Overall, the effect would likely be negligible adverse.

Vegetation – Riparian/Wetland Resources
Prohibitions on surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams may affect up to 23,831 acres (0.71%). Salable minerals RFA is 114 acres (less than 0.01%), and little of this development would be likely within riparian or wetland areas. The effect would be negligible adverse.

Invasive Species and Pest Management
Invasive species and pest management actions could include area- and/or species-specific treatment strategies, applied on a project-specific basis to public lands. These treatments may increase salable minerals project costs due to temporary access delays to project sites. However, successful treatments will likely also decrease the spread of undesirable species, resulting in likely lower planned project expenses or avoidance of additional project costs; a negligible beneficial effect would be likely.

Fish and Wildlife Resources – Fish
Prohibited are surface-disturbing and disruptive activities within 0.25 mile of naturally occurring water bodies containing acceptable fish species (51,745 acres, 1.1%). Reservoirs and riparian areas are managed to improve potential fisheries. Other actions will likely increase project costs. These areas are already mostly avoided due to mitigation on Wyoming DEQ Mine Permits; the salable minerals RFA is 114 acres. It is unlikely a project would be proposed in the restricted areas. A minor adverse effect would be likely, as these acres are essentially closed to salable minerals activities.

Fish and Wildlife Resources – Wildlife
Timing limitations and prohibitions required in Alternative B will adversely affect the salable minerals resource, including: the three WHMAs (4,583 acres, 0.14%); 0.5 mile of big game migration corridors (9,587 acres, 0.46%); elk crucial winter range and calving areas (75,175 acres, 2.25%); 750 feet year-round of sharp-tailed grouse leks (940 acres, 0.03%) and 0.64 mile seasonally (7,607 acres, 0.23%); and the biologic buffer of active raptor nests (255,129 acres, 7.62%). In addition, removal of elk security habitat is prohibited (132,148 acres, 3.95%), and an WHMA is recommended to be designated for the Fortification Creek elk herd's crucial and yearlong ranges (12,419 acres, 0.37%). Other restrictions also apply which will likely increase projects costs, including applying seasonal restrictions on existing projects (approximately 530

acres, 0.02%). With approximately 25 percent of salable minerals projects occurring in/near these areas, and an RFA of 114 acres, the likely effect would be moderate adverse. Some projects may experience increased costs, due to needing to amend project designs and/or areas, and delays. The year-round prohibitions essentially remove those acres from salable minerals activities.

Special Status Species – Plants
Surface-disturbing activities are required to avoid SSS plant habitat (126,811 acres, 3.79%), necessitating possible modifications of some project sites and/or access roads. These habitat areas are quite small, and given the salables RFA of 114 acres, the likely effect is minor adverse; these prohibited acres are essentially removed from potential use.

Special Status Species – Fish
Surface-disturbing and disruptive activities are prohibited are within 0.25 mile of any waters containing SSS fish (818 acres, 0.02%). Other prohibitions and requirements also apply which increase project costs. However, due to the small area where SSS fish are found the overall effect will be negligible adverse.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Surface-disturbing, disruptive, and/or occupancy activities are restricted or prohibited to conserve SSS wildlife within the following areas: prairie dog colonies (6,156 acres, 0.18%); Greater Sage-Grouse habitat (4.0-mile perimeter around occupied and undetermined leks and winter concentration areas, regardless of habitat suitability - 467,897 acres, 14%; greater than 4.0 miles of occupied and undetermined leks in nesting and brood-rearing habitat seasonally - 91,528 acres, 2.73%); seasonally within 1.5 miles of SSS raptor nests (113,784 acres, 3.40%); biologic buffer of SSS raptors (28,437 acres, 0.85%); and habitats of SSS amphibians and reptiles (176,636 acres, 5.28%). Other requirements also apply which will likely increase project costs: restoration of disturbed sagebrush communities on BLM surface; increasing visibility of existing fencing in Greater Sage-Grouse habitat; and anti-perching devices on powerlines in occupied Greater Sage-Grouse habitat. Some projects may not be approved if they would result in more than one disturbance or 3 percent of total surface disturbance per 640 acres. Approximately 50 percent of salable minerals projects occur in these areas, and their RFA is 114 acres. The likely effect would be major adverse, as year-round prohibitions essentially close those acres to salable minerals activities.

Heritage and Visual Resources

Cultural Resources
Surface-disturbing activities are prohibited within five miles or visual horizon of historic properties that retain their integrity of setting (330,592 acres, 9.88%). Salable minerals activities would be prohibited in areas containing historic properties that retain their historic setting (totaling 128,338 acres, 3.83%). Other requirements will likely increase salable minerals project costs: archeological monitors for all surface-disturbing activities, and Native American monitors when requested by tribes. The likely effect is major adverse, as these prohibitions essentially close these acres to salable minerals activities.

Paleontological Resources
Salable mineral activity would be prohibited within areas containing paleontological resources of high quality or importance (860 acres, 0.03%); these areas would be designated for special management, as they are identified. Salable minerals activities would be prohibited in certain areas containing paleontological resources of high quality or importance (40 acres,

less than 0.01%), which essentially removes these acres from salables uses; the effect would be negligible adverse. Other requirements would likely increase salable minerals project costs: paleontological field surveys for all PFYC Class 3, 4, and 5 formations; monitoring of surface-disturbing activities on all PFYC Class 4 and 5 formations, and Class 3 as needed.

Visual Resources
Areas will be managed according to their VRM classes. Visual simulation and mitigation design are required within or viewable from areas of VRM Classes I to III; this will increase project costs. The effect would likely be negligible adverse.

Land Resources

Forest Products
Required fencing of regeneration areas may temporarily limit access to certain salable minerals projects, although relatively few salable minerals projects occur in/near wooded areas. The likely effect is negligible adverse due to increased costs from temporary inaccessibility to certain sites.

Lands and Realty
Land tenure adjustments could increase or decrease BLM surface and/or federal mineral estate (see Alternative A). Lands having resource value will be retained (76,223 acres, 2.28%). Lands identified for disposal (120,722 acres, 3.61%) will be disposed of, with longest retention of those with higher resource values. Lands will be acquired as willing sellers make them available, with no priority to those adjacent to large blocks of BLM surface or areas of high recreational potential. Although it is difficult to predict which land tenure adjustments will occur during the planning period, if all those currently identified were to occur, the salable minerals resource would decrease (44,449 acres, 1.33%). It is more likely that much fewer acres will be disposed of; overall, the effect would likely be up to negligible adverse.

Renewable Energy
Approved renewable-energy projects on public lands would result in segregations of those acres from mineral entry, closing those acres to salable minerals activities until they are released from those segregations. Some renewable-energy projects may not be incompatible with certain salable minerals activities; see Alternative A. It is predicted that 5,000 acres of BLM surface (0.15% of BLM-administered salable minerals resource) will be disturbed during the planning period for these projects. The effect could potentially be up to that total amount, and would be negligible adverse.

Rights-of-Way and Corridors
ROWs will need to be placed within identified corridors, and away from major transportation routes. The RFA for ROWs is 18,011 acres of BLM surface (0.54% of BLM-administered salable minerals resource), and that for salable minerals is 532 acres; conflict over all 532 acres would be negligible adverse impacts (0.02%). In addition, ROWs for salable minerals projects are relatively rare (see *Impacts Common to All Alternatives*). CCS research and projects would be prohibited.

Travel and Transportation Management
A number of area-specific restrictions to motor vehicle use may increase salable minerals project costs for certain project proponents. However, these areas might not be completely inaccessible as a number of exploration activities can be performed without motorized vehicle. Projects in

these areas are not likely to be common as salable minerals are plentiful elsewhere; the effect would likely be negligible adverse, from increased costs for relatively few projects.

Recreation
A total of two ERMAs (totaling 726,573 acres, 22%) and eight SRMAs (totaling 55,529 acres, 1.66%) are proposed for designation, with closure to salable minerals activities in all SRMAs designated via this RMP (except for administrative use only). This could result in up to a minor adverse effect, as the acres in all designated SRMAs will be closed to salable minerals activities. Some of these potential SRMAs are already under some restrictions, and some are in areas not likely to be sought for salable mineral activities due to ruggedness of terrain and distance to likely markets, however.

Lands with Wilderness Characteristics
One area of lands with wilderness characteristics (12,237 acres, 0.37%) is recommended to be managed to emphasize primitive recreational opportunities and natural values, which includes closing to salable minerals activities. Much of this area is not likely to be sought for salable minerals activities, however, due to rugged terrain and long distances to markets.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock. Salable minerals project costs may increase; the overall effect would be negligible adverse.

Special Designations

Areas of Critical Environmental Concern
A total of eight ACECs are proposed for designation (totaling 511,000 acres, 16%). Designation of any ACEC would close it to salable minerals activities; up to a major adverse impact. One of these eight ACECs, the Sagebrush Ecosystem ACEC, was proposed to help protect sagebrush habitat, which would help protect the Greater Sage-Grouse (467,897 acres, 14%). However, some of these potential ACECs are already under some restrictions, and some are in areas not likely to be sought for salable mineral activities due to ruggedness of terrain and distances to markets.

Scenic or Back Country Byways
A number of roads will be evaluated during the planning period for their eligibility to be proposed as National BCBs or Scenic Byways; possibly up to 89 miles of road or more. No effect is anticipated, as expected, as designation would not preclude salable minerals activities.

Wild and Scenic Rivers
One WSR (2,664 acres, 0.08%) is under Congressional review, and is managed according to Manual 6400 - *Wild and Scenic Rivers*, which includes surface disturbance restrictions. If Congress does not designate this WSR, the present restrictions would likely continue until Congress acts on the designation. Although Congress is not expected to act during the planning period, these restrictions result in a negligible adverse effect to the salable minerals resource. This area is not a likely target for salable minerals activities, however, given its remote location and rugged terrain.

Wilderness Study Areas
Currently, there are three areas in the planning area where salable minerals activities are restricted while under Congressional review: the WSAs, (totaling 28,931 acres, 0.86%). Congress is not expected to act during the planning period, and the BLM recommends not officially designating these areas. Whether Congress designates these areas or not, they will

remain restricted from salable minerals activities to retain these areas' characteristics. There would be no effect.

Socioeconomic Resources

Social and Economic Conditions
The BLM will consider local and regional economic development and land use plans. BLM management could further restrict or limit certain lands, or not limit or restrict others, as a result of the implementation of this action. In addition, mitigation strategies will be developed as needed to resolve conflicts that have detrimental effects to multiple resources. The effect is difficult to predict, but may result in slightly more area being restricted; the effect would be negligible adverse.

4.2.5.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource utilization, and the likely resulting effects on the federal salable minerals resource during the planning period due to their implementation.

Salable Minerals
The three WSAs (totalling 28,931 acres) are already restricted to salable minerals activities. Conservation measures implemented for other resources under Alternative C would result in a total of 57,213 acres being closed to or restricted from salable minerals activities (1.71%). This would leave 3,290,908 acres open to salable mineral activities, 98 percent of the resource.

Physical Resources

Air Quality
Quantitative air quality modeling is not required. There would be no effect.

Soil
Surface-disturbing activities are allowed, as consistent with other resource values. These include areas with severe erosion hazard, poor reclamation suitability, LRP, and on slopes equal to or greater than 25 percent; no effect to the salable minerals resource.

Water Resources
Allowed is surface disturbance within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams; there would be no effect to the salable minerals resource.

Cave and Karst Resources
A buffer is required around significant cave entrances (11 acres, less than 0.01%), although salable minerals projects in/near these areas is unlikely (see Alternative A); negligible adverse effect, as these acres would essentially be closed to mineral materials activities.

Mineral Resources

Locatable Minerals
A total of 11,373 acres were withdrawn for three big-game WHMAs, and this acreage remains withdrawn. A total of 28,931 acres (comprising the three WSAs) are restricted to prevent wilderness impairment. There are no additional areas recommended for withdrawal. This leaves

777,310 acres open for locatable minerals activities and therefore could potentially effect that number of acres of the salable minerals resource. However, the RFA for locatable minerals is 1,460 acres and 2,098 for salable minerals. Even if there are conflicts between these two resources over all 1,460 acres, that is 0.04 percent of the salable minerals resource. Conflict in those areas is unlikely, as salable minerals are plentiful on lands outside the areas likely to be developed for locatable minerals. Also, these lands would be not be closed to salable minerals activities, but some areas could potentially be temporarily inaccessible, increasing project costs; the effect would be negligible adverse.

Leasable Minerals - Coal
The RFA for coal projects is 195,700 acres and 2,098 for salable minerals. Even if there are conflicts between these two resources over all 2,098 acres, that is 0.06 percent of the salable minerals resource. Conflict in those areas is unlikely though, as known deposits of salable minerals are plentiful outside areas most likely to be developed for coal. Also coal projects do not close those areas to salable minerals. Negligible adverse effects are anticipated due to increased project costs from delays due to possible conflicts.

Leasable Minerals - Fluids
A total of 30,520 acres will be closed to fluid mineral leasing, leaving 3,356,010 acres open to oil and gas projects. Conflict with oil and gas projects could potentially affect up to the entire salable minerals resource. However, the RFA for oil and gas projects is 22,255 acres, 2,098 for salable minerals. Even if there are conflicts between these two resources over all 2,098 acres, that is 0.06 percent of the salable minerals resource. Conflict in those areas is unlikely, as salable minerals are plentiful outside the areas likely to be developed for oil and gas projects. Impacts would likely be increased costs for some projects; the effect would be negligible adverse.

Fire and Fuels Resources

Full protection strategies and tactics will be used across the entire planning area, likely resulting in types and extents of effects similar, although greater, overall to those under Alternative A. There is not likely to be many salable minerals projects affected due to temporary inaccessibility to project areas, and those effects would be negligible adverse from increased project costs.

Biological Resources

Vegetation – Forests and Woodlands
Types of effects are similar to, but likely of greater extent than those under Alternative A, as silviculture and pest control treatments, techniques, and methods will be more extensively used. There would be a negligible adverse effect to salable minerals activities due to potentially increased costs.

Vegetation – Grassland and Shrubland Communities
Desirable non-native species will be allowed for reclamation activities, likely leading to decreased project costs (see Alternative A); a negligible beneficial effect would be likely.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities are allowed within 500 feet of riparian/wetland systems, aquatic habitats, and floodplains, as consistent with other resource values. The required Wyoming DEQ LQD Mine Permits already include avoidance or minimization/mitigation for such areas,

although most of these types of areas would be avoided due to problems inherent to them. There would be no effect.

Invasive Species and Pest Management
Invasive species and pest management actions could include area- and/or species-specific treatment strategies. These treatments may increase salable minerals project costs due to temporary access delays to project sites. However, successful treatments will likely also decrease the spread of undesirable species, resulting in potentially lower project expenses or avoidance of additional project costs; a negligible beneficial effect would be likely.

Fish and Wildlife Resources – Fish
Surface-disturbing activities are allowed within 0.25 mile of naturally occurring water bodies containing acceptable fish species. Reservoirs and riparian areas are managed to improve other resources first and potential fisheries second. Other actions may lead to increased project costs; a negligible adverse effect would be likely.

Fish and Wildlife Resources – Wildlife
Two seasonal restrictions occur under Alternative C: a WHMA is proposed to be designated for the Fortification Creek elk herd's crucial range (12,419 acres, 0.37%), which includes year-round restrictions; and a seasonal prohibition within 0.5 mile of active raptor nests (4,855 acres, 0.15%). Few salable minerals projects occur in/near these areas, and these restrictions would likely lead to increased project costs for few projects; the likely effect would be negligible adverse.

Special Status Species – Plants
Surface-disturbing activities that could adversely affect SSS plant habitat are allowed, but not within known populations. These habitat areas are quite small, leading to a relatively small amount of lands unavailable for mineral materials activities; the likely effect would be negligible adverse.

Special Status Species – Fish
Surface-disturbing and disruptive activities are prohibited within 500 feet of any waters containing SSS fish, when their effects cannot be mitigated (308 acres, less than 0.01%). With salable minerals plentiful, most or all SSS fish areas can be avoided. As these acres are essentially closed to salable minerals activities, the effect would be negligible adverse.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Restrictions occur under Alternative C include: maintain current habitat utilized by SSS; manage traditional wildlife migration and travel corridors consistent with other resources; manage surface-disturbing and disruptive activities consistent with other resources; require anti-perching devices on new powerlines within occupied Greater Sage-Grouse habitat; restrictions on surface-disturbing and disruptive activities within 0.25 mile of the perimeter of leks (3,594 acres, 0.11%); seasonal prohibitions within 2 miles of occupied leks (203,724 acres, 6.08%) and within Greater Sage-Grouse winter concentration areas; a year-round disturbance-free buffer of at least 0.5 mile around known bald eagle nests and winter roosts (402 acres, 0.01%); a seasonal limited activity zone within one mile of known nests and eagle roosts (3,013 acres, 0.09%); and seasonal species-specific prohibitions within 0.25 mile of SSS raptor nests (75,276 acres, 2.25%). Approximately 50 percent of salable minerals projects occur in/near these areas, so a fair number of such projects might need to be modified. As year-round prohibitions/restrictions essentially close those areas to salable minerals activities, this decreases the acres available; there would be a minor adverse effect.

Heritage and Visual Resources

Cultural Resources

Surface disturbances are allowed in areas containing historic properties when appropriate mitigation is accomplished. Archeological monitors are required on a project-specific basis, increasing project costs; Native American monitors are not required. Overall there would be a negligible adverse effect.

Paleontological Resources

Paleontological field surveys are required for all projects potentially affecting PFYC Class 4 and 5 formations, adding some cost to certain salable mineral projects. Identification and designation of casual collection areas for common invertebrate, plant, and petrified wood fossils. There would likely be a negligible adverse effect.

Visual Resources

Visual simulation may be utilized on a project-specific basis which would increase project costs. Salable minerals are plentiful and able to be accommodated even with any VRM Class II restrictions. Overall the effect is likely negligible adverse.

Land Resources

Forest Products

An array of forest products will be available from across the entire planning area; a negligible adverse effect is likely due to slightly increased likelihood of temporary lack of access to certain few projects.

Lands and Realty

Land tenure adjustments could increase or decrease BLM surface and/or federal mineral estate. Lands having agricultural potential or water will be disposed of (76,223 acres, 2.28%). Other lands identified for disposal (120,722 acres, 3.61%) will be disposed of, with the longest retention of those with higher resource values. It is difficult to predict which land tenure adjustments will occur during the planning period (see Alternative A). If all these lands are disposed of (totaling 196,945 acres, 5.88%), the salable minerals resource will decrease by up to that amount, depending on the mineral estate ownerships of the various lands. It's more likely that much fewer acres will be disposed of (see Alternative A); there would likely be up to a minor adverse effect.

Renewable Energy

Not all renewable-energy projects are incompatible with salable minerals activities; see Alternative A. Although no renewable energy projects have been received to date, it is predicted that 40,000 acres of BLM surface will be disturbed during the planning period (1.19%). Although renewable-energy projects are not necessarily incompatible with salable minerals activities, these lands will be segregated from mineral entry (see Alternative A), thus decreasing the salable minerals resource by up to that amount; there would be likely up to a minor adverse impact, though.

Rights-of-Way and Corridors

Above-ground facilities such as powerlines are to be placed along major transportation routes; however, no current or historic salable minerals projects utilize powerlines. Any future projects requiring new powerlines would have increased projects costs. ROWs for salable minerals projects are rare (see *Impacts Common to All Alternatives*). The RFA for ROWs for

other uses (such as for oil/gas roads and equipment) is 57,083 acres (7.34%). However, ROWs are not necessarily incompatible with salable minerals projects (see *Impacts Common to All Alternatives*). It is more likely that fewer acres will be affected; overall the effect would likely be up to minor adverse. CCS research and projects are allowed, where consistent with other resource values; this could occur over up to the entire acreage of BLM surface (777,310 acres, 23%). CCS projects are not necessarily incompatible with salable minerals projects.

Travel and Transportation Management
Some areas are restricted or closed to motorized travel. These areas are not completely inaccessible to salable minerals activities, but these restrictions would make exploration and development activities more challenging and increase costs; there would likely be a negligible adverse effect.

Recreation
A total of six SRMAs are recommended for designation, totaling 33,261 acres (0.99%), although designation of these areas would not close them to salable mineral development if those activities are consistent with other resource values. There would be no effect.

Lands with Wilderness Characteristics
No lands would be managed for wilderness characteristics; there would be no effect.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock, thereby increasing some salable minerals project costs; there would be a negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
No ACECs are recommended for designation; there would be no effect.

Scenic or Back Country Byways
No roads will be evaluated during the planning period for their eligibility to be proposed as National BCBs or Scenic Byways; there would be no effect.

Wild and Scenic Rivers
One WSR is under Congressional review, and is managed according to Manual 6400 – *Management of Wild and Scenic Rivers*, which includes surface disturbance restrictions. If Congress does not designate the WSR, and Congress is not expected to act during the planning period, these restrictions will be lifted. This area is not a likely target for salable minerals activities, however, given its remote location and rugged terrain. There would be no effect.

Wilderness Study Areas
Currently, there are three areas in the planning area where salable minerals activities are already prohibited while under Congressional review: the WSAs, totalling 28,931 acres. Congress is not expected to act during the planning period, and the BLM recommends not officially designating these areas. However, any WSAs released by Congress would be subject to considerations for lands with wilderness characteristics; therefore, the current surface disturbance restrictions will continue to apply until a plan amendment is completed.

Socioeconomic Resources

Social and Economic Conditions
The BLM is to develop management strategies to recognize and point out conflicts expected to affect multiple resource use, and to incorporate to the extent possible local and regional economic development and land use plans. The effect is difficult to predict, but may result in slightly more area being restricted; there would be a negligible adverse effect.

4.2.5.6. Alternative D

This section describes management actions under Alternative D, the Proposed RMP which strikes a balance between resource use and resource conservation, and the likely resulting effects on the federal salable minerals resource during the planning period due to their implementation.

Salable Minerals
The three WSAs (totalling 28,931 acres) are already restricted to salable minerals activities. Conservation measures implemented for other resources under Alternative D would result in a total of 623,061 acres (12%) being closed to or restricted from salable minerals activities, leaving 2,725,060 acres (88% of the current resource) open to salable mineral activities. There would be no effect.

Physical Resources

Air Quality
Quantitative air quality modeling and mitigation to ensure project emissions would approach or exceed emissions standards are required for projects that could exceed standards. This would increase project costs; the effect would be negligible adverse.

Soil
Surface-disturbing activities in areas with severe erosion hazard, poor reclamation suitability, LRP, and on slopes equal to or greater than 25 percent are not prohibited unless the soil resource cannot be conserved. Less than 10 percent of current salable minerals projects are in such areas on BLM surface, and soils are conserved during operations. The effect would likely be negligible adverse.

Water Resources
Surface disturbance within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams is allowed where resource objectives are met. These areas are already avoided due to their inherent problems, and other salable minerals projects can avoid water resources. A negligible adverse effect is likely due to increased project costs.

Cave and Karst Resources
Surface-disturbing activities are prohibited within a site-specific buffer around significant cave entrances (11 acres, less than 0.01%). Salable minerals projects are not likely in these areas due to the rugged terrain and long distance to likely areas of use. There would be a negligible adverse effect, due to these acres essentially being closed to salable minerals activities.

Mineral Resources

Locatable Minerals
A total of 11,373 acres were withdrawn for three big game WHMAs, and this acreage remains withdrawn. A total of 61,818 acres are recommended for withdrawal under various management

actions for other resources (the three WSAs are not recommended for withdrawal; this leaves 715,492 acres open to locatable minerals activities. The RFA for locatable minerals is 1,256 acres and 1,198 for salable minerals. Even if there are conflicts over all 1,198 acres, that is 0.04 percent of the salable minerals resource. Conflict is unlikely, as salable minerals are plentiful outside the areas likely to be developed for locatable minerals. Overall the effect would be negligible adverse, due to increased costs for some projects due to delays or needing their sites altered.

Leasable Minerals - Coal
The RFA for coal projects is 195,700 acres and 1,198 for salable minerals. Even if there are conflicts over all 1,198 acres, that is 0.04 percent of the salable minerals resource. Conflicts in areas of likely coal development are unlikely though, as salable minerals are plentiful outside these areas. Some projects might experience higher project costs, due to delays and/or changing sites.

Leasable Minerals - Fluids
A total of 72,276 acres will be closed to fluid mineral leasing, leaving 3,314,254 acres open to oil and gas projects. Conflict with oil and gas projects could potentially affect up to that number of acres of the salable minerals resource. However, the RFA for oil and gas projects is 14,869 acres; 1,198 for salable minerals. Even if there are conflicts over all 1,198 acres, that is 0.04 percent of the salable minerals resource. Conflict in those areas is unlikely, as salable minerals are plentiful outside the areas likely to be developed for oil and gas projects; overall the effect is likely negligible adverse, due to delays and increased costs for certain projects.

Fire and Fuels Resources

Fire response and treatment will vary to meet other resource objectives. Relatively few salable minerals projects might be affected through temporary restriction of access to sites; there would be a negligible adverse effect.

Biological Resources

Vegetation – Forests and Woodlands
Types of effects are similar to, but likely of slightly lesser extent than, those under Alternative A; some silviculture and pest control treatments, techniques, and methods will be less extensively used and some more. Few salable mineral projects occur in/near forests and woodlands; a negligible adverse effect is likely due to increased costs for few projects.

Vegetation – Grassland and Shrubland Communities
Desirable non-native species allowed for short-term reclamation activities, but only with native species during final reclamation. This would increase project costs due to the use of native seed species; there would be a negligible adverse effect.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities are allowed within 500 feet of riparian/wetland systems and aquatic habitats where other resource objectives are met. These areas are usually avoided for salable minerals development; there would likely be a negligible adverse effect.

Invasive Species and Pest Management
Planning and actions would be required to manage invasive species, these would increase project costs but decrease the spread and of invasive species; there would be a negligible beneficial effect.

Fish and Wildlife Resources – Fish
Surface-disturbing activities are allowed within 0.25 mile of naturally occurring water bodies containing acceptable fish species where fish resource objectives can be met (51,745 acres, 1.55%). Fisheries enhancement in reservoir design is utilized consistent with other resources. Other actions will likely increase project costs. These areas are already mostly avoided due to mitigation on Wyoming DEQ Mine Permits; a negligible adverse effect is likely due to increased costs for few projects.

Fish and Wildlife Resources – Wildlife
Distance and/or timing limitations or prohibitions will adversely affect the salable minerals resource. These are within: the three WHMAs (totaling 4,583 acres, 0.14%); 0.5 mile of big game priority travel corridors (9,587 acres, 0.46%); big game crucial winter range and elk calving areas (98,411 acres, 2.94%); 0.25 mile year-round of occupied sharp-tailed grouse leks (940 acres, 0.03%), and seasonally within 2 miles of occupied leks in potential nesting and early brood-rearing habitat (48,127 acres, 1.44%); and within USFWS Wyoming Ecological Services' recommended spatial buffers for breeding raptors (255,129 acres, 7.62%). In addition, retention of 85 percent of existing elk security habitat is required (existing acreage 132,148 acres, 3.95%). A WHMA is not recommended to be designated for the Fortification elk herd; instead, the current management (BLM 2011c) is to be retained. Other restrictions also apply which will likely increase project costs, including applying seasonal restrictions on existing projects when wildlife resources are not met (approximately 530 acres, 0.02%). With approximately 25 percent of salable minerals projects occurring in/near these areas, the likely effect will be moderate adverse, due to many of these acres essentially being closed to salable minerals activities.

Special Status Species – Plants
Surface-disturbing activities are prohibited within SSS plant habitat (237,279 acres, 7.09%) when the populations would not be conserved. Also, predisturbance flowering season surveys are required prior to project approval. These habitat areas are typically quite small, and few salable minerals projects are likely in these areas. The likely effect is moderate adverse, as these acres will essentially be closed to salable minerals activities.

Special Status Species – Fish
Surface-disturbing activities are prohibited within 0.25 mile of any waters containing SSS fish species, unless it benefits the species (818 acres, 0.02%). Other prohibitions and requirements apply, likely increasing project costs. Overall there would be a negligible adverse effect, as these acres will essentially be closed to salable minerals activities.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Surface-disturbing, disruptive, and/or occupancy activities are prohibited or restricted to conserve SSS wildlife within the following areas: prairie dog colonies, unless suitable habitat for SSS dependent upon prairie dogs is not affected (6,156 acres, 0.18%); year-round within at least 0.5 mile of bald eagle riparian corridors (12,937 acres, 0.38%); seasonally within the USFWS recommended buffer and year-round within species-specific biologic buffer of active SSS raptor nests (17,417 acres, 0.52%); and habitats of SSS amphibians, reptiles, and bats, unless populations and habitat can be conserved (176,636 acres, 5.28%). Powerlines are to be designed to minimize wildlife-related impacts, are to avoid certain areas of high avian use, and are prohibited within certain distances of Greater Sage-Grouse leks, areas, or habitat; this will likely lead to increased project costs.

Alternative D would apply the following surface-disturbing activities to the extent necessary to prevent unnecessary or undue degradation in:

- Greater Sage-Grouse Core Population Areas:

  Prohibit surface disturbing activities, disruptive activities, and occupancy within 0.6 mile of the perimeter of occupied Greater Sage-Grouse leks (independent of habitat suitability). Allow no more than one oil and gas or mining location and no more than 5 percent disturbance per 640 acres within the DDCT analysis area (4 mile buffer of occupied leks within 4 miles of proposed surface disturbance restricted to Core Population Area and Connectivity Corridor). Design and manage facilities to prevent WNv transmission. Avoid overhead electric transmission lines and bury electrical distribution lines where possible; if not possible, then locate overhead lines at least 0.6 miles from the perimeter of occupied Greater Sage-Grouse leks and install raptor perch guards. Prohibit electric overhead transmission lines unless within one-half mile either side of existing 115 kV or larger transmission lines creating a corridor no wider than one mile. Limit noise sources to 10 dBA above ambient noise measured at the perimeter of occupied Greater Sage-Grouse leks from March 1 to May 15, 6 PM to 8 AM, unless scientific findings indicate a different noise level is appropriate. In addition, limit noise sources in other important Greater Sage-Grouse habitats if research and/or policy indicate the need. Locate new roads, used to transport products or waste, greater than 1.9 miles and other new roads, such as roads for site access, greater than 0.6 miles from the perimeter of occupied Greater Sage-Grouse leks. Construct roads to minimum design standards needed. Restore disturbed sagebrush communities on BLM surface to meet the Wyoming DEQ community-specific full shrub density standard (Chapter 4 Rules and Regulations, option III) for all predisturbance shrub species and 5 percent minimum canopy cover of sagebrush. A 90 percent confidence interval is required to demonstrate achievement of the standard. The standard must be demonstrated the last year of the responsibility period, and all planted shrubs shall have been in place for at least two years. Prohibit surface disturbing and disruptive activities from March 15 to June 30 (independent of habitat suitability). Prohibit surface disturbing and disruptive activities within Greater Sage-Grouse winter concentration areas from December 1 to March 14.

- Greater Sage-Grouse Core Population Connectivity Corridors:

  Prohibit surface-disturbing activities, disruptive activities and occupancy within 0.6 mile of the perimeter of occupied Greater Sage-Grouse leks (independent of habitat suitability). Allow no more than 5 percent total surface disturbance per 640 acres within the DDCT analysis area (4 mile buffer of occupied leks within 4 miles of proposed surface disturbance, restricted to Core Population and Core Population Connectivity Corridors. Design and manage facilities to prevent WNv transmission. Avoid overhead electric transmission lines and bury electric distribution lines where possible; if not possible, locate overhead lines at least 0.6 miles from the perimeter of occupied Greater Sage-Grouse leks and install raptor perch guards. Locate new roads, used to transport products or waste, greater than 1.9 miles and other, new such as site access, greater than 0.6 mile from the perimeter of the occupied Greater Sage-Grouse leks. Construct roads to minimum design standards needed, and facilities with motion, light sources, noise (10 decibels above ambient), with a height greater than 4.5 feet. Restore disturbed sagebrush communities on BLM surface to meet the Wyoming DEQ community-specific full shrub density standard (Chapter 4 Rules and Regulations, option III) for all predisturbance shrub species and 5 percent minimum canopy cover of sagebrush. A 90 percent confidence interval is required to demonstrate achievement of the standard. The standard must be demonstrated the last year of the responsibility period, and all planted shrubs shall have been

in place for at least two years. Prohibit surface disturbing and disruptive activities within 4 miles of occupied Greater Sage-Grouse leks from March 15 to June 30 (independent of habitat suitability, restricted to within Core Population Connectivity Corridors). Prohibit surface disturbing and disruptive activities within Greater Sage-Grouse winter concentration areas, from December 1 to March 14.

- Occupied Greater Sage-Grouse habitat outside of Core Population Areas and Core Population Connectivity Corridors:

  Prohibit or restrict surface-disturbing and disruptive activities within 0.25 mile of the perimeter of occupied Greater Sage-Grouse leks. Reduce surface disturbance for authorizations within 0.25 mile of occupied Greater Sage-Grouse leks. Design and manage facilities to prevent WNv transmission. Bury electric distribution lines where possible; if not possible, then locate overhead lines at least 0.5 mile from the perimeter of occupied Greater Sage-Grouse leks and install raptor perch guards. Restore disturbed sagebrush communities on BLM surface to meet the Wyoming DEQ community-specific full shrub density standard (Chapter 4 Rules and Regulations, option III) for all predisturbance shrub species and 5 percent minimum canopy cover of sagebrush. A 90 percent confidence interval is required to demonstrate achievement of the standard. The standard must be demonstrated the last year of the responsibility period, and all planted shrubs shall have been in place for at least two years. Recommend for all surface-disturbing activities on BLM surface adjacent to priority habitat, within or adjacent to lands involved in Greater Sage-Grouse conservation projects, or support an 85 percent Greater Sage-Grouse population density. BLM parcels less than 640 acres that only meet the population density factor may be excluded. Prohibit surface disturbing and disruptive activities within 2.0 miles of occupied Greater Sage-Grouse leks, from March 15 to June 30 (independent of habitat suitability), and within Greater Sage-Grouse winter concentration areas from December 1 to March 14.

Approximately 50 percent of salable minerals projects occur in or near SSS habitat; the likely effect will be moderate adverse.

Heritage and Visual Resources

Cultural Resources

Surface disturbance is prohibited within Pumpkin Buttes, Cantonment Reno, Dull Knife Battlefield, Crazy Woman Battlefield, Contributing and unevaluated segments of the Bozeman Trail, all rock art sites, rock shelter sites, and Native American burials (15,382 acres, 0.46%). Surface disturbance is allowed within 3 miles of those areas, if the development is not visible or will result in a weak contrast rating to the setting (188,488 acres, 5.63%). Prohibitions and other measures will be used to mitigate adverse effects to sensitive sites such as TCPs and or sacred sites. Other requirements include: requiring archeological monitors for projects according to established strategy, establishing agreements to provide tribal access to Pumpkin Buttes, other TCPs, and sacred sites on BLM surface, and requiring Native American monitoring for surface-disturbing projects in accordance with agreements or on a project-specific basis. CRPPs will be developed for Pumpkin Buttes, sites associated with Red Cloud's War and the Great Sioux War (including Dull Knife Battle, Cantonment Reno, Crazy Woman Battle, and Bozeman Trail), and the South Big Horn Mountains; it is uncertain at this time what restrictions or requirements might be included in these CRPPs. Many of such areas are already protected to a certain degree by other means, and salable minerals are plentiful elsewhere; the effect will be up to moderate adverse due to those acres prohibited being essentially closed to salable minerals activities.

Paleontological Resources
Areas containing paleontological resources of high quality or importance would be designated for special management as they are identified (860 acres, 0.03%); these areas are to be avoided by salable minerals activities. Requiring paleontological field surveys for all PFYC Class 4 and 5 formations, and Class 3 as needed, with monitoring of surface-disturbing activities in such areas as based on the survey results, would increase project costs. Overall, there would be a negligible adverse effect due to certain areas becoming essentially closed to salable minerals activities.

Visual Resources
Areas will be managed according to their VRM classes, except certain areas (such as SRMAs, ACECs, lands with wilderness characteristics, Powder River Breaks, Fortification Creek); some of these areas will be managed according to more scenic management. Required within VRM Class II areas is completion of visual simulation and mitigation design; these may be required on a project-specific basis within VRM Class III areas with high visual sensitivity. These will likely increase project costs; the effect is likely negligible adverse.

Land Resources

Forest Products
Temporarily fencing off of regeneration or treatment areas may be needed, and may temporarily limit access to certain salable minerals projects. Relatively few salable minerals projects occur in/near wooded areas; there would likely be a negligible adverse effect.

Lands and Realty
Land tenure adjustments could increase or decrease BLM surface and/or federal mineral estate (see Alternative A). Lands will be acquired and disposed of based on resource values, including but not limited to, disposals of lands with agricultural potential and water (potentially 76,223 acres, 2.28%). Other management actions include: disposal of BLM surface lands identified for disposal (120,722 acres, 3.61%), and other lands not identified but meeting appropriate disposal criteria, would be available for disposal. Acquisition of lands from willing sellers would occur consistent with other resource values, with priority given to those lands adjacent to large blocks of BLM surface (before those in other areas). It is difficult to predict which land tenure adjustments will occur during the planning period, although currently identified disposals total 196,945 acres (5.88%). It is much more likely that fewer acres will be affected (see Alternative A); overall would more likely be up to a minor adverse effect.

Renewable Energy
Although no renewable-energy projects for public lands in the planning area have been received to date, it is predicted that 75,240 acres of BLM surface will be disturbed during the planning period (2.25%). Although not all renewable-energy projects are incompatible with salable minerals activities, these lands would be segregated from mineral entry (see Alternative A), thereby reducing the salable minerals resource up to that total amount. It is much more likely that fewer acres will be affected, however (see Alternative A); the effect is likely to be up to minor adverse.

Rights-of-Way and Corridors
Transmission lines and above-ground facilities will be placed within existing ROWs and other disturbed areas. ROWs for salable minerals projects are uncommon (see *Impacts Common to All Alternatives*), and these actions would likely have an overall negligible adverse effect, due to possible increased costs for extremely few projects. The predicted disturbance from

other ROWs is 38,762 acres of BLM surface (1.16%). However, ROWs are not necessarily incompatible with salable minerals projects (see Alternative A). It is more likely that fewer acres will be affected. CCS proposals will be evaluated; assessing the likely level of effect on the salable minerals resource from these opportunities is difficult, as no projects for public lands in the planning area have been received to date. However, up to the entire acreage of BLM surface (777,310 acres, 23%) could be affected (see Alternative A); however, CCS projects are not necessarily incompatible with salable minerals activities.

Travel and Transportation Management
A number of area-specific restrictions to motor vehicle use may increase salable minerals project costs for certain project proponents, but these areas might not be completely inaccessible as a number of salable minerals activities can be performed without motorized vehicles. These actions may require redesigning and/or reconstructing certain roads, and restricting use of certain roads during certain time periods, increasing project costs. Projects in these areas are not likely to be common as salable minerals are plentiful elsewhere, but will have increased costs; there would likely be a negligible adverse effect.

Recreation
The planning area is proposed to be divided into eight ERMAs (349,663 acres, 10.44%) and seven SRMAs (54,160 acres, 1.62%). Designation of ERMAs would not close those areas to locatable mineral activities, but would likely add some requirements for analysis and/or mitigation, increasing project costs. Designation of SRMAs would close them to salable mineral development, except for administrative use only. A minor adverse effect is likely, as closure of the designated SRMAs acres decreases the acres of salable minerals resource.

Lands with Wilderness Characteristics
One area of lands with wilderness characteristics (6,864 acres, 0.21%) is recommended to be closed to salable minerals activities. Although this area is not likely to be sought for salable minerals activities, due to rugged terrain and long distance to where these minerals would likely be used, these acres would be closed, decreasing the resource. There would be a negligible adverse effect.

Livestock Grazing Management
Temporarily fencing off areas being explored and/or mined might be needed to protect livestock. Salable minerals project costs may increase; there would be an overall negligible adverse effect.

Special Designations

Areas of Critical Environmental Concern
A total of two ACECs are recommended for designation, totalling 2,849 acres (0.09%). These areas would be managed under site-specific management plans, which include closing them to salable minerals activities. Parts of these potential ACECs are already under some restrictions, and parts are in areas not likely to be sought for salable mineral activities due to ruggedness of terrain and distance to likely places of use. There would be a negligible adverse effect.

Scenic or Back Country Byways
A number of roads will be evaluated during the planning period for their eligibility to be proposed as National BCBs or Scenic Byways. There would be no effect.

Wild and Scenic Rivers
One WSR is under Congressional review, and is managed according to Manual

6400 - *Wild and Scenic Rivers*, which includes surface disturbance restrictions. If Congress denies its designation, these restrictions will continue to retain the areas' characteristics; Congress is not expected to act during the planning period, however. These restrictions result in negligible adverse effect to the salable minerals resource (2,664 acres, 0.08%). This area is not a likely target for salable minerals activities, however, given its remote location and rugged terrain.

Wilderness Study Areas
Currently, there are three areas in the planning area where salable minerals activities are restricted while under Congressional review: the WSAs (totaling 28,931 acres). In addition, all motorized and mechanized equipment will be prohibited in these areas. Congress is not expected to act during the planning period, and the BLM recommends not officially designating these areas. These areas will remain restricted from salable minerals activities (see Alternative A); there would be no effect.

Socioeconomic Resources

Social and Economic Conditions
The BLM is to work with other entities (local, state, federal, private) to develop mitigation strategies for promoting a healthy and sustainable social and economic environment. The BLM is to work with all stakeholders to identify socioeconomic impacts of BLM actions and develop strategies to mitigate those impacts where possible to promote sustainability in a multiple resource use environment. The effect is difficult to predict, but may result in slightly more area being restricted, or more requirements that would increase project costs; negligible adverse.

4.2.5.7. Cumulative Impacts

The current total available BLM-administered federal salable minerals resource amounts to 3,348,121 acres. The current total available salable minerals resource that BLM does not administer comprises the remainder of the planning area, 3,979,322 acres (7,356,374 total acres in the planning area, less 3,348,121 acres of BLM–administered salables mineral, and less the 28,931 acres that are already closed to salable minerals activities). The existence of federal mineral estate does not imply the presence of salable minerals of sufficient quality and/or quantity to make them economically viable to develop in those lands (see Chapter 3). Alternative A forecasts that approximately 532 acres of federal mineral estate will be disturbed during federally-authorized exploration and development activities (BLM), and approximately 4,768 acres of non-federal mineral estate during similar activities not involving federal authorization (non-BLM); see Appendix G (p. 1937). Under the other alternatives, these acres are: Alternative B – 114 acres BLM, 14,304 acres non-BLM; Alternative C – 2,098 acres BLM, 7,152 acres non-BLM; Alternative D – 1,198 acres BLM, 11,178 acres non-BLM. The actual current acres (Alternative A) and projected potential acres (alternatives B through D) of the BLM-administered portion of the federal salable minerals resource explored and/or developed are all less than 1 percent of this resource; the equivalent non-BLM acres (given above, and in Appendix G (p. 1937)) are less than 1 percent of that resource.

The current acres under exploration/development were obtained from BLM's LR2000 database (BLM acres) and Wyoming DEQ LQD's files (non-BLM acres). The projected acres under alternatives B through D were obtained by approximating how much salable minerals mining might occur under each of those scenarios: Alternative B is the most restrictive for BLM-administered lands, while Alternative C is the least restrictive, and Alternative D is

anticipated to lie between those two extremes. Alternative B's BLM acres were approximated to be 25 percent of that for Alternative A — this approximation takes into account the actual number of BLM-administered acres that are already authorized to continue to be mined and yet to be mined, as well as those actual and approximated acres that will be reclaimed during the planning period. Alternative B Non-BLM acres were approximated to be quite large, taking two important factors into account: (1) as BLM-administered lands are greatly restricted under Alternative B, this likely will result in more non-BLM acres being mined to make up for the decrease in BLM-administered lands available for mining, and (2) the additional very likely potential for mining to increase in the planning area overall. Alternatives B through D, for both types of acres, take into account the very real likelihood that mining will continue to increase in the planning area due to the nation's and world's continually increasing populations and technological advances: our needs for minerals are likely to increase, and continue increasing, into the future. In addition, for the salable minerals currently mined in the planning area (sand, gravel, clinker), there are several other materials with similar qualities also available that may substitute for them. Alternative C's BLM acres were approximated to be roughly 400 percent of that for Alternative A (an increase of roughly 300% over what is currently occurring) – this approximation takes into account the likelihood that more BLM-administered acres will be mined, given the lesser restrictions on these lands; non-BLM acres are also projected to increase, though not as greatly as under Alternative B. Alternative D's BLM and non-BLM acres were both approximated to be roughly 225 percent of that for Alternative A (an increase of roughly 125% over what is currently occurring) — this approximation takes into account the likelihood that all lands will likely experience more mining into the future, and that fewer acres are proposed to be closed or restricted from salable minerals activities.

In general, BLM-authorized salable minerals activities disturb far fewer acres in the planning area than do BLM-authorized oil and gas or coal activities (see Appendix G (p. 1937)), and that such BLM-authorized activities disturb fewer acres in the planning area than do non-BLM activities. Salable minerals demand and production has decreased somewhat over the last several years. This is mainly due to the sharp decrease in CBNG-related activities as the natural gas price fell several years ago. CBNG is still being developed, however, as the natural gas price has been rebounding. Activities related to deeper oil/gas development have increased dramatically, however, off-setting the decreased CBNG activity to a fair degree. The crude oil price remains high, and many more oil/gas wells are being developed. Advances in long horizontal well completions, as well as successfully completing multiple horizontal wells on single pads, has allowed oil/gas operators to drill more wells and increase the production per well dramatically. Although the pads needed for horizontal wells tend to be much larger than for CBNG or vertical oil/gas wells, there are far fewer of them, leading to a decrease in road-building as well. Stricter air quality standards have resulted in a continued decreasing overall demand for scoria for road maintenance, as it tends to create more dust than sand/gravel; increasingly more sand/gravel is used for road maintenance. The coal mines still use large quantities of scoria, however, as it is much more abundant than sand/gravel in the areas where the coal mines are located. An overall increasing population means roads are travelled more, which increases road building and maintenance demands. Portions of several county roads have been improved over the last couple of years, and aggregate use in those projects also off-set some of the falling off of demand due to the decreased CBNG activity. Although the demand for salable minerals in the planning area has decreased somewhat over the last several years, the forecast is that demand for these minerals has experienced its' potentially lowest level and will rise again during the planning period. However, it will likely rise at a much slower rate, and to not as great a height, as seen in the period of roughly 2003–2010.

4.2.5.8. Conclusion

The alternatives listed in ascending order from least to most adverse in terms of effects on the salable minerals resource are: A, C, D, B.

Alternative A is the continuation of current management. Alternative B emphasizes resource conservation, and therefore generally places the most constraints on, and is the most restrictive to, development. Alternative C emphasizes resource use, and therefore places the least constraints on, and is the least restrictive to, development. Alternative D is the Proposed RMP, which strikes a middle ground between resource conservation and resource use, and therefore places a more moderate amount of constraints on development.

4.3. Fire and Fuels Management

The goals of fire and fuels management are to protect life and property; protect or enhance natural resources; maintain or restore landscape-level fire regimes; and vegetation characteristics. Fire and fuels management strategies focus on these goals and encourage the use of vegetative treatments to accomplish the goals. This chapter describes the potential effects of BLM actions on fire and fuels management, and ability to meet the goals.

4.3.1. Unplanned Fire (Wildfire)

The BFO will manage wildfires based on ecological, social, and legal consequences, and the circumstances under which wildfires occur. Firefighter and public safety is the first priority in every fire management activity. Where geographically allowed within an RMP planning area, unplanned ignitions may be managed for both protection and resource benefit (multiple objectives). Unplanned ignitions not managed to meet resource & protection objectives would be managed solely to meet protection objectives.

4.3.1.1. Methods and Assumptions

Actions that affect wildfire management are those that facilitate or constrain suppression activities; alter the complexity or costs of wildfire management; increase or allow fuel loading to increase; or change the potential for human-caused wildfires. Actions that require inventory, analysis, or added decision levels to emergency response would increase the complexity of wildfire management.

Actions which contribute to the health of plant communities and the landscape are beneficial to unplanned fire management because they support the goals of fire and fuels management. In plant communities/systems with the highest departures from natural or historical disturbance regimes (fire regimes condition class [FRCC2] and FRCC3), inaction or reduced actions could exacerbate or expand acres of undesirable conditions and increase the potential for atypical fire behavior and high-severity fire effects. In Wildland-urban Interface (WUI) areas high fuel loads would increase the complexity of suppression operations, so actions that constrain fuels treatments in these areas would consequently affect management of wildfires and would increase costs.

Wyoming BLM standardized surface use definitions specify that fire could be a surface-disturbing activity. This means both fire suppression activities and the fires themselves could be considered surface disturbances, which may in turn produce conflicting direction or guidance especially where wildfire might be used to meet multiple objectives. In most cases wildfire will not

alter the vegetation beyond natural site conditions, but suppression actions generally will. Therefore for simplicity and clarity of analysis in this section, suppression actions are considered surface-disturbing activities whereas wildfire is not.

Impact analyses and conclusions are qualitatively based on the constraints versus facilitative management actions of other resources, while considering fire history, current vegetation, expected fire behavior, and previous management experience responding to unplanned ignitions in the planning area.

4.3.1.2. Impacts Common to All Alternatives

For unplanned fire, some fire suppression activities are broadly constrained in certain areas to protect sensitive resources. For example, fire retardant is restricted or prohibited in specific areas to protect water sources and rock art, and heavy equipment is constrained in cultural sites, WSAs, and other sensitive areas. There is further description in the specific resources.

Fire and Fuels Management

In general fire and fuels management actions common to all are beneficial to unplanned fire because they focus on coordinated and collaborative pre-planning, which adds safety and facilitates or simplifies emergency decisions. There are two restrictions to fire suppression tactics which have minor adverse effects to wildfire management: retardant or foam is prohibited within 300 feet of surface water sources; and fire retardant is restricted or prohibited as appropriate to protect rock art. These restrictions affect about one percent of BLM-administered lands and have a minor adverse effect on fire management. Other suppression restrictions, such as use of heavy equipment, are discussed within the alternatives.

Prescribed fire and other fuels treatments would affect wildfire management in the following ways:

- Mitigate high-intensity fire behavior and undesirable effects on resources
- Support fire suppression activities by adding safety and options to operations
- Decrease adverse effects on resources from suppression actions
- Restore or maintain appropriate fire regimes and improve FRCC classes
- Reduce costs of wildfire suppression activities.

Fuels and other vegetation projects which reduce hazardous fuels are especially helpful in conifer settings and in developed areas. Treatment acres vary across alternatives and are discussed for each alternative, but overall, fire and fuels management common to all alternatives would have a minor beneficial effect on management of unplanned fires.

Physical Resources

Air Quality

Wyoming DEQ can require ambient air quality monitoring on a case-by-case basis for unplanned fires. On fires in which the BLM has jurisdictional authority, the AQD requires visual monitoring and reporting for fires that exceed 50 acres. Depending on air quality conditions during a wildfire, potential restrictions could constrain or prevent the use of fire for resource benefit. Air quality management common to all alternatives would have a negligible adverse effect on management of unplanned fires. This does not vary across the alternatives and is not discussed further within this section.

Soil and Water Resources
Rehabilitating all surface-disturbing activities (firelines) would ultimately benefit fire management even though the short-term workload would be increased. Costs of wildfire suppression includes rehabilitation of fire suppression damages and this should be incorporated as much as possible into the fire operations. This has negligible effects on fire management.

For unplanned ignitions that might be managed for multiple objectives, the pre-identified area would require an authorization which includes site-specific reclamation plans. The extra planning step would have a negligible adverse effect on fire management. Soils and water management common to all alternatives would have a negligible adverse effect on management of unplanned fires.

Cave and Karst Resources
Management of cave and karst resources has little effect on wildfire management. A resource advisor would be consulted during wildfire events to determine constraints, especially where fires might be managed for multiple objectives. This has negligible adverse effects on wildfire management and is not discussed further in Unplanned Fire (Wildfire).

Mineral Resources

Minerals exploration and development would increase the complexity of fire management actions. The potential for human-caused fires increases during minerals exploration and development activities, as does the need to protect industrial interface areas. The proliferation of roads in remote areas could increase fire occurrence by introducing additional human-caused ignition sources, although the associated road network and new water impoundments would improve emergency vehicle access and enable an earlier response to fires. Roads could be used as control lines during suppression actions.

Although mineral resources development would vary across the alternatives, the trade-offs described above would apply to all the alternatives. In this respect, effects would not be highly variable among the alternatives, and are therefore not discussed for each alternative. The effects on fire management and emergency response depend very much on sites and circumstances, and should be considered during activity-level planning.

Overall, mineral resources management common to all alternatives would have a minor adverse effect on management of unplanned fires.

Biological Resources

Vegetation
Using an integrated approach for managing and maintaining plant communities for a diversity of native species, habitats, seral stages, and distribution; and managing forests and woodlands in desired ecological conditions would have a minor beneficial effect on wildfire management by maintaining or restoring natural fire regimes or other disturbance regimes. Specific management actions for the vegetation communities are discussed in the alternatives.

Invasive Species and Pest Management
Cooperative IPM programs with non-BLM partners would benefit wildfire management by using landscape level-plans and actions to control annual bromes. Managing invasive plant species by utilizing best available science could increase local understanding of wildfire as a management

tool, whether it is used for resource objectives where annual bromes are present, or used as an integrated process to control annual bromes. Requiring disturbed areas (firelines) to be treated for invasive species should be part of the wildfire response and has negligible effects on fire management. Overall, management of invasive species and pest management actions common to all alternatives would have a negligible beneficial effect on management of unplanned fires. There is further discussion in alternatives B, C, and D.

Fish and Wildlife Resources
Specific vegetation goals for habitat management would be considered during decisions to implement limited versus full suppression strategies for unplanned fire. Depending on circumstances, limited suppression strategies that allow more acres to be burned might be less obtrusive than aggressive actions that minimize acreage burned; however, in some cases such as protection of Greater Sage-Grouse habitat, aggressive suppression actions may be required to protect the habitat from fire.

Constraints on surface-disturbing and disruptive activities would typically increase incident complexity by adding decisions to emergency actions, although constraints might be waived as necessary to accommodate appropriate suppression tactics that would protect the habitat or site. Timing restrictions that extend to July 31 would affect management of unplanned ignitions for resource objectives, though these restrictions generally occur in sagebrush settings where protection of the habitat would be prioritized over other resource benefits. Overall, fish and wildlife resources management actions common to all alternatives would have a negligible adverse effect on management of unplanned fires. There is further discussion in each alternative.

Special Status Species (including Greater Sage-Grouse)
Specific goals for habitat protection or enhancement would be considered during decisions to implement limited versus full suppression strategies for unplanned fire in SSS habitats. Where policy and pre-planning is in place, incident complexity could be reduced.

Management of sensitive plant species is discussed within the alternatives.

For Greater Sage-Grouse Priority Habitat Core Population Area and Connectivity Corridor, suppression response would follow current BLM management guidelines and fire management BMPs to protect the habitat. Suppression actions could include all tactics necessary to maximize protection of sagebrush communities and suitable habitat. This protection strategy simplifies emergency decisions but may increase costs. This does not vary across the alternatives and is not discussed further in this section. Specific surface-disturbing and timing restrictions vary across the alternatives and are discussed further in alternatives B and D, where unplanned ignitions may be managed for resource benefit.

Year-round restrictions would apply to bald eagle roosts or winter use areas, and the buffer could be extended depending on site circumstances and human activities. For nesting raptors, surface-disturbing activities would be prohibited within a buffer through spring and summer. Suppression strategies would strive to protect the habitat and nests while minimizing disruption, though the variable buffers add complexity to wildfire response especially where unplanned fire could be managed to meet other resource objectives.

Overall common management of SSS has a negligible adverse effect on fire management.

Heritage and Visual Resources

Cultural Resources
Management or protection plans for special areas or historic properties would provide preplanned direction for the Wyoming High Plains District (WHPD) Fire Management Plan (FMP) and reduce the complexity of wildfire response. Overall, cultural resources management actions common to all alternatives would have a negligible beneficial effect on management of unplanned fires. See further discussion for alternatives B through D.

Paleontological Resources
Field surveys of paleontological resources would indicate where heavy equipment would be constrained. In addition, a resource advisor would be consulted during wildfire events. This would have negligible effects on wildfire management and is not discussed further in Unplanned Fire.

Visual Resources
Management of visual resources would not affect emergency management of unplanned fires. When considering the use of wildfire to meet resource goals and objectives, VRM would not likely constrain this activity. This would not effect wildfire management. This does not vary across the alternatives and is not discussed further in Unplanned Fire.

Land Resources

Forest Products
See the discussion under each alternative below.

Lands and Realty
Exchanging lands to consolidate blocks of BLM-administered lands, disposing of isolated public lands, and pursuing easements to access public lands would improve wildfire management options and safety. Alternatives A, B, and D consider or prioritize these types of actions. See Alternative C for further discussion. Lands and realty actions common to all alternatives would have a minor beneficial effect on management of unplanned fires.

Renewable Energy
As with mineral resources, renewable-energy development could increase the complexity of wildfire management actions. The potential for human-caused fires would increase, as would the need to protect industrial interface areas. The proliferation of roads in remote areas could increase wildfire occurrence by introducing additional human-caused ignition sources, although the associated road network would improve emergency vehicle access and enable an earlier response to wildfires. Roads could be used as control lines during suppression actions.

Although renewable-energy development would vary across by alternative, the trade-offs described above would apply to all alternatives. In this respect, the effects are not highly variable among the alternatives so are not discussed further in this section. The effects on wildfire management and emergency response depend very much on sites and circumstances, and would be considered during activity-level planning.

Overall, renewable-energy management actions common to all alternatives would have a negligible adverse effect on management of unplanned fires.

Rights-of-Way and Corridors
Management of ROWs and corridors does not effect wildfire management and is not discussed further in Unplanned Fire.

Travel and Transportation Management
Closed areas, or limiting motorized vehicle travel to designated routes would help prevent accidental fires. However when considering the use of wildfire to meet resource goals and objectives, closed areas could increase the complexity of wildfire management decisions. With consideration of these trade-offs, TTM common to all alternatives would have a negligible adverse effect on management of unplanned fires. Restrictions and closed areas vary across the alternatives and are discussed further in each alternative.

Recreation
SRMA designations and associated recreation values could constrain management of unplanned fires for resource benefit. Full protection strategies would be required where new facilities are developed. Increased human activities associated with facilities could contribute to accidental fires, although improved access to the sites could enable an earlier response to wildfire. Although SRMA designations vary across the alternatives, these trade-offs apply to all alternatives and are not further discussed in this section. Recreation management common to all alternatives would have a minor adverse effect on management of unplanned fires.

Lands with Wilderness Characteristics
Management of wilderness characteristics is discussed in alternatives B and D, but otherwise has no effect on wildfire management.

Livestock Grazing Management
The allocation of resource reserve allotments would benefit fire management by providing temporary grazing opportunities when rest or deferment is required after wildfires. This varies across the alternatives and is assessed within the alternatives.

Livestock grazing strategies generally would include rest periods after vegetative treatments, including treatments through unplanned fires. Under some circumstances, such as adaptive management of annual bromes, this could unnecessarily postpone or constrain activities that benefit range, fire, and fuels management. See the alternatives for further impacts and discussion about rest periods. Vermeire et al. (2011) found that annual grasses were reduced in the Northern Great Plains following summer fire.

Special Designations

Areas of Critical Environmental Concern
Management of ACECs and effects on wildfire management is discussed in alternatives B and D, but otherwise does not affect wildfire management.

Scenic or Back Country Byways and Wild and Scenic Rivers
Management of these special designations does not effect wildfire management and is not discussed further in Unplanned Fire.

Wilderness Study Areas
Wildfire management activities, strategies, and tactics would follow the policy and guidelines in BLM Manual 6330 – Management of Wilderness Study Areas to preserve or enhance the natural character of WSAs and avoid unnecessary impairment of a WSA's suitability for preservation as wilderness. Approximately four percent of BLM-administered lands in the planning area are under wilderness review and affect wildfire management decisions. Appendix Q (p. 2511) provides more information from BLM Manual 6330 – Management of Wilderness

Study Areas. Additional restrictions for motorized and mechanized equipment is discussed further in alternatives B through D.

Socioeconomic Resources

Social and Economic Conditions and Health and Safety
Ensuring that local and regional economic development and local land use plans are considered in BLM actions, and working with local agencies to foster public awareness benefits fire and fuels management. Reducing or eliminating physical hazards through appropriate mitigations benefits fire and fuels management by adding safety to fire operations. This does not vary across the alternatives and is not discussed further in this section.

4.3.1.3. Alternative A

Fire and Fuels Management

Fuels treatments under Alternative A are allowed to treat about two percent of BLM-administered lands (approximately 14,000 acres) during the planning period. This could accomplish fuels reduction objectives in developed interface areas, which would improve wildfire suppression options and decrease costs. Treatments in other areas could achieve project-level objectives, but likely would not achieve landscape objectives. Fire and fuels management under Alternative A would have a minor beneficial effect on wildlife management. In this alternative wildfire suppression costs would be commensurate with the values to be protected. See further discussion under *Impacts Common to All Alternatives*.

Alternative A would continue management in accordance with the 1985 RMP as amended in 2001. Under this alternative, variable suppression strategies are balanced with resource values. There are no geographically identified areas in this alternative to manage unplanned ignitions for both protection and resource benefit (multiple objectives), so the overall objective of wildfire management is to suppress the fire.

Physical Resources

Soil and Water Resources
Alternative A would restrict surface-disturbing activities in areas of high erosion hazard, on slopes equal to or greater than 25 percent, and on soils with poor reclamation suitability, and within 500 feet of water sources. The authorized officer could waive the restrictions, but in whole these restrictions increase the complexity of immediate suppression decisions. Alternative A management of soils and water would have a minor adverse effect on wildfire management.

Biological Resources

Vegetation – Forests and Woodlands and Vegetation – Grassland and Shrubland Communities
Managing vegetation to meet forest and rangeland health objectives would influence hazardous fuel loads, and would likely reduce the potential for large-scale high-severity wildfire effects. For example, forest management actions that reduce conifer encroachment in aspen communities would influence fire behavior by restoring barriers to the spread of fire. At the

landscape-level, where vegetation has been managed to create mosaics of diverse structural/seral stages, the size and intensity of wildfires would likely be reduced. Alternative A management of forests and woodlands and grasslands and shrublands would have a negligible beneficial effect on wildfire management.

Vegetation – Riparian/Wetland Resources
See Soil and Water. The restrictions within 500 feet of water sources also apply to this resource.

Invasive Species and Pest Management
See *Impacts Common to All Alternatives*.

Fish and Wildlife Resources
In addition to effects described under *Impacts Common to All Alternatives*, Alternative A seasonal restrictions on surface disturbances near sharp-tailed grouse leks and active raptor nests would affect suppression strategies. Although the affected area for sharp-tailed grouse would be small, year-round restrictions for raptor nests apply to approximately 33 percent of BLM-administered lands in the planning area. Depending on raptor species, the timing restriction could apply until mid summer and would influence suppression strategies during the height of the fire season. Alternative A management of wildlife resources would have a minor adverse effect on wildfire management.

Special Status Species (including Greater Sage-Grouse)
See *Impacts Common to All Alternatives*.

Where fires occur in limber pine settings, fire management activities would follow current Wyoming BLM guidelines.

For Greater Sage-Grouse habitat *Impacts Common to All Alternatives* discusses fire management guidelines and BMPs. Because unplanned ignitions are managed in this alternative for suppression objectives only, specific surface disturbing and timing restrictions in this alternative have negligible additional affects on fire management.

Heritage and Visual Resources

Cultural Resources
See *Impacts Common to All Alternatives*.

Land Resources

Forest Products
Under Alternative A, the commercial harvest of wood products, diseased old growth, and over-stocked forests would reduce fuel loading, improve defensible space in WUI areas, and contribute to safer and less costly suppression operations. There would be more ignition sources during management activities, but the risk would be mitigated by fire restrictions during severe fire seasons.

Timber harvest methods such as clear-cuts, which create fuel breaks and mimic fire regimes, could reduce the size of wildfires. However limiting clear-cut methods to fewer than 20 acres would not support landscape-scale fire regime objectives in lodgepole pine settings and other stand-replacement disturbance regimes.

During and after the planning period, pre-commercial thinning would provide cost-effective benefits for forest health and associated reductions in fuel loads.

Overall, Alternative A management of forest products would have a minor beneficial effect on wildfire management.

Lands and Realty
See *Impacts Common to All Alternatives*.

Travel and Transportation Management
In addition to the effects common to all alternatives, under Alternative A there would be very few BLM-administered acres closed year-round to motorized vehicles. This would simplify fire suppression activities. Approximately 16 percent of BLM-administered lands in the planning area would be closed during winter, which would not typically affect wildfire management. Alternative A management of travel and transportation would have a negligible adverse effect on wildfire management.

Livestock Grazing Management
Resource reserve allotments would be considered on a project specific basis, which would not likely facilitate wildfire management actions by providing temporary grazing opportunities where rest or deferment is required after wildfires. This would have a negligible adverse effect on management of unplanned fires.

In addition to effects common to all alternatives, under Alternative A, livestock rest periods after wildfire could include the first year and deferred grazing the following growing season. Under some circumstances, such as adaptive management of annual bromes, this could unnecessarily postpone or constrain activities that benefit range, fire, and fuels management.

4.3.1.4. Alternative B

Alternative B would emphasize resource conservation and natural processes where appropriate, while protecting sensitive resources. Response to wildfires would vary from full protection where fire would be undesirable, to monitoring fire behavior in areas where fire can be used to meet multiple objectives. This alternative would use a full range of fire management actions and makes the whole planning area available to consider areas where wildfire could be managed for resource benefit (multiple objectives).

Fire and Fuels Management

Under Alternative B, hazardous fuels reduction treatments would be allowed on 0.4 percent of BLM-administered land (approximately 3,500 acres) during the planning period. Treatments would focus on developed interface areas, but would not be allowed at levels necessary to meet Community Wildfire Protection Plan objectives during the planning period. Treatments outside developed interface areas would likely be rare, but unplanned ignitions could be managed to meet resource objectives in those areas and to meet desired fire regime characteristics. Alternative B fire and fuels management actions would have a negligible beneficial effect on wildfire management. By using unplanned ignitions for multiple objectives costs of fire suppression might be reduced, but constraints from other resources would likely complicate this strategy and effect costs.

Physical Resources

Soil and Water Resources
Alternative B effects on wildfire management would be similar to effects under Alternative A, except that the authorized officer could not waive prohibited surface disturbances. This adds risk to wildfire management, and adds complexity in managing fires for multiple objectives. Because surface-disturbing activities are prohibited within 500 feet of water sources, Alternative B could deny the use of water for suppression operations, which does not effectively address firefighter and public safety. In terms of acres affected, Alternative B soils and water management would have a minor adverse effect on wildfire management.

Biological Resources

Vegetation – Forests and Woodlands and Vegetation – Grassland and Shrubland Communities
Under Alternative B, managing forests and woodlands with an emphasis on natural processes would allow insect and disease, wildfire, and other natural disturbances to run their natural courses. This could be beneficial in areas where historical or desirable vegetative characteristics could be maintained by natural processes.

However, in recent decades, natural and human-caused disturbances have been prevented or eliminated in many forested areas, and other management practices have altered vegetation and fuel characteristics. These activities have created a departure from historical conditions where heavy fuel loads, ladder fuels, and high stand densities occur in contiguous areas across the forested landscape. Wildfire behavior in these areas would likely be high intensity and could produce undesirable, high-severity fire effects and large fires. Under this alternative, natural fuel breaks such as moist aspen communities could eventually be replaced by drier, more flammable conifer vegetation, and conifer expansion into grassland communities would contribute to large fires.

Vegetation treatments under this alternative would not be allowed at levels that could compliment the use of fire for resource benefit. Using silviculture treatments only when catastrophic events threaten the public and surrounding lands would not effectively address firefighter and public safety, or the priorities of Community Wildfire Protection Plans.

Overall, Alternative B management of forests and woodlands and grassland and shrubland communities would have a negligible beneficial effect on wildfire management.

Vegetation – Riparian/Wetland Resources
These effects are the same as described above in Physical Resources, Soil and Water. Alternative B effects on wildfire management would be similar to effects under Alternative A, except that the authorized officer could not waive prohibited surface disturbances. This adds risk to wildfire management, and adds complexity in managing fires for multiple objectives. Because surface-disturbing activities are prohibited within 500 feet of water sources, Alternative B could deny the use of water for suppression operations, which does not effectively address firefighter and public safety. In terms of acres affected, Alternative B Riparian/Wetland Resources management would have a minor adverse effect on wildfire management.

Invasive Species and Pest Management
In addition to effects common to all alternatives, under Alternative B, developing pest management areas would generally facilitate fire management planning. This would have a minor beneficial effect on wildfire management.

Fish and Wildlife Resources – Fish and Fish and Wildlife Resources – Wildlife
In addition to effects common to all alternatives, the following specific restrictions under Alternative B would increase incident complexity by adding decisions to emergency actions; and would complicate managing fires for multiple objectives:

- Surface-disturbing and disruptive activities would be prohibited within 0.25 mile (1,320 feet) of naturally occurring waterbodies that contain desirable fish. Though only about 1 percent of BLM-administered lands are affected, this could complicate the use of water for suppression operations.
- Surface-disturbing and disruptive activities would be prohibited in elk winter range and calving areas until June 30, which affects about 10 percent of BLM-administered lands. Though natural ignitions would be rare it is possible they would occur in late June, a time of year when weather and fuel parameters would allow wildfires to be managed for resource benefit.
- Seasonal restrictions for sharp-tailed grouse leks would be the same as under Alternative A.
- Buffers for active raptor nests during critical times would affect about 55 percent of BLM-administered lands.

At a minimum, these restrictions could affect 55 percent of BLM-administered lands in the planning area and have a major adverse effect on wildfire management, whether the strategy is suppression or multiple objectives.

Special Status Species (including Greater Sage-Grouse)
In addition to impacts common to all alternatives, the following specific restrictions under Alternative B would increase incident complexity by adding decisions to emergency actions; and would complicate managing fires for multiple objectives:

- Surface-disturbing activities that could adversely affect special status plant habitats would be prohibited, including the use of suppression chemicals and motorized fire suppression vehicles. This management action adversely affects about 16 percent of BLM-administered lands and would not effectively address firefighter and public safety. In limber pine settings, fire management activities would follow the Wyoming BLM guidelines for five-needle pines.
- Buffers for active raptor nests would be extended during critical times and could affect about 14 percent of BLM-administered lands.
- Surface disturbance would be prohibited in special status reptile and amphibian habitats, including floodplains, wetlands, ephemeral channels, and south-facing rock outcrops. Although these areas could be mapped and incorporated into the WHPD FMP, they are intricate and complex across the landscape, occupy approximately 23 percent of BLM-administered lands in the planning area, and would increase the complexity of incident management.
- Within occupied Greater Sage-Grouse habitat surface disturbance restrictions would affect about three percent of BLM-administered lands. Seasonal restrictions would affect about 60 percent of BLM-administered lands until mid-June, which would add complexity and cost to suppression operations. Because sagebrush preservation would be a priority, unplanned ignitions would likely not be managed for resource benefit in these areas.

These restrictions could affect fire management on 23 percent of BLM-administered lands in the planning area. These restrictions would result in increased fuel loading and therefore fire size due to decreased ability to control damaging fires and have a major adverse effect on wildfire management, whether the strategy is suppression or multiple objectives.

Heritage and Visual Resources

Cultural Resources
In addition to effects common to all alternatives, Alternative B would prohibit surface disturbances in areas with historic properties or within 5 miles of the visual horizon of historic properties. This would have a major adverse effect on decisions and suppression strategies for wildfires.

Land Resources

Forest Products
Under Alternative B, offering only sawtimber from forest treatments, limiting timer harvest areas to five acres, and not utilizing pre-commercial thinning would not efficiently meet hazardous fuels objectives. This would have a minor adverse effect on wildfire management.

Lands and Realty
See *Impacts Common to All Alternatives*.

Travel and Transportation Management
In addition to effects common to all alternatives, Alternative B would close motorized vehicle use year-round on approximately 80 percent of BLM-administered lands in the planning area. When deciding to use wildfire to meet resource goals and objectives, this would have a major adverse effect on wildfire management actions and incident decisions.

Lands with Wilderness Characteristics
Managing lands with wilderness characteristics to emphasize ecosystem health and natural values could provide opportunities to manage unplanned ignitions for resource benefit. For conifer communities in particular, this would help to maintain or improve diverse structural/seral stages at the landscape-level, which would improve forest health and fuel loads. This would have a minor beneficial effect on wildfire management. However in Alternative B, management actions would restrict access or constrain surface disturbances which could limit the use of wildfire for resource benefit. This would have a negligible adverse effect on wildfire management.

Livestock Grazing Management
The creation and maintenance of reserve common allotments would facilitate wildfire management actions by providing temporary grazing opportunities where rest or deferment is required after wildfires. This would have a negligible beneficial effect on management of unplanned fires.

A minimum of two years rest from livestock grazing would be required after managing wildfire for resource benefit. Where there are no alternative pastures, this potential hardship to lessees could eliminate the use of unplanned ignitions to meet multiple objectives. This is a concern for fire management in this alternative since fuels treatments are also limited and desired vegetation goals may be difficult to achieve. Minimum two years rest could also postpone or constrain other activities, such as adaptive grazing management to control annual bromes. This would have a minor adverse effect on managing wildfire to meet resource goals and objectives.

Special Designations

Areas of Critical Environmental Concern
Alternative B effects on wildfire management from ACEC management actions would be the same as described under *Impacts Common to All Alternatives*, except that Alternative B would

not allow surface disturbance on approximately 511,000 acres of BLM-administered lands in the planning area. This would have a moderate adverse effect on fire management decisions.

Wilderness Study Areas
Motorized and mechanized equipment would be prohibited in WSAs in this alternative, which affects about four percent of BLM-administered lands. This has a minor adverse effect on wildfire management, whether the objectives are for resource benefit or for suppression.

4.3.1.5. Alternative C

Alternative C would emphasize resource use. Fire management under this alternative would place more emphasis on full protection strategies, with fewer constraints on the use of heavy equipment. There are no geographically identified areas in this alternative to manage unplanned ignitions for both protection and resource benefit (multiple objectives), so the overall objective of wildfire management is to suppress the fire.

Fire and Fuels Management

The scale of fuels treatments under Alternative C would allow about five percent of BLM-administered lands (approximately 42,000 acres) to be treated during the planning period. Hazardous fuels reduction objectives could be accomplished in developed interface areas. Throughout the planning period, treatments in other areas could improve landscape-level fire regime conditions in portions of the planning area, and could compensate for the adverse effects of full suppression strategies for wildfires. Based on acres, this would have a moderate beneficial effect on wildfire management. With the emphasis on resource protection strategies and wildfire suppression objectives costs of suppression would be higher in this alternative, though the allowed levels of fuels treatments might offset this especially in areas of concern such as WUI.

Physical Resources

Soil and **Water Resources**
Alternative C soils management would not restrict surface-disturbing activities in areas of high erosion hazard, on slopes equal to or greater than 25 percent, and on soils with poor reclamation suitability. Alternative C water management would allow surface-disturbing and disruptive activities within 500 feet of riparian and wetland systems, aquatic habitats, and floodplains. Alternative C soils and water management actions would simplify fire management decisions and activities.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative C, actively managing forests and woodlands to maximize forest health and to prevent expansion into other plant communities also would meet fuels management objectives. This would have a minor beneficial effect on wildfire management.

Vegetation – Riparian/Wetland Resources
Alternative C would allow surface-disturbing and disruptive activities within 500 feet of riparian and wetland systems, aquatic habitats, and floodplains. This would simplify fire management decisions and activities and has a minor beneficial effect on fire management.

Invasive Species and Pest Management
Alternative C invasive species and pest management actions would be the same as described under *Impacts Common to All Alternatives*, except that management under Alternative C would be reactive. This could complicate management of unplanned ignitions for resource benefit, which would have a negligible adverse effect on wildfire management.

Fish and Wildlife Resources
In general, Alternative C would allow surface-disturbing and disruptive activities in wildlife habitat. This would simplify fire management decisions, and could allow a full range of options to manage unplanned ignitions for multiple objectives, although this alternative would emphasize full protection strategies. This management would have a negligible beneficial effect on wildfire management.

Special Status Species (including Greater Sage-Grouse)
Alternative C management would allow surface-disturbing activities in plant habitats, but not in areas with known special status plant populations. This includes the use of fire suppression vehicles and suppression chemicals. This management would simplify fire management decisions, depending on the location of special status plant populations and the status of inventories. In limber pine settings, fire management activities would follow the Wyoming BLM guidelines for five-needle pines.

For Greater Sage-Grouse habitat, *Impacts Common to All Alternatives* discusses fire management guidelines and BMPs. Because unplanned ignitions are managed in this alternative for suppression objectives only, specific surface disturbing and timing restrictions in this alternative have negligible additional affects on fire management.

Alternative C management would not prohibit surface disturbance in special status reptile and amphibian habitats. This would simplify fire management decisions, and could allow a full range of options to manage unplanned ignitions for multiple objectives, although this alternative emphasizes full protection strategies.

Overall, Alternative C management of SSS would have a negligible beneficial effect on wildfire management.

Heritage and Visual Resources

Cultural Resources
Under Alternative C, management or protection plans for special areas or historic properties would not be developed, which would mean some management decisions would be made during incident response. This management would have a negligible adverse effect on wildfire management.

Land Resources

Forest Products
Alternative C forest products management would affect wildfire management similar to Alternative A, except that Alternative C would limited the size of harvest areas by terrain and forest BMPs, rather than for predetermined acreages. This would efficiently meet wildfire and fuels management objectives for hazardous fuels reduction, and have a moderate beneficial effect on wildfire management.

Lands and Realty
Under Alternative C, public lands could be disposed of, but exchanges and access easements would not be considered or pursued. Because there would not be opportunities to consolidate public lands, fire management strategies and complexity would not change from current conditions. This would have a negligible beneficial effect on wildfire management.

Travel and Transportation Management
Alternative C effects from TTM would be similar to effects under Alternative A, except that Alternative C would allow travel up to 300 feet off designated routes. This would increase the potential for human-caused fires and have a negligible adverse effect on wildfire management.

Livestock Grazing Management
Alternative C effects on wildfire management from livestock grazing management would be similar to effects under Alternative A, but Alternative C would allow deferment within the first year rather than total rest. This could provide more opportunities to manage unplanned ignitions for resource benefit.

Special Designations

Wilderness Study Areas
Motorized equipment would be prohibited in WSAs in this alternative, which affects about four percent of BLM-administered lands. This has a minor adverse effect on the protection strategies of wildfire management.

4.3.1.6. Alternative D

Alternative D would generally allow resource use if the activity can be conducted in a manner that conserves physical, biological, and heritage and visual resources, and would emphasize moderate constraints on resource uses to reduce adverse effects on resource values. Under this alternative, fire management would balance suppression strategies with resource values and desired conditions. Protection strategies would be used in developed areas such as WUI and industrial interface areas. In other areas wildfires might be managed for multiple objectives, to enhance other resources, such as wildlife habitat and forest health. This alternative would use a full range of fire management actions and makes the whole planning area available to consider areas where wildfire could be managed for multiple objectives.

Fire and Fuels Management

In Alternative D heavy equipment is generally limited to existing roads and trails, and is prohibited in sensitive areas unless there are safety issues or the expected fire effects would cause more resource damage than the suppression actions. These sensitive areas include the more obvious resources such as cultural, soils, and wetlands, but also include restrictions in Greater Sage-Grouse habitat and in lands with wilderness characteristics. In lands with wilderness characteristics, efficient use of heavy equipment would likely be difficult in any case. In Greater Sage-Grouse habitat where protection of sagebrush is a priority and burning out should be avoided, additional restrictions on suppression tactics would complicate fire management decisions. This would have an adverse effect to wildfire response, though the affects on fire management as a whole is based on acres of fuels treatments (next paragraph).

Similar to Alternative A, fuels treatments in this alternative would be allowed on about two percent of BLM-administered lands (approximately 14,000 acres) during the planning period. Treatments could accomplish fuels reduction objectives in developed interface areas which would improve fire suppression options, safety, and costs. Treatments in other areas could achieve project-level objectives but would likely not achieve landscape objectives. In addition to the allowed treatments, managing wildfires for multiple objectives could contribute to fuels reduction and improve FRCC. This would have a minor beneficial effect on fire management.

Physical Resources

Air Quality

The Wyoming DEQ can require ambient air quality monitoring on a case-by-case basis for unplanned fires. On fires in which the BLM has jurisdictional authority, the AQD requires visual monitoring and reporting for fires that exceed 50 acres. Depending on air quality conditions during a wildfire, potential restrictions could constrain or prevent the use of fire for resource benefit. Air quality management common to all alternatives would have a negligible adverse effect on management of unplanned fires.

Soil and Water Resources

Subject to evaluation, Alternative D would allow surface-disturbing activities on highly erosive soils, on slopes equal to or greater than 25 percent, and on soils with poor reclamation suitability. This would provide flexibility to manage unplanned ignitions for multiple objectives or other sensitive resources, and would have a negligible beneficial effect on wildfire management.

Based on management decisions for other resource values, allowing surface disturbance within 500 feet of water sources would provide more options to safely manage unplanned ignitions or to meet objectives for other sensitive resources. Managing riparian and uplands to restore perennial flows or standing water would benefit wildfire management objectives by creating natural fire breaks.

Overall, Alternative D soils and water management would have a negligible beneficial effect on wildfire management.

Mineral Resources

See *Impacts Common to All Alternatives*. Minerals exploration and development would increase the complexity of wildfire management actions. The potential for human-caused fires would increase with minerals exploration and development, as would the need to protect industrial interface areas. The proliferation of roads in remote areas could increase fire occurrence by introducing additional human-caused ignition sources, although the associated road network and new water impoundments would improve emergency vehicle access and enable an earlier response to wildfire. Roads could be used as control lines during suppression actions. Alternative D management of leasable coal and fluid minerals would have a negligible adverse and a minor adverse effect on wildfire management, respectively.

Biological Resources

Vegetation – Forests and Woodlands and Grassland and Shrublands

Under Alternative D, managing forests and woodlands to maximize forest health and to emphasize

multiple resource values would benefit wildfire management activities by reducing fuel loads, creating defensible space and operational options, and enhancing firefighter and public safety. This management would have a minor beneficial effect on wildfire management.

Vegetation – Riparian/Wetland Resources
These effects are the same as those for Water Resources, above. Based on management decisions for other resource values, allowing surface disturbance within 500 feet of water sources would provide more options to safely manage unplanned ignitions or to meet objectives for other sensitive resources. Managing riparian and uplands to restore perennial flows or standing water would benefit wildfire management objectives by creating natural fire breaks. Alternative D Riparian/Wetland Resources management would have a negligible beneficial effect on wildfire management.

Overall, Alternative D soils and water management would have a negligible beneficial effect on wildfire management.

Invasive Species and Pest Management
Alternative D effects on wildfire management from invasive species and pest management would be the same as described under *Impacts Common to All Alternatives*. In addition, long-range pest management plans with treatment areas prioritized could benefit wildfire management planning by providing guidance for activities, as would designating and prioritizing areas for the treatment of annual bromes. This management would have a minor beneficial effect on wildfire management.

Fish and Wildlife Resources – Fish and Fish and Wildlife Resources – Wildlife
In general, Alternative D would provide opportunities to evaluate surface-disturbing and disruptive activities, and allow those activities if specific criteria could be met. This would provide opportunities to designate areas and manage unplanned ignitions for multiple objectives and for other sensitive resources. Wildlife management actions such as burying powerlines would also benefit wildfire and fuels management by enhancing safety during operations.

There would be two exceptions, as follows:

- Surface-disturbing and disruptive activities would be prohibited in elk calving areas and in crucial big-game winter range during WGFD-specified dates, which would include about 13 percent of BLM-administered lands during winter and spring when limited suppression strategies could be most viable. Although natural ignitions would be rare in spring, they are still possible and would affect the decision to manage unplanned ignitions for resource benefit.
- Surface-disturbing activities would be prohibited within specific buffers when those activities could disrupt nesting raptors. For most species, the seasonal restriction would be implemented from early spring until mid summer, which would include about eight percent of BLM-administered lands until July 15 and four percent of BLM-administered lands until July 31. This would affect wildfire complexity and suppression options, as well as the decision to manage unplanned ignitions for resource benefit.

These two restrictions would affect at least four percent of BLM-administered lands and would have a moderate adverse effect on fire management. Consultation with a resource advisor would be necessary to provide direction for suppression strategies in these two situations. However, weighing the allowed actions in this alternative with the constraints, the overall affect to fire management would be minor adverse.

Special Status Species (including Greater Sage-Grouse)
Similar to management of fish and wildlife resources, Alternative D SSS management would

provide opportunities to evaluate surface-disturbing and disruptive activities, and allow them if specific criteria could be met. Depending on circumstances, this would simplify wildfire incident management.

The following actions are specific to this alternative and would affect incident management decisions and complexity:

- For known populations of special status plants, Alternative D management would be similar to management under Alternative C, but Alternative D would allow the use of suppression chemicals within known populations if that use would be consistent with the biology of the plant. In limber pine settings, fire management activities would follow the Wyoming BLM guidelines for five-needle pines.
- Within Greater Sage-Grouse Priority Habitat, surface disturbance restrictions would affect about 20 percent of BLM-administered lands from March until late June. Because sagebrush protection would be a priority, these restrictions would add cost and complexity to suppression operations. Unplanned ignitions would likely not be managed for resource benefit in these Core Population Areas and Connectivity Corridors. In occupied habitat outside Priority Habitat, about 46 percent of BLM-administered lands would be affected by these same seasonal restrictions, adding cost and complexity to suppression operations. Although natural ignitions would be rare before June 15, they are still possible in late June when weather and fuel conditions might allow unplanned ignitions to be managed for resource benefit. Restrictions outside of Greater Sage-Grouse Priority Habitat would reduce large portions of the landscape that might otherwise be available to manage unplanned ignitions for resource benefit. This could have major adverse effects to wildfire management.
- Buffers for active raptor nests would follow USFWS recommendations for distance and timing restrictions, and would affect about four percent of BLM-administered lands.
- Depending on surveys and circumstances, surface disturbance would be allowed in special status reptile, amphibian, and bat habitats.

Weighing the allowed actions in this alternative with the constraints, the overall effects to fire management would be minor adverse.

Heritage and Visual Resources

Cultural Resources

Alternative D would prohibit surface disturbance within identified sites. Management plans described under *Impacts Common to All Alternatives* would provide preplanned guidance that would typically reduce decision timelines, thereby reducing complexity during wildfire incident management. Alternative D management of cultural resources would have a negligible adverse effect on wildfire management.

Land Resources

Forest Products

Under Alternative D, offering forest products throughout the planning area could enhance local markets and encourage cost-effective alternatives to slash disposal, which would benefit fuels management activities. Pre-commercial thinning and other practices that create healthy forest stands would benefit wildfire and fuels management by efficiently reducing fuel loads and ladder fuels. Rather than being restricted by predetermined acreages, treatment areas could

follow topographic features and could be planned to mitigate wildfire spread and behavior. This management would have a minor beneficial effect on wildfire management.

Lands and Realty
Under Alternative D, exchanging lands to consolidate blocks of BLM-administered lands and pursuing easements to access public lands would improve wildfire management and safety on public lands. Limited suppression actions would be more feasible, which would reduce firefighter exposure and would likely decrease suppression costs. Alternative D lands and realty management would have a minor beneficial effect on wildfire management.

Travel and Transportation Management
Alternative D effects from management of travel and transportation would be similar to effects under Alternative C. Travel would be allowed up to 300 feet off designated routes. This would increase the potential for human-caused wildfires and have a negligible adverse effect on wildfire management.

Lands with Wilderness Characteristics
Managing lands with wilderness characteristics to emphasize ecosystem health and natural values could provide opportunities to manage unplanned ignitions for resource benefit. For conifer communities in particular, this would help to maintain or improve diverse structural/seral stages at the landscape-level, which would improve forest health and fuel loads. This would have a negligible beneficial effect on wildfire management.

Livestock Grazing Management
Under Alternative D, designating future resource reserve allotments would provide options for adaptive management for temporary grazing when rest or deferment is required in other areas after managing fire for resource benefit. Livestock grazing rest or deferment could be required as necessary after fire events or other vegetative treatments, which would allow flexibility to manage for multiple resources and objectives. Alternative D livestock grazing management would have a minor beneficial effect on wildfire management.

Special Designations

Areas of Critical Environmental Concern
Alternative D effects on wildfire management from ACEC management would affect surface disturbance on less than one percent of BLM-administered lands in the planning area, which would have a negligible adverse effect on wildfire management decisions.

Wilderness Study Areas
Motorized and mechanized equipment would be prohibited in WSAs in this alternative, which affects about four percent of BLM-administered lands. This has a minor adverse effect on wildfire management, whether the objectives are for resource benefit and/or for suppression.

4.3.1.7. Cumulative Impacts

Cumulative impacts relevant to unplanned fire include the interaction of planned fire treatments and the allowed levels of those treatments. Management of unplanned and planned fire both contribute to human safety, suppression costs, and vegetation conditions on the landscape. The

Conclusion section below and the *Cumulative Impacts* for Planned Fire section discuss these interactions and long-term effects on the landscape.

4.3.1.8. Conclusion

The alternatives are compared here by considering fire management strategies and costs, and the contributed benefits of the allowed levels of fuels treatments. One of the goals of fire and fuels management is to restore natural (historically characteristic) fire regimes, vegetation structures, and plant communities on the landscape during the planning period. The alternatives are weighed against this goal.

Alternative A is based on current fire management in which variable suppression strategies are balanced with resource values and protection needs. In this alternative unplanned ignitions are not managed for resource benefit (multiple objectives), but limited or conditional suppression strategies would be used where resource values do not require full protection. Costs of suppression actions would be commensurate with the values to be protected. When combined with allowed acres of prescribed fire treatments, there would be an opportunity to reduce fuel loading and improve landscape-level fire regime conditions in portions of the planning area. This in turn could potentially reduce the costs of suppression actions. Through variable suppression strategies and workable resource constraints, this alternative would provide a reasonable framework for wildfire management to partially meet the goals of fire and fuels management at costs which would likely be less than alternatives B and C, but higher than Alternative D. Those alternatives provide further explanation.

Under Alternative B, there would be an opportunity to use a full range of fire management strategies to meet multiple objectives. This would provide options, where appropriate, to reintroduce fire into fire-dependent ecosystems and to reduce undesirable effects from suppression actions. However, in this alternative managing unplanned ignitions for resource benefit would likely be rare because of human developments, specific resource issues, and combinations of constraints from sensitive resources. An emphasis on sagebrush protection would further reduce opportunities to use wildfire to meet other resource objectives. In theory suppression costs should be lowest in this alternative because a full range of strategies could be used, but constraints, resource conditions, reduced levels of vegetation treatments, and resource protection needs could elevate costs to the highest of all the alternatives. Planned vegetative treatments (prescribed fire) under this alternative would not be of an adequate scale (0.4% of BLM-administered lands) to affect fire regime conditions and fuel loading at the landscape level, and therefore would not provide potential reduced costs to suppression actions. In this alternative, The goal of reintroducing fire into fire-dependent ecosystems could be pursued via unplanned ignitions, but the overall effects of wildfire might not meet desired conditions. Costs of this alternative are addressed further in the Emergency Stabilization and Rehabilitation (ES&R) section.

Alternative C emphasizes full suppression strategies to protect resources. Other than immediate protection of resources, this alternative would not pursue the goals of fire management, and suppression costs would be higher than the other alternatives. Only planned ignitions (prescribed fire) under this alternative could influence landscape conditions during the planning period and could offset the effects of full suppression strategies for wildfires.

Alternative D combines wildfire management strategies from Alternative B with allowed acres of prescribed fire treatments from Alternative A, where suppression strategies could be balanced with resource values and desired conditions; unplanned ignitions could be managed for resource

benefit; and vegetation treatments could reduce fuel loading and improve landscape-level fire regime conditions in portions of the planning area. With the combination of prescribed fire and the allowed use of fire for resource benefit, suppression costs would likely be the lowest of all alternatives. This combination of fire management strategies, reasonable resource constraints, and allowed levels of vegetative treatments would provide the best opportunity to accomplish fire management goals.

Whether considering fire and fuels management as a whole, or unplanned ignitions alone, Alternative D would provide the best balance to meet the fire management goal in a multiple-use environment.

4.3.2. Planned Fire (Prescribed Fire)

The goal of prescribed fire is to accomplish hazardous fuel objectives and protect or enhance natural resources by restoring natural fire regimes to the landscape.

4.3.2.1. Methods and Assumptions

Natural or historical fire frequency and severity maintains characteristic vegetation structure, health, fuel loads, and fire effects in all but the most severe weather and drought conditions. Prescribed fire and other vegetative treatments could improve or maintain healthy disturbance regimes on the landscape, improve vegetative health, and decrease hazardous fuel loadings.

Vegetative treatments in conifer settings alter fire behavior and severity by reducing ladder fuels and decreasing canopy cover, thereby inhibiting the vertical spread of fire and reducing the risk of crowning, spotting, and high-intensity fires. These treatments are especially helpful in urban interface, rural intermix, or other developed areas. Treatments affect resources and fire management in the following ways:

- Mitigate high-intensity fire behavior and undesirable effects to resources
- Support fire suppression activities by adding safety and options to operations
- Decrease adverse effects to resources from suppression actions
- Restore or maintain appropriate fire regimes and improve FRCC classes
- Reduce costs of wildfire suppression activities.

In areas with the highest departures from natural or historical disturbance regimes, inaction or reduced actions could exacerbate or expand acres of undesirable conditions.

Areas identified by Community Wildfire Protection Plans receive priority for vegetative treatments under any alternative. As possible, treatments would be implemented in other areas for resource benefit and to restore natural fire regimes. Treatment acres addressed for fire and fuels management include prescribed fire, but touch on the mechanical treatments addressed for forests and woodlands, and forest products. In some areas, mechanical treatments would be followed with prescribed fire. Some mechanical treatments, such as mowing, grinding, or hand thinning, would be used in grass or shrub communities to meet desired conditions or to protect resource values. Specific treatment sites have not been identified for parts of the planning area not covered by Community Wildfire Protection Plans, but undesirable vegetation conditions would be targeted.

Impact analyses and conclusions are qualitatively based on the constraints or facilitative actions from other resources, and how those actions could affect the implementation of vegetation treatments to meet fire regime or fuel loading conditions. Analysis is based on interdisciplinary

team knowledge of resources and past treatments in the planning area, and best professional judgement of the effects of other management actions on vegetation treatment projects.

4.3.2.2. Impacts Common to All Alternatives

Resource issues under any alternative could require location and timing restrictions for vegetative treatments. However, for most activities, interdisciplinary planning would consider constraints versus beneficial effects, and would identify mitigation measures or restrictions necessary for successful implementation.

Fire and Fuels Management

Where limited suppression or resource-benefit strategies could be used on unplanned ignitions, hazardous fuels reduction objectives could be met. Depending on scale and fire effects, fire regime conditions could be improved on the landscape to achieve desired plant communities (DPCs) and seral mixes. Fire and fuels management common to all alternatives would have a minor beneficial effect on prescribed fire as a management tool.

Physical Resources

Air Quality
Prescribed fire is managed to comply with Wyoming DEQ-AQD smoke-management rules and regulations. Ambient air quality issues have rarely limited implementation of prescribed fires. Air quality management actions common to all alternatives would have a negligible adverse effect on prescribed fire as a management tool. This does not vary across the alternatives and is not discussed further in this section.

Soil, Water Resources, and Cave and Karst Resources
These impacts are variable and discussed below under each alternative.

Mineral Resources

Management actions for mineral resources does not effect prescribed fire management and is not discussed further in this section.

Biological Resources

Vegetation
Managing plant communities for a diversity of native species, habitats, seral stages, and distribution, and managing forests and woodlands and grasslands and shrublands in desired ecological conditions would benefit fire and fuels management by maintaining or restoring natural fire regimes. Management of these vegetative communities common to all alternatives would have a minor beneficial effect on prescribed fire as a management tool. Specific vegetation management actions vary across the alternatives and are discussed further in each alternative.

Invasive Species and Pest Management
Cooperative IPM programs with non-BLM partners would benefit fire and fuels management by controlling weeds at the landscape level.

Managing annual bromes by utilizing best available science could increase understanding of fire as a management tool and allow continued use of prescribed fire to meet other resource objectives or even control annual bromes. Depending on scale and success of annual brome management, natural fire regimes and fire behavior and effects could be maintained or improved.

Invasive species and pest management actions common to all alternatives would have a negligible beneficial effect on prescribed fire as a management tool.

Fish and Wildlife Resources
Long-term benefits and short-term adverse effects for habitat enhancement projects would provide a foundation for analysis of vegetative treatments. In general, timing restrictions or prohibiting surface disturbance from fall through spring would reduce opportunities to implement prescribed fire treatments. In some situations, especially in forested settings, prescribed fire might not be available as a treatment option because weather and fuel prescriptions could not be satisfied during summer and early fall.

For most of the alternatives, timing restrictions and prohibiting surface disturbance in elk calving areas would affect approximately four percent of BLM-administered lands in the planning area during spring. Timing restrictions also would apply to elk winter range during fall and winter, although those constraints would affect only about one percent of BLM-administered lands in the planning area. See Alternative D for further discussion.

Year-round restrictions on surface disturbance near sharp-tailed grouse leks and active raptor nests could constrain treatments on about 33 percent of BLM-administered lands in the planning area. Seasonal restrictions for active raptor nests could affect treatments on about 50 percent of BLM-administered lands in the planing area, particularly during early spring when weather and fuel parameters are often most favorable for prescribed fire. See Alternative B for further discussion.

Discussions for individual alternatives address year-round restrictions for big-game travel corridors, and seasonal restrictions and surface disturbances near sharp-tailed grouse leks, active raptor nests, and near natural waterbodies that contain desirable fish species.

Fish and wildlife resources management actions common to all alternatives would have a major adverse effect on prescribed fire as a management tool.

Special Status Species (including Greater Sage-Grouse)
Goals and policies for SSS management would guide decisions to implement vegetative treatments in SSS habitats. Long-term benefits and short-term adverse effects would provide a foundation for analysis of treatments.

Where treatments occur in limber pine settings, current Wyoming BLM guidelines and prescriptions would be followed to enhance or maintain limber pine stands. This has negligible to minor adverse effects on fuels treatments.

For Greater Sage-Grouse habitats, fuels treatments would follow current BLM management guidelines and fuels management BMPs to protect or enhance the habitat. The emphasis on sagebrush preservation would reduce opportunities to implement prescribed fire or other vegetative treatments to achieve other resource objectives. However in unoccupied habitat, there could be site-specific opportunities to improve or restore fire regimes and associated fire behavior

and severity. For example, reducing conifer encroachment in Greater Sage-Grouse habitat would remove uncharacteristic conditions and restore suitable habitat.

In general, year-round restrictions would apply to bald eagle roosts or winter use areas, which would affect less than two percent of BLM-administered lands in the planning area. For other nesting raptors, year-round and seasonal restrictions would affect approximately four percent of BLM-administered lands in the planning area. As further described for each alternative, these effects vary somewhat by alternative.

Heritage and Visual Resources

Cultural Resources

Management or protection plans for special areas or historic properties would provide direction for vegetative treatments. See Alternative C for further discussion. Cultural resources management actions common to all alternatives would have a minor beneficial effect on prescribed fire as a management tool.

Paleontological Resources

Field surveys would indicate where mitigation measures must be developed for vegetative treatments. This would have a negligible adverse effect on prescribed fire management and does not vary across the alternatives.

Visual Resources

VRM Class I and II management objectives require that visual resources be maintained, or that changes to the visual resource be unnoticeable to the casual observer. Depending on the project site, constraints could restrict the size or shape of vegetative treatment areas. About four percent of BLM-administered lands are in Class I areas in WSAs, which does not vary across the alternatives. This scale could have a minor adverse effect on prescribed fire and fuels management, but mitigation measures would likely be developed for successful design and implementation of projects. Impacts common to all alternatives would have a negligible adverse effect on prescribed fire as a management tool. Other than WSAs, VRM is variable and is discussed further in each alternative.

Land Resources

Forest Products

Management of forest products varies across the alternatives and is discussed below under each alternative.

Lands and Realty

Exchanging lands to consolidate blocks of BLM-administered lands, disposing of isolated public lands, and pursuing easements to access public lands would facilitate fuels management actions at the project and landscape levels. Alternatives A, B, and D consider or prioritize these types of actions which has a minor beneficial effect on prescribed fire management. See Alternative C for further discussion.

Renewable Energy

Management of renewable energy resources does not effect prescribed fire management and is not discussed further in this section.

Rights-of-Way and Corridors
Management of ROW and corridors does not effect prescribed fire management and is not discussed further.

Travel and Transportation Management
Closing areas seasonally or year-round would reduce opportunities to implement vegetative treatments. Closures would vary across the alternatives and are further discussed by alternative. TTM actions common to all alternatives would have a negligible adverse effect on prescribed fire as a management tool.

Recreation
SRMA designations and associated recreation values could constrain vegetative treatments, especially prescribed fire. However, in some cases treatments might be needed to reduce hazardous fuel loads near recreation facilities. Recreation management actions common to all alternatives would have a negligible adverse effect on prescribed fire as a management tool.

Lands with Wilderness Characteristics
Managing lands with wilderness characteristics to emphasize ecosystem health and natural values is compatible with prescribed fire and other vegetative treatments. For conifer communities in particular, this would help to maintain or improve diverse structural/seral stages at the landscape-level, which would improve forest health and fuel loads. This would have a negligible beneficial effect on prescribed fire management. See Alternative B for further discussion.

Livestock Grazing Management
The creation and maintenance of reserve common allotments varies across the alternatives, but where allowed, could provide temporary grazing opportunities where rest or deferment is required after vegetative treatments. Resting treatment areas as necessary prior to prescribed fire would facilitate implementation by extending burn windows. Livestock grazing management actions common to all alternatives would have a minor beneficial effect on prescribed fire as a management tool.

Livestock grazing strategies generally would include rest periods after vegetative treatments. Under some circumstances, such as adaptive management of annual bromes, this could unnecessarily postpone or constrain grazing strategies that benefit range, fire, and fuels management. Vermeire et al. (2011) found that annual grasses were reduced in the Northern Great Plains following summer fire. See the alternatives for further discussion about rest periods. In management common to all, this negligible adverse effect is less important than the minor beneficial effects from creating reserve common allotments.

Special Designations

Areas of Critical Environmental Concern
ACECs are not designated in alternatives A and C, but are discussed further in alternatives B and D.

Scenic or Back Country Byways and Wild and Scenic Rivers
See the discussion in alternatives B and D, but these special designations otherwise have no effect on prescribed fire management.

Wilderness Study Areas
Fuels management activities must follow the policy and guidelines of BLM Manual

6330 – Management of Wilderness Study Areas to preserve or enhance the natural character of WSAs and avoid unnecessary impairment of a WSA's suitability for preservation as wilderness. Appendix Q (p. 2511) provides more information from BLM Manual 6330 – Management of Wilderness Study Areas. This does not vary across the alternatives and is not discussed further in this section, however further restrictions on motorized and mechanized equipment is discussed within the alternatives.

Socioeconomic Resources

Social and Economic Conditions and Health and Safety

Ensuring that local and regional economic development and local land use plans are considered in BLM actions, and working with local agencies to foster public awareness benefits fire and fuels management. Reducing or eliminating physical hazards through appropriate mitigations benefits fire and fuels management by adding safety to fire operations. This does not vary across the alternatives and is not discussed further in this section.

4.3.2.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended in 2001. Under this alternative, the BLM would treat approximately 14,000 acres with prescribed fire and other fuels treatments. Mechanical treatments are discussed in the *Forests and Woodlands* section.

Fire and Fuels Management

Under Alternative A, unplanned ignitions could be managed with limited suppression strategies, which would help meet fuels and fire ecology objectives at the project level. This would have a minor beneficial effect on fuels management.

Physical Resources

Soil

Under Alternative A, there would be restrictions and prohibitions on surface-disturbing activities in areas of high erosion hazard, on slopes equal to or greater than 25 percent, and on soils with poor reclamation suitability. The authorized officer could waive these restrictions and prohibitions, so hazardous fuels projects could be considered in areas covered by County Wildfire Protection Plans or where high fuel loads threaten other resource values. Alternative A soils management would have a minor adverse effect on the use of prescribed fire as a management tool.

Water Resources

Alternative A would prohibit surface disturbance within 500 feet of water sources, which could increase the complexity of implementing prescribed fire. However, the authorized officer could waive the prohibition as appropriate for successful implementation. Alternative A water management would have a minor adverse effect on the use of prescribed fire as a management tool.

Cave and Karst Resources

In Alternative A there are no constraints on surface use for vegetative treatments, which would have a negligible beneficial effect on prescribed fire management.

Biological Resources

Vegetation – Forests and Woodlands and Grassland and Shrubland Communities
Under Alternative A, managing vegetation to meet forest and rangeland health standards also would meet fuels management objectives. Reducing hazardous fuel accumulations would likely improve fire regime conditions. This management would have a minor beneficial effect on the use of prescribed fire as a management tool.

Vegetation – Riparian/Wetland Resources
Alternative A would prohibit surface disturbance within 500 feet of water sources, which could increase the complexity of implementing prescribed fire. However, the authorized officer could waive the prohibition as appropriate for successful implementation. Alternative A riparian management would have a minor adverse effect on the use of prescribed fire as a management tool.

Invasive Species and Pest Management
See *Impacts Common to All Alternatives*.

Fish and Wildlife Resources
See *Impacts Common to All Alternatives*.

Special Status Species (including Greater Sage-Grouse)
See *Impacts Common to All Alternatives*.

Heritage and Visual Resources

Cultural Resources
See *Impacts Common to All Alternatives*.

Visual Resources
Under Alternative A, the approximately four percent of BLM-administered lands in the planning area are managed as VRM Class I, which could affect the sizes, shapes, or placement of vegetative treatments. This scale could have a minor adverse effect on prescribed fire and fuels management, but mitigation measures would likely be developed for successful design and implementation of projects. There would be few constraints for Class II areas. This management would have a negligible adverse effect on the use of prescribed fire as a management tool.

Land Resources

Forest Products
Under Alternative A, the commercial harvest of wood products, diseased old growth, and overstocked forests would reduce fuel loading, improve defensible space in WUI areas, and contribute to safer and less expensive suppression operations.

Timber harvest methods (e.g., clear-cuts) that create fuel breaks could reduce the size of wildfires. However, limiting clear-cut methods to fewer than 20 acres would not support landscape-scale fire regime objectives in lodgepole pine settings.

Pre-commercial thinning would provide cost-effective benefits for forest health and associated reductions in fuel loads during and after the planning period.

Overall, Alternative A management of forest products would have a minor beneficial effect on the use of prescribed fire as a management tool.

Lands and Realty
See *Impacts Common to All Alternatives*.

Travel and Transportation Management
Under Alternative A, seasonally closed roads would affect approximately 16 percent of BLM-administered lands in the planning area, and would reduce opportunities to implement prescribed fire treatments during times when weather and fuel parameters can be most viable.

Recreation
See *Impacts Common to All Alternatives*.

Livestock Grazing Management
Also see *Impacts Common to All Alternatives*. Resource common allotments would not be designated in this alternative, so would not benefit fire and fuels management by providing temporary grazing opportunities where rest or deferment is required after vegetation treatments.

Livestock grazing rest periods after vegetative treatments could include the first full year and deferment the following season. In some cases, such as adaptive management of annual bromes, this could unnecessarily postpone or constrain grazing strategies that benefit range, fire, and fuels management. This would have a negligible adverse effect on the use of prescribed fire as a management tool.

Special Designations

See *Impacts Common to All Alternatives*.

4.3.2.4. Alternative B

Alternative B would emphasize resource conservation. Under this alternative, the BLM would treat approximately 3,500 acres with prescribed fire and other fuels treatments. Mechanical treatments are discussed in the *Forests and Woodlands* section.

Fire and Fuels Management

Under Alternative B, managing wildfires for resource benefit could help meet fuels and fire ecology objectives, and compensate for constraints on allowable acres for prescribed fire treatments. This management would have a minor beneficial effect on the use of prescribed fire as a management tool.

Physical Resources

Soil
Alternative B effects on the use of prescribed fire as a management tool would be similar to effects under Alternative A, except that under Alternative B, the authorized officer could not waive prohibitions on surface disturbances. Specifically, prescribed fire projects would be prohibited on highly erosive soils, which accounts for approximately 28 percent of BLM-administered lands in the planning area. Hazardous fuels projects could not be considered in areas where high fuel loads

threaten structures or other resource values. Alternative B soils management would have a major adverse effect on the use of prescribed fire as a management tool.

Water Resources
Alternative B effects on the use of prescribed fire as a management tool would be similar to effects under Alternative A, except that the authorized officer could not waive prohibitions on surface disturbances within 500 feet of water sources. As for soils management, hazardous fuels projects could not be considered in these areas. In addition, this restriction could deny the use of water for prescribed fire operations in nearby areas. Alternative B water management actions would have a minor adverse effect on the use of prescribed fire as a management tool.

Cave and Karst Resources
Cave and karst management in Alternative B would prohibit timber harvest activities on approximately 13 percent of the BLM-administered lands. This would have a major adverse effect on mechanical treatments done by machine. However, hand thinning and prescribed fire would likely be allowed with mitigation measures in place. This would have a negligible adverse effect on prescribed fire management.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative B, managing forests and woodlands with an emphasis on natural processes would allow insects and disease, wildfire, and other natural disturbances to run their natural courses. This could be beneficial in areas where historical or desirable vegetation characteristics are healthy and could be maintained by natural processes.

However, in recent decades, natural and man-made disturbances have been prevented or eliminated in many forested areas. This has created a departure from historical conditions, with high stand densities, ladder fuels, and heavy fuel loads in contiguous areas across the forested landscape. Wildfire behavior in these areas would likely be intense and could produce undesirable, high-severity fire effects. Under Alternative B, natural fuel breaks such as moist aspen communities would eventually be replaced by drier, more flammable conifer vegetation, and conifer expansion into grassland communities would contribute to larger fires.

Using silviculture treatments only when catastrophic events threaten the public and surrounding lands would not effectively address firefighter and public safety, or the priorities of Community Wildfire Protection Plans.

Overall, Alternative B forests and woodlands management actions would have a minor beneficial effect on the use of prescribed fire as a management tool.

Vegetation – Riparian/Wetland Resources
Alternative B effects on the use of prescribed fire as a management tool would be similar to effects under Alternative A, except that the authorized officer could not waive prohibitions on surface disturbances within 500 feet of water sources. Alternative B riparian management actions would have a minor adverse effect on the use of prescribed fire as a management tool.

Invasive Species and Pest Management
In addition to the effects described under *Impacts Common to All Alternatives*, under Alternative B, identifying pest management areas would generally facilitate fuels management planning. This would have a minor beneficial effect on the use of prescribed fire as a management tool.

Fish and Wildlife Resources
Specific to Alternative B, the following restrictions would affect implementation of fuels projects and other vegetative treatments:

- Surface-disturbing and disruptive activities would be prohibited within 0.25 mile of naturally occurring waterbodies that contain desirable fish. This would affect approximately seven percent of BLM-administered lands in the planning area.
- Prohibiting surface-disturbing and disruptive activities in crucial elk winter range, in big-game migration corridors, and in elk calving areas would reduce opportunities to implement prescribed fire treatments on approximately seven percent of BLM-administered lands in the planning area. In some cases, especially in forested settings where much of this habitat occurs, prescribed fire might not be available as a treatment option because weather and fuel prescriptions could not be satisfied during summer and early fall. Designating elk crucial and year-round ranges for the Fortification Creek elk herd could exclude prescribed fire treatments from an additional four percent of BLM-administered lands.
- Seasonal restrictions for active raptor nests would constrain treatments as far away as 1.5 miles, which could affect approximately 55 percent of BLM-administered lands in the planning area. This would especially affect treatments near red-tailed hawk nests and several species of owl, whose timing restrictions cover early spring when fire prescriptions often are most feasible.

Overall, Alternative B management of fish and wildlife resources would have a major adverse effect on the use of prescribed fire as a management tool.

Special Status Species (including Greater Sage-Grouse)
Specific to Alternative B, the following restrictions would affect implementation of fuels projects and other vegetative treatments and would have major adverse effects to prescribed fire management:

- Surface-disturbing activities that could adversely affect special status plant habitats would be prohibited, including the use of suppression chemicals in motorized fire suppression vehicles. These constraints could affect the implementation of some vegetative treatments on approximately 16 percent of BLM-administered lands in the planning area, although project planning could provide options to accommodate the restrictions. Where treatments occur in limber pine settings, current Wyoming BLM guidelines and prescriptions would be followed to enhance or maintain limber pine stands.
- Seasonal restrictions for active raptor nests would constrain treatments as far away as 1.5 miles. This would affect treatments on approximately 14 percent of BLM-administered lands in the planning area when prescribed fire often is most feasible.
- Prohibiting surface-disturbing and disruptive activities in special status reptile and amphibian habitats, regardless of species presence, would greatly constrain vegetative treatments in and near ephemeral channels, 100-year floodplains, and south-facing rock outcrops. These sites occupy approximately 23 percent of BLM-administered lands in the planning area.
- Within occupied Greater Sage-Grouse habitat, surface disturbance restrictions would affect about three percent of BLM-administered lands, and seasonal restrictions would affect about 60 percent of BLM-administered lands until mid-June. Because sagebrush preservation would be a priority, much of the landscape could be unavailable to meet other vegetation goals.

Heritage and Visual Resources

Cultural Resources
Under Alternative B, surface disturbance in areas with historic properties or within 5 miles of

the visual horizon of historic properties would be prohibited. Hazardous fuels projects or other vegetative treatments could not be considered in those areas. This would have a major adverse effect on the use of prescribed fire as a management tool.

Visual Resources
Under Alternative B, approximately 32 percent of BLM-administered lands in the planning area would be managed as VRM Class I or Class II, which could affect the sizes, shapes, or placement of vegetative treatments. In addition, visual simulation and mitigation designs would be performed for all vegetative treatments in VRM Classes I to III areas. This management would have a major adverse effect on the use of prescribed fire as a management tool.

Land Resources

Forest Products
Under Alternative B, offering only sawtimber from forest treatments, limiting harvest areas to 5 acres, and not utilizing pre-commercial thinning would not efficiently meet hazardous fuels objectives. This management would have a negligible adverse effect on the use of prescribed fire as a management tool.

Lands and Realty
See *Impacts Common to All Alternatives*.

Travel and Transportation Management
Alternative B effects from TTM would be the same as described under *Impacts Common to All Alternatives*, except that approximately 80 percent of BLM-administered lands in the planning area would be closed year-round to motorized vehicles, and another 2 percent would be closed during winter. These restrictions would seriously limit the implementation of vegetative treatments and would have a major adverse effect on the use of prescribed fire as a management tool.

Recreation
Under Alternative B, vegetative treatments could be constrained by restrictions on surface-disturbing activities in SRMAs, which would affect approximately seven percent of BLM-administered lands in the planning area. However in some sites, treatments might be needed to reduce hazardous fuel loads around recreation facilities. Because of the restrictions on surface-disturbing activities, Alternative B recreation management would have a moderate adverse effect on the use of prescribed fire as a management tool.

Lands with Wilderness Characteristics
Managing lands with wilderness characteristics to emphasize ecosystem health and natural values could provide opportunities to implement prescribed fire to accomplish multiple objectives. For conifer communities in particular, this would help to maintain or improve diverse structural/seral stages at the landscape-level, which would improve forest health and fuel loads. This would have a minor beneficial effect on prescribed fire management. However in Alternative B, associated management actions would restrict access or constrain surface disturbances which would limit vegetative treatments. Overall, this would have a minor adverse effect on prescribed fire.

Livestock Grazing Management
Under Alternative B, resource reserve common allotments would be designated in this alternative, which would benefit fire and fuels management by providing temporary grazing opportunities where rest or deferment is required after vegetation treatments, however, a minimum of two years

rest from livestock grazing would be required after prescribed fire treatments. Where there are no alternative pastures, this potential hardship to lessees could restrict or prevent prescribed fire projects. Under some circumstances, such as adaptive management of annual bromes, this could postpone or constrain other grazing strategies that would benefit range, fire, and fuels management. This management would have a negligible adverse effect on the use of prescribed fire as a management tool.

Special Designations

Areas of Critical Environmental Concern
Depending on site characteristics, values, and protection measures, newly designated ACECs could either encourage or discourage the use of prescribed fire to maintain ecological conditions. Site-specific management plans would be developed for each area to provide guidance for vegetation management activities. In Alternative B, 511,000 acres of BLM-administered lands in the planning area would have restrictions on surface disturbance, and prescribed fire would be subject to the terms of site-specific plans. This would have a moderate adverse effect on the use of prescribed fire as a management tool.

Scenic or Back Country Byways and Wild and Scenic Rivers
Such designations could influence the application of vegetative treatments, depending on values or constraints described for other resources. Constraints would have an adverse effect on prescribed fire management. Conversely, these types of designations can provide educational opportunities for interpretive displays about disturbance ecology, fire, and vegetative treatments, which would have a beneficial effect on prescribed fire management. Overall, these designations would likely have a negligible adverse effect on prescribed fire management.

Wilderness Study Areas
All motorized and mechanized equipment would be prohibited in WSAs, which would preclude prescribed fire and many other vegetation treatments on about four percent of BLM-administered lands. This would have a minor adverse effect on fuels management.

4.3.2.5. Alternative C

Alternative C would emphasize resource use. During the planning period, approximately 42,000 acres would be treated with prescribed fire and other fuels treatments. Mechanical treatments are discussed in the *Forests and Woodlands* section.

Fire and Fuels Management

Under Alternative C, full protection strategies for wildfires would not meet fuels and fire ecology objectives, but the allowed levels of prescribed fire treatments under this alternative would compensate to meet landscape-level objectives in some areas. This management would have a negligible beneficial effect on the use of prescribed fire as a management tool.

Physical Resources

Soil and Water Resources
Under Alternative C, there would be no restrictions or prohibitions on surface-disturbing activities in areas of high erosion hazard, on slopes equal to or greater than 25 percent,

and on soils with poor reclamation suitability. Surface-disturbing and disruptive activities would be allowed within 500 feet of riparian/wetland systems, aquatic habitats, and floodplains. This would facilitate implementation of fuels treatment projects. Overall, Alternative C management of soils and water would have a negligible beneficial effect on the use of prescribed fire as a management tool.

Cave and Karst Resources
Surface disturbance restrictions and buffers from cave and karst management would affect very few acres and would have negligible adverse effects for prescribed fire management.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative C, actively managing forests and woodlands to maximize forest health and to prevent expansion into other plant communities also would meet fuels management objectives. This management would have a minor beneficial effect on the use of prescribed fire as a management tool.

Vegetation – Riparian/Wetland Resources
Also see Soil and Water, above. Under Alternative C, surface-disturbing and disruptive activities would be allowed within 500 feet of riparian/wetland systems, aquatic habitats, and floodplains. This would facilitate implementation of fuels treatment projects. Management riparian and wetland resources would have a negligible adverse effect on the use of prescribed fire as a management tool.

Invasive Species and Pest Management
Alternative C effects from invasive species and pest management would be the same as described under *Impacts Common to All Alternatives*, except that management would be reactive and could complicate prescribed fire management. This management would have a negligible adverse effect on the use of prescribed fire as a management tool.

Fish and Wildlife Resources
In general, Alternative C would allow surface-disturbing and disruptive activities in wildlife habitat. This would facilitate implementation of fuels treatment projects.

Special Status Species (including Greater Sage-Grouse)
Except for effects described in *Impacts Common to All Alternatives*, the following actions in Alternative C would facilitate implementation of fuels treatment projects and would have a negligible beneficial effect on prescribed fire management:

- Surface-disturbing activities would be allowed in special status plant habitats but not within known populations of such plants. This includes the use of fire suppression vehicles and suppression chemicals. Where treatments occur in limber pine settings, current Wyoming BLM guidelines and prescriptions would be followed to enhance or maintain limber pine stands.
- Surface disturbance would not be prohibited in special status reptile and amphibian habitats.

Restrictions for Greater Sage-Grouse habitat management would be similar to *Impacts Common to All Alternatives* with a minor adverse effect on Planned Fire, however this is not included in the assessment for this alternative.

Heritage and Visual Resources

Cultural Resources

Under Alternative C, required cultural resources surveys would be performed in vegetative treatment units to identify sites and mitigation measures before treatment. Otherwise, this alternative would allow surface-disturbing activities near cultural sites. Alternative C management would have a negligible beneficial effect on the use of prescribed fire as a management tool.

Visual Resources

Under Alternative C, approximately four percent of BLM-administered lands in the planning area would be managed as VRM Class I. However, all Class II areas would be managed as Class III, which would remove most restrictions on vegetative treatments. Alternative C management of visual resources would have a negligible beneficial effect on the use of prescribed fire as a management tool.

Land Resources

Forest Products

Under Alternative C, offering an array of forest products to facilitate management of forests and woodlands would also meet fuels management objectives. In time, new local markets may be created which could lower costs for vegetation treatments. Alternative C management of forest products would have a moderate beneficial effect on the use of prescribed fire as a management tool.

Lands and Realty

Under Alternative C, there would be disposals of public lands, but exchanges and access easements would not be considered or pursued. With no opportunity to consolidate public lands, fuels management planning and vegetative treatments would remain complex in many areas. This management would have a negligible adverse effect on the use of prescribed fire as a management tool.

Travel and Transportation Management

In Alternative C, the effects of TTM on fuels management would be the same as described under *Impacts Common to All Alternatives*, although under this alternative, very few BLM-administered acres would be closed year-round to motorized vehicles. However, seasonally closing roads would affect approximately 16 percent of BLM-administered lands in the planning area and would reduce opportunities to implement prescribed fire treatments during times when weather and fuel parameters would be most viable. This management would have a major adverse effect on the use of prescribed fire as a management tool.

Recreation

See *Impacts Common to All Alternatives*.

Livestock Grazing Management

Alternative C effects would be similar to effects under Alternative A, but Alternative C would allow deferment within the first year after treatment, rather than total rest. This could open more opportunities to implement prescribed fire treatments, and have a negligible beneficial effect on the use of prescribed fire as a management tool, especially because reserve common allotments would not be designated in this alternative.

Special Designations

Wilderness Study Areas
All motorized equipment would be prohibited in WSAs, which would preclude prescribed fire and many other vegetation treatments on about four percent of BLM-administered lands. This would have a minor adverse effect on fuels management.

4.3.2.6. Alternative D

Alternative D would generally allow resource use if the activity benefits resource values, can be done in a manner that conserves resource values, or provides adequate mitigation to reduce adverse effects on sensitive resources. During the planning period, approximately 14,000 acres could be treated with prescribed fire and other fuels treatments. Mechanical treatments are discussed in the *Forests and Woodlands* section. Alternative D is the Proposed RMP.

Fire and Fuels Management

Under Alternative D, unplanned ignitions could be managed for resource benefit or with limited suppression strategies. Either strategy could meet fuels and fire ecology objectives and therefore have a minor beneficial effect on the prescribed fire management.

Physical Resources

Soil
Subject to evaluation, Alternative D would allow surface-disturbing activities on highly erosive soils, on slopes equal to or greater than 25 percent, and on soils with poor reclamation suitability. This would provide flexibility to manage prescribed fire and other vegetative treatments for multiple objectives or for other priorities such as fuels reduction in WUI areas. Alternative D soils management actions would have a negligible beneficial effect on the use of prescribed fire as a management tool.

Water Resources
Based on management decisions for resource values, allowing surface disturbance within 500 feet of water sources would provide flexibility to manage prescribed fire efficiently and safely and to meet other resource objectives. Managing riparian and uplands to restore perennial flows or standing water would benefit fuels management objectives by creating natural fuel breaks and restoring vegetative communities. These management actions would have a negligible beneficial effect on the use of prescribed fire as a management tool.

Cave and Karst Resources
Surface disturbance restrictions and buffers from cave and karst management would affect few acres and have negligible adverse effects for prescribed fire management.

Biological Resources

Vegetation – Forests and Woodlands and Grassland and Shrubland Communities
Under Alternative D, managing forests and woodlands to maximize forest health and to emphasize multiple resource values would benefit fire and fuels management by reducing fuel loads and

restoring characteristic fire regimes and plant communities. This would have a minor beneficial effect on the use of prescribed fire as a management tool.

Vegetation – Riparian/Wetland Resources
See *Water*, above.

Invasive Species and Pest Management
In addition to the effects described under *Impacts Common to All Alternatives*, Alternative D would include long-range pest management plans with treatment areas prioritized. This could benefit fuels management by providing guidance for activities, as would designating and prioritizing areas for the treatment of annual brome grasses. This management would have a minor beneficial effect on the use of prescribed fire as a management tool.

Fish and Wildlife Resources
In general, Alternative D would provide opportunities to evaluate surface-disturbing and disruptive activities, and allow those activities if specific criteria could be met. Prescribed fire and other vegetative treatments could be implemented for multiple objectives or for other priorities, such as fuels reduction in developed interface areas. The exceptions are:

- Surface-disturbing and disruptive activities would be prohibited in crucial big-game winter range and in calving areas. Under Alternative D, approximately 12 percent of BLM-administered lands in the planning area would be affected, much of it in conifer settings. In some situations, especially in forested settings, prescribed fire might not be available as a treatment option because weather and fuel prescriptions could not be satisfied during summer and early fall.
- Surface-disturbing activities would be prohibited within specific buffers when those activities could disturb nesting raptors. For most species, the seasonal restriction would be in place from early spring until mid summer, and would affect approximately 7 percent of BLM-administered lands in the planning area. This restriction could reduce opportunities to implement vegetative treatments, although for many projects, site-specific evaluations would identify mitigation measures necessary for successful implementation.

Alternative D wildlife management actions include burying powerlines. This would enhance the safety of fire and fuels operations.

Overall, because of surface-disturbing constraints for big game and nesting raptors Alternative D fish and wildlife management actions would have a moderate adverse effect on the use of prescribed fire as a management tool.

Special Status Species (including Greater Sage-Grouse)
Alternative D effects from SSS management would be similar to effects described under *Impacts Common to All Alternatives*. However, Alternative D would provide opportunities to manage special status plant habitats or implement treatments in habitats if treatments are known to enhance the species' distribution or if projects would not be within known populations of such plants. Where treatments occur in limber pine settings, current Wyoming BLM guidelines and prescriptions would be followed to enhance or maintain limber pine stands.

Alternative D, surface-disturbing and disruptive activities would be allowed where amphibian, reptile, and bat species occur if specific criteria could be met. This would provide opportunities to manage prescribed fire and other vegetative treatments for multiple objectives, other sensitive species, or for other priorities, such as fuels reduction in WUI areas.

For Greater Sage-Grouse Core Population Areas and Connectivity Corridors, fuels treatments would follow current BLM management guidelines and fuels management BMPs to protect or enhance the habitat. About two percent of BLM-administered lands would have year-round surface-disturbing restrictions in Core Population Areas and Connectivity Corridors, and at least 20 percent of BLM-administered lands would have seasonal restrictions from March through late June.

Not considering restrictions in Greater Sage-Grouse habitat, Alternative D management of SSS would have negligible beneficial effects on prescribed fire management.

Heritage and Visual Resources

Cultural Resources

Alternative D would prohibit surface disturbance within identified sites, although the total BLM-administered area affected would be less than one percent. This would have a negligible adverse effect on the use of prescribed fire as a management tool.

Visual Resources

Under Alternative D, managing SRMAs, ACECs, and lands with wilderness characteristics as VRM Class II could restrict surface disturbance on approximately 63 percent of BLM-administered lands in the planning area. Depending on visual values, vegetative treatments could be constrained. However some treatments would mimic natural processes and restore characteristic plant communities, thereby contributing to the visual appeal. Because of these trade-offs, Alternative D management of visual resources would have a minor adverse effect rather than a major adverse effect on the use of prescribed fire as a management tool.

Land Resources

Forest Products

Under Alternative D, offering forest products throughout the planning area could enhance local markets and encourage cost-effective alternatives to slash disposal, which would benefit fuels management activities. Pre-commercial thinning and other practices that create healthy forest stands would benefit fire and fuels management by efficiently reducing fuel loads and ladder fuels. Rather than being restricted by predetermined acreages, treatment areas could follow topographic features and could be planned to mitigate fire spread and behavior. This management would have a minor beneficial effect on the use of prescribed fire as a management tool.

Lands and Realty

Under Alternative D, exchanging lands to consolidate blocks of BLM-administered lands, disposing of isolated public lands, and pursuing easements to access public lands would facilitate fuels management actions at the project and landscape levels. This management would have a minor beneficial effect on the use of prescribed fire as a management tool.

Travel and Transportation Management

Alternative D effects would be similar to effects under Alternative C because approximately five percent of BLM-administered lands in the planning area would be closed year-round to motorized travel. However, under Alternative D, seasonal closures would include approximately 10 percent of public lands in big-game crucial winter range. In some situations, especially in forested settings, prescribed fire might not be available as a treatment option because weather and fuel prescriptions could not be satisfied during summer and early fall. Alternative D management of

transportation and access would have a moderate adverse effect on the use of prescribed fire as a management tool.

Recreation (minor adverse)
Alternative D effects would be similar to those described under *Impacts Common to All Alternatives*. In addition, vegetative treatments could be constrained under Alternative D by restrictions for surface-disturbing activities in SRMAs, although in some cases treatments might be needed to reduce hazardous fuel loads. This management would have a minor adverse effect on the use of prescribed fire as a management tool.

Lands with Wilderness Characteristics
Managing lands with wilderness characteristics to emphasize ecosystem health and natural values could provide opportunities to implement prescribed fire to accomplish multiple objectives. For conifer communities in particular, this would help to maintain or improve diverse structural/seral stages at the landscape-level, which would improve forest health and fuel loads. This would have a negligible beneficial effect on prescribed fire management.

Livestock Grazing Management
Under Alternative D, designating future reserve common allotments would provide adaptive management options for temporary grazing when rest or deferment is required in other areas after prescribed fire treatments. Livestock grazing rest or deferment might be required as necessary after fires or other vegetative treatments, which would allow flexibility to manage for multiple resources and objectives. Alternative D livestock grazing management would have a minor beneficial effect on the use of prescribed fire as a management tool.

Special Designations

Areas of Critical Environmental Concern
Depending on site characteristics, values, and protection measures, newly designated ACECs could either encourage or discourage the use of prescribed fire to maintain ecological conditions. Site-specific management plans would be developed for each area to provide guidance for vegetation management activities. Alternative D would restrict surface disturbance on less than one percent of BLM-administered lands in the planning area, which would have a negligible adverse effect on prescribed fire management and other vegetative treatments.

Scenic or Back Country Byways and **Wild and Scenic Rivers**
Such designations would influence the application of vegetative treatments, depending on values or constraints described for other resources. Constraints would have an adverse effect on prescribed fire management and other vegetative treatments. Conversely, these types of designations can provide educational opportunities for interpretive displays about disturbance ecology and fire, and vegetative treatments, which would have a beneficial effect on prescribed fire management. Overall, these designations would likely have a negligible adverse effect on prescribed fire management.

Wilderness Study Areas
All motorized and mechanized equipment would be prohibited in WSAs, which would preclude prescribed fire and many other vegetation treatments on about four percent of BLM-administered lands. This would have a minor adverse effect on fuels management.

4.3.2.7. Cumulative Impacts

WUI areas would receive priority for vegetative treatments. Under any alternative, non-BLM partners would mechanically treat approximately 3,200 acres of WUI on other public and private lands during the planning period. Non-BLM partners also would use prescribed fire on approximately 2,000 acres near such WUI areas as subdivisions and campgrounds. When combined with BLM treatments (except under Alternative B), developed areas such as urban interface or rural intermix would likely have received hazardous fuels reduction treatments at least once during the planning period. Some areas might have been treated twice, or would be due for reentry. This would create favorable conditions for fire suppression actions, which would increase the likelihood of early success at fire containment, or would lower the risk to structures.

As possible, BLM prescribed fire treatments would be implemented in remote areas for resource benefit and to restore characteristic fire regimes. Treatments in these areas would contribute to the goal of improving fire regime conditions and vegetative structure on the landscape.

Under alternatives A and D, prescribed fire could be implemented on approximately 14,000 acres of BLM-administered lands in the planning area during the planning period, which is approximately 700 acres per year. Hazardous fuels objectives in WUI areas would likely be accomplished. Vegetative treatments in other areas could achieve project-level objectives, but there is little opportunity to use prescribed fire to improve landscape-level fire regime conditions. Some resource constraints or restrictions in these alternatives could be waived or mitigated, especially in Alternative D, which would help to accomplish the treatments.

In Alternative D, unplanned ignitions could be managed using a full range of strategies, including resource benefit objectives, which would contribute to fuels reduction objectives on those sites.

Alternative B would allow prescribed fire on only approximately 3,500 acres during the planning period, which is approximately 175 acres per year. Hazardous fuels objectives in developed interface areas would be partially accomplished, but might not keep pace with interface growth. Vegetative treatments in other areas would be minimal or none because of other resource constraints or restrictions. There would not be opportunities to use prescribed fire to improve fire regime conditions at any scale. Unplanned ignitions could be managed to restore fire to the landscape, but restrictions from other resources could constrain its use in most cases.

Under Alternative C, prescribed fire could be implemented on approximately 42,000 acres during the planning period, which is approximately 2,100 acres per year. Hazardous fuels objectives in developed interface areas could be fully accomplished. In addition, the scale of vegetative treatments in other areas could improve landscape-level fire regime conditions in portions of the planning area. Treatments would be necessary to maintain fire on the landscape and to offset the effects of full protection of unplanned ignitions.

4.3.2.8. Conclusion

For planned ignitions (prescribed fire), Alternative C would allow the greatest opportunity and fewest constraints to meet landscape-level fire regime and fuel objectives. This alternative would provide flexibility to plan and implement vegetative treatments as necessary to meet desired vegetation conditions in the planning area. At approximately 2,100 acres per year, there would be an excellent opportunity to implement prescribed fire projects and other treatments in developed interface and other areas.

Conversely, Alternative C would emphasize full protection strategies for unplanned ignitions, which would impede progress toward meeting desired fire regime conditions and other vegetation objectives. Because of this discrepancy, Alternative C does not best meet the overall goals and objectives of fire and fuels management, whereas Alternative D would allow a reasonable mix of planned and unplanned ignitions to meet multiple objectives.

4.3.3. Stabilization and Rehabilitation

At present, there is no programmatic plan for the BFO to address ES&R activities. Projects would be implemented on a case-by-case basis following the guidance in BLM Handbook H-1742-1, Burned Area Emergency Stabilization and Rehabilitation. Regardless of alternative, interdisciplinary planning would consider constraints and long-term effects, and would identify mitigation measures or restrictions necessary for successful implementation of ES&R projects. Appendix Q (p. 2511) provides more information about ES&R planning, funding, and implementation.

4.3.3.1. Methods and Assumptions

ES&R treatments are planned actions for emergency stabilization and repair of damages or anticipated damages from the undesirable effects of fire. Rehabilitation of fire lines and other suppression damage is an incident response action and should be performed by suppression resources shortly after the fire is contained. For example if heavy equipment is used to create fire lines, it will generally be needed to rehabilitate the lines and should be used if possible before being demobilized from the incident.

Impact analyses and conclusions are qualitatively based on expected fire effects versus the level of fire management strategies across the alternatives.

4.3.3.2. Impacts Common to All Alternatives

ES&R projects must follow management guidance from the approved RMP, and must have activity plans and decisions in place before they may be implemented.

4.3.3.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended in 2001 and maintained. Suppression strategies under this alternative would balance conservation of resource values with protection of developed areas. Although high-severity fire effects are possible, appropriate response to unplanned ignitions would likely minimize the need for ES&R treatments.

4.3.3.4. Alternative B

With an emphasis on natural processes under Alternative B, conservative levels of vegetation treatments, and current fuel load conditions, large-scale high-severity fire effects would be likely in some areas, especially conifer settings. More ES&R projects would be needed than have historically been implemented in the planning area. Motorized and mechanized equipment would be prohibited in WSAs except in emergency situations, which would make Burned Area Rehabilitation (BAR) projects difficult or impossible to implement.

4.3.3.5. Alternative C

Under Alternative C, suppressing fires at smallest size could minimize total acres of wildfire, thereby reducing the need for emergency stabilization treatments. In addition, prescribed fire treatments would help offset undesirable vegetation conditions that would develop from lack of fire disturbance. However, aggressive protection actions in this alternative could create excessive damages from fireline construction and rehabilitation, and contribute to other resource concerns such as damaged soils and spread of invasive plants. Motorized equipment would be prohibited in WSAs except in emergency situations, which would make BAR projects difficult to implement.

4.3.3.6. Alternative D

Alternative D suppression strategies balance conservation or enhancement of resource values with protection of developed areas. Although high-severity fire effects would be possible, appropriate response to unplanned ignitions should minimize the need for ES&R treatments. In addition, allowing a full range of suppression actions would generally reduce surface disturbance from suppression actions and minimize the need for fire line rehabilitation. However, motorized and mechanized equipment would be prohibited in WSAs except in emergency situations, which would make BAR projects difficult or impossible to implement.

4.3.3.7. Cumulative Impacts

In any alternative, implementing ES&R projects on fire-damaged lands would create immediate and cumulative beneficial effects. This is especially applicable to important watersheds in developed areas, or to restoration of sensitive resources and wildlife habitats.

4.3.3.8. Conclusion

Stabilization and rehabilitation projects would be implemented under any alternative as necessary to repair or mitigate damage or undesirable fire effects. Alternatives A and D would provide practical management of unplanned fires so that effects from suppression actions versus fire effects could be balanced. However, undesirable fire effects would be possible under any alternative and will require ES&R activities.

4.4. Biological Resources

4.4.1. Vegetation – Forests and Woodlands

This section describes potential effects on the forest and woodland communities in the planning area from BLM management of resources and resource uses under the alternatives. The *Vegetation – Forests and Woodlands* section of Chapter 3 describes existing conditions of these vegetative communities. Healthy forests and woodlands support other resources (e.g., physical and biological resources) and resource uses (e.g., forest products and recreation). Actions that remove forest or woodland vegetation for purposes other than promoting forest health and sustainability are considered adverse (e.g., minerals development or road construction). Conversely, actions that promote healthy forest and woodland communities are considered beneficial, including those that might reduce vegetative cover over the short term (e.g., prescribed fire or pest management).

4.4.1.1. Methods and Assumptions

Indicators of forest and woodland health are the amount, diversity, and age-class structure of the forest and woodland communities. The goal is to sustain healthy forest and woodland communities in their desired ecological conditions. Forest and woodland communities should be sustainable, resilient, diverse, and able to recover from natural and human disturbances. The types of projected effects under the alternatives are similar; however, the potential amount of acres disturbed would vary by specific allowable uses and management actions associated with individual alternatives, as described below. Appendix G (p. 1937) identifies the projected amount of surface disturbance in the planning area.

Short-term effects would result during initial surface disturbance (vegetation removal) before revegetation is completed, or from decreases in forest health that do not result in a change of the vegetative community. Long-term adverse effects would be changes in vegetative community type that would restrict reestablishment of the desired vegetative community. The scale of effects would be the same as identified in the Introduction of Chapter 4.

Assumptions

Assumptions and methods used in this analysis include, but are not limited to the following:

- This impact analysis and its conclusions are based on interdisciplinary team knowledge of resources in the planning area, reviews of existing literature, and information from other agencies.
- Spatial analysis was performed using the ESRI ArcGIS 10.0 computer software.
- Effects are quantified where possible. Effects are based on the acreage of forest (51,225 acres) and woodland (26,147 acres) communities on BLM surface in the planning area.
- In the absence of quantitative data, best professional judgment was used. Effects are sometimes described using ranges of potential effects or in qualitative terms, if appropriate.
- Forest inventory data was collected on the larger BLM forest management area in 2005.

4.4.1.2. Impacts Common to All Alternatives

Vegetation – Forests and Woodlands
The BLM goal is to sustain healthy forest and woodland communities in their desired ecological conditions. Forest management techniques, which include silvicultural operations such as thinning, timber stand improvement, and planting, can 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 uncharacteristic wildland fires.

Physical Resources

Air Quality
Restrictions on vegetative treatments to mitigate adverse effects on air quality would vary depending on air quality conditions in the immediate area at the time of proposed treatments. Potential short-term adverse effects on vegetative treatments include planning and timing restrictions to minimize emissions associated with fugitive dust or smoke. This effect would be minor.

Soil
A reclamation plan is required for all surface-disturbing activities. Forest health projects could be restricted in areas with unstable soils or particularly steep terrain where reclamation is challenging. This would have a minor adverse effect on forests and woodlands management.

Water Resources
In areas with high-value water resources, management practices could be limited to prevent water quality degradation. Modification of forest health projects would be necessary in these areas in accordance with the Wyoming State Forestry BMPs. There are 3,895 acres (7.6%) of BLM-administered forest lands and 243 acres (0.9%) of woodlands within 500 feet of water resources. Water management actions would have a minor adverse effect on forest and woodland communities.

Cave and Karst Resources
Caves and karst management actions common to all alternatives are procedural and would not effect forest and woodland communities.

Mineral Resources

Locatable Minerals
Public lands not formally withdrawn from minerals entry would be available for locatable minerals development. At present, locatable minerals operations affect 0.3 percent of BLM-administered forest and woodlands communities (138 and 92 acres, respectively). The trend in locatable minerals development in the planning area is predicted to be similar throughout the planning period. The effect on forest and woodland resources would be negligible adverse.

Leasable Minerals – Coal
The potential acreage available for coal leasing is extensive, but the foreseeable activity would be confined to central Campbell County and north-central Sheridan County. Coal leasing and development would not affect BLM-administered forest and woodland resources, and is not further addressed in this section.

Leasable Minerals – Fluids
Federal fluid mineral estate in the planning area would be available to fluid minerals leasing unless it is identified as closed. Based on the predicted activity from oil and gas operators surveyed as part of the reasonably foreseeable development forecast, conventional oil and gas development (potential of low to moderate could occur on 3,468 acres (13%) of BLM-administered woodlands. CBNG development could occur on 5,737 acres (22% of BLM-administered woodlands). Physical disturbance and loss of vegetation would be much less than the acreage where fluid mineral activities occur, typically less than two percent for CBNG. The result would be a minor adverse effect on forest and woodland resources.

Salable Minerals
There are 205 acres (1.2%) of sand and gravel deposits in forest management areas (Billy Creek and the Horn). With the typically small size of salable minerals development, small acreages would be removed. The foreseeable development scenarios for all alternatives predict less than one percent of BLM surface would be disturbed through salable minerals development. Although sand and gravel deposits are present in slightly more than one percent of the forested areas, it is not likely the entire limited amount of predicted salable minerals development would occur in forested areas. Therefore, salable minerals development would have a negligible adverse effect

on forest and woodland communities. The effects would be the same scale under all alternatives. Therefore, salable minerals development is not further addressed in this section.

Fire and Fuels Management

Fire management can affect forest and woodland community health. Fuels treatment projects can promote forest and woodland health by reducing the potential for catastrophic wildfire. Large wildland fires could change the seral state of the forest or woodland. Wildland fire use for resource benefit promotes forest and woodland health. Fire and fuels management common to all alternatives would have a major beneficial effect on forests and woodlands.

Biological Resources

Vegetation – Grassland and Shrubland Communities
Grassland and shrubland communities overlap forest and woodland communities and play an important role in creating vegetative mosaics and diversity for both vegetation types. The overlap benefits forest and woodland health. When forest management activities are performed, the soil is scarified for the introduction of seeds and openings for the grasses and shrubs, diversity in vegetation is produced. The grasses and shrubs protect the soil and water resources and provide cover and browse. Grassland and shrubland management actions common to all alternatives would have a major beneficial effect on forests and woodlands.

Vegetation – Riparian/Wetland Resources
The Wyoming Forestry BMPs require streamside management buffers. These buffers are located with consideration of slope, aspect, stream type, and stream life. This could reduce the acres available for forest health treatments, and have a moderate adverse effect on forests and woodlands.

Invasive Species and Pest Management
The requirements to control invasive species and revegetate disturbed areas would increase the cost of forest health projects. Requirements to flush equipment and reseed only with approved seed are examples of the restrictions that would increase operation costs. However, the ability to control invasive species and pests plays a vital role in sustaining forest and woodland health. Overall management to control invasive species and pests would have a moderate beneficial effect on forests and woodlands.

Fish and Wildlife Resources – Wildlife and Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)
The management of fish and wildlife including sensitive, Threatened, and Endangered species and their habitats would affect forest and woodland health. Fish and wildlife management actions could preclude or seasonally restrict forest health treatments in areas with habitat for these species, such as during the nesting season near raptor nests. Vegetative manipulations such as the removal of conifers to improve sagebrush habitat for Greater Sage-Grouse would decrease the area of forests and woodlands. Management of special status plant species and communities could preclude forest management projects in places where such species are present. Many wildlife species are dependent upon healthy forest and woodland communities; habitat enhancements for these species would benefit forest and woodland communities. In all, these management actions would have a negligible adverse effect on forest and woodland communities.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources
Management of cultural and paleontological resources could indirectly affect forest and woodland health through increased costs to stabilize and protect significant sites. The likelihood of significant sites within forest and woodland health treatments is low; therefore, these management actions would have a negligible adverse effect on forests and woodland communities.

Visual Resources
Management of VRM Class II areas would control the size, shape and amount of acres included in a forest health project or could limit or prohibit certain types of disturbances. Management of VRM Class III and IV areas would include minor limitations.

Land Resources

Forests Products
Providing for personal use forest products in an ecologically sustainable manner would have a major beneficial effect on the management of forests and woodland resources.

Lands and Realty
Lands and realty management actions common to all alternatives would not effect forest and woodland health.

Renewable Energy
Portions of the planning area including the southern Big Horn Mountains and the southern PRB have good potential for renewable-energy development, primarily wind energy. Effects on forest and woodland communities from renewable-energy development could include the removal of forest cover. These areas would be taken out of production for the life of the renewable-energy project. The areas where renewable energy potential overlaps with forests and woodlands is limited; therefore, the impact would be minor adverse.

Rights-of-Way and Corridors
The extension of new access roads into forest and woodland communities could allow for better access to conduct forest health treatments. Common to all management actions limit the amount of surface disturbance and vegetation removal. These management actions will have a minor effect on forest and woodland communities as they are not expected to be widespread.

Travel and Transportation Management
The extension of new access roads into forest and woodland areas could allow for better access to conduct forest health treatments. Common to all management actions regulate route construction and transportation use limiting vegetation removal and resource damage which is a major benefit to the forest and woodland communities.

Recreation (minor adverse
Management actions common to all alternatives promote dispersed recreation use of a casual nature. Dispersed casual use activities can lead to impacts such as trampling of regeneration, or carving on trees but overall the level of impact should be minor.

Lands with Wilderness Characteristics
The likelihood of any newly acquired lands meeting size and naturalness requirements for wilderness characteristics is so low that it is considered to be no effect.

Livestock Grazing Management
Livestock are to be managed to achieve healthy rangeland standards; therefore the regeneration of aspen and other deciduous trees and shrubs in forested, wooded, and riparian areas should only be negligibly affected by livestock grazing.

Special Designations

Areas of Critical Environmental Concern
A management plan would be prepared for any designated ACECs. Management prescriptions would likely limit surface disturbing activities and vegetation loss that would benefit forest and woodland communities. The acreage to be included in ACECs would likely be small and therefore the overall benefit minor.

Scenic or Back Country Byways
Management actions common to all alternatives have no measurable effect on the forests and woodlands resource, nor would those management actions that vary by alternative; therefore, byways will not be discussed further in this section.

Wild and Scenic Rivers
The portion of the Middle Fork Powder River that is suitable and eligible for WSR designation contains minimal forest or woodland vegetation. Management of WSRs would not affect the forests and woodlands resource and will not be discussed further in this section.

Wilderness Study Areas
WSAs are managed to preserve natural conditions and processes including forest and woodland communities. Intensive management to promote forest health would be restricted, however less intrusive options such as prescribed fire are available. The overall result should be a negligible adverse effect.

Socioeconomic Resources

Social and Economic Conditions and Health and Safety

The socioeconomic management actions common to all alternatives and the management actions that vary by alternative have no measurable effect on forest and woodland communities and will not be not discussed further in this section.

4.4.1.3. Alternative A

This section describes management actions and potential effects under Alternative A, which would continue management in accordance with the 1985 RMP as amended and maintained.

Vegetation – Forests and Woodlands
Under Alternative A designing forest management treatments, including timber harvesting, to meet overall resource management objectives to protect or improve biodiversity and water quality would have a beneficial effect on forest and woodlands and create healthy ecosystems. With the number of treatments and acreage (4,000 to 6,000 acres) anticipated to be treated including diseased old growth or overstocked forests, the benefit is moderate (7.7% of forest and woodland communities).

Physical Resources

Air Quality

Under Alternative A, analysis of activities and air quality modeling may be performed on a project-specific basis. Large-scale treatments involving thousands of acres, such as planned (prescribed) fires or pest management treatments, would likely be the only activities for which air quality modeling and impacts mitigation would be necessary. Forest and woodland treatments of this scale are not common, the adverse effect on implementing forest and woodland health treatments would be negligible.

Soil

Alternative A would prohibit or control surface-disturbing activities on sensitive soils, subject to management approval, on a project-specific basis. Forest and woodland communities commonly occur on sensitive soils. There are 30,819 acres (60%) of BLM-administered forest communities on slopes equal to or greater than of 25 percent, and 2,741 acres (54%) in areas with poor reclamation suitability. Woodland figures are similar; 9,213 acres (35%) of BLM-administered woodlands are on slopes equal to or greater than of 25 percent, and 19,282 acres (74%) in areas with poor reclamation suitability. Preventing surface-disturbing activities and vegetation removal generally benefits forest and woodland communities. However, under Alternative A, the authorized officer could waive the prohibitions resulting in loss of forest and woodland communities. The management actions could also prevent or control treatments to benefit forest and woodland health. Overall, the effect of these management actions on forest and woodland communities is moderate beneficial.

Water Resources

The only water management action under Alternative A that would directly effect forest and woodland vegetation is a 500-foot restriction on surface-disturbing activities around springs, reservoirs, water wells, and perennial streams. Like many management actions under Alternative A, the authorized officer can waive the prohibition, and there are no defined waiver criteria. This has resulted in inconsistent management. There are 3,895 acres (7.6%) of BLM-administered forest lands and 243 acres (0.9%) (243 acres) of woodlands within 500 feet of water resources. Alternative A water management actions would have only a minor beneficial effect on forest and woodland communities because management actions could be inconsistently applied.

Cave and Karst Resources

Alternative A does not include management actions for cave and karst resources, and actions in those areas would be considered on a project-specific basis. Management would likely focus on entrances to significant caves. There are no documented significant caves in BLM-administered woodland communities, and three in forest communities. Caves are generally located in rock formations and not in the forest or woodland communities. Therefore, management of cave and karst resources would have a negligible effect on forest and woodland communities.

Mineral Resources

Locatable Minerals

Under Alternative A, existing withdrawals from locatable minerals entry would continue. At present, locatable minerals operations affect 0.3 percent of BLM-administered forest and woodlands communities (138 acres and 92 acres, respectively). The trend in locatable minerals development is predicted to be similar throughout the planning period. The effect to forest and woodland resources would be negligible adverse.

Leasable Minerals – Fluids
Based on the predicted leasable fluid minerals activity under Alternative A, conventional activity (potential of moderate or above) could occur on 1,209 acres (2.7%) of BLM-administered forest lands and 1,942 acres (7.4%) of woodlands. CBNG activity would occur on 2,148 acres (4.7%) of BLM-administered forest lands and 5,779 acres (22%) of woodlands. Physical disturbance and the loss of vegetation would be much less than the acreage where fluid minerals activity occurs, typically less than two percent for CBNG. The result would be a minor adverse effect on forest and woodland resources.

Fire and Fuels Management

Under Alternative A, applying different levels of suppression efforts and restricting the use of some types of suppression equipment would have a direct beneficial effect on forest and woodland vegetation. Short-term effects from the fire itself would be direct and beneficial to some tree species, ecosystems, and natural regeneration. Prescribed fire also would have a direct beneficial effect on forests and woodlands over the short and long terms, because the burn conditions are typically less severe than for wildfires. However, short-term effects would be the destruction of any litter on the surface and the current year's growth.

Biological Resources

Vegetation – Grassland and Shrubland Communities
There is no previous decision under this alternative.

Vegetation – Riparian/Wetland Resources
Alternative A would prohibit surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams which protects forest and woodland communities. However, the management action would also prohibit treatments designed to promote forest and woodland health. This would affect approximately 23,831 acres, unless the authorized officer waives the prohibition. Aspen, cottonwood, ash, and willow often grow in these moist areas; prescribed management would limit surface-disturbing activities and ensure the reproduction and maintenance of these species. Overall, the management actions balance to a negligible beneficial effect on forests and woodlands.

Invasive Species and Pest Management
Approximately 50 to 100 acres are treated annually in the Big Horn Mountains to manage invasive species. At present, no pesticide applications are employed; however, if a pesticide is produced to control species such as the mountain pine beetle, aerial applications would be beneficial. Invasive species treatments have a negligible effect on forest and woodlands.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Alternative A has few decisions to guide management of fish. At present, the practice is to cooperate with the WGFD in introducing or reintroducing native and desirable non-native fish in the planning area where there is potential habitat; to design reservoirs to enhance fisheries where there is a potential; and to maintain reservoirs and riparian areas to improve or enhance potential fisheries. Improving habitat should be a direct benefit. However, the effect would be adverse if anglers and other recreationists attracted to these areas develop foot and motorized vehicle trails and unintentionally introduce invasive species. Special status fish species are presently limited to the Tongue River drainage. Overall, Alternative A fish management would have a negligible beneficial effect on forests and woodlands.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)

The reintroduction or augmentation of acceptable wildlife species in suitable habitats could have a long-term effect on forest and woodland management. Considering surface-disturbing activities on a project-specific basis could benefit forest and woodland management by providing management flexibility. Under Alternative A, there would be prohibitions on surface-disturbing and disruptive activities in crucial elk winter range (50,586 acres) and elk calving areas (27,851 acres). Alternative A management for upland game birds would have a negligible adverse effect on forests and woodlands management as there are only woodland communities near sharp-tailed grouse leks. Alternative A would prohibit surface disturbance or occupancy within a biologic buffer around active raptor nests. Seasonally restricting surface-disturbing activities within 0.5 mile of raptor nests would affect approximately 385,148 acres. This could limit the timing for forest health operations. Waivers to allow surface-disturbing activities or occupancy could have a beneficial effect on forest and woodland management.

Under Alternative A, providing and managing habitat for T&E and special status wildlife species on all public lands in compliance with the ESA, approved recovery plans, and BLM policy associated with management of habitat could have beneficial or adverse effects on forest and woodland communities. Focusing on single species often can adversely effect other species and resources. Under this alternative, prohibiting surface disturbance and occupancy within a 0.25-mile radius of the center of Greater Sage-Grouse leks, would affect approximately 3,594 acres, and seasonally prohibiting surface disturbance within an additional 1.75-mile radius would affect approximately 203,724 acres. Establishing a year-round disturbance-free buffer for eagle winter roosts would affect approximately 402 acres, and adding a 1-mile limited activity zone for roosts (November 1 to April 1) would affect approximately 3,013 acres. This would have a minor adverse effect on forest and woodland management because most of these nests occur in riparian forests, but would have a greater effect around northern goshawk nests which tend to nest in coniferous upland forests.

These management actions regulate surface-disturbing activities which promote wildlife habitat conservation and therefore forest and woodland conservation. However, the management actions could also limit treatments designed to promote forest and woodland health. Overall, Alternative A wildlife management actions would benefit forest and woodlands communities to a moderate degree.

Special Status Species – Plants

Alternative A does not include management for special status plant species, which are therefore considered on a project-specific basis. Forest and woodland projects would consider special status plants. Most special status plants are typically rare and have small populations; it is not likely they would adversely effect forest and woodland management. Limber pine is present on approximately 13,927 acres of the planning area. Single-species management specifically for limber pine could have a minor adverse effect on overall forest and woodland management.

Heritage and Visual Resources

Cultural Resources

Alternative A would apply NSO stipulations to mineral leases along potentially eligible and significant segments of the Bozeman Trail and within the Crazy Woman Battle Site. Alternative A would protects these two sites, which are in shrubland communities, from surface-disturbing mineral activities. This management action would not prevent treatments designed to promote

woodland health. These management actions effects on forest and woodland management would be negligible beneficial.

Paleontological Resources
Alternative A does not include management actions for the protection of paleontological resources and it is unlikely that management of significant paleontological sites would effect forest and woodland communities.

Visual Resources
VRM Class II management objectives require that the visual resources in these areas be maintained or that changes to visual resources not be noticeable to the casual observer. VRM management could restrict the type, size, and shape of surface-disturbing activities, including forest health activities, in these areas. Other forested areas in the planning area would be managed under VRM Class III and IV, which impose fewer restrictions on surface-disturbing actions. The acreage of forests and woodlands protected from surface-disturbing activities would be greater than the acres of forest and woodland health treatments prevented. Overall, Alternative A management of visual resources would have a moderate beneficial effect on forest and woodlands management.

Land Resources

Forests Products
The ability to offer an array of products and one Million Board Feet (MMbf) for a 10-year period with regeneration would benefit the health and sustainability of forest communities. Limiting clear-cuts to 20 acres could hinder management activities in instances of treatments for insect and disease or other natural forces. However, timber stand improvement activities, such as precommercial thinning would be beneficial to forest and woodland health.

Lands and Realty
Alternative A management of lands and realty would not effect forests and woodlands.

Renewable Energy
Alternative A does not address the development of renewable energy resources. Portions of the Big Horn Mountains and southern PRB have potential for renewable-energy development, especially wind energy. Effects on forest and woodland communities from renewable-energy development could include the removal of forest cover. Renewable energy projects within forest communities are not anticipated to be common, in part due to the necessary removal of the forest vegetation. Projects within woodland communities are more likely. Overall, renewable energy management would have a minor adverse effect on forest and woodlands communities.

Rights-of-Way and Corridors
Under Alternative A, ROW disturbances from BLM actions are estimated to affect approximately 38,762 acres (Appendix G (p. 1937)). Surface disturbance and occupancy will not be allowed on slopes equal to or greater than 25 percent, which would affect approximately 215,496 acres and directly benefit all plant communities over the long term. ROW management actions do not restrict forest and woodland health management treatments. Overall, Alternative A management of ROWs and corridors would have a moderate beneficial effect on forests and woodlands.

Travel and Transportation Management
Alternative A would limit motorized vehicle use to existing roads and routes. Under this

alternative, closing areas with saturated soils or steep slopes (approximately 170,590 acres) to motorized vehicles would have a direct beneficial effect on vegetation. Closing certain areas to vehicular travel (approximately 3,650 acres), limiting travel to designated routes (737,166 acres), and seasonal route closures (37,646 acres) would reduce vehicle damage to woodland vegetation and forest regeneration. These management actions combine to have a moderate beneficial effect on forest and woodland communities.

Recreation
Under Alternative A, recreation site development is anticipated to disturb approximately five acres. Most recreation use is dispersed casual use which has little long-term effect to forest and woodland communities.

Lands with Wilderness Characteristics
Alternative A would continue to manage forest and woodland areas for multiple resource values and not manage any lands for wilderness characteristics. There would be no effect on the forests and woodlands resource.

Livestock Grazing Management
Under Alternative A, livestock grazing would not be authorized on approximately 4,000 acres of public land in the canyons and slopes of the southern Big Horn Mountains because of rough terrain and steep slopes and approximately 6,000 acres (1%) where grazing has been determined to be incompatible with other resource uses or values. Livestock grazing tends to be a compatible resource use with forest and woodland communities, except in areas of aspen or other deciduous regeneration. Alternative A would provide for a minimum of two years rest from livestock grazing following prescribed burns and other vegetative treatments, and allow additional rest where necessary to achieve resource goals and objectives.

Special Designations

Areas of Critical Environmental Concern
There are presently no ACECs within the planning area; therefore, there would be no anticipated impacts to forest and woodland communities.

Wilderness Study Areas
WSAs are managed to preserve natural conditions and processes including forest and woodland communities. Intensive management to promote forest health would be restricted, however less intrusive options such as prescribed fire are available. The overall result would be a negligible adverse effect.

4.4.1.4. Alternative B

This section describes management actions under Alternative B, which would emphasize resource conservation, and the likely resulting effects on forest and woodland communities.

Vegetation – Forests and Woodlands
Alternative B would minimize treatments in forests and woodlands, allowing insects, disease, an other forces to run their course. Management would not be proactive in addressing forest and woodland health. Forests and woodlands could become more susceptible to insects and disease. This management strategy would allow accumulation of fuels which sustain wildfires. The expansion of forests and woodlands into meadows would reduce species and landscape diversity.

Physical Resources

Air Quality

Alternative B would require air quality modeling and mitigation for adverse effects on air quality for proposed industrial activities with the potential to approach or exceed emission standards. Few large-acreage vegetative treatments to promote forest and woodland health are predicted. Therefore, the effect on forest and woodland resources would be negligible.

Soil

Alternative B would prohibit surface-disturbing activities on sensitive soils. Forest and woodland communities commonly occur on sensitive soils. There are 30,819 acres (60%) of forest communities on BLM surface on slopes equal to or greater than 25 percent and 2,741 acres (54%) in areas with poor reclamation suitability. Woodland figures are similar; 9,213 acres (35%) of BLM-administered woodlands on slopes equal to or greater than 25 percent and 19,282 acres (74%) in areas with poor reclamation suitability. Alternative B soils protections would be absolute and would prevent disturbance in the forest and woodland communities. The absolute protections could prevent treatments to promote forest or woodland health. The acreage of forests and woodlands protected from surface-disturbing activities would be much greater than the acres of forest and woodland health treatments prevented; therefore, overall a major beneficial effect on forest and woodland communities is anticipated.

Water Resources

Alternative B would prohibit surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams. There are 3,895 acres (7.6%) of BLM-administered forest lands and 243 acres (0.9%) of woodlands within 500 feet of water resources. The absolute protections could prevent treatments to promote forest or woodland health. The acreage of forests and woodlands protected from surface-disturbing activities would be greater than the acres of forest and woodland health treatments prevented; therefore, overall a moderate beneficial effect on forest and woodland communities is anticipated.

Cave and Karst Resources

Alternative B would prohibit surface-disturbing activities in cave and karst areas.
There are 33,942 acres (66%) of BLM-administered forest and 4,729 acres (18%) of woodland communities on karst formations. The absolute protections could prevent treatments to promote forest or woodland health. The acreage of forests and woodlands protected from surface-disturbing activities would be greater than the acres of forest and woodland health treatments prevented; therefore, overall a major beneficial effect on forest and woodland communities is anticipated.

Mineral Resources

Locatable Minerals

Alternative B would recommend withdrawal from minerals entry 15,870 acres (31%) of BLM-administered forest lands and 10,777 acres (41%) of woodlands. This would have major beneficial effect on forest and woodland resources by preventing potential surface-disturbing activities.

Leasable Minerals – Fluids

Based on the predicted fluid minerals activity under Alternative B, conventional activity (potential of moderate or above) could occur on 340 acres (1.0%) of BLM-administered forest lands and 812 acres (6.9%) of woodlands. CBNG activity could occur on 900 acres (2.7%)

of BLM-administered forest lands and 2,820 acres (24%) of woodlands. Physical disturbance and loss of vegetation would be much less than the acreage where fluid minerals activity occurs, typically less than two percent for CBNG. The result would be a minor adverse effect on forest and woodland resources.

Fire and Fuels Management

Alternative B fire and fuels management activities would have a major beneficial effect on forest and woodland resources. Fuel treatment projects would be performed in forested areas to reduce the potential hazard of wildfire. These projects can reduce the amount of woody material on the ground and alter the structure of both the understory and overstory of trees, changing the composition and structure of the stand, and allow for regeneration.

Unplanned ignitions achieving resource benefit also would benefit forest and woodland communities. In areas where this practice is allowed, wildland fire could alter stand composition and be a beneficial occurrence for regeneration, creating age-class diversity and sustainability.

Biological Resources

Vegetation – Grassland and Shrubland Communities
Regenerating native plant species and performing reclamation activities would contribute to ecosystem health by conserving soils, water, and creating diversity.

Vegetation – Riparian/Wetland Resources
Surface-disturbing activities would be prohibited within 500 feet of waterbodies. The Wyoming Forestry BMPs require streamside management zones (MZs), which benefit forest and woodland resources. These actions would have a moderate beneficial effect on forest and woodland communities.

Invasive Species and Pest Management
Alternative B would allow aerial applications of insecticides. However, this has not been the preferred treatment on the forest and woodland landscapes with the types of insects encountered and the current insecticides used. Invasive species and pest management does not concentrate in forest and woodland areas, but those areas would benefit from inclusion into a plan of treatment, which would result in healthier forests and woodlands. Sanitation harvest and biological treatments are the most common treatments in forest and woodland areas. Alternative B invasive species and pest management actions would have a major beneficial effect on forests and woodlands.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Alternative B would prohibit surface-disturbing activities within 0.25 mile of fish-bearing waterbodies which could include projects designed to promote forest health. The acreage of forests and woodlands protected from surface-disturbing activities would be greater than the acres of forest and woodland health treatments prevented; therefore, overall a minor beneficial effect on forest and woodland communities is anticipated due to the limited BLM surface near fish-bearing waters. Special status fish species are presently limited to the Tongue River drainage, limiting the benefit to forest and woodland communities to negligible.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)

Under Alternative B, applying prohibitions and seasonal restrictions to surface-disturbing activities for big game and other wildlife species would benefit wildlife habitat including forest and woodland communities. However, they could also limit treatments designed for forest or woodland health. The management of Sensitive, Threatened, and Endangered species and their habitats would affect all woodland management activities on 26,000 acres. Amphibian and reptile habitat includes 36,680 acres or 47 percent of the forest and woodland communities. Alternative B management of general wildlife and special status wildlife species would have a major beneficial effect on forest and woodlands communities.

Special Status Species – Plants
Surface–disturbing activities would be prohibited within special status plant habitat.
Most special status plants are rare and have specialized habitat requirements, some of which may include forest and woodland communities. Limber pine is present on approximately 13,927 acres of the planning area. Single-species management specifically for limber pine could adversely effect overall forest and woodland management. Cumulatively SSS plant management would likely have a minor adverse effect on forest and woodland communities.

Heritage and Visual Resources

Cultural Resources
Under Alternative B, establishing and identifying historic sites and creating a 5-mile buffer around those sites could have a major beneficial effect by preventing surface-disturbing activities within forest and woodland communities. The absolute protections could prevent treatments to promote forest or woodland health. The acreage of forests and woodlands protected from surface-disturbing activities would be greater than the acres of forest and woodland health treatments prevented; therefore, overall a major beneficial effect on forest and woodland communities is anticipated.

Paleontological Resources
Surface-disturbing activities, including forest health activities, would be prohibited in areas with paleontological resources of high quality or importance. However, at present, there are no high-quality paleontological areas in the forested areas, and typically the areas are small. The acreage of forests and woodlands protected from surface-disturbing activities would be greater than the acres of forest and woodland health treatments prevented. Therefore, the effect on forest and woodland communities would be negligible beneficial.

Visual Resources
Under Alternative B, VRM Class II areas would prohibit or limit surface-disturbing activities on approximately 217,021 acres. VRM Class III and IV areas encompass 276,107 and 258,866 acres respectively, and would have minor limitations that could allow surface-disturbing activities. VRM Class II management objectives require that the visual resources in these forested areas be maintained or that changes to visual resources not be noticeable to the casual observer. VRM constraints would restrict the types, sizes, and shapes of surface-disturbing activities, including forest health treatments, in these areas. Other forested areas in the planning area would be managed as VRM Class III, which would impose few restrictions on forest management actions. The acreage of forests and woodlands protected from surface-disturbing activities would be greater than the acres of forest and woodland health treatments prevented. Overall, Alternative B management of visual resources would have a moderate beneficial effect on forest and woodlands management.

Land Resources

Forests Products

Limiting timber harvest options to a five acre select group harvest and preventing precommercial stand improvement operations would limit the available prescriptions to promote sustainability and forest and woodland health, a major adverse effect.

Lands and Realty

Under Alternative B, land acquisitions, pursuit of easements, and retaining lands with resource value would improve overall management of public lands. Effects on vegetation would vary depending on the type of action and would be project specific. Effects would be negligible for individual projects, but could be major when considered together or if the BLM pursued and completed a large acquisition.

Renewable Energy

Portions of the Big Horn Mountains and PRB area have a potential for renewable-energy (e.g., wind) development, however, renewable energy development is excluded from most of these areas in Alternative B. If renewable-energy development were to occur in forest or woodland communities it would include the removal of forest cover. Alternative B management of renewable energy would have a negligible adverse effect on forest and woodlands management.

Rights-of-Way and Corridors

Under Alternative B, designating corridors for utility ROW, constructing new ROW projects adjacent to existing projects, a development plan to concentrate communications sites, approving ROWs to access private lands, and a transportation management system would reduce loss of forest and woodland communities. Concentrating sites and corridors would have a direct, major beneficial effect on vegetation over the long term.

Travel and Transportation Management

Alternative B would limit motorized vehicle use to designated routes, close 625,854 acres to motorized travel, and seasonally limit motorized travel on another 18,259 acres. These actions would reduce vehicle damage to woodland vegetation and forest regeneration. These management actions combine to have a moderate beneficial effect on forest and woodland communities.

Recreation

Under Alternative B, development of recreational facilities and opportunities would be limited to designated SRMAs (55,529 acres). SRMAs would be managed to protect natural and cultural values, including vegetation resources. Most recreation use would be dispersed casual use which has little long-term effect to forest and woodland communities. Overall, Alternative B recreation management would have a negligible beneficial effect on forest and woodland communities.

Lands with Wilderness Characteristics

Alternative B would manage 12,237 acres for wilderness characteristics. The lands with wilderness characteristics area is predominately forest. Commercial treatments would be prohibited while forest health treatments would be allowed. Wilderness characteristics management results in a moderate beneficial impact to the forest and woodland communities.

Livestock Grazing Management

Under Alternative B, livestock grazing would not be authorized where grazing has been determined to be incompatible with other resource uses or values. Livestock grazing tends to be a compatible resource use with forest and woodland communities, except in areas of aspen

or other deciduous regeneration. Alternative B would provide for a minimum of two years rest from livestock grazing following vegetative treatments and restore vegetation in areas to achieve resource objectives. Because livestock grazing tends to be compatible with forest and woodland communities, livestock predominantly graze on grass and forbs not woody plants, the overall beneficial effect of these management actions on forest and woodland communities would be minor.

Special Designations

Areas of Critical Environmental Concern
Eight ACECs would be designated with Alternative B. Surface-disturbing activities would be prohibited in ACECs preventing loss of forest and woodland vegetation. Treatments for forest and woodland health could be authorized. These management actions would be a major benefit to the sustainability of forest and woodland communities.

Wilderness Study Areas
WSAs are managed to preserve natural conditions and processes including forest and woodland communities. Intensive management to promote forest health would be restricted, however less intrusive options such as prescribed fire are available. The overall result should be a negligible adverse effect.

4.4.1.5. Alternative C

This section describes management actions under Alternative C, which would emphasize resource utilization, and the resulting effects on forest and woodland communities. The effects described above under *Impacts Common to All Alternatives* would be in addition to the effects described below for management actions under Alternative C.

Vegetation – Forests and Woodlands
Alternative C provides for intensive management including designing treatments specific to forests and woodlands, the health of those communities would improve and the forest would be better able to resist the effects of disease, insects, and wildfire. The old growth, tree species, age-class diversity, stand density, and other characteristics that are important objectives for healthy forests would be met. Alternative C management of forests and woodlands would have a major beneficial effect on that resource.

Physical Resources

Air Quality
Alternative C would not require air quality monitoring for industrial activities. There would be no effect on forest and woodland communities from Alternative C air quality management actions.

Soil
Alternative C soils management actions would include allowing surface-disturbing activities on slopes equal to or greater than 25 percent and on soils with a severe erosion hazard, as long as those activities would be consistent with other resource values. Forest management practices would be implemented, but methods would be designed to accommodate slopes, erosion hazard, and soil moisture content consistent with the Wyoming Forestry BMPs. Allowing proposed activities on badlands, rocky outcrops, or on slopes susceptible to mass movement would make approximately 218,928 acres available for forest and woodlands management. Alternative C

would also allow mineral development and other land uses on these same areas which could result in the loss for forest and woodland vegetation. Overall, Alternative C soils management actions would have a moderate beneficial effect on forest and woodlands management, although vegetation loss could increase healthy forest and woodland communities would be maintained.

Water Resources
Alternative C would allow surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams. There are 3,895 acres (7.6%) of BLM-administered forest lands and 243 acres (0.9%) of woodlands within 500 feet of water resources. Mitigating adverse effects on forest and woodland communities would likely not prevent vegetation removal. Therefore, Alternative C water management actions would have a moderate adverse effect on forest and woodlands resources.

Cave and Karst Resources
Surface-disturbing activities, including timber harvests, would be required to maintain a buffer (likely 100 feet) around the entrances to significant caves. There are no documented significant caves in BLM-administered woodland communities, and three in forest communities. Caves are generally located in rock formations and not in the forest or woodland communities. Therefore, management of cave and karst resources would have a negligible effect on forest and woodland communities.

Mineral Resources

Locatable Minerals
Alternative C would not recommend any additional minerals withdrawals. Under Alternative C, locatable minerals are available on 26,007 acres in the forest areas of the Big Horn Mountains. There are also woodlands included in the acres available for locatable minerals development. At present, locatable minerals operations affect 0.3 percent of BLM-administered forest and woodlands communities, 138 and 92 acres, respectively. The locatable minerals development trend is predicted to be similar throughout the planning period, and the effect on forest and woodland resources would be negligible adverse.

Leasable Minerals – Fluids
Based on the predicted fluid minerals activity under Alternative C, conventional activity (potential of moderate or above) could occur on 1,205 acres (2.7%) of BLM-administered forest lands and 1,936 acres (7.7%) of woodlands. CBNG activity could occur on 2,057 acres (4.7%) of BLM-administered forest lands and 5,512 acres (22%) of woodlands. Physical disturbance and loss of vegetation would be much less than the acreage where fluid minerals activity occurs, typically less than two percent for CBNG. The result would be a minor adverse effect on forest and woodland resources.

Fire and Fuels Management

Under Alternative C, full suppression throughout the planning area without consideration of individual forest and woodland species, density, slopes, and other characteristics would have a moderate adverse effect on forests and woodlands. Full suppression would prevent most fires from growing into large fires. Wildfire could not be used for resource benefit including to promote forest health.

Biological Resources

Vegetation – Grassland and Shrubland Communities
Allowing the planting of desirable non-native species would have a beneficial effect for forest and woodlands by hastening reclamation and vegetation recovery.

Vegetation – Riparian/Wetland Resources
Alternative C management would allow surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams. This management would allow for project-specific adjustments for slope, aspect, stream type, and other conditions. Wyoming Forestry BMPs and other mitigation measures would be incorporated to reduce adverse effects to water resources. Mitigating adverse effects on forest and woodland communities would likely focus on reclamation, not preventing vegetation removal. Therefore, Alternative C management actions would have a moderate adverse effect on forest and woodlands resources.

Invasive Species and Pest Management
Alternative C would allow aerial applications of insecticides. However, this has not been the preferred treatment on the forest and woodland landscapes with the types of insects encountered and the current insecticides used. Invasive species treatment emphasis would be only on species on the Wyoming list and prioritized based on risk of spread onto private lands. Because there would likely be little invasive species and pest treatment, the benefit to forest and woodland communities would be negligible.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Alternative C would allow surface-disturbing activities within 0.25 mile of fish-bearing waterbodies consistent with other resource values. This management would affect 3,432 acres (19%) of the forested areas. Forest management activities could be subject to some regulation for the protection of other resources, but protective buffers would not be likely to extend more than 500 feet from fish-bearing waters. The effect on the forest and woodland communities would be beneficial. Special status fish species are presently limited to the Tongue River drainage, limiting the benefit to forest and woodland communities to negligible.

Fish and Wildlife Resources – Wildlife
Alternative C would not apply many restrictions on surface-disturbing and disruptive activities to protect wildlife which could result in the loss of forest and woodland communities, a major adverse effect.

Special Status Species – Plants
Surface-disturbing activities would be prohibited within special status plant populations. Most special status plants are typically rare and have small populations; it is not likely they would adversely affect forest and woodland management. Limber pine is present on approximately 13,927 acres of the planning area. Single-species management specifically for limber pine could have a minor adverse effect on overall forest and woodland management.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative C includes restrictions for the protection of Greater Sage-Grouse and special status raptors but not protection of prairie dog colonies or herptile habitat. The foreseeable loss of forest and woodland communities from Alternative C management of special status wildlife species would be a major adverse effect.

Heritage and Visual Resources

Cultural Resources
Alternative C would allow surface disturbance in areas around historic sites, which would have a long-term adverse effect on forests and woodlands. Because most cultural sites are small, the overall effect on forest and woodland communities would be minor.

Paleontological Resources
No high-quality paleontological areas would be protected; such areas are typically small. Therefore, the effect on the forest products program would be negligible adverse.

Visual Resources
Alternative C would manage all parts of the planning area outside of WSAs as VRM Class III or IV, and would require visual simulations on a project-specific basis. This would have a major adverse effect on forest and woodland communities by providing for surface-disturbing activities within forests and woodland communities.

Land Resources

Forests Products
The ability to manage forests and woodlands to offer a diversity of products would be beneficial to forest and woodland health. However, managing to maximize economic returns without consideration of other resources and without any topographical design or harvest limits could be damaging to the resource. Regeneration would not have any protections and only minimum stocking requirements would be met. Overall the promotion of economic activity over resource protection would have a moderate adverse effect on the forest and woodland communities.

Lands and Realty
Under Alternative C, disposing of lands with resource value could have a long-term adverse effect on forest and woodlands communities if many forest and woodland areas are disposed of. Removing the option of acquiring the forest and woodlands adjacent to larger blocks also would have a long-term adverse effect by denying access opportunities and not acquiring lands that have natural values. These adverse effects would be major.

Renewable Energy
Under Alternative C, renewable-energy development must be consistent with all other resources values. All public lands in the planning area would be open to such development with limited restrictions to protect other resources. Renewable energy projects would be unlikely in forested areas due to the cost of removing the forest cover. Renewable energy projects would be more likely in woodland areas. The potential for loss of forest and woodland communities from renewable energy development would be moderate.

Rights-of-Way and Corridors
Alternative C provides few restrictions on the placement of ROWs which would result in the loss of forest and woodland vegetation. Based on the reasonably foreseeable ROW activity, the impact to forest and woodland communities would be minor.

Travel and Transportation Management
Under Alternative C, allowing motorized vehicle use on saturated soils and steep slopes would have a long-term adverse effect on forest and woodland areas and the watershed. This management would open all roads to motorized vehicle use and would allow access to management areas where regeneration could be damaged by OHV use. The adverse effect on forest and woodlands management would be major.

Recreation
Under Alternative C, 30,570 acres would be designated as SRMAs. There is little overlap between the forest and woodlands community and designated SRMAs in Alternative C. Allowing additional recreation facilities where they are supported by recreational use could affect forest and woodlands communities, depending on where future facilities are located. The overall effect of recreation management actions to the forest and woodlands resources is negligible.

Lands with Wilderness Characteristics
Alternative C does not propose any special management related to lands with wilderness characteristics, thus there would be no effect on the forests and woodlands resource.

Livestock Grazing Management
Under Alternative C, allowing livestock grazing in regeneration areas and after prescribed fire would affect the sustainability and health of forests and woodlands by limiting species and age-class diversity. This would have a major adverse effect on forest and woodlands management.

Special Designations

Areas of Critical Environmental Concern
There would be no ACECs within the planning area under Alternative C; therefore, there would be no anticipated impacts to forest and woodland communities.

Wilderness Study Areas
WSAs are managed to preserve natural conditions and processes including forest and woodland communities. Intensive management to promote forest health would be restricted, however less intrusive options such as prescribed fire are available. The overall result should be a negligible adverse effect.

4.4.1.6. Alternative D

This section describes management actions under Alternative D, the Proposed RMP, and the likely resulting effects on forest and woodland resources due to its implementation. The effects described above under *Impacts Common to All Alternatives* would be in addition to the effects described below for management actions under Alternative D.

Vegetation – Forests and Woodlands
Alternative D would manage vegetative treatments considering the health of forests and woodlands and multiple resource needs. Projects would be designed and managed to meet all resource needs, forest health would improve, and forests would be better able to resist disease, insects, and wildfire. The old growth, tree species, age-class diversity, stand density, and other characteristics that are important objectives for healthy forests would be met. This management would provide forest products derived from vegetative treatments in forests and woodlands. Alternative D management of forests and woodlands and forest productions would have a major beneficial effect on forest and woodland resources.

Physical Resources

Air Quality
Alternative D would require air quality modeling and mitigation for adverse effects on air quality for proposed industrial activities with the potential to approach or exceed emission standards.

Few large-acreage vegetative treatments, to which this requirement would apply, are predicted. Therefore, the effect on forest and woodland resources would be negligible adverse.

Soil
Alternative D would allow surface-disturbing activities on sensitive soils, where adequately mitigated. Forest and woodland communities commonly occur on sensitive soils. There are 30,819 acres (60%) of forest communities on BLM surface on slopes equal to or greater than 25 percent and 2,741 acres (54%) in areas with poor reclamation suitability. Woodland figures are similar; 9,213 acres (35%) of BLM-administered woodlands on slopes equal to or greater than 25 percent and 19,282 acres (74%) in areas with poor reclamation suitability. These management actions would not prevent vegetation removal, but would promote the stabilization and reclamation of soil resources. This would benefit the long-term recovery of forest and woodland resources. Because most surface-disturbing activities would still occur, the soils protections would have a moderate beneficial effect on forest and woodland communities.

Water Resources
Alternative D would allow surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams in accordance with defined criteria. There are 3,895 acres (7.6%) of BLM-administered forest lands and 243 acres (0.9%) of woodlands within 500 feet of water resources. The mitigation for adverse effects on forests and woodlands would focus on reclamation and not prevent vegetation removal. Therefore, Alternative D water management actions would likely adversely effect forest and woodland resources to a moderate degree.

Cave and Karst Resources
Surface-disturbing activities, including forest and woodland treatments, would be required to maintain a buffer around the entrances to significant caves. There are no documented significant caves in BLM-administered woodland communities, and three in forest communities. Caves are generally located in rock formations and not in the forest or woodland communities. Therefore, management of cave and karst resources would have a negligible effect on forest and woodland communities.

Mineral Resources

Locatable Minerals
Alternative D would recommend locatable minerals withdrawals on 26,007 acres in forested areas of the Big Horn Mountains, a major benefit to forest and woodland communities by preventing potential vegetation removing activities.

Leasable Minerals – Fluids
Based on the predicted fluid minerals activity under Alternative D, conventional activity (potential of moderate or above) could occur on 949 acres (2.2%) of BLM-administered forest lands and 1,576 acres (6.5%) of woodlands. CBNG activity could occur on 1,968 acres (4.6%) of BLM-administered forest lands and 5,350 acres (22%) of woodlands. Physical disturbance and loss of vegetation would be much less than the acreage where fluid minerals activity occurs, typically less than two percent for CBNG. The result would be a minor adverse effect on forest and woodland resources.

Fire and Fuels Management

Under Alternative D, using full suppression of wildland fire in the WUI and recreation areas could have beneficial and adverse effects on forests and woodlands, depending on the species of trees, the fire intensity, and the suppression tactics required. Alternative D would provide flexibility in choosing fire management tactics. This would have a moderate beneficial effect on forest and woodland resources.

Biological Resources

Vegetation – Grassland and Shrubland Communities
Allowing desirable non-native plant species for short-term reclamation activities prior to seeding native species would be beneficial to the forest and woodlands by promoting restoration of native communities creating biological diversity and healthy vegetative communities. Because reclamation activities are limited to disturbed areas, the benefit to forest and woodland communities would be minor.

Vegetation – Riparian/Wetland Resources
Alternative D management would allow surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams with appropriate mitigation. Mitigation would ensure that riparian resources are protected while allowing for surface-disturbing activities. Wyoming Forestry BMPs require a 200-foot buffer and other mitigation measures incorporated into project designs. The overall result would be a minor beneficial effect (less than 5% of forest and woodlands affected).

Invasive Species and Pest Management
Alternative D would allow aerial applications of insecticides, and BLM resource specialists would be able to determine plants and areas for treatment and prioritize areas for treatment. This would have a minor beneficial effect on the forest and woodlands resource.

Fish and Wildlife Resources – Fish and **Special Status Species – Fish**
Alternative D would allow surface-disturbing activities within 0.25 mile of fish-bearing waterbodies where resources could be adequately protected. This management would affect 3,432 acres (19%) of forested areas. However, because surface-disturbing activities would be subject to restrictions for the protection of fish and other resources the loss of forest and woodland communities should be reclaimable and therefore a moderate effect. Special status fish species are presently limited to the Tongue River drainage, limiting the benefit to forest and woodland communities to negligible.

Fish and Wildlife Resources – Wildlife
Under Alternative D, surface-disturbing activities would be required to maintain current amounts of crucial elk habitat and hiding cover. There are timing restrictions and a few prohibitions in Alternative D for the protection of wildlife species and their habitat. These management actions would ensure the sustainability of forest and woodland communities. Surface-disturbing activities would still occur within forest and woodland communities; therefore, the overall effect is moderate beneficial.

Special Status Species – Plants
Alternative D would require that populations of special status plants be conserved. Limber pine is present on approximately 13,927 acres of the planning area. Single-species management specifically for limber pine could have a minor adverse effect on overall forest and woodland management.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Most of the forest and woodland areas include amphibian and reptile habitat. Surface-disturbing activities would have to conserve all SSS. Raptor nest sites and other SSS habitat would also limit surface-disturbing activities. The result would be a major beneficial effect to the sustainability of forest and woodland communities.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources
Forest and woodland areas contain few cultural and paleontological resources where surface disturbance would be prohibited. Most sites are small which means the protections offered forest and woodland communities are also small. Alternative D management of cultural and paleontological resources would have a minor beneficial effect on forest and woodlands management.

Visual Resources
Under Alternative D, forest and woodlands areas in the Big Horn Mountains would be managed under VRM Class II, which could restrict surface-disturbing activities. VRM constraints would restrict the types, sizes, and shapes of surface-disturbing activities. This would have a moderate beneficial effect on forest and woodlands communities, by ensuring the sustainability of forest and woodland communities, while allowing for resource uses.

Land Resources

Forests Products
The ability to offer a variety of products for sale while designing and implementing treatments in an ecologically sound manner would be beneficial to forests and woodlands. Management for multiple resources would benefit forests and woodlands by conserving soils, waters, wildlife and other vegetative communities. Regeneration would be protected as needed and silvicultural treatments required to create and maintain forest and woodland health and sustainability consistent with other resource values, would be available.

Lands and Realty
Under Alternative D, acquiring and disposing of lands based on all resource values and acquiring lands adjacent to large blocks of BLM-administered lands would have a long-term beneficial effect on forest areas in the southern Big Horn Mountains and the scattered woodlands throughout the planning area. The scale of the benefits is minor due to the long and complex nature of land acquisitions.

Renewable Energy
Portions of the Big Horn Mountains and PRB area have a potential for renewable-energy (e.g., wind) development, however, renewable energy development is excluded from most of these areas in Alternative D. If renewable-energy development were to occur in forest or woodland communities it would include the removal of forest cover. Alternative D management of renewable energy would have a negligible adverse effect on forest and woodlands management.

Rights-of-Way and Corridors
Under Alternative D, allowing for the ROW transmission lines to be co-located, would reduce surface-disturbing activities, resulting in a minor benefit forests and woodlands.

Travel and Transportation Management
Under Alternative D, limiting motorized vehicle use to designated routes and managing roads consistent with forest and woodland resources would have a moderate beneficial effect on forest and woodlands management.

Recreation
Under Alternative D, 54,160 acres would be designated as SRMAs. SRMAs would be managed to balance recreational opportunities with protection of natural and cultural values, including vegetation resources. Most recreation use would be dispersed casual use which has little long-term effect to forest and woodland communities. Allowing additional recreation facilities where they are supported by recreational use could affect forest and woodlands communities, depending on where future facilities are located. The overall effect of recreation management actions to the forest and woodlands resources is negligible.

Lands with Wilderness Characteristics
Managing 6,864 acres for wilderness characteristics would protect forest and woodland communities. Treatments for forest health could be authorized, subject to mitigation for impacts to wilderness characteristics. Management actions for lands with wilderness characteristics would have a moderate beneficial effect on forest and woodlands resources by protecting forest and woodland communities.

Livestock Grazing Management
Alternative D would include actions and treatments to reduce potential damage to regeneration from livestock grazing to meet resource objectives, including grazing deferment after wildfires. This would have a minor beneficial effect on forest and woodlands management.

Special Designations

Areas of Critical Environmental Concern
Two ACECs would be designated with Alternative D. Surface-disturbing activities would be prohibited in ACECs preventing loss of forest and woodland vegetation. Treatments for forest and woodland health could be authorized. Due to the small acreage (2,849 acres), these management actions would be a minor benefit to the sustainability of forest and woodland communities.

Wilderness Study Areas
WSAs are managed to preserve natural conditions and processes including forest and woodland communities. Intensive management to promote forest health would be restricted, however less intrusive options such as prescribed fire are available. The overall result should be a negligible adverse effect.

4.4.1.7. Cumulative Impacts

The effects on forest and woodlands health from past actions are included in the description of the affected environment (Chapter 3). Forest and woodlands comprise 1.2 percent of the total acres in planning area, but they play an important role in supporting many resource values, including watersheds, wildlife, and recreation.

The intermingling of private, state, and USFS lands with BLM-administered lands throughout the planning area ensures that activities outside of BLM's control would continue. Surface-disturbing

activities within forest and woodland communities would continue on adjacent private, State of Wyoming, and USFS lands.

Silviculture treatments other resource management activities, and the construction of houses and other structures on private, State of Wyoming, and USFS lands would reduce forest and woodland acres and create more fragmentation and edge effects. Land fragmentation leads to declines in forest health and reduced biodiversity.

Decades of fire suppression and limited mechanical vegetation treatments have led to a decline in forest health, especially at the landscape scale. While some forests and woodlands appear to be thriving and healthy, on a landscape scale, forest health and the associated wildlife habitat are at risk to catastrophic loss. Because of human interference with the natural systems, these systems no longer function in the ways that have sustained them for millennia. The continued increases in the WUI or industrial development, continued fire suppression without adequate reintroduction of fire into these systems, and the inability to develop forest stands that are resilient to disturbance could lead to stand-replacing events.

Proposed management actions for forest and woodland management would affect less than one percent of the total watershed and forest and woodland acres on BLM-administered land in the planning area and the entire Big Horn ecosystem.

4.4.1.8. Conclusion

It is anticipated and logical that forest and woodland management would benefit the health of the ecosystem, benefit the health of forests and woodlands, and protect the watershed and the entire ecosystem. The primary difference between the alternatives is the number of acres anticipated for management actions and therefore the acres of forest and woodland communities affected. Alternative B, the most conservative alternative, would allow treatment on the fewest acres, and the Alternative C, the least conservative alternative, would allow for more management options on more acres of forest woodlands.

4.4.2. Vegetation – Grassland and Shrubland Communities

This section describes potential impacts to vegetation in the grassland and shrubland communities from management actions under other resource programs. Chapter 3 provides a general discussion and information about vegetative community types. FLPMA and the Wyoming Standards for Healthy Rangelands (Appendix P (p. 2501)) direct the BLM to manage vegetative resources toward maintenance or restoration of the physical function and biological health of vegetative ecosystems. Objectives are to maintain or improve the health and trends in plant communities that conserve soil and water, and provide forage, wildlife habitat, SSS habitat, recreation, scenic, ecological, and scientific benefits for consumptive and nonconsumptive uses.

Management actions that would contribute to the decline in abundance, distribution, or diversity would result in adverse impacts. Beneficial impacts include actions that protect, enhance, or restore these communities.

Direct impacts result from surface-disturbing and other activities that cause removal of and/or mechanical damage to plants, invertebrates, and biological soil crusts, both in terms of amount (overall biomass, density, cover) and in terms of diversity (species presence and richness). Direct

impacts may also be the deposition of invasive species individuals or propagules (e.g., seeds or spores), soil compaction and/or erosion.

Indirect impacts result from activities that alter the quality and health of grassland and shrubland communities and may include soil compaction and erosion, dust deposition from nearby disturbances, loss of biological crusts, changes in hydrology, decreases in forb production due to loss of pollinators, and encroachment of invasive plant species are considered indirect impacts.

For purposes of analysis, short-term impacts result from activities that contribute to the decline in abundance or distribution within five years after the activities; long-term impacts are those that require more than five years reclaim or restore.

4.4.2.1. Methods and Assumptions

This section describes the methods and assumptions used in the impact analysis for grasslands and shrublands communities.

Activities affect vegetative resources by altering, disturbing, or removing soil and vegetation. This impacts analysis and the conclusions are based on interdisciplinary team knowledge of resources in the planning area, review of existing literature, and information provided by other agencies. Existing literature and analyses include the Buffalo RMP (1985), the PRB EIS (BLM 2003c), USDA NRCS ESDs for Major Land Resource Area (MLRA) 58B Northern Rolling High Plains, and WGFD spatial mapping and analysis. Spatial analysis was performed using the ESRI ArcGIS Desktop 10 computer software. Effects are quantified where possible. In the absence of quantitative data, impacts are expressed qualitatively based on professional judgement and interdisciplinary team knowledge.

Assumptions

To assist and simplify analysis of alternative effects on the condition of grassland and shrubland communities and the responses to different stimuli depending on the type and the level of activity. This analysis is based on the following assumptions, although there could be fluctuations based on climatic, economics, and other conditions:

- Protection of soils from disturbances and soil health, including microbes and invertebrates, are the main factors for sustaining healthy native plant communities.
- Soil and plant ecosystem management will determine the overall health of watersheds in conjunction with climate and, topography.
- Plant and plant-community health would determine the health of habitat for wildlife, habitats for special status plant species and wildlife, and the quality and quantity of forage.
- The Standards for Healthy Rangelands & Guidelines for Livestock Grazing Management for Public Lands Administered by the BLM in the State of Wyoming (BLM 1997) (referred to hereinafter as the Wyoming Standards for Healthy Rangelands) are designed to determine the health of the grassland and shrubland plant communities.
- The factors with the greatest impact to vegetative and soil health include the introduction and expansion of invasive plants species, primarily cheatgrass, surface-disturbing activities, large grazing ungulates, and large-scale catastrophic events (wildfire and drought).
- Precipitation levels and soil characteristics, namely high-saline soils with minimal soil structure, are the dominant limiting factors affecting reclamation potential and should be a dominant factor in determining locations of developments.

- Based on the definition of surface-disturbing activity (see Glossary), energy development is identified as the primary source and generally increases the potential for accelerated erosion.
- Surface disturbances substantially increase the likelihood of the spread of invasive plant species.
- Grazing and browsing, whether by livestock or wildlife, is important for maintaining the health of grassland and shrubland communities. Improper grazing can decrease plant vigor and ground cover, lead to increased erosion, degrade soil nutrients and the ability of soil to retain water, and impact rangeland health.
- Updated plant inventories are crucial to the management of public lands.

Significance Criteria

4.4.2.2. Impacts Common to All Alternatives

The importance of having baseline vegetation information to determine management goals and objectives drives the need for a complete vegetative inventory for the entire planning area.

Vegetation – Grassland and Shrubland Communities
Managing vegetative communities in accordance with Wyoming Standards for Healthy Rangelands provides minimum standards for determining rangeland health and provides the guidelines to aid communities that do not meet the standards. Using an integrated management approach (e.g., mechanical, chemical, and biological treatments; prescribed fire; and grazing management techniques) would maintain, restore, and enhance the health and diversity of plant communities to achieve resource or multi-resource objectives, including but not limited to, improving species richness and plant structure diversity, promoting a variety of age classes, increasing plant densities, and reducing or removing undesirable plants. Most vegetative treatments would directly benefit grasslands and shrublands, and the benefits would be long term so long as appropriate follow-up management was applied. Maintaining sustainable forage levels for livestock and wildlife habitats and managing grasslands and shrublands to protect, preserve, or enhance plant communities are continuing practices that result in direct and indirect beneficial impacts to grassland and shrubland communities over the long term.

Managing the siting of facilities and related infrastructure (e.g., utility corridors and roads) and planning and developing travel routes, recreational facilities, mineral exploration and development sites, and ROW would reduce impacts. Reclamation has been difficult due to, among other things, lack of soil structure, limited precipitation, soil textures, inversion of spoil piles, unavailability of seed of preferred species, herbicide application to reclaimed sites, re-disturbance of reclaimed sites, drought, and improperly applied techniques. Vegetation, if not timely established, would facilitate soil erosion, introduction of invasive species, and changes in site biodiversity due to the introduction or departure of native species or the use of non-native species. Grasses and forbs would dominate reclaimed sites initially and forbs and shrubs would return over a longer period. Developing a contingency plan to address catastrophic natural events such as drought, wildfires, and large-scale pest infestations by incorporating strategies that best protect vegetative resources would result in direct, short-term, beneficial effects to vegetation during the event and to the long-term overall health of plant communities. Working with landowners to reestablish disturbed sites to healthy plant communities on split estate lands would directly benefit plant communities by reestablishing native vegetative species and densities, therefore improving the health of those plant communities and decreasing the opportunity for invasive species to establish and spread in the short and long term.

Physical Resources

Air Quality

Adherence to rules and regulations and enhancing cooperative processes are administrative processes that would have no direct effect on grassland and shrubland communities. Dust that covers vegetation reduces the photosynthesis process by blocking light and potentially water from reaching the plant cells. Travel on roads that are or will be surfaced with either gravel or scoria, if untreated, would force large amounts of dust into the air; this dust could settle on vegetation. Reducing dust emissions and overall air quality management throughout the planning area would have a major beneficial effect on grassland and shrubland resources.

Soil

Management actions include evaluating impacts to soil resources from proposed surface-disturbing activities using NRCS soil survey data and onsite investigation; and authorizing surface-disturbing activities that include plans for reclamation. These management actions help maintain and improve soil conditions and minimize soil erosion. Protecting soils and minimizing or mitigating impacts would result in direct, long-term, beneficial impacts to grasslands and shrublands.

Water Resources

Water management actions include managing surface-disturbing activities to prevent degradation of water quality for all waters; managing water resources to meet the Wyoming Standards for Healthy Rangelands to achieve PFC; meeting Wyoming water quality standards; and taking appropriate actions to improve the biological, chemical, and geomorphic conditions of streams. Protecting and enhancing water quality and water functions would result in indirect, long-term, beneficial impacts to grasslands and shrublands.

Cave and Karst Resources

Conducting cave inventories and significance determinations would not impact grasslands and shrublands.

Mineral Resources

Leasable Minerals – Coal , Locatable Minerals, Leasable Minerals – Fluids, and Salable Minerals

Management actions Common to All Alternatives include any lands not withdrawn [closed] to mineral entry, closed to leasing or closed to mineral material disposal are available for exploration or development for locatable, leasable, and salable minerals; areas open to oil and gas leasing would be open to geothermal development. Coal development will occur in areas identified as acceptable for further coal leasing consideration. All oil and gas mineral estate are open to leasing (Map 12) unless specifically identified as closed.

Impacts to grasslands and shrublands from the listed management actions would be direct and include long- and short-term impacts ranging from small and localized removal of vegetation to large-scale disturbances covering several hundred acres. The severity of effects would vary, depending on the amount of activity, the size of the disturbance, and the success of reclamation efforts (e.g., impacts from uranium mining would be negligible; impacts from CBNG and coal development would be minor). Surface disturbance and infrastructure from mineral development can fragment vegetative communities and alter plant community structure, diversity, and landscapes. Impacts can be short term until revegetation is successful. There would be long-term

adverse impacts associated with surface disturbance, site developments, infrastructure, roads and utility corridors, and unsuccessful or partially successful reclamation. Effects on grassland and shrubland resources from mineral resource development would be direct, long term, and adverse.

Leasable – coal mineral exploration and development could be permitted in one to five percent of all grassland and shrubland communities in the planning area; therefore management actions common to all alternatives for coal would have minor adverse effects on grassland and shrubland communities. Locatable mineral, leasable fluid mineral, and salable mineral exploration and development could each be permitted in greater than ten percent of all grassland and shrubland communities; therefore management actions common to all alternatives would all have major adverse effects on grassland and shrubland communities.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Most wildfires in the planning area are ignited by lightening in fine fuels (cured grasses), especially cheatgrass. Management actions include rehabilitating fire lines constructed by heavy equipment or on steep slopes to prevent or control erosion. Rehabilitation would include, but not be limited to, water barring and reseeding. Surface disturbance and soil compaction resulting from fire line construction, use of heavy equipment, and other fire-suppression activities would result in direct adverse effects by flattening or removing vegetation, potentially removing root systems of plants, particularly trees and shrubs, and increasing erosion, especially on steep slopes. The response to fire depends on the size, location, intensity, season, timing, and amount of post-fire precipitation, and preexisting plant community condition and the abundance of invasive plant species in the area. Large fires (100 acres or more) occur every five to seven years. Management actions also include cooperating and pursuing agreements with other agencies and landowners to perform landscape treatments to enhance fuels management and restore fire-adapted ecosystems. Prescribed fire, hazardous-fuels reduction, and WUI projects that include fire would result in direct beneficial impacts. These activities are planned on a project-specific basis, are generally applied in the cooler seasons (spring, fall, and winter), and often involve adjacent land owners. Protection from wildfire or enhancement of vegetation by applying planned ignitions would have a direct, beneficial effect on grassland and shrubland communities over the long term.

In shrubland communities, the impacts from fire usually are long term and depend on the scale and severity of the disturbance. Prescribed fires and wildland fires typically result in the complete mortality of Wyoming big sagebrush. Wyoming big sagebrush recovers very slowly from both types of burns at all sites, even those with relatively moist conditions. Full recovery to pre-burn sagebrush canopy cover would take well over 100 years (Montana Natural Heritage Program 2007).

Biological Resources

Vegetation – Forests and Woodlands
There are no management actions for forests and woodlands in the *Impacts Common to All Alternatives* section.

Vegetation – Riparian/Wetland Resources
Management actions include managing riparian and wetland systems to enhance ecosite vegetation conditions and improve water quality; preventing degradation, loss, or destruction of riparian and wetland habitat; and managing all riparian systems with sensitive species concerns

to a succession stage appropriate for that system, including vertical and horizontal vegetative structure and composition. As riparian/wetland systems occur in or near greater than ten percent of the grassland and shrubland communities in the planning area, implementation of actions to protect, enhance, and prevent degradation, loss, and destruction of these systems would result in indirect, long-term, major, beneficial effects on adjacent upland plant communities.

Invasive Species and Pest Management
Historically, chemical or biological treatments are the most common treatment methods; in the future, IPM practices will be actively applied to manage designated pests on public surface lands. IPM uses a variety of tools to accomplish control, including, but not limited to, herbicide application, mechanical treatments (mowing), biological treatments (insects, fungi), cultural treatments (prescribed burns), and any combination thereof. Use of certified weed seed-free vegetation products ensures invasive species would not be unintentionally introduced. Encouraging minimum disturbance accomplishes two purposes it reduces reclamation efforts and costs, and reduces the size of area for invasive species to establish.

Removing native vegetation and disturbing soils make sites vulnerable to invasive species; these sites must be managed to reduce opportunities for invasive species to establish and spread. Areas of primary concern are surface disturbance sites, including roads, trails, utility corridors, recreation sites, mineral development sites, gravel pits, mines, and surface water. Herbicide treatment can directly benefit native species by reducing competition for water and soil nutrients. Herbicide treatments, if broad spectrum, can result in direct, long-term, adverse effects on non-target forbs and shrubs. Invasive species management would result in direct beneficial impacts over the long term.

Requiring all disturbance areas be treated would ensure the responsible party, whether the BLM or another entity, manages for invasive species. Animal and Plant Health Inspection Service-Plant Pest Quarantine (APHIS) responds to many new introductions of plant pests to eradicate, suppress, or contain them through various programs in cooperation with state departments of agriculture and other government agencies. These can be emergency or longer-term domestic programs that target specific pests. APHIS is the lead agency for monitoring pest species and coordinating with the county weed and pest control districts and the BLM to administer control treatments on public lands.

Controlling invasive species by chemical and mechanical methods could have a direct adverse effect on other plant species. As an example, if an herbicide is nonselective for all broadleaf plants, the chemical could adversely affect forb species. If mechanical methods are used, any plant in the direct path of the application would be affected. Biological treatments are generally species specific and effects would be adverse, direct, and long-term to the pest species; removing pest species would have an indirect beneficial effect on other plants by improving the health of the vegetative community. Control measures for leafy spurge include grazing, biological agents, and herbicide. Biological agents have spread to concentrations of leafy spurge not accessible by motorized vehicle and difficult to access by foot. Management of this species would have a direct, beneficial effect over the long term.

Control treatments have not been pursued for cheatgrass because this species is currently not listed on the Wyoming Weed and Pest Control Act Designated List and a lack of funding. Cheatgrass results in direct, long-term, adverse impacts to grasslands and shrublands.

Fish and Wildlife Resources – Fish and **Special Status Species – Fish**
Management actions common to all alternatives for fish and SSS fish are either administrative or

do not overlap grasslands and shrublands and would have no effect on grassland and shrubland communities.

Fish and Wildlife Resources – Wildlife
Maintaining, enhancing, and protecting important wildlife habitats to ensure suitable habitat components and minimize disturbance in these areas would indirectly promote the long-term health of vegetative communities. Wildlife browsing or grazing has less effect on grassland and shrubland communities, because wildlife frequently move and tend to not re-graze forage unless they are confined. Wildlife trails, bedding areas, and other congregation areas result in direct, long-term, adverse effects on grasslands and shrublands, but the scope of these effects would be negligible.

Upland game birds, raptors, and migratory birds can depend on grassland and shrubland communities for cover (upland game birds), food sources, and protection. Actions that protect or enhance habitats for these species would result in indirect, long-term, major beneficial effects.

Special Status Species – Plants and Special Status Species – Wildlife (including Greater Sage-Grouse)
SSS are given priority consideration in planning and implementing on-the-ground activities and projects. Some species require early seral ecological conditions, such as black-tailed prairie dogs and mountain plover. Actions that maintain or enhance these habitats result in direct adverse effects on the long-term health of vegetation by promoting water and wind erosion of soil. Management action for special status plant species common to all alternatives promotes health of the habitats which would also promote improving health of the grassland and shrubland communities in which they could occur. Special status plant habitats occur in one to five percent of grassland and shrubland communities in the planning area; therefore, the beneficial effects would be minor. Management actions common to all alternatives for special status wildlife species encourage managing vegetation composition, diversity and structure in Greater Sage-Grouse habitats; thereby improving the health of grassland and shrubland communities. Habitats for special status wildlife species are within greater than ten percent of all grassland and shrubland communities in the planning area; therefore, the beneficial effects would be major.

Heritage and Visual Resources

Cultural Resources
Management actions under all alternatives would generally focus on avoiding, stabilizing, and protecting cultural sites. These actions would decrease surface-disturbing activities on or near such sites. This could result in the adjustment of a project location or design. Areas important to Native American tribes would be managed to minimize disturbances; this would benefit shrublands and grasslands. Data recovery excavations would include surface disturbance and vegetation removal, but these areas are generally small (less than one acre), and data recovery excavations would have short-term, direct, adverse effects on grassland and shrubland resources. Overall, management actions that avoid or protect cultural resources by prohibiting or limiting soil disturbance would have a negligible beneficial effect on grasslands and shrublands.

Paleontological Resources
No effects are anticipated from paleontological management actions.

Visual Resources
Management of VRM Class I and II areas could prohibit or limit some surface-disturbing

activities. Management of VRM Class III and IV areas would include minor limitations on surface disturbance; this would have an indirect minor beneficial effect on grasslands and shrublands, depending on the locations, types, and durations of approved projects.

Land Resources

Forest Products

Management actions common to all alternatives for forest products do not affect grassland and shrubland communities.

Lands and Realty

Land acquisitions, pursuit of easements, and tenure adjustments would improve management of the public lands overall. Effects on grasslands and shrublands would vary, depending on the type and extent of the action. Actions that would remove public land management from small scattered parcels and promote larger seamless tracts of public land would benefit management of grasslands and shrublands.

Vegetation on land proposed for exchange or acquisition could be indirectly affected by such action due to a change in ownership and management. Management actions that promote vegetative resources, such as habitat enhancement, would benefit grasslands and shrublands and actions that promote surface disturbance and vegetation removal would have an adverse effect; these effects would be long term.

Overall, lands and realty management actions could occur in one to five percent of grassland and shrubland communities; therefore, management actions Common to All Alternatives would have minor adverse effects on grasslands and shrublands.

Renewable Energy

Cooperating with stakeholders to coordinate renewable-energy opportunities would have no effect on grasslands and shrublands as this action is administrative.

Rights-of-Way and Corridors

Actions to minimize surface disturbance and adverse effects on other resources, and to locate new ROWs adjacent to or in existing disturbed areas would lessen adverse effects from ROWs. New ROWs and corridors could be located in greater than ten percent of all grassland and shrubland communities in the planning area; therefore, management actions common to all alternatives for ROWs and corridors would have direct, long-term, major, adverse effects on grasslands and shrublands.

Travel and Transportation Management

Roads and trails have a direct adverse effect on vegetation, but are necessary to conduct management and development on public lands. Management actions include provisions to inventory and evaluate upgrade, maintain, or close and reclaim, reduce surface water runoff and erosion and restrict motorized vehicles to designated roads and trails and temporary and permanent road and trail closures. All these management actions would reduce erosion, protect and stabilize soils and vegetation, and reduce opportunities for invasive species and weeds to establish. Overall, transportation and access would be permitted in one to five percent of all grassland and shrubland communities in the planning area; therefore the management actions common to all alternatives would have minor adverse effects on them.

Recreation
Development of recreational opportunities, trails, maintenance of established sites, facility construction, and designating trails to caves all would have the potential to directly affect native grassland and shrubland communities. Trails, roads, campgrounds, and facilities remove vegetation for the life of the development. Adjacent vegetation would be indirectly affected by trampling, dust, and erosion from vegetatively denuded sites. Erosion and decreased vegetative cover would occur from soil compaction and the channelization of surface water runoff in ruts and road ditches. Recreation management actions that involve disturbance of the soil and vegetation removal would have minor adverse effects on grasslands and shrublands by promoting soil erosion, removing plant, and providing an opportunity for invasive species to establish.

Lands with Wilderness Characteristics
Management actions common to all alternatives for wilderness characteristics include evaluation of lands only and would have no effect on grassland and shrubland communities.

Livestock Grazing Management
Livestock grazing strategies, including implementation of the Wyoming Standards for Healthy Rangelands, Allotment Management Plan (AMP) and grazing agreement implementation, proper livestock management, and installation of range improvement projects, are designed to assist in achieving appropriate levels of forage consumption by livestock and wildlife. AMPs and grazing agreements include defined rotations, deferments, periods of rest from grazing, manipulation of season of use, and grazing intensity. Over time, these actions can alter the amounts and types of vegetation present on the landscape; therefore, they can be used as tools to directly and indirectly manipulate and improve plant community composition, plant structure, plant cover, and vigor of vegetation. Construction and location of range improvements helps disperse livestock and can be used as management tools. Strategies will be developed and implemented to minimize adverse effects on vegetation during periods of drought. Prescribed-burn areas will be managed before the treatment to ensure needed fuels are available. Grazing (livestock and wildlife) has adverse and beneficial effects on grasslands and shrublands, depending on grazing intensity (utilization), timing (allowances for re-growth during active growing season), season of grazing, rangeland health, and precipitation.

Historic and current trailing of livestock on the established stock driveways can contribute to disturbed soil, trampled vegetation, deposited manure, loss of plant cover, and localized areas dominated by annuals and invasive and other weed species. The major stock driveways (The Slip, Trabing Road, and Hazelton Road) are designated county roads; therefore, effects from trailing constitute only a small portion of adverse effects. Trailing is also short term, occurring only two to three weeks in spring and fall. Trailing livestock would have a negligible adverse effect on vegetation.

Livestock grazing allotments contain greater than ten percent of all grassland and shrubland communities in the planning area; therefore, proper livestock grazing management would have a major beneficial effects on them.

Special Designations

Areas of Critical Environmental Concern, Scenic or Back Country Byways, Wild and Scenic Rivers, and Wilderness Study Areas
Management actions associated with special designations would be to maintain or enhance their natural characteristics and emphasize primitive, nonmotorized activities to maintain current

natural values. Special designations could increase popularity with recreationists and increase use in these areas, resulting in increased potential for vegetation disturbance and removal and invasive plant and weed species establishment. Overall, management actions that prohibit disturbance of the soil or removal of native vegetation would have a negligible beneficial effect on grasslands and shrublands plant communities.

Socioeconomic Resources

Social and Economic Conditions
Multiple entities depend on public lands for their livelihoods or a portion of their livelihoods. Public land natural resources also can add to the quality of life, and benefits from these can be directly and indirectly derived from activities such as hunting, outfitting, fishing, and guided hunts and tours. Managing in a way that considers these sources of employment and income can be beneficial and adverse to vegetation and would be similar to those described for recreation.

Health and Safety
Management actions designed to prevent accidental spills of hazardous materials would benefit grassland and shrubland communities by protecting riparian and upland areas. Because hazardous materials (e.g., oil, oil and gas by-products, pesticides, and cleaning solvents) are being produced and transported in the planning area, there is a threat of accidents or spills. There would be no adverse effects on vegetation unless there was an accident or spill. If there was a spill, mitigation and cleanup would rarely succeed in recovering a riparian or upland area to its original condition over the short term; therefore, there would long-term adverse effects. Reclamation of abandoned mines would have a direct beneficial effect by reducing erosion, protecting and stabilizing soils and vegetation, and reducing opportunities for invasive species and weeds to establish on grassland and shrubland communities at the affected sites over the long term.

The following sections describe impacts by alternative. These impacts would be in addition to the impacts common to all alternatives described above.

4.4.2.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended and maintained. This section describes potential impacts to grassland and shrubland communities from management of other resources under Alternative A.

Vegetation – Grassland and Shrubland Communities
Alternative A would continue management in accordance with the 1985 RMP as amended and maintained, which did not include specific decisions for management of grasslands and shrublands. With no specific management decisions, reclamation would be guided by BLM policy, which allows use of non-native species. Use of non-native species could directly benefit grasslands and shrublands by quickly establishing vegetation on sites reducing the opportunity for erosion and invasive plant establishment. This could indirectly benefit vegetative communities by reducing erosion potential. Achieving successful reclamation would directly benefit the surrounding plant community and could help discourage invasive species.

Physical Resources

Air Quality
The types of effects to grassland and shrubland communities from Alternative A would be

the same beneficial effects as described in the *Impacts Common to All Alternatives* section for air quality (vegetation conservation). In Alternative A, though, these impacts would be analyzed on a project-specific basis. Without monitoring or oversight on a programmatic level, lack of consistency would cause the beneficial effects to likely only be negligible. Air quality resource management actions under Alternative A would have negligible beneficial effects on grassland and shrubland communities.

Soil

Soils management under Alternative A would prohibit surface-disturbing activities from March 1 through June 15, and on slopes equal to or greater than 25 percent unless the authorized officer waives the prohibition. These protective measures have a beneficial effect by not allowing soil disturbance and vegetation removal. However, waivers allow for inconsistent application of management and could allow activities when and where soils would be highly susceptible to erosion. Restricting surface-disturbing activities on soils with poor reclamation suitability on a project-specific basis does protect the soil resource in these specific areas. Soils management under Alternative A would allow for surface-disturbing activities on 22 percent of BLM-administered public land, on slopes equal to or greater than 25 percent, 58 percent of BLM-administered public land with poor reclamation suitability. Current management decisions do not address limitations and restrictions on badlands, rock outcrops, and slopes susceptible to mass movement and all current decisions can be waived. Current management decisions have soil protective measures that have a beneficial effect on the vegetation but do not adequately address and protect all soils capable of eroding and this lack of decisions has a direct adverse long-term effect. Protective measures for soils would conserve vegetation in greater than ten percent of all grassland and shrubland communities in the planning area. Without oversight on a programmatic level or allowing waivers without specified criteria, it is likely that the beneficial effects would be reduced by half, making the major beneficial effects only moderate.

Water Resources

Alternative A prohibits surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams unless the authorized officer waives the prohibition. This management would affect approximately 19,861 acres of BLM-administered public land. This allows inconsistent management application and could allow activities at distances that could adversely affect water quality and quantity; remove or crush vegetation, thus reducing its ability to hold the soils and filter sediment; reduce or degrade habitat for numerous plant and animal species that inhabit these water systems; and reduce or degrade potential habitat for SSS. The prohibition decision is beneficial but the ability to implement waivers without identified criteria reduces that to minor. Impacts could have direct and indirect effects that could be short term (days to months) or long term (months to years).

Cave and Karst Resources

There are no current management actions for this resource.

Mineral Resources

Locatable Minerals

Under Alternative A, withdrawing the Amsden Creek, Middle Fork Canyon, and Kerns Game Ranges (4,583 acres) from mineral location, and restricting locatable minerals activities in the Fortification Creek, Gardner Mountain, and North Fork WSAs (approximately 28,931 acres) would have a direct, long-term, beneficial effect on vegetative communities at these sites because surface-disturbing activities would not be allowed or would be restricted. Under the

locatable minerals program for the planning area, it is estimated that BLM actions would disturb approximately 554 acres over the next 20 years (less than 1% of available acres). This would have a negligible adverse effect on grassland and shrubland communities.

Leasable Minerals – Coal

The effects of coal development would be long term for the life of the project and would require successful reclamation to ensure the vegetative component was reestablished to predisturbance vegetative states and to reduce the potential introduction and establishment of invasive plant species. Although significant acreage is open to study and exploration, only a portion would be developed. Under current management, approximately 195,700 acres (4%) would be disturbed; 120,700 would be reclaimed, 45,500 acres are actively mined, leaving approximately 75,000 acres disturbed over the long term (Appendix G (p. 1937)).

Leasable Minerals – Fluids

Alternative A would continue to lease and allow development of federal oil and gas and would close the WSAs (28,931 acres) to leasing. Site development, roads, and utility corridors associated with oil and gas activities would be surface-disturbing activities that would require successful reclamation. Under the leasable CBNG program for the planning area, development could be permitted in greater than ten percent of grassland and shrubland communities; therefore management actions for leasable fluid minerals under Alternative A would have a major adverse effect on them. Overall, it is estimated that BLM CBNG actions would disturb approximately 2,258 acres over the next 20 years (less than 1% of the total available acres). Reclamation will occur on 903 acres. Under the leasable oil and gas conventional program for the planning area, overall it is estimated that BLM actions would disturb approximately 8,317 acres over the next 20 years. Reclamation will occur on 5,575 acres (Appendix G (p. 1937)). This management action would promote surface-disturbing activities that would have a direct adverse effect on those grassland and shrubland plant communities. There is no anticipated disturbance from geothermal-related activities.

Salable Minerals

Salable minerals activities would be prohibited in the Fortification Creek, Gardner Mountain, and North Fork WSAs (approximately 28,931 acres). Prohibiting soil-disturbing mineral activity would have a direct beneficial effect for the long term on those protected plant communities. The estimated areas of surface disturbance from salable minerals activities over the next 20 years would be small (530 acres disturbed) (Appendix G (p. 1937)). Long-term disturbance of vegetative communities would have a direct adverse effect on grassland and shrubland communities. Salable minerals, under Alternative A could be permitted in greater than ten percent of all grassland and shrubland communities in the planning area; therefore, the effects would be minor.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)

Both wildland fire and prescribed fire have adverse and beneficial effects on grassland and shrubland communities. In the short term, wildland fires and prescribed-fire projects would reduce canopy and ground cover through the direct loss of vegetation, litter, and duff, thereby exposing soils to potential wind and water erosion and increasing the potential for runoff. Fires also can promote the spread of invasive species by leaving soil bare and transporting invasive plants and seeds by human activity, on tools, and on vehicles. In the long term, because of the role fire historically played in these communities, fire can increase vegetative species and seral-stage

diversity across the landscape, rejuvenate decadent plants, and improve the overall health of these communities (Thonicke et al. 2001).

Current management uses prescribed fire to achieve desired vegetative and wildlife habitat management objectives. Prescribed fire is an important vegetation management tool and fires are planned on a landscape basis, usually with multiple land owners involved. Management objectives using prescribed fire can include increasing the age and species diversity of plant communities, increasing plant vigor, and enhancing nutrient cycling. Prescribed fires reduce fuels loading and minimize the risk of catastrophic wildland fires; therefore, short-term effects associated with prescribed fire generate long-term benefits by reducing the risk of highly damaging catastrophic wildland fires. Prescribed fire can adversely affect non-targeted species in the same vegetative community. Prescribed fires usually burn at lower temperatures, enabling more rapid recovery of the surviving plant species. The change in ground-surface temperature could damage vegetation root structure, but usually would not destroy the root crown of perennial grasses, thereby enabling them to flourish after fires have removed the undesirable or competing vegetation. Prescribed fires can be controlled to times of year when fire would be less likely to damage soils through excessive heating. Prescribed fires generally are not possible in areas with oil and gas development and in WUI areas.

Biological Resources

Vegetation – Forests and Woodlands

Designing vegetative treatments, including sagebrush spraying or burning, to meet overall resource management objectives to protect or improve biodiversity and water quality would affect vegetation. Plant recipients of the treatments would be directly and adversely affected, but overall, vegetative communities would indirectly benefit through improved health over the long term (10 or more years, depending on the treatment). Forest and woodland management would impact less than one percent of grassland and shrubland communities in the planning area; therefore, management action for forests and woodlands would have negligible beneficial effects on grassland and shrubland communities.

Vegetation – Riparian/Wetlands Communities

Current management prohibits surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams. This prohibition of surface disturbance and associated vegetation removal would have direct, beneficial effects over the long term. The authorized officer may waive the prohibition which could allow surface-disturbing activities. Removing vegetation by exceptions to the prohibition would have a direct adverse effect and would increase the potential for soil erosion. This would contribute to movement of sediments into the water systems, which would affect water quality. Riparian/wetland resource health indirectly affects grassland and shrubland communities by proximity. Riparian/wetland systems occur in or near greater than ten percent of all grassland and shrubland communities in the planning area; therefore, the prohibitions would have major beneficial effects on grassland and shrubland communities. Without oversight on a programmatic level or allowing waivers without specified criteria, though, it is likely that the beneficial effects would be reduced by half, making the major beneficial effects only moderate.

Invasive Species and Pest Management

The goal for managing invasive and pest species is to maintain weed seed-free, native communities to sustain their natural values. Under Alternative A, areas with established invasive plant patches would be treated to control unwanted species, which would protect native plant

communities from initial invasion or expansion of invasive species. Control of invasive and pest species on public lands (approximately 8,000 acres annually) in cooperation with county weed and pest control districts would have direct and indirect, short- and long-term, and beneficial and adverse effects on grasslands and shrublands. Most of the control effort would include the use of chemical, mechanical, and biological methods. Long-term disturbances over the next 20 years are estimated to affect approximately 1,000 acres from BLM actions, with 7,000 acres of reclamation.

Pest (e.g., grasshoppers) control would primarily be by chemical (insecticide) application; effects on grasslands and shrublands would be indirect, beneficial and short term.

Fish and Wildlife Resources – Fish
Alternative A would apply constraints on surface-disturbing and disruptive activities on a project-specific basis. These constraints should affect greater than ten percent of all grassland and shrubland communities over the long term; thereby having major beneficial effects. Without oversight on a programmatic level or allowing waivers without specified criteria, though, it is likely that the beneficial effects would be reduced by half, making the major beneficial effects only moderate by not providing protection of vegetation, soils, and soil microbial activity from surface disturbing activities.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Current management actions include surface disturbance and occupancy prohibitions or restrictions in the Ed O. Taylor, Kerns, Bud Love, and Amsden Creek Game Ranges in crucial elk winter range between November 15 and April 30; in elk calving areas; within 750 feet of sharp-tailed grouse leks any time, within an additional 0.64-mile radius of sharp-tailed grouse leks from April 1 through May 30; within a 0.25-mile radius of the center of Greater Sage-Grouse leks, and within an additional 1.75-mile radius from March 1 to June 15 unless the authorized officer waives the prohibition. Prohibitions of surface disturbance is a direct, major benefit by denying plant removal and soil disturbance. Without oversight on a programmatic level or allowing waivers without specified criteria, though, it is likely that the beneficial effects would be reduced by half, making the major beneficial effects only moderate.

Special Status Species – Plants
Limiting surface disturbing activities in habitats with known populations of special status plants species would have a direct, beneficial effect on grasslands and shrublands over the long term. Special status plants occur in less than one percent of all grassland and shrubland communities in the planning area; therefore, management actions for special status plant species, under Alternative A, would have negligible beneficial effects on them.

Special Status Species – Fish
Restricting surface-disturbing and disruptive activities near any water that contains special status fish species would affect approximately 818 acres (less than one percent of the grassland and shrubland communities in the planning area), which would have a direct, negligible, beneficial impact to grasslands and shrublands over the long term.

Heritage and Visual Resources

Cultural Resources
Current management decisions protect cultural sites near the Bozeman Trail. Prohibiting surface-disturbing activities for cultural resources, under Alternative A, would conserve

vegetation in one to five percent of the grassland and shrubland communities in the planning area. This would have direct minor beneficial effects on grassland and shrubland communities over the long term.

Paleontological Resources
No effects are anticipated from paleontological management actions.

Visual Resources
Management of VRM Class I and II areas could prohibit or limit some surface-disturbing activities. Management of VRM Class III and IV areas would include minor limitations on surface disturbance within one to five percent of the grassland and shrubland communities in the planning area. This would have an indirect minor beneficial effect on grasslands and shrublands, depending on the locations, types, and durations of approved projects.

Land Resources

Forest Products
No effects are anticipated from forest products management actions.

Lands and Realty
The types of effects from Alternative A would be the same minor adverse effects as described in the *Impacts Common to All Alternatives* section for lands and realty (vegetation loss and degradation).

Renewable Energy
Alternative A does not establish guidelines for the development of renewable-energy resources. Under the renewable-energy program for the planning area, overall it is estimated that approximately 20,000 acres would be disturbed over the next 20 years. This would have a direct, moderate, adverse effect as renewable energy actions could be permitted in, and cause removal of vegetation in five to ten percent of the grassland and shrubland communities in the planning area.

Rights-of-Way and Corridors
Current management actions under Alternative A include locating transmission lines and transportation facilities within identified corridor areas to the extent feasible. This action concentrates the surface disturbance to designated areas, thereby reducing the amount of disturbed acres overall. Also, surface disturbance and occupancy will not be allowed on slopes of 25 percent or more. ROWs and corridors could be permitted in five to ten percent of the grassland and shrubland communities in the planning area. ROW disturbances are estimated to affect approximately 38,762 acres (Appendix G (p. 1937)). This would have a direct, moderate, and adverse effect over the long term.

Travel and Transportation Management
Motorized travel removes plants and decreases plant production and species composition; this contributes to accelerated soil erosion. Limiting motorized vehicle use to existing roads and vehicle routes would concentrate adverse effects. Current decisions under Alternative A include closing areas with saturated soils and with slopes equal to or greater than 25 percent (approximately 170,590 acres) to motorized vehicles; this would have a direct beneficial effect on vegetation, soils, and water quality over the long term. In addition, closing certain areas to vehicular travel (approximately 3,650 acres), limiting vehicular travel to designated roads and trails (737,166 acres) in other areas, and seasonally closing areas from November 15 to April 30 (approximately 37,646 acres) would directly benefit grassland and shrubland communities over

the long term by protecting vegetation and soils overall and at times when erosion could occur. For a list of areas closed to motorized travel, see the *Travel and Transportation Management* section of this chapter.

Recreation
Under Alternative A, recreation-site development is anticipated to disturb approximately five acres, with successful reclamation on all five acres. Unless waived by the authorized officer, Alternative A prohibits surface disturbance or occupancy in the Red Wall/Hole-in-the-Wall area, in Middle Fork Canyon and with 0.5 mile of the canyon rims, and in the Dry Creek Petrified Tree EEA. Prohibiting surface disturbance has a direct beneficial effect on the vegetation. Waivers allowing surface-disturbing activities would likely be limited in number but would have a direct adverse effect on plant communities and would be in effect for the duration of the project or permit over the long term (usually 10 or more years) Recreational site development will remove the majority of the vegetation due to impacts from motorized vehicles and human acclivity, these sites would have a direct, negligible, adverse effects for the long term.

Lands with Wilderness Characteristics
Presently no areas outside the three WSAs are managed for the preservation of their wilderness characteristics.

Livestock Grazing Management
Under Alternative A, livestock grazing is not authorized on approximately 4,000 acres of public land in the canyons and slopes of the southern Big Horn Mountains because of the rough terrain and steep slopes. Livestock grazing is allowed on all public lands in the resource area except on approximately 6,000 acres (1%) where it has been determined to be incompatible with other resource uses or values. Most of these areas are have fragile soil surfaces, shallow soils, and steep slopes, and produce little vegetation.

Native grasslands evolved with grazers, and many grass species respond positively to leaf removal by propagating, which increases vegetative cover (Anderson 2006) Current decisions include allocating temporary increases in available forage first to wildlife to meet the population objectives of the WGFD. Any of the increased forage not needed for wildlife would be available for livestock use. Any permanent increases in the amount of forage produced would be considered for watershed protection and wildlife habitat before authorizing additional livestock use. Management actions that protect watersheds and enhance habitats would have a direct beneficial effect on grasslands and shrublands communities.

Under Alternative A, a minimum of two years rest from livestock grazing would be provided following prescribed fire and other vegetative treatments. Additional rest might be allowed where necessary to achieve resource goals and objectives. Impacts from vegetative treatments, including prescribed fire, would include deferring planned areas from grazing to leave grasses (fine fuels) to help carry the ignition. Prescribed fire and other treatments would cause 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 vegetation, increase vegetative diversity, modify vegetation types (e.g., a change from shrubs to herbaceous vegetation), and modify age class and structure. Treatments would have a beneficial effect on grasslands and shrublands.

Current management allows development of range improvements. These result in localized short-term disturbances to grassland and shrubland communities, including the flattening or loss of vegetative cover due to construction activities. Placement of water, salt, or other supplements results in trampling of vegetation and small bare areas of livestock and wildlife concentration.

Where salt and mineral supplements are not in containers, changes in soil chemistry could delay long-term recovery of vegetation. Long-term loss of vegetation would occur near pits and reservoirs and along fence lines where there are roads or animal trails. However, improved management due to additional water sources, fences, and other improvements potentially improve plant composition and vigor. Estimates for surface disturbance over the planning area in the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately 4 acres, with successful reclamation on 2 acres and 2 acres of long-term disturbance. Pipelines are estimated to disturb 40 acres, with successful reclamation on 35 acres and 5 acres of long-term disturbances. Fences would disturb approximately 70 acres (80 miles), with successful reclamation on approximately 50 acres (57 miles) and approximately 20 acres disturbed over the long term. Wells are estimated to disturb 1 acre.

Special Designations

Areas of Critical Environmental Concern, Scenic or Back Country By-ways, and Wild and Scenic Rivers
Alternative A does not include special designations. Areas have been identified and are being managed under interim management criteria that protects the resource. Current management may not have adequate management actions to protect the vegetative resources which has a direct, negligible adverse effect on grasslands and shrublands.

Wilderness Study Areas
If Congress decides not to designate the WSAs as wilderness, Alternative A would allow leasing for minerals. The WSAs currently encompass less than one percent of the grassland and shrubland communities in the planning area. This would have a direct adverse effect on grassland and shrubland communities due to the surface-disturbing activities of development and needed infrastructure. Adverse effects would continue for the life of the permit or lease. At present, there are no decisions addressing motorized travel in these areas. Limiting motorized travel would benefit vegetation unless it restricts the application of herbicides to control invasive species in the plant communities.

Socioeconomic Resources

Social and Economic Conditions
No effects are anticipated from social and economic management actions.

Health and Safety
No effects are anticipated from health and safety management actions.

4.4.2.4. Alternative B

This section describes management actions under Alternative B, which emphasizes resource conservation, and the likely resulting effects on grassland and shrubland resources from those management actions.

Vegetation – Grassland and Shrubland Communities
The management action includes authorizing only native plant species for all reclamation activities, eliminating the concern of cross pollination of non-native species with native species and competition for water and soil nutrients, overall, creating a more naturally healthy plant

community. However, native plants can be more difficult to establish than some non-native species that have specific plant characteristics that assist in achieving reclamation objectives.

Physical Resources

Air Quality

Under Alternative B, air quality modeling would be performed on a project-specific basis. In addition, projects expected to approach or exceed emissions standards would be evaluated for potential mitigation strategies. This would protect the health of all of the plant communities and would have a major beneficial effect on grassland and shrubland communities.

Soil

Soils management actions under Alternative B would include prohibiting surface-disturbing activities on slopes equal to or greater than 25 percent (approximately 170,590 acres or 22% of public land acres), on soils with a severe erosion hazard (approximately 215,496 public land acres or 28%), and on soils with poor reclamation potential (approximately 455,090 public land acres or 58%). Management actions would also prohibit certain proposed activities on badlands, rock outcrops, or slopes susceptible to mass movement, which would affect approximately 218,928 public land acres or 28 percent. All these actions would serve to protect the soil resource which would have direct beneficial effects on grassland and shrubland communities over the long term. In general, protecting soils directly correlates to protecting vegetation by reducing erosion potential and providing a healthy medium in which plants can grow. This would occur in greater than ten percent of the grassland and shrubland communities in the planning area; therefore the management actions for soil under Alternative B would have major beneficial effects on grassland and shrubland communities.

Water Resources

Watershed management actions to prohibit surface disturbance within 500 feet of any natural or man-made water feature (approximately 19,861 public land acres or 2.5%) would have a direct beneficial effect on vegetation and water quality in these sensitive sites. This action would prohibit removal of vegetation and disturbance of soil which would reduce potential for soil runoff into nearby water systems that could contribute to the impairment of water quality. Other management actions include prohibiting activities that would result in surface discharge of water and prohibiting construction of on-channel reservoirs that could adversely affect natural flow regimes. These actions would directly benefit grassland and shrubland communities by preventing the natural transition of plant species from dry land species to more wetland-tolerant species in grasslands and shrublands, and minimizing the opportunity for invasive plant species to establish on these sites. Managing riparian and upland areas to restore perennial flow or standing water in historically perennial systems would return these systems to their natural state and would provide habitat for numerous flora and fauna species. The removal and reclamation of unneeded CBNG reservoirs would directly benefit vegetative communities over the long term by returning these systems to their natural state and reducing the opportunity for invasion and spread of undesirable plant species. All of these actions would have a minor beneficial effect on grasslands and shrublands plant communities.

Cave and Karst Resources

Caves and karsts are generally present in rock formations. Alternative B management actions to prohibit surface-disturbing activities in cave and karst areas and implementation of cave-specific management plans would directly benefit grassland and shrubland communities by limiting soil and vegetation disturbance from minerals development or other human activities.

Approximately 101,455 public land acres or 13 percent would be protected from disturbance. Trails leading to popular cave and karst areas could trample and remove vegetation, which would have a direct adverse effect on those plants over the long term. Management actions to protect cave and karst resources would have a major beneficial effect on grasslands and shrublands.

Mineral Resources

Locatable Minerals

In addition to areas currently withdrawn or restricted from locatable minerals development, Alternative B includes new areas to protect and preserve cultural, paleontological, recreation, lands with wilderness characteristics, and other special designation resource values (ACECs, Scenic or BCBs, WSRs, and WSAs). This would result in 2,686,776 acres (13%) available. Locatable minerals development has a direct adverse effect on vegetation over the long term, and protecting these areas would benefit grassland and shrubland plant communities. Under the locatable minerals program for the planning area, it is estimated that BLM actions would disturb approximately 277 acres over the next 20 years. Reclamation would occur on 72 acres. The long-term disturbance would have a adverse effect on those plant communities directly affected. Locatable minerals could be permitted in greater than ten percent of the grassland and shrubland communities in the planning area; therefore, management actions for locatable minerals under Alternative B would have major adverse effects on them.

Leasable Minerals – Coal

Under Alternative B, where development occurs, vegetation would be directly and adversely affected over the long term for the life of the project and would require successful reclamation to ensure the native vegetative component was reestablished to predisturbance conditions and to reduce the potential establishment and spread of invasive plant species. Under this alternative, approximately 186,600 acres would be disturbed, with reclamation occurring on approximately 120,600 acres, 36,500 acres being actively mined, and approximately 66,000 acres disturbed over the long term. This long-term disturbance has a direct and adverse effect on those vegetative communities. Alternative B management of leasable coal resources would have a major adverse effect on grasslands and shrublands.

Leasable Minerals – Fluids

Under Alternative B, management to conserve other resources would make 2,612,920 acres of public land closed to fluid minerals leasing (41% of total public land acres). This large amount of protected acreage would directly benefit vegetation; however, in areas of development, the effect would be direct, adverse, and long term. The fluid mineral program is estimated to disturb approximately 286 acres over the next 20 years. Long-term disturbances have a direct and adverse effect on those vegetative communities (Appendix G (p. 1937)). Leasable fluid mineral exploration and development could occur in one to five percent of the grassland and shrubland communities in the planning area; therefore management actions for fluid minerals would have a minor adverse effect on grasslands and shrublands.

Salable Minerals

Alternative B would close leasing in accordance with management identified to conserve other resources. This would result in 3,218,690 acres of federal mineral estate (88%) closed to salable minerals development. Alternative B would result in reducing adverse effects to grassland and shrubland communities because additional acreage would not be developed over the long term and only a small portion of public land would be developed. Estimated acres of disturbance for salable minerals over the next 20 years would be negligible (114 acres) (Appendix G (p. 1937)).

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Alternative B management actions apply full suppression in areas where fire is undesirable affecting approximately 42,232 acres. Monitoring fire behavior only in areas where fire can be used as a management tool based on resource goals and objectives would directly benefit grassland and shrubland communities by enhancing/restoring the natural fire regime of these communities. Limiting suppression vehicles to existing roads and trails unless they are in identified full suppression areas would affect approximately 739,910 acres, and rehabilitating all fire-related damage would directly benefit vegetative communities over the short and long terms by reducing the potential for vegetation compaction or removal and soil erosion. Alternative B protected acres would be the same as under Alternative A. Long-term, the application of prescribed fire to improve grassland and shrubland communities (plant species diversity, production and vigor) and wildlife habitat objectives is estimated to affect approximately 3,500 acres from BLM actions. All acres would be successfully reclaimed (Appendix G (p. 1937)). This management would have minor beneficial effects.

Rehabilitating all fire-related damage would directly benefit vegetative communities over the short and long terms by reducing the potential soil erosion and limiting opportunities of invasive species establishment. Using wildland fire and other vegetative treatments to restore fire-adapted ecosystems and to reduce hazardous fuels would benefit native vegetation by returning a historic fire regime to the ecosystem; reducing hazardous fuels reduces the opportunity for wildfire and severe impacts from wildfires. Long-term, the application of prescribed fire to support grassland and shrubland communities and wildlife habitat objectives is estimated to affect approximately 3,500 acres from BLM actions. All acres are expected to be successfully reclaimed (Appendix G (p. 1937)).

Under Alternative B, prescribed fire and other vegetation treatments would be used to restore fire-adapted ecosystems and reduce hazardous fuels. Wyoming big sagebrush requires 50–120 years or more recovery time after fire. Evidence suggests that particularly in Wyoming big sagebrush, a program of prescribed burning is unwarranted or inadvisable if maintaining and restoring sagebrush landscapes and sagebrush-dependent species is the goal (Baker 2006). Prescribed fire would have minor beneficial effects on grasslands and major adverse effects on shrublands. Unplanned fire would have negligible to major effects, depending on the fire size, soil type, type of vegetative community, and burn conditions.

Biological Resources

Vegetation – Forests and Woodlands
No effects are anticipated from forests and woodlands management actions.

Vegetation – Riparian/Wetland Resources
Alternative B, prohibiting surface-disturbing activities for mineral leasing within 500 feet of riparian and wetlands systems, aquatic habitats, and floodplains (approximately 23,831 acres) would directly benefit adjacent grassland and shrubland communities. Restoring vegetation on all CBNG-supported wetland and riparian systems would return those hydric systems in the upper watershed back to upland vegetation and reclaim the large numbers of systems constructed to receive CBNG produced water. These systems are very susceptible to water-tolerant invasive species such as salt cedar and Canada thistle, and reclamation would establish competitive native species. Reclamation also would include eradication of invasive species. These management

actions would occur in one to five percent of the grassland/shrubland communities in the planning area and would have a minor beneficial effect on the health of them.

Invasive Species and Pest Management
Alternative B would control invasive plant species in cooperation with county weed and pest districts. Treating plants on the Wyoming Weed and Pest Control Act Designated List, the appropriate county lists, and other species of concern as determined by BLM resource specialists would treat all species that adversely affect native plant communities. Annual bromes (cheatgrass) are present throughout the planning area; therefore, a treatment management plan addressing cheatgrass should incorporate the entire planning area. Treatment of annuals would improve the ecological condition of the vegetative communities and reduce the potential for wind and water to erode soil. Non-selective herbicides could affect other broadleaf plants (forbs, special status plant species, and shrubs) along with the target species. Aerial application of pesticides would allow for treatment of large acreages for widespread species such as cheatgrass and leafy spurge, and lower rates of herbicide so other non-target, yet susceptible, species would be less affected. All these actions would have direct beneficial effects on grasslands and shrublands over the long term. Long-term disturbances over the next 20 years are estimated to affect approximately 15,000 acres from BLM actions, with 13,000 acres of reclamation (Appendix G (p. 1937)).

Fish and Wildlife Resources – Fish
Alternative B management actions would consider fish and fish habitat in reservoir, riparian and wetland systems, and perennial water management. Alternative B would apply constraints on surface-disturbing and disruptive activities providing protection of vegetation, soils, and soil microbial activity from surface disturbing activities adjacent to or within greater than ten percent of the grassland and shrubland communities in the planning area. Management actions for fish under Alternative B would have major beneficial effects on grassland and shrubland communities.

Fish and Wildlife Resources – Wildlife
Alternative B management actions include distance and timing limitations or prohibitions on surface disturbance and occupancy in or near big-game and elk crucial winter ranges or big-game transition ranges, elk calving areas, within 750 feet of upland game bird leks at any time and an additional 0.64-mile radius from April 1 through May 30, and within a biological buffer zone around nests of conservation concern raptor species. Limitations and prohibitions protecting the soil surface for wildlife would conserve vegetation in five to ten percent of the grassland and shrubland communities in the planning area. Management actions under Alternative B for wildlife would have direct, moderate, beneficial effects on grasslands and shrublands over the long term.

Special Status Species – Plants
Alternative B management actions that prohibit surface-disturbing or disruptive activities in designated areas would affect approximately 126,811 acres (less than 1%) of grassland and shrubland communities. Limiting these activities in habitats with known populations of special status plants species would have a direct, negligible, beneficial effect on grasslands and shrublands over the long term.

Special Status Species – Fish
Alternative B management actions that prohibit surface-disturbing and disruptive activities with 0.25 mile of any water that contains special status fish species and prohibit impoundments where they could adversely affect such fish would affect approximately 818 acres (less than 1%), which would have a direct, negligible, beneficial impact to grasslands and shrublands over the long term.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Maintenance or enhancement of special status wildlife species habitat will usually directly benefit the surrounding plant community unless the SSS requires a habitat contrary to "typical" habitats, such as the prairie dog and the mountain plover, which are associated with short-grass prairie dominated by blue grama (*Bouteloua gracilis*). These species require a degraded ecological state of health to thrive. Providing these habitat requirements would have a direct adverse effect on the plant community over the long term. Prohibiting surface-disturbing and disruptive activities in all prairie dog colonies to provide suitable habitat for SSS that depend on prairie dog colonies would affect 6,156 acres.

Alternative B management actions would prohibit renewable-energy projects in Greater Sage-Grouse nesting, brood-rearing, and winter concentration areas. Actions would prohibit or avoid surface-disturbing activities within 4.0 miles of the perimeter of occupied or undetermined Greater Sage-Grouse leks year-round, would prohibit surface-disturbing activities within four miles of occupied leks from March 1 to June 30, and prohibit surface-disturbing activities within wintering habitat from November 15 to March 14, which in total would affect approximately 467,897 acres. Other areas include identified nesting and early brood-rearing habitat outside the four-mile lek buffer, which would affect approximately 135,194 acres, and Greater Sage-Grouse winter habitat, including winter concentration areas, which would affect approximately 226,595 acres. The larger the area protected from surface disturbances the greater the benefit to vegetative communities. Alternative B management actions that prohibit or avoid surface-disturbing activities would have a direct, beneficial effect on associated grassland and shrubland communities over the long term.

Alternative B management would avoid surface-disturbing and disruptive activities and occupancy in Greater Sage-Grouse winter habitat, including winter concentration areas, from November 15 to March 14 and allow no more than three percent removal of sagebrush habitats per 640-acre section. The action to allow no more than three percent removal of sagebrush habitats per 640-acre section might or might not benefit grassland and shrubland communities, depending on the ecological condition of the communities and other resource objectives. Alternative B management actions would also restore, where appropriate, all disturbed grassland and shrublands to Greater Sage-Grouse habitats. This would increase the health of these systems.

Alternative B management actions that prohibit surface-disturbing and disruptive activities for the protection of special status amphibian and reptile species and their habitats would affect approximately 176,636 acres. This would have a direct, beneficial effect on grasslands and shrublands by protecting vegetation and soils from disturbance.

Overall, the prohibitions/restrictions for special status wildlife habitats would encompass and conserve vegetation within greater than ten percent of the grassland and shrubland communities in the planning area; therefore the management actions for special status wildlife resources under Alternative B would have major beneficial effects on these communities.

Heritage and Visual Resources

Cultural Resources
Prohibiting surface disturbance in areas with historic properties, or within five miles or the visual horizon (whichever is closer) would affect approximately 330,592 public land acres of historic properties that retain their integrity of setting. These prohibitions would conserve vegetation within greater than ten percent of the grassland and shrubland communities in the planning

area; therefore they would have a direct, major, beneficial effect on grassland and shrubland communities by keeping soils and vegetation intact.

Paleontological Resources
Requiring paleontological field surveys to determine types and locations of classes, monitoring, and then initiating protective measures, including limiting or prohibiting surface-disturbing activities, would protect vegetation from possible large-scale surface disturbance. This could affect up to 754,668 acres of public land (greater than ten percent of the grassland and shrubland communities). Protecting lands with paleontological resources could promote paleontological excavation and research activities. These small (under one acre) short-term activities would have a direct adverse effect on grasslands and shrublands by disturbing soils and removing vegetation for the life of the project through successful reclamation. It is estimated that approximately 200 acres would be disturbed, with successful reclamation anticipated on all acres (Appendix G (p. 1937)). Overall there would be a major beneficial effect.

Visual Resources
Under Alternative B, the BLM could prohibit or limit some surface-disturbing activities in VRM Class II areas on about 217,021 acres and thereby protect grassland and shrubland communities. VRM Class III and IV areas encompass approximately 276,107 and 258,866 acres respectively, on which the BLM would allow surface-disturbing activities with some limitations. Prohibiting or limiting surface-disturbing activities for management of visual resources would occur in five to ten percent of the grassland and shrubland communities and would, therefore, have a moderate beneficial effect.

Land Resources

Forest Products
No effects are anticipated from forest products management actions.

Lands and Realty
Alternative B management actions would pursue land disposals, acquisitions, easements, or land tenure adjustments for lands holding custodial grazing allotments, and sales independent of other resource values. As they pertain to the overall management of public lands if pursed and completed, these actions would improve public land management capabilities overall and would occur in five to ten percent of the grassland and shrubland communities, having an indirect, moderate, beneficial effect on grassland and shrubland communities over the long term.

Renewable Energy
Alternative B management actions would affect development in the public lands by excluding specific areas on about 730,530 acres and avoid areas from mineral leasing on about 45,441 acres. These restrictions would lessen the adverse effects to grassland and shrubland communities if the energy developments involved surface-disturbing activities. Under the renewable-energy program for the planning area, overall for the next 20 years it is estimated that BLM actions would disturb approximately 5,000 acres. Reclamation would occur on 4,500 acres (Appendix G (p. 1937)). These management actions would allow renewable-energy development within one to five percent of the grassland and shrubland communities in the planning area, therefore, having a minor adverse effect on grasslands and shrublands.

Rights-of-Way and Corridors
Management actions include prohibiting ROW on slopes equal to or greater than

25 percent and on highly erodible soils to minimize impacts to soil resources. Requiring co-location of new communication sites within designated areas, authorizing transmission lines in identified corridors, and avoid constructing facilities along major transportation routes. All these actions would reduce surface disturbance directly reducing adverse effects to vegetation over the long term by limiting removal or mechanical damage to vegetation and reduce the potential for water and wind to erode soil. ROW development on public land would be excluded on 706,556 acres and avoided on 56,857 acres of public land. ROW disturbances are estimated to affect approximately 5,750 acres for pipelines and 28 acres for communications sites during the planning period; all pipeline acres are expected to be successfully reclaimed. Roads are estimated to affect 9,275 acres, with successful reclamation on approximately 2,690 acres 6,585 acres of long-term disturbances on the public lands. Powerlines are estimated to affect approximately 2,458 acres, with successful reclamation on approximately 245 acres and 2,213 acres of long-term disturbance (Appendix G (p. 1937)). These Alternative B management actions would allow ROWs and corridors to be permitted in greater than ten percent of grassland and shrubland communities; therefore, having a major adverse effect on grasslands and shrublands.

Travel and Transportation Management

Alternative B management actions would allow motorized vehicles off designated routes with a special use permit. Management actions would close areas with saturated soils or on slopes of 25 percent or greater, in habitat for SSS, special designation areas (a total of 625,854 acres), and in big game ranges during specific timeframes; also limit travel to designated roads and trails on 137,126 acres. These actions would protect the grassland and shrubland resources during conditions when soil and plants are highly susceptible to erosion, but may affect implementation of restoration projects. Prohibiting vehicular travel on saturated soils and requiring closure and reclamation of roads if they are heavily eroded, washed out, or if other access roads in better condition are available would directly benefit vegetative resources. Transportation and access would be restricted in more than 80 percent of the grassland and shrubland communities in the planning area; therefore management actions under Alternative B for transportation and access would have a moderate beneficial effect on grasslands and shrublands.

Recreation

Alternative B management actions to designate eight areas as SRMAs, for 55,529 acres, with possible consideration of additional lands for SRMA designation, and prohibit surface disturbance in designated SRMAs unless the disturbance is for administrative purposes would generally help protect, maintain, and enhance vegetative resources. However, the BLM promotes visitor use and access in SRMAs, which would increase the areas' popularity and visitation. This would increase vegetation disturbance from trampling and increase the potential for invasive plant species introduction and spread. SRMAs under Alternative B encompass one to five percent of the grassland and shrubland communities in the planning area. Alternative B management actions would have a minor adverse effect on grasslands and shrublands over the long term.

Lands with Wilderness Characteristics

Alternative B includes management actions for lands with wilderness characteristics, which would directly benefit vegetative communities by limiting surface-disturbing activities in those areas on approximately 12,237 acres, less than one percent of the grassland and shrubland communities. This management would have a negligible beneficial effect on grasslands and shrublands.

Livestock Grazing Management

Alternative B livestock grazing management actions include: (1) prohibiting increases in livestock stocking rates as a result of vegetative treatments; (2) providing a minimum of two years rest

following prescribed fire, wildfire (in lieu of an approved plan), and other vegetative treatments, with additional rest where necessary; (3) limiting or prohibiting livestock grazing where it has been determined to be incompatible with other resource values; (4) locating livestock salt or mineral supplements a minimum of 0.5 mile from water sources, riparian areas, and aspen stands; (5) designating and managing future resource reserve common allotments as needed; and (6) authorizing permanent increases in forage allocations to wildlife habitat and watershed protection as the first priority and to livestock grazing as the second priority. All these management actions benefit vegetative communities. Prohibiting increases in livestock stocking rates would ensure benefits to vegetation gained through treatment would not be lost to increased grazing pressure. Locating salt and mineral supplements away from water sources and other sensitive areas would discourage livestock from congregating and would alleviate long-term impacts from animals and hoof action. Reserve common allotments would enable other pastures and allotments to be rested if needed. Treatment and project-related deferment or rest allows vegetation to complete two life-cycles, or more if determined needed, before resuming livestock grazing. Increases in forage would be allocated to watershed protection and wildlife habitat to meet health standards before making it available to livestock. Construction of range improvements would have a direct adverse effect on vegetation for the life of the project. All other livestock-related actions would have an indirect beneficial effect over the long term.

Estimations for surface disturbance over the planning area in the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately 4 acres, with successful reclamation on 2 acres and 2 acres of long-term disturbance. Pipelines are estimated to disturb 40 acres, with successful reclamation on 35 acres and 5 acres of long-term disturbances. Fences would disturb approximately 100 acres (120 miles), with successful reclamation on approximately 70 acres (84 miles) and approximately 30 acres of long-term disturbance. Wells are estimated to disturb 1 acre, with successful reclamation (Appendix G (p. 1937)).

Alternative B livestock grazing management would have a moderate beneficial effect on grasslands and shrublands.

Special Designations

Areas of Critical Environmental Concern

Alternative B management actions include designating eight areas as ACECs, which would affect approximately 511,000 acres. The associated management plans for these sites would initiate specific conservation to protect soils and vegetation from surface-disturbing activities, including minerals development, vehicular travel, ROW, and any other activity not compatible with retaining or enhancing the area's values. All these restrictions would have direct, minor, beneficial effects on grasslands and shrublands over the long term.

Scenic or Back Country Byways

Evaluating the road system for potential designation could indirectly benefit vegetation because some activities (minerals and energy development) might be discouraged based on scenic values. This management would have a negligible beneficial effect on grasslands and shrublands.

Wild and Scenic Rivers

The portion of the Middle Fork Powder River portion that is suitable and eligible for WSR designation is awaiting Congressional action. Until Congress acts, or if Congress releases the corridor from WSR consideration, management would continue in accordance

with the Middle Fork Interim Management Plan to retain its free-flowing characteristics and outstanding resource values. Under the designation or continuation of interim management, upland vegetation would indirectly benefit from special management actions. This management would have a negligible beneficial effect on grasslands and shrublands.

Wilderness Study Areas
There are three WSAs in the planning area totaling 28,931 acres. There are restrictions to preserve wilderness conditions in these areas until Congress acts on their Wilderness status. Designation of these areas and interim management is based on conservation of the natural resources, which would directly benefit vegetative communities and limit vehicular travel and surface-disturbing activities. This management would have a negligible beneficial effect on grasslands and shrublands.

Socioeconomic Resources

No effects are anticipated from socioeconomic resources management actions

4.4.2.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource utilization, and the likely resulting impacts to grassland and shrubland resources.

Vegetation – Grassland and Shrubland Communities
The management action allowing non-native plant species (mostly sterile, small-grain cereal crops such as oats, triticale, and barley) for initial (one to two years) reclamation practices would provide another tool for achieving reclamation goals, but also would provide the opportunity for non-native species to be introduced. Non-native species could cross pollinate with native species, outcompete native species for water and soil nutrients, and move out of their original niche and become an invasive species. Use of non-native species could directly benefit grasslands and shrublands by quickly establishing vegetation on sites reducing the opportunity for erosion and invasive plant establishment. This could indirectly benefit vegetative communities by reducing erosion potential. Achieving successful reclamation would directly benefit the surrounding plant community and could help discourage invasive species.

Physical Resources

Air Quality
There would be no air quality modeling under Alternative C. Industrial projects would be expected to approach or exceed emissions standards, and no mitigation strategies would be examined. This would have indirect adverse impacts to grassland and shrubland communities. Vegetation is possibly more sensitive to air pollutants than humans. In particular, acid rain has left areas barren or with severely damaged vegetation. Ground-level ozone and reactive nitrogen can cause discoloration, damage, and loss of leaves, which can reduce photosynthesis by as much as fifty percent. As a result, biologically significant quantities of reactive nitrogen are now reaching the highest places. At lower elevations in the western United States, introduced grasses stoked by nitrogen are overwhelming many ecosystems. Plants also become more vulnerable to attacks by pests, disease, and environmental disasters. Consequently, the plant's ability to store food, grow, and reproduce is hindered. Adverse impacts to vegetation would be major.

Soil
There would be no constraints for surface-disturbing activities under Alternative C. Allowing surface-disturbing activities would directly remove and mechanically damage vegetation, remove soils and soil microbes, decrease forage availability, remove habitat and increase opportunities for invasive species where development occurs throughout the planning area. This action would have a direct, major, adverse effect on grasslands and shrublands communities.

Water Resources
There would be no constraints surface-disturbing activities under Alternative C. Management actions include allowing on-channel reservoirs, which locates these in the most productive vegetative sites. Surface discharge would be authorized when permitted by the State of Wyoming, which would promote upland vegetation transition to hydric species including invasive species such as tamarix and Canada thistle. All these actions would have a direct moderate adverse effect on grasslands and shrublands over the long term.

Cave and Karst Resources
Alternative C management actions include establishing project-specific buffers (100 feet, for a total of 11 acres of protection) from significant cave entrances to protect caves from surface-disturbing activities. This would have a direct, negligible, beneficial effect on grasslands and shrublands.

Mineral Resources

Locatable Minerals
Alternative C does not include recommendations for new withdrawals or restrictions on locatable minerals development. Lands open to mineral entry (open is about 3,319,535 acres – including greater than ten percent of the grassland and shrubland communities in the planning area and withdrawn are about 11,373 acres) are consistent with other resource values. Grassland and shrubland communities would be directly and adversely affected by not protecting more areas from locatable minerals activities. Under the locatable minerals program for the planning area, overall it is estimated that BLM actions would disturb approximately 1,455 acres over the next 20 years. Reclamation would occur on 378 acres. Alternative C management of locatable minerals would have a major adverse effect on grassland and shrubland communities.

Leasable Minerals – Coal
Development is only likely to occur in those areas identified ad acceptable for further coal leasing consideration. Where development does occur there is a direct and adverse impact to the vegetation through removal and mechanical damage. Effects are long term until successful reclamation is achieved. Allowing these surface-disturbing activities would have a direct, minor, adverse effect on vegetation in these areas.

Leasable Minerals – Fluids
Alternative C makes all lands administratively available for development (within greater than ten percent of the grassland and shrubland communities in the planning area). Development would include surface-disturbing activities at the production sites as well as all the necessary infrastructure. Surface-disturbing activities would have a direct and adverse effect on vegetation for the long term until required successful reclamation is achieved. Native grasses and forbs would dominate reclaimed sites initially, and forbs and shrubs would return over a longer period. Mechanical removal and injury to the vegetation would occur. Soil removal and compaction wold occur and channelization of surface runoff in ruts and road ditches is

likely. Alternative C management of leasable fluid minerals would have a major adverse effect on grasslands and shrublands. Under the CBNG program for the planning area, overall it is estimated that BLM actions would disturb 13,200 acres over the next 20 years. Reclamation will occur on 5,280 acres. Under the leasable conventional oil and gas program for the planning area, overall it is estimated that BLM actions would disturb approximately 9,055 acres over the next 20 years. Reclamation will occur on 6,070 acres. There is no anticipated disturbance from geothermal activities.

Salable Minerals
Alternative C does not recommend new closures or restrictions. The existing closures and restrictions were imposed to protect and preserve other resource values. Not adding areas to be protected from these minerals activities would have a direct, adverse effect on grassland and shrubland communities. For salable minerals over the next 20 years, the estimated areas of surface disturbance would be occur in greater than ten percent of grassland and shrubland communities in the planning area; 2,090 acres disturbed, 392 acres reclaimed, and 1,698 acres long-term disturbance (Appendix G (p. 1937)).

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative C, management actions that involve full suppression regardless of other resource objectives would have a direct adverse effect on grassland and shrubland communities. The use of heavy equipment with few constraints would have a direct adverse effect on vegetative communities over the short and long terms by increasing the opportunities for water and soil erosion, soil compaction, and invasive plant species establishment. Long-term estimates for the application of prescribed fire to support grassland and shrubland communities and wildlife habitat objectives is estimated to affect approximately 42,000 acres from BLM actions. All acres are expected to be successfully reclaimed.

Biological Resources

Vegetation – Forests and Woodlands
No effects are anticipated from forests and woodlands management actions.

Vegetation – Riparian/Wetland Resources
Alternative C management actions would allow surface-disturbing and disruptive activities and apply standard lease terms for mineral leasing within 500 feet of riparian and wetlands systems, aquatic habitats, and floodplains. This would have a direct adverse effect on the adjacent grassland and shrubland communities by promoting activities that would lead to soil erosion. Restoring vegetation only on direct CBNG disturbance areas (e.g., dams and reservoirs) rather than on all CBNG-supported riparian and wetland systems would benefit only a very small number of the systems overall. All systems are very susceptible to water-tolerant invasive species such as salt cedar and Canada thistle. This would have an adverse effect on the health of greater than ten percent of the adjacent grassland and shrubland communities.

Invasive Species and Pest Management
Under Alternative C, restricting aerial application to only insecticides would limit herbicide applications to motorized vehicle and hand application. This would restrict where application could occur and the size of treatments, therefore allowing vast acreages (in the case of leafy spurge, which inhabits thousands of acres across multiple landscapes, plant communities, remote

locations, and a variety of terrain) to go untreated. This would have a direct adverse effect on upland and hydric plant communities over the long term. Long-term disturbances over the next 20 years are estimated to affect approximately 10,000 acres from BLM actions; reclamation would occur on 8,500 acres (Appendix G (p. 1937)).

Annually treating only designated areas for cheatgrass would be ineffective because there would be only small, scattered treatments and most of the cheatgrass would be unaffected. This would have an adverse effect on grassland and shrubland communities.

Fish and Wildlife Resources – Fish
Alternative C management actions would consider other resources a higher priority than fish and fish habitat in reservoir, riparian and wetland systems, and perennial water management. Alternative C would not apply constraints on surface-disturbing and disruptive activities, and would apply only the standard lease terms for minerals leasing in naturally occurring waterbodies. This lack of constraints would indirectly and adversely affect these systems over the long term by not providing protection of vegetation, soils, and soil microbial activity from surface disturbing activities. Prioritizing other resources considerations above fish and fish habitat could also adversely or beneficially effect greater than ten percent of the vegetation depending on the management action.

Fish and Wildlife Resources – Wildlife
Alternative C wildlife management actions, including management for big-game species, upland game birds, migratory birds, special status plants, special status fish, and special status amphibians and reptiles, would not be implemented on a project-specific basis. Alternative C would manage special areas consistent with other resource values, rather than for wildlife species, except raptors, and would not apply constraints on locations and timing of surface disturbances. These management actions would still conserve vegetation within greater than ten percent of the grassland and shrubland communities in the planning area. Management actions for wildlife under Alternative C would have indirect and direct, major beneficial effects on vegetative communities over the long term.

Special Status Species – Plants
Alternative C management actions would allow aerial application of herbicide treatments in areas with habitat for special status plant species. The alternative would restrict treatments in areas of known special status plant populations. This would conserve vegetation in less than one percent of the grassland and shrubland communities in the planning area and would have a direct, negligible, beneficial long-term effect. Other invasive management methods would be applied in habitats of known species.

Special Status Species – Fish
Alternative C management actions would prohibit surface-disturbing and disruptive activities in less than one percent of grassland and shrubland communities, if impacts could not be mitigated. Other actions include designing impoundments and instream structures to minimize impacts on or near existing or potential sites and habitats. These actions would reduce, but not prevent, direct adverse effects such as surface-disturbing activities that could affect upland vegetation; however, the primary effect would be to the riparian habitat adjacent to the stream. All effects would be long term.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Maintenance or enhancement of SSS habitat usually benefits the plant communities. However, vegetation in the prairie dog towns is already in lower ecological state, with a large component of

cheatgrass. Alternative C management actions that would allow surface-disturbing activities in prairie dog habitat would adversely affect vegetation by direct mechanical removal or damage to plants, removal of soil medium, and increase the opportunity for resident cheatgrass to spread. Impacts to grasslands and shrublands would be direct, adverse, and long term.

Alternative C management actions would allow renewable-energy projects in Greater Sage-Grouse nesting, brood-rearing, and winter concentration areas. Management would prohibit or avoid surface-disturbing activities within a specified distance from designated leks, identified nesting and early brood-rearing habitat, and Greater Sage-Grouse winter habitat during specific periods, some areas would prohibit surface-disturbing activities yearlong. Only those areas protected from surface disturbance year-round would benefit the vegetation. Those areas, under Alternative C still conserve greater than ten percent of the grassland and shrubland communities in the planning area. All other management actions would be adverse since surface disturbance could occur. There would be no limit on the amount of sagebrush removal, so decision would be based on multiple resources rather than only on Greater Sage-Grouse habitat. Allowing surface disturbance has a adverse effect on grassland and shrubland communities.

Alternative C management actions would allow surface-disturbing and disruptive activities in known areas of special status amphibian and reptile species and their habitats. This would have a direct, adverse effect on those habitat types over the long term.

Overall, management action for special status wildlife species under Alternative C would have major beneficial effects on grassland and shrubland communities.

Heritage and Visual Resources

Cultural Resources

Alternative C management would allow surface disturbance in areas with historic properties which would have a direct adverse effect on vegetation over the long term by mechanical removal or damage to the vegetation, removal of the soil medium, increasing the opportunities for soil erosion and invasive species establishment. The areas open to disturbance encompass one to five percent of the grassland and shrubland communities in the planning area; therefore, management actions for cultural resources under Alternative C would have minor adverse effects on grassland and shrubland communities.

Paleontological Resources

Alternative C management actions that would limit the requirement for paleontological field surveys to all PFYC Class 4 and 5 formations potentially affected by proposed activities would affect 28,177 acres. Lack of protective measures, including limiting or prohibiting surface-disturbing activities, would subject vegetation to possible direct, moderate, adverse effects by removal or damage to vegetation. Under Alternative C, this could occur in one to five percent of otherwise protected grassland and shrubland communities, therefore, management action for paleontological resources would have minor adverse effects on grassland and shrubland communities.

Visual Resources

Under Alternative C, WSAs and WSRs are managed as VRM Class I (30,103 acres), manage VRI Class II as VRM Class III (167,334 acres), and manage all VRI Class III and IV areas (584,500 acres) as VRM Class IV. Management would be applied at a lower level of VRM class, therefore more surface disturbing activities would be allowed within five to ten percent

of grassland and shrubland communities. This would have a direct, moderate, adverse effect on vegetation over the long term.

Land Resources

Forest Products

No effects are anticipated from forest products management actions.

Lands and Realty

Alternative C management actions would not pursue land disposals, acquisitions, easements, or land tenure adjustments for lands holding custodial grazing allotments, and sales independent of other resource values. Lands otherwise available for these actions contain greater than ten percent of the grassland and shrubland communities in the planning area, therefore, effects to grasslands and shrublands would be indirect, major, adverse, and long term.

Renewable Energy

Alternative C would allow sites and areas for energy development, which would likely involve surface-disturbing activities within greater than ten percent of the grassland and shrubland communities in the planning area. This would have a major adverse effect on grassland and shrubland communities. Under the renewable-energy program for the planning area, overall it is estimated that BLM actions would disturb approximately 40,000 acres over the next 20 years. Reclamation will occur on 22,500 acres (Appendix G (p. 1937)).

Rights-of-Way and Corridors

Alternative C would not apply constraints on ROW and corridor placement or development. Not limiting surface disturbance and not avoiding activities on slopes equal to or greater than 25 percent would have a direct adverse effect (removal) on vegetation over the long term. ROW disturbances are estimated to affect approximately 20,000 acres for pipelines and 84 acres for communications sites during the planning period; successful (100%) reclamation is estimated to occur on all affected acres. Roads are estimated to affect 27,825 acres, with successful reclamation on approximately 12,800 acres; the remaining 15,025 acres would experience long-term disturbances on public lands. Powerlines are estimated to affect approximately 7,374 acres, with successful reclamation on approximately 737 acres and 6,637 acres of long-term disturbance (Appendix G (p. 1937)). ROWs and corridors, under Alternative C would be permitted in one to five percent of the grassland and shrubland communities in the planning area; therefore, the adverse effects would be moderate.

Travel and Transportation Management

Alternative C management actions would allow motorized vehicles within the stock driveways, on saturated soils and on slopes greater than 25 percent, and in special species habitat. These actions would have a direct, long-term, moderate adverse effect by not protecting the protecting the soil or vegetation resources within five to ten percent of the grassland and shrubland communities in the planning area.

Recreation

Alternative C management actions include designation six areas as SRMAs with no consideration to additional lands for SRMA designation, leasing minerals in accordance with management for areas surrounding SRMAs, and allowing surface disturbance and salable minerals development in the six designated SRMAs. Mineral leasing and surface disturbance would be allowed, this would have a direct adverse effect on vegetation over the long term. Visitor use

and access is promoted in SRMAs, which would increase popularity and visitation, increase vegetation disturbance from trampling, and increase the potential for invasive plant species introduction and spread. This would also have a direct and adverse effect over the long term. SRMAs encompass less than ten percent of the grassland and shrubland communities in the planning area; therefore, the management actions for recreation under Alternative C would have negligible adverse effects on them.

Lands with Wilderness Characteristics
Alternative C management actions include managing the Land with Wilderness Characteristics areas the same as the surrounding areas. There are no significant protective measures for the surrounding areas therefore the management actions. Effects on grasslands and shrublands from these actions would be indirect, minor, adverse, and long term as vegetation removal could occur in one to five percent of grassland and shrubland communities in the planning area that are present in lands with wilderness characteristics.

Livestock Grazing Management
Alternative C management actions include allowing increases in livestock stocking rates as a result of vegetative treatments and providing a maximum of two years rest following prescribed fire, wildfire (in lieu of an approved plan), and other vegetative treatments. This would compromise the health of vegetative communities. Livestock are often attracted to new vegetation following vegetative treatments and fires. If not monitored, these sites can be over utilized, and increasing stocking rates could compound the issue. Two years of rest might not be sufficient to achieve preferred ecological state and vegetation management goals. Grazing of young seedling plants would reduce their ability to compete with more aggressive plants, which often are invasive or less palatable and less nutritious species.

Estimates of surface disturbances in the planning area over the next 20 years for range improvement projects include spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately four acres, with successful reclamation on two acres and two acres of long-term disturbance. Pipelines are estimated to disturb 40 acres, with successful reclamation on 35 acres and five acres as long-term disturbance. Fences would disturb approximately 100 acres (120 miles), with successful reclamation on approximately 70 acres (84 miles) and 30 acres of long-term disturbance. Wells are estimated to disturb one acre, with successful reclamation (Appendix G (p. 1937)).

Overall, Alternative C livestock grazing management allotment occur in greater than ten percent of the grassland and shrubland communities in the planning area, therefore, the management actions under this alternative would have a major adverse effect on them.

Special Designations

Areas of Critical Environmental Concern
Alternative C would not designate ACECs. Lack of designation would allow these areas that contain less than ten percent of the grassland and shrubland communities in the planning area to be eligible for surface-disturbing activities, among other actions, which would have a direct, negligible, adverse effect on vegetative communities.

Scenic or Back Country Byways
No evaluation of the road system for potential designation would occur. Activities would not

be discouraged based on scenic values. This management would have no effect on grasslands and shrublands.

Wild and Scenic Rivers
Alternative C management would be the same as management in the surrounding areas until Congress acts. Rather than developing a specific management plan for this area, these management actions would be generic. The Middle Fork Powder River area contains less than one percent of the grassland and shrubland communities in the planning area. Grassland and riparian communities would indirectly benefit over the long term from this management action, but likely not to the same degree as the more protective measures under a specific management plan.

Wilderness Study Areas
There are three WSAs in the planning area totaling 28,931 acres and encompass less than one percent of the grassland and shrubland communities in the planning area. Alternative C management would be the same as management in surrounding areas, which would be generic and might not address all resource issues. This would have an indirect, negligible, adverse effect on grassland and shrubland communities over the long term.

Socioeconomic Resources

No effects are anticipated from socioeconomic resources management actions.

4.4.2.6. Alternative D

This section describes management actions under Alternative D, which presents the Proposed RMP, a compromise between resource conservation and resource use, and the potential impacts to grasslands and shrublands from those management actions.

Vegetation – Grassland and Shrubland Communities
Under Alternative D, allowing non-native plant species for initial reclamation practices would provide another tool for achieving reclamation goals. These species would only be used on those sites where native species have proven not to establish or the timing of native plant seedling establishment is not conducive to establishment (months of low precipitation with higher climatic temperatures). Plant establishment is critical to prevent erosion of soil and reduce the opportunities for invasive species establishment. It is anticipated that non-native species would be used in the short term (one to three years). As stated in Chapter 2 of the Integrated Vegetation Management Handbook (H-1740-2) (BLM 2008c); it is the policy of the BLM to manage for biologically diverse, resilient and productive native plant communities to sustain the health and productivity of the public lands. This policy recognizes that, for a variety of reasons, not every acre of public land will contain native plants and that, in certain circumstances to prevent further site degradation and improve functionality, non-native plants may be used as part of post fire stabilization and rehabilitation activities as well as in restoration to achieve short-term site stabilization objectives. However, where practical, uses and activities will be conducted to favor the health and persistence of native plant communities where they currently exist and rehabilitation or restoration actions will be undertaken to improve their diversity, resiliency and productivity. The policy in BLM Manual 1745 requires that native species shall be used except under limited circumstances. Diverse, healthy, and resilient native plant communities provide the greatest opportunity to be successful in meeting multiple use objectives. Although native plants are always given first consideration, as a last resort, it maybe be beneficial to introduce non-native, non-invasive plant materials to break unnatural disturbance cycles or to prevent

further site degradation by noxious or invasive plants (H-1740-2) (BLM 2008c) and promote native species development by creating a favorable environment for native species success. Use of non-native species could have the direct benefit of quickly establishing vegetation on sites, stabilizing soils, and reducing the opportunity for erosion and invasive species establishment. This would directly benefit vegetative communities over the short and long terms. Non-native species could outcompete native plants for water and soil nutrients and move out of their original niche and become an invasive. These outcomes would have a direct adverse effect on grasslands and shrublands. There also would be a small potential risk of non-native species cross pollinating with native species.

Physical Resources

Air Quality

Effects to grassland and shrubland associated with air quality management actions in Alternative D would be the same as those described in Alternative B.

Soil

Surface-disturbing activities would be allowed under Alternative D when soil resource objectives can be met. Development on and disturbance of sensitive soils would have approved site-specific construction, stabilization, and reclamation plans to conserve the soil resource and meet reclamation and resource objectives. Alternative D would avoid surface disturbances on badlands, rock outcrops, and slopes susceptible to mass movement unless site-specific construction, stabilization, and reclamation plans to conserve the soil resource and meet reclamation and resource objectives are submitted and approved.

Alternative D would allow development on a total of 3,285,316 acres (within greater than ten percent of the grassland and shrubland communities in the planning area). Alternative D would have a direct, long-term, effect on grassland and shrubland communities. Under Alternative D, restrictions for construction on sensitive soils will likely be permitted and would have major adverse effects on grassland and shrublands in the planning area.

Water Resources

Alternative D would allow surface disturbances within 500 feet of springs, water wells, perennial streams, CBNG reservoirs, and non-CBNG reservoirs (within one to five percent of the grassland and shrubland communities in the planning area) in accordance with identified criteria and based on management decisions considering other resource values. This management would have a direct, long-term, beneficial effect on grasslands and shrublands. Disturbance in these areas would have a direct adverse effect on vegetation and water quality in these sensitive sites; however, meeting the stipulations and criteria would reduce the areas where development could occur and would minimize adverse effects. Allowances for on-channel reservoirs could have a direct adverse effect on vegetation.

Cave and Karst Resources

Alternative D management actions include establishing project-specific buffers (100 feet, for a total of 11 acres of protection – less than one percent of the grassland and shrubland communities in the planning area) from significant cave entrances to protect caves from timber sales and surface-disturbing activities. This would have a negligible, beneficial effect on grasslands and shrublands over the long term.

Mineral Resources

Locatable Minerals
In addition to areas currently withdrawn or restricted, Alternative D includes a number of new areas to conserve other resource values; this would leave 4,720,586 acres open to mineral entry, with 82,691 acres recommended for withdrawal from mineral entry in addition to the 11,373 acres of existing withdrawals. Grassland and shrubland communities would directly benefit over the long term from the additional withdrawn acreage. However, in the greater than ten percent of the grassland and shrubland communities in the planning area where development did occur, any related actions that disturbed the surface would have a direct and adverse effect until successful reclamation is achieved. Under the locatable minerals program for the planning area, overall it is estimated that BLM actions would disturb approximately 1,252 acres over the next 20 years. Reclamation would occur on 329 acres (Appendix G (p. 1937)). This long term disturbance would have a direct major adverse effect on the vegetative communities.

Leasable Minerals – Coal
Federal coal minerals are likely to be developed in areas identified as acceptable for further coal leasing consideration. In areas where coal development does occur, or where gasification facilities are constructed, grasslands and shrublands would be directly and adversely affected for the life of the project until reclamation goals and objectives are achieved.

Leasable Minerals – Fluids
Alternative D would make lands available for fluid minerals leasing and exploration in accordance with management identified to conserve other resources within greater than ten percent of the grassland and shrubland communities in the planning area. This management would make a total of 79,777 acres of federal land closed to minerals leasing. Overall, it is estimated that BLM's actions would disturb approximately a total of 14,869 acres over the next 20 years. Reclamation would occur on 8,127 acres (Appendix G (p. 1937)). This long-term disturbance of 6,742 acres would have a direct major adverse effect on vegetative communities.

Salable Minerals
Alternative D would open 2,725,060 acres of federal minerals to salable minerals exploration and development and would close 623,061 acres. Salable are not predicted to impact large acreage but where salable minerals are leased and developed (within greater than ten percent of the grassland and shrubland communities in the planning area), vegetation would be directly and adversely impacted by the mechanical removal or damage to the vegetation; soils also would be directly and adversely impacted until reclamation goals and objectives are met. For salable minerals development over the next 20 years, the estimated areas of surface disturbance would be 1,193 acres disturbed, 224 acres reclaimed, and 969 acres of long-term disturbance (Appendix G (p. 1937)).

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative D, response to wildland fires would vary from full suppression in areas where fire is undesirable, to monitoring fire behavior in areas where fire can be used as a management tool based on resource goals and objectives. Alternative D prohibits heavy equipment use within specifically identified areas totaling approximately 503,612 acres of public land except when human safety is at risk or if the effects of fire would cause more resource damage than the use of heavy equipment. Prohibiting heavy equipment would directly benefit vegetation over the short and long terms. Full protection strategies and tactics would be used in designated areas on approximately 38,760 acres. All protective measures have a direct, long-term, negligible,

beneficial effect on vegetation. All fires would be evaluated for rehabilitation and severity of impacts. Alternative D would use prescribed fire, wildland fire, and other vegetative treatments to meet management objectives. Effects from management actions would be direct, beneficial and long term.

Biological Resources

Vegetation – Forests and Woodlands
No effects are anticipated from forests and woodlands management actions.

Vegetation – Riparian/Wetland Resources
Alternative D would allow surface-disturbing activities when riparian/wetland and other resource objectives can be met on 23,831 acres (one to five percent of the grassland and shrubland communities in the planning area). Reclaiming vegetation on all CBNG riparian and wetland systems in accordance with ecological site protection measures would achieve returning all water-affected systems to their pre-CBNG natural state. These actions would have an indirect, minor, beneficial effect on vegetation.

Invasive Species and Pest Management
Alternative D would allow aerial application in areas where topography, extent of infestation, target species, and timing limit other application methods. Areas with annual bromes would be designated and prioritized for treatment. These actions would have a direct, moderate, beneficial effect on vegetative communities over the long term.

Fish and Wildlife Resources – Fish
Alternative D management actions would consider fish and fish habitat in reservoir, riparian/wetland systems, and perennial water management. Alternative D would apply constraints on surface-disturbing and disruptive activities providing protection of vegetation, soils, and soil microbial activity from surface-disturbing activities within greater than ten percent of the grassland and shrubland communities in the planning area; therefore, the management actions for fish under Alternative D would have major beneficial effects on grassland and shrubland resources.

Fish and Wildlife Resources – Wildlife
Alternative D would prohibit surface disturbance and occupancy in established big-game winter ranges, unless in doing so, the resource objectives are achieved. Any limitations, restrictions, or prohibitions on surface-disturbing activities and motorized travel would directly benefit greater than ten percent of the grasslands and shrublands communities over the long term. Activities that enhance habitat for wildlife would likely have a direct, major, beneficial effect on grassland and shrubland communities over the long term.

Special Status Species – Plants
Alternative D management actions would allow surface-disturbing activities, ROW, and motorized travel in habitats of special status plant species (126,811 acres, or 17%, of public land – five to ten percent of grassland and shrubland communities), but not in the area of known populations. This would have a moderate beneficial effect long term.

Special Status Species – Fish
Alternative D management actions would prohibit surface-disturbing and disruptive activities within 0.25 mile of any water that contains special status fish species (818 acres). This area of restriction also encompasses one to five percent of the grassland and shrubland

communities in the planning area. This action would have a direct, minor, beneficial effect on grasslands and shrublands over the long term.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative D would allow surface-disturbing and disruptive activities in active prairie dog colonies, within defined criteria, that do not adversely affect special status wildlife species that depend on the habitat provided by the colonies. Allowing these activities in prairie dog habitat would further impact vegetation that is already in a lower ecological state and increase the opportunity for resident cheatgrass to spread. Adverse effects to grasslands and shrublands would be direct and long-term.

Alternative D management actions would prohibit renewable-energy projects in Greater Sage-Grouse Priority Habitat Area. Actions also would prohibit or avoid surface-disturbing activities during specific periods within a specified distance from designated leks, identified nesting and early brood-rearing habitat, and Greater Sage-Grouse winter habitat. There would be no more than 5 percent removal of sagebrush habitat in Priority Habitat Area; outside these areas there would be no limitation on the amount of sagebrush removal. Decisions would also be based on management of occupied Greater Sage-Grouse habitats and Priority Habitat Area of Greater Sage-Grouse. In addition, lands that meet identified criteria would be prioritized for restoration to Greater Sage-Grouse habitat. These would have beneficial effects on vegetative communities.

Alternative D management actions would allow surface-disturbing and disruptive activities in accordance with defined criteria in known areas of special status amphibian and reptile species and their habitats. Known populations would be protected with an additional 1,640 feet (500 meter) buffer. This would affect approximately 176,636 acres, and would have a direct, beneficial effect over the long term.

Overall, protective measures for special status wildlife species would also conserve vegetation within greater than ten percent of the grassland and shrubland communities in the planning area; therefore, management actions for special status wildlife resources under Alternative D would have major beneficial effects on these vegetative communities.

Heritage and Visual Resources

Cultural Resources
Alternative D would prohibit surface disturbance in areas with historic properties, or within three miles or the visual horizon (whichever is closer) of historic properties that retain their integrity of setting (approximately 188,488 acres, less than ten percent of the grassland and shrubland communities in the planning area). This would have a direct, negligible, beneficial effect on grasslands and shrublands over the long term.

Paleontological Resources
Requiring paleontological field surveys and initiating protective measures would protect vegetation from possible large-scale surface disturbance within one to five percent of the grassland and shrubland communities in the planning area. This could affect up to 754,668 acres of public lands. This would result in a minor beneficial impact on grasslands and shrublands.

Visual Resources
Under Alternative D, VRI Class II areas and special emphasis areas (SRMAs, ACECs, etc.) would be managed as VRM Class II. All VRI Class III areas, plus the Powder River Breaks and Fortification Creek, would be managed as VRM Class III. VRM Class I and II areas could

prohibit or limit some surface-disturbing activities. VRM Class III and IV areas would have some limitations that could allow surface-disturbing activities. Overall, these management actions would occur in greater than ten percent of the grassland and shrubland communities in the planning area and, therefore, have a direct, major, beneficial effect on them over the long term.

Land Resources

Forest Products

No effects are anticipated from forest products management actions.

Lands and Realty

Alternative D management actions would pursue land disposals, acquisitions, easements, or land tenure adjustments for lands holding custodial grazing allotments, and sales in accordance with other resource values within greater than ten percent of the grassland and shrubland communities in the planning area. As they pertain to the overall management of public lands if pursed and completed, these actions would improve public land management overall and would have an indirect, long-term, major, beneficial effect on grassland and shrubland communities.

Renewable Energy

Alternative D management actions would exclude renewable-energy development in the southern Big Horn Mountains, areas closed to mineral leasing for fluids and solids, locatables, salables, ROW exclosures areas, and other areas where surface disturbance is prohibited for a total exclusion acreage of 396,995 public land acres. Renewable energy development would also be avoided on 340,912 public land acres, leaving less than 6 percent of public land available for development. (See Map 56 for specific locations.) Under the renewable-energy program for the planning area, overall it is estimated that BLM actions would disturb approximately 75,240 acres over the next 20 years. Reclamation would occur on 50,240 acres (Appendix G (p. 1937)). This management would have a minor adverse, and long term effect on the vegetation.

Rights-of-Way and Corridors

Alternative D management actions would exclude 79,777 acres from ROW development and avoid an additional 321,149 acres. Newly proposed transmission lines and ground facilities would be allowed within existing ROW and other disturbance areas. ROW activities would be avoided on slopes equal to or greater than 25 percent and on highly erodible soils. All these actions would have a direct, beneficial effect on grasslands and shrublands over the long term (Appendix G (p. 1937)). ROW disturbances are estimated to affect approximately 14,000 acres for pipelines and 56 acres for communications sites during the planning period; successful reclamation is estimated to occur on all affected acres. Powerlines are estimated to affect approximately 4,916 acres (1,900 miles), with successful reclamation on approximately 491 acres, leaving 4,425 acres of long-term disturbance (Appendix G (p. 1937)). These disturbances are allowed to occur within one to five percent of the grassland and shrubland communities in the planning area; therefore they would have minor adverse effects on those resources.

Travel and Transportation Management

Alternative D would close special designation areas to motorized vehicle use. Motorized vehicle use in stock driveways would be allowed on designated routes. Motorized vehicle use would be allowed with travel management designations in SSS habitat and on saturated soils or on slopes 25 percent or greater if resource management objectives can be met. Alternative D would limit motorized vehicle travel to designated roads and trails, consistent with management of other resources and would seasonally prohibit travel in game ranges. Alternative D management actions

would allow disturbance in less than one percent of the grassland and shrubland communities in the planning area and would have a direct, negligible adverse effect on grassland and shrubland communities over the long term.

Recreation
Alternative D management actions to designate seven specified areas as SRMAs, 54,160 acres, with possible consideration of additional lands for SRMA designation, and prohibiting surface disturbance in designated SRMAs unless for administrative use would generally help protect, maintain, and enhance vegetative resources. Alternative D allows additional recreation facilities consistent with other resource values, these would have a direct adverse effect on vegetation in and around the facilities over the long term. Visitor use and access is promoted in SRMAs, which would increase popularity and visitation and increase vegetation disturbance from trampling and increase the potential for introduction and spread of invasive plant species. SRMAs under Alternative D encompass one to five percent of the grassland and shrubland communities in the planning area. Alternative D management actions would have a minor adverse effect on grasslands and shrublands over the long term.

Lands with Wilderness Characteristics
Alternative D actions would include managing lands with wilderness characteristics to emphasize vegetative health, natural values, and primitive recreational opportunities on about 6,864 acres along the face of the Big Horn Mountains. These areas would conserve vegetation within less than one percent of the grassland and shrubland communities in the planning area. Managing these lands to those standards would have an indirect, negligible, beneficial effect over the long term.

Livestock Grazing Management
Alternative D management actions include management of Category M allotments would be to achieve multiple resource health and objectives, rather than maintaining a certain number of Category M allotments and Animal Unit Months (AUMs). Range improvements would be developed in accordance with resource needs and livestock management objectives, rather than developing range improvements and then monitoring to detect undesirable changes. AMPs would continue to be developed, but increases in vegetative production would be allocated for watershed protection first, then forage and habitat, rather than allocated for wildlife first, then livestock use. Livestock grazing would be allowed on all public lands except for areas described under Alternative A, with the addition of evaluated areas determined to be incompatible with other resource uses or values such as entrances of caves, campgrounds, and culturally significant sites. Permanent increases in forage allocations would be considered for watershed protection, livestock grazing, wildlife habitat, and other resource values. Rest and deferment following wildfires, prescribed fires, and vegetative treatments would continue until resource objectives were met, rather than based on a specific timeframe. Other management actions that do not address previous decisions include locating livestock salt and mineral supplements, designating future resource reserve common allotments, and allowing increases in livestock stocking rates as a result of vegetative treatments when resource objectives for the project are met. Construction of range improvements would have a direct adverse effect on vegetation for the life of the project but they are a tool for improving grazing management and this would benefit the vegetative communities. All other livestock-related actions would have an indirect, beneficial effect over the long term.

Estimations for surface disturbance over the planning area in the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately four acres, with successful reclamation on two acres and two acres of long-term disturbance. Pipelines

are estimated to disturb 40 acres, with successful reclamation on 35 acres and five acres of long-term disturbances. Fences would disturb approximately 38 acres (200 miles), with successful reclamation on approximately 35 acres (140 miles) approximately three acres of long-term disturbance. Wells are estimated to disturb one acre, with successful reclamation (Appendix G (p. 1937)).

Alternative D livestock grazing management would have a moderate beneficial effect on grasslands and shrublands.

Special Designations

Areas of Critical Environmental Concern
Alternative D management actions include designating two areas as ACECs, which would affect approximately 2,849 acres, including less than one percent of the grassland and shrubland communities in the planning area. The associated management plans for these sites would initiate specific conservation to protect soils and vegetation from surface-disturbing activities. This would have a direct, negligible, beneficial effects over the long term.

Scenic or Back Country Byways
The effects to grassland and shrubland communities from scenic or BCBs under Alternative D would be the same negligible beneficial effects as described in Alternative B.

Wild and Scenic Rivers
The effects to grassland and shrubland communities from WSRs under Alternative D would be the same negligible beneficial effects as described in Alternative B.

Wilderness Study Areas
There are three WSAs in the planning area totaling 28,931 acres, including less than one percent of the grassland and shrubland communities in the planning area. There are restrictions to preserve wilderness conditions in these areas until Congress acts on these WSAs. Designation of these areas and interim management is based on conservation of the natural resources, which would limit vehicular travel and surface-disturbing activities. This management would have a negligible beneficial effect on grasslands and shrublands.

Socioeconomic Resources

No effects are anticipated from socioeconomic resources management actions.

4.4.2.7. Cumulative Impacts

Chapter 4 describes effects to grassland and shrubland plant communities from past and present actions, federal and non-federal as part of the affected environment. Non-federal actions will affect vegetation similar to federal actions but mitigation for effects to vegetation resources would differ between federal and non-federal actions. The primary non-BLM authorized activities in the planning on and adjacent to public land have the potential to affect plant communities by changing species diversification within plant communities, the relative distribution of plant communities, and the relative occurrence of seral stages of those communities. The extent of non-federal activity is several times greater than BLM activities because BLM administers approximately 11 percent of the surface acreage in the planning area. These actions could improve or impair wildlife habitat, soil and water resources, and riparian and wetland habitats,

and those improvements or impairments could extend to other adjacent ownerships. The impacts from adjacent land owners would involve livestock grazing, habitat manipulation, and invasive species. Because of the intermingled ownership pattern, grazing management and the acres of livestock grazing on BLM surface versus non-federal surface does not change appreciably, and acre for acre, similar effects on vegetation would be anticipated.

4.4.3. Vegetation – Riparian/Wetland Resources

This section describes potential impacts to the vegetation in riparian/wetland systems from management actions under other resource programs. Chapter 3 provides a general discussion and information about riparian and wetland community types.

Most riparian lotic (flowing) systems in the planning area originate in the southern Big Horn Mountain watersheds and flow northeasterly to the plains. Other systems, but not all, are found along the major river and stream corridors, such as the Powder River, Crazy Woman Creek, Clear Creek, and Little Powder River. FLPMA and the Wyoming Standards for Healthy Rangelands (Appendix P (p. 2501)) direct the BLM to manage vegetative resources toward the maintenance or restoration of the physical function and biological health of vegetative ecosystems. Objectives are to maintain and improve the health and trend in plant communities that conserve soil and water, and provide forage, wildlife habitat, SSS habitat, recreation, scenic, ecological, and scientific benefits for consumptive and nonconsumptive uses.

Implementing any of the alternatives could cause direct or indirect impacts. Because riparian/wetland systems are limited and are often the most productive lands, humans, livestock, and wildlife disproportionately affect these areas compared to the same types or extent of actions in upland systems. All alternatives usually would avoid or minimize direct effects on riparian and wetland systems whenever possible. An impact to riparian and wetland systems affects the physical, chemical, or biological components of the ecosystem. Actions that contribute to the decline in abundance, distribution, or functionality of riparian and wetland systems would result in adverse effects; beneficial effects would result from activities that protect or restore these habitat types. Direct impacts to riparian and wetland systems result from surface-disturbing activities that remove or mechanically damage vegetation or the ground surface in these systems. Indirect impacts to riparian and wetland systems result from actions within a watershed that cause a change in riparian and wetland functionality (e.g., increased rates of sediment loading or changes in hydrology), a change in water chemistry, and spread of invasive plant species. For purposes of this analysis, short-term effects include actions that contribute to the decline in abundance or distribution of these systems, but can be reclaimed or restored within five years after the action; long-term effects require more than five years to repair or reclaim.

4.4.3.1. Methods and Assumptions

This section describes the methods and assumptions used in the impact analysis for riparian/wetland systems.

Activities affect vegetative resources by altering, disturbing, or removing soil and vegetation. This impacts analysis and conclusions are based on interdisciplinary team knowledge of resources in the planning area, review of existing literature, and information provided by other agencies. Existing literature and analyses include the Buffalo RMP (1985), the PRB EIS (BLM 2003c), and WGFD Spatial Mapping and Analysis. Spatial analysis was performed using the ESRI

ArcGIS Desktop 10.0 computer software. Effects are quantified where possible. In the absence of quantitative data, best professional judgement or interdisciplinary team knowledge was used. Potential impacts are sometimes described using ranges, or in qualitative terms if appropriate. Many impacts are described qualitatively because suitable data are not unavailable.

Assumptions

- Baseline inventory is needed to determine current riparian/wetland health and to develop management plans. The most recent assessment is more than 20 years old.
- Riparian and wetland systems comprise only a small portion of public lands, but offer more species and diversity than any other land type.
- Some riparian systems are evaluated during assessments for the Wyoming Standards for Healthy Rangelands (Appendix P (p. 2501)). Where assessments for healthy rangeland standards have been performed, riparian plant systems are functioning properly or are in the process of achieving PFC.
- Livestock and wildlife use typically is disproportionately higher in riparian and wetland systems than in upland systems. Improper grazing can adversely affect these systems throughout the year, but generally results in greater adverse effects in spring and early summer, when soils are wet (and therefore more vulnerable to compaction) and stream banks are more vulnerable to sloughing.
- It is assumed that the more surface disturbance in a watershed, the greater the probability that excess surface runoff and sediment will enter the stream and contribute to the loss of riparian and wetland functionality.
- Stream channels and land health can degrade quite rapidly. Recovery is often a much slower process. It is generally more efficient to prevent degradation than to recover a degraded system.
- Partnering with adjacent surface owners would allow achievement of PFC or DFC on longer reaches of qualifying streams and systems.
- Wetted systems are known to attract special status plant species, but also invasive plant species.

Significance Criteria

An adverse effect on water resources as a result of project actions would be considered potentially significant if it violates objectives associated with water quality, watershed, and soils management and its magnitude is such that special mitigation is warranted or it persists indefinitely.

Impacts on water quality, watersheds, and soils would be considered significant if any of the following were to occur:

- Unmitigated loss of wetlands or wetland function (EOs 11990 and 11988) or activities that would degrade riparian and wetland systems such that, as a minimum physical state, PFC and Wyoming Standards for Healthy Rangelands (Appendix P (p. 2501)) are not being maintained.
- Streamflow characteristics of perennial streams are altered such that established fisheries, wildlife, livestock, recreation, domestic, municipal, and industrial uses are affected.
- The alteration of stream hydraulic geometry by accelerated runoff and erosion (i.e., undue erosion, sedimentation, or mass wasting) beyond that expected through natural processes.
- The natural flow to or level of groundwater in existing springs, seeps, artesian wells, or permitted water supply wells is reduced to the point where beneficial uses cannot be maintained.
- Water quality is degraded to the level livestock and/or humans avoid it or is not fit for consumption.

4.4.3.2. Impacts Common to All Alternatives

Vegetation – Riparian/Wetland Resources
Riparian systems are some of the most productive ecosystems in the western United States, with a great diversity of plant and wildlife species. Healthy riparian systems purify water by removing sediment as it moves through vegetation. Stream bank erosion is prevented as riparian vegetation absorbs and dissipates the energy of flood waters. They also provide crucial habitat for wildlife, fish, and some SSS.

A baseline riparian inventory and information is needed to establish management goals and objectives and set priorities for these systems. Chapter 3 states the basis for this need – development and implementation of activity plans to manage riparian systems to be at or above, or continue to be improving toward, PFC while achieving Wyoming Standards for Healthy Rangelands. Management plans must be developed and implemented with continued monitoring to maintain, restore, and enhance the health and diversity of plant systems to achieve resource or multi-resource objectives, including but not limited to, improving species richness and plant structure diversity (vertical and horizontal vegetative structure and composition), promoting a variety of age classes, increasing plant densities, reducing or removing undesirable plants, addressing sensitive species concerns, and improving water quality. Riparian and wetland systems are able to recharge and rebound faster than other vegetative systems in the planning area.

For these systems to function properly, partnerships must be developed to enhance and expand these resource systems and to prevent degradation, loss, or destruction of riparian/wetland systems and habitats, regardless of land ownership.

Physical Resources

Air Quality
Adherence to rules and regulations and enhancing cooperative processes are administrative processes that would have no direct effect on riparian/wetland resources. Dust that covers vegetation reduces the photosynthesis process by blocking light and potentially water from reaching the plant cells. Travel on roads that are or will be surfaced with either gravel or scoria, if untreated, would force large amounts of dust into the air; this dust could settle on vegetation. Reducing dust emissions and overall air quality management throughout the planning area would have a major beneficial effect on riparian/wetland resources.

Soil and Water Resources
Management actions aimed at maintaining or improving soil conditions and minimizing soil erosion also would maintain or improve the health of vegetation. Management actions, including managing surface-disturbing activities; managing water resources; managing to achieve PFC, and meeting Wyoming water quality standards would benefit the associated riparian/wetland systems. All these actions would have a direct, long-term, beneficial effect on riparian and wetland systems. Also beneficial would be appropriate actions to improve the biological, chemical, and geomorphic conditions of streams adversely effected by BLM-authorized actions and permitted activities. Management actions common to all alternatives for soil occur within greater than ten percent of riparian/wetland vegetation; therefore they would have major beneficial effects on riparian/wetland resources.

Water quality, watershed, and soils management actions that allow for surface discharge of produced waters into stream channels from oil and gas activities would alter riparian vegetation

to accommodate higher quantity and persistence of flow regimes. Alteration of hydrologic conditions can affect the physical and chemical properties, such as pH, soil salinity, sediment properties, oxygen content, and nutrient availability, in wetlands (BLM 2003c). In ephemeral channels, existing vegetation would be lost through erosional processes. In more stable locations where vegetation could reestablish, composition would be dominated by salt-tolerant species. Perennial drainages would widen and have more defined channels. Where regulated flows mimic natural patterns, site stability would be maintained and vegetative cover and structure would be improved, while composition would shift to more salt-tolerant species. Management actions common to all alternatives for water occur within greater than ten percent of riparian/wetland vegetation; therefore they would have major beneficial effects on riparian/wetland resources.

Cave and Karst Resources

Cave inventories could benefit riparian/wetland resources. Riparian/wetland vegetation communities would be monitored through these inventories. Inventories would occur within greater than ten percent of riparian/wetland communities; therefore, management actions common to all alternatives would have major beneficial effects on riparian/wetland resources.

Mineral Resources

Leasable Minerals – Coal , Locatable Minerals, Leasable – Minerals – Fluids, and Salable Minerals

Coal development occurs primarily in areas identified as acceptable for further coal leasing consideration. Coal resources occur within less than one percent of riparian/wetland communities; therefore, management actions common to all alternatives for coal would have a negligible effect on riparian/wetland resources.

Any lands not withdrawn (closed) to mineral entry, closed to leasing or closed to mineral material disposal are available for exploration or development for locatable, leasable, and salable minerals. Most fluid mineral development occurs in east-central Johnson County, southern Campbell County, and northern and eastern Sheridan County. Most of the headwaters and riparian/wetland systems are a part of the southern Big Horn Mountain watersheds in southwestern Johnson County. For these major riparian and wetland systems, there is minimal conflict with fluid minerals development. For wet systems co-located in CBNG development areas, additional water and modifications (sediments, nutrients, and mineral loading or loss) could modify existing riparian and wetland systems. The largest proportion, approximately 80 percent, of the habitat disturbance would be caused by construction of linear facilities such as pipelines, roads, and powerlines. Straight-line construction of these facilities is the most cost-effective method; therefore, riparian and wetland areas would be in the path of construction. Roads and powerline and pipeline corridors are likely to cross riparian areas in particular. Well pads, compressor station pads, and many water-handling facilities would not cause loss of riparian and wetland systems because they would be located in upland sites. Some of the disturbance would be short term, such as construction of buried pipelines and overhead powerlines, while other disturbances would be long term or essentially permanent, such as construction of roads. The road system, pipelines, and utility corridors associated with minerals activities would affect soil erosion by generating excess overland flow from road surfaces and cut slopes and directing water into channels. The direct discharge of produced water that could reach local riparian and wetland areas also would affect these systems. Increases in surface water flow would have a direct adverse effect on existing riparian and wetland areas due to the large increase in water volume. These

processes can impair stream banks, alter hydrologic functions, and alter the composition and physical structure of riparian and wetland systems.

Habitat loss in riparian and wetland systems would occur directly through construction of roads, pipelines, powerlines, and some water-handling facilities. Habitat loss in riparian and wetland systems can substantially affect plant and animal species that depend on these ecosystems. Many plants grow only in seasonally flooded or saturated soils associated with riparian and wetland systems. These indirect adverse effects would degrade riparian and wetland systems. Roads, well pads, or powerlines adjacent to riparian and wetland systems cause various wetlands species to disappear from physical impacts. Decreases in the species richness can occur due to soil erosion, changes to hydrological patterns, and invasive plant species (BLM 2003c).

Locatable, fluid, and salable minerals are all available within greater than ten percent of riparian/wetland communities; therefore, management actions common to all alternatives for locatable minerals, leasable fluid minerals, and salable minerals would each have moderate adverse effects on riparian/wetland resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
The following management actions would directly benefit riparian/wetland systems: (1) prohibiting the use of retardant or foam within 300 feet of surface water sources, (2) rehabilitating fire lines constructed using heavy equipment, or on steep slopes, to prevent or control erosion, and (3) rehabilitation, including water barring and reseeding. Actions that would prevent water quality impairment and minimize erosion potential would be beneficial. These actions would reduce opportunities for soil and water erosion, thus preventing movement of sediments that could impair water quality and modify streamflow. Minimizing erosion potential would have an indirect, long-term, beneficial effect on riparian and wetland systems. Prohibitions for use of retardants or foam would occur within greater than ten percent of riparian/wetland vegetation communities; therefore, management actions common to all alternatives for unplanned and planned fire would have major beneficial effects on riparian/wetland resources.

Biological Resources

Vegetation – Forests and Woodlands
There are no management actions common to all alternatives for forest and woodland resources; therefore, there would be no effects to riparian/wetland resources.

Vegetation – Grassland and Shrubland Communities
Management actions to: (1) manage vegetative communities in accordance with Wyoming Standards for Healthy Rangelands and Guidelines for Livestock Grazing Management; (2) use an integrated management approach to maintain, restore, and enhance the health and diversity of plant communities; (3) manage grasslands and shrublands; (4) manage planning and development of travel routes, recreational uses, mineral exploration, and development sites; and (5) the siting of facilities and related infrastructure (e.g., utility corridors and roads) and ROW to reduce impacts to vegetative resources all would benefit nearby riparian and wetland systems. Management actions that improve the health of the surrounding upland vegetative community would indirectly benefit riparian and wetland systems. Limiting surface-disturbing activities nearby would directly benefit riparian and wetland systems by reducing opportunities for soil erosion, water erosion and water quality impairment, and limiting the opportunity for invasive plant species to establish and

expand. Grassland and shrubland management actions would have major beneficial effects on riparian and wetland systems.

Invasive Species and Pest Management
Management actions include implementing and maintaining cooperative IPM programs on public lands adjoining deeded and state lands, and limiting surface disturbance to the minimum needed for safe project completion to limit the spread of invasive plant species. These actions would benefit riparian and wetland systems by controlling invasive species regardless of land status. Riparian and wetland systems commonly traverse private, state, and federal lands. Minimizing the area of surface disturbance would benefit riparian and wetland systems by reducing the area of potential invasive species establishment. Management actions also include the use of vegetation products certified to be free of weed seed on all BLM-administered projects and lands. Application of herbicides can be beneficial and adverse, depending on the species being controlled and the herbicide itself. Non-selective herbicides could affect other broadleaf plants (forbs, special status plant species, and shrubs) along with the target species. Certain herbicides are safe for water application and others require a certain buffer, depending on application method (10 feet for hand, 25 feet for boom, and 100 feet for aerial - all BLM standard buffer zones - unless the herbicide label states or recommends a wider buffer). Stricter requirements would be no aerial application within 0.25 to 0.5 mile of wetlands, riparian systems, and aquatic habitats, and no vehicle or hand application within 0.25 mile of these same habitats. The greater the buffer area around sensitive resources where chemicals are applied or mixed, the less potential for impacts to habitats within the buffer area associated with vegetation removal, soil disturbances, or chemical spills. Other implications for establishing buffers in wetlands, riparian systems, and aquatic habitats is the difficulty of treating invasive species in wetland systems. There is the possibility of invasive species spread, which could allow invasive species to out-compete native species and potentially destroy the natural, native riparian/wetland communities.

Salt cedar is a shrub and a concern in some riparian and wetland systems because it transpires large amounts of water, resulting in salinization of soil around the plant (BLM 2007m). This species is a phreatophyte, which is a deep-rooted plant that obtains water from the water table. As a result, salt cedar could outcompete native riparian shrubs and herbaceous plants, thereby radically altering and affecting system functions. Salt cedar does not depend on surface disturbances outside the riparian zone to increase its ability to invade riparian and wetland systems.

Fish and Wildlife Resources – Fish
Providing public access would have a direct adverse effect on riparian and wetland systems over the long term because this activity would promote foot or primitive vehicular trails, which would trample native species and could introduce invasive species to these systems. Providing public access to fish-bearing waters would have an adverse long-term impact. Managing harmful non-native riparian vegetation in river and stream systems important to fish species would promote increased health of riparian systems. Five to ten percent of all riparian/wetland communities within the planning area are located along fish-bearing water systems; therefore, management actions common to all alternatives for Fish and Wildlife Resources – Fish would have moderate beneficial effect on riparian/wetland resources.

Fish and Wildlife Resources – Wildlife
Elk, deer, and pronghorn are attracted to and often congregate in riparian and wetland systems. Extensive browsing of desirable shrubs in riparian habitats could affect the density, height, and vigor of such species as willows, aspen, water birch, cottonwood, dogwood, and currant. In localized areas, elk have substantially affected riparian habitats through trampling, wallowing,

and grazing. Beaver can dramatically change the nature of a stream and the riparian and wetland systems with which it is associated. In most cases, changes to riparian and wetland systems created by beaver activity are beneficial. Management actions maintain or improve important wildlife habitats through vegetative manipulations, habitat improvement projects, and livestock grazing strategies; all these would indirectly improve any associated riparian/wetland systems. Improved habitat would correlate directly to improved health for the riparian zone. If wildlife populations grazed or inhabited riparian/wetland systems to the point of overgrazing and habitat degradation, adverse effects would result. Management actions common to all alternatives for wildlife resources would have a major beneficial effect on riparian/wetland systems.

Special Status Species – Fish and Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)

All measures in all SSS common to all alternatives that protect and enhance SSS habitat in riparian and wetland systems would directly benefit those systems over the long term. These include such actions as assisting authorized agencies in the restoration or reestablishment of SSS habitats; supporting the WGFD in obtaining water rights for the benefit of special status fish habitat; implementing actions set forth in recovery plans, conservation measures, terms and conditions, and appropriate BMPs and reasonable and prudent measures in biological opinions for T&E species. It is possible that special status plant species could take precedence over other native species; protection measures such as limiting or prohibiting treatments of invasive plants and pests, could contribute to the demise of other native specie. This would have an indirect, adverse effect for the long term. Special status fish habitats occur within less than one percent of all riparian/wetland vegetation communities within the planning area; therefore, management actions for special status fish species would have negligible beneficial effects on riparian/wetland resources.

Management of SSS generally involves restricting activities in the vicinity of special status plants or occupied wildlife habitat either year-round or during specific times of the year. As a result, riparian and wetland systems in the vicinity of buffer zones of SSS can benefit from less public use. Under all alternatives, no water development or salt, mineral, or forage supplements are allowed in areas inhabited by special status plant species. This restriction will prevent trampling of plants and changes to the soils that support special status plant species.

Habitats important to special status wildlife species occurs within greater than ten percent of all riparian/wetland vegetation communities within the planning area; therefore, management actions common to all alternatives for special status plant and special status wildlife species would have major beneficial effects on riparian/wetland resources.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources

Management actions include inventories for these resources. Lack of inventories means the locations of significant sites are not known. It is difficult to determine the extent of impacts to riparian/wetland systems from management of these resources. Cultural sites are often found close to streams, natural springs and seeps, and larger waterbodies. Therefore, protecting these cultural sites would directly benefit riparian and wetland systems. However, data recovery excavations would include direct and long-term soil surface disturbance and vegetation removal, but these areas are generally small (less than one acre). Vegetation disturbance would usually be direct and adverse but short term.

Cultural resources occur within greater than ten percent of all riparian/wetland vegetation communities and areas of high paleontological resources occur within five to ten percent of all riparian/wetland communities within the planning area; therefore, management actions common to all alternatives for cultural resources would have major beneficial effects and for paleontological resources moderate beneficial effects to riparian/wetland resources.

Visual Resources

Management of visual resources in VRM Class I and II areas could prohibit or limit some surface-disturbing activities and thereby protect riparian and wetland systems. VRM Class III and IV areas would have minor limitations. Management actions of visual resources that limit or prohibit surface-disturbing activities would have a direct and beneficial effect on riparian and wetland systems. Visual resources would be managed within greater than ten percent of all riparian/wetland vegetation communities within the planning area; therefore, management actions common to all alternatives would have major beneficial effects on riparian/wetland resources.

Land Resources

Forest Products

Prohibiting timber harvest within 200 feet of surface waters would directly benefit riparian and wetland systems over the long term; the fewer disturbances, the fewer impacts to the resource, including reducing the opportunity for invasive species to establish. Building roads and trails for timber removal would also need to be included in this management action to minimize potential soil erosion and water quality impairment. Forest products occur within less than one percent of all riparian/wetland communities within the planning area; therefore, management actions common to all alternatives for forest products would have negligible beneficial effects on riparian/wetland resources.

Lands and Realty

Considering land use authorizations (e.g., permits and leases) on a project-specific basis consistent with other resource objectives, and withdrawals from surface disturbances and minerals development on a project-specific basis would benefit riparian/wetland resources if those actions are consistent with riparian and wetland resource objectives. Withdrawals would have a direct, beneficial impact by limiting or denying the opportunity for surface disturbance and its associated impacts.

Vegetation on land proposed for exchange or acquisition would be indirectly affected due to a change in ownership and management. Land withdrawals, or available for exchanges and/or acquisitions occur in one to five percent of all riparian/wetland communities within the planning area; therefore, management actions common to all alternatives for lands and realty would have minor adverse or beneficial effects on riparian/wetland resources.

Renewable Energy

Effects are difficult to predict because renewable energy is considered future development, but most impacts are likely to occur from the removal of vegetation to construct these facilities. Most of the planning areas has low potential for wind-energy development; however, one area with high potential is the southern Big Horn Mountains (DOE 2010). Wind-energy development in that area could affect numerous riparian and wetland systems. Wind energy is likely to occur within one to five percent of riparian/wetland communities; therefore management action common to all alternatives for renewable energy will have minor adverse effects on riparian/wetland resources.

Rights-of-Way and Corridors
Most ROWs are associated with mineral development, which is primarily in south Campbell County, east-central Johnson County, and northern and eastern Sheridan County. For systems that might be affected, the effects from surface disturbance would be direct, adverse and long term. Corridors would limit locations and reduce acreages disturbed and would have a direct and long-term effect. ROWs and corridors will likely occur within greater than ten percent of all riparian/wetland communities within the planning area; therefore, management actions common to all alternatives for ROWs and corridors will have major adverse effects on riparian/wetland resources.

Travel and Transportation Management
Management actions to design, construct, and maintain roads and trails in consideration of other resources and to minimize surface disturbance, changes to surface water runoff, and erosion would have a beneficial effect on riparian and wetland systems over the long term. Transportation and access would occur within five to ten percent of all riparian/wetland communities in the planning area; therefore management actions common to all alternatives for transportation and access would have moderate effects on riparian/wetland resources.

Recreation
Management includes avoiding riparian and wetland habitat or developing and managing recreation sites, recreation facilities, and recreation access in a manner that minimizes impacts to riparian and wetland habitats, and prohibiting dispersed camping and commercial camps within 200 feet of surface water. Avoiding riparian and wetland habitat would be a management priority and would directly benefit these systems. However, it might be difficult to control recreation activities in these areas. If not controlled, recreation activities would likely have a direct adverse effect on riparian and wetland systems. Recreational activities will occur within less than one percent of all riparian/wetland communities in the planning area; therefore management actions common to all alternatives for recreation will have negligible adverse effects on riparian/wetland resources.

Lands with Wilderness Characteristics
Areas recognized as having wilderness characteristics would be managed to maintain suitability for preservation as wilderness. This would have indirect, beneficial effects on riparian and wetland systems. Lands with wilderness characteristics encompass less than one percent of all riparian/wetland communities within the planning area; therefore, management actions common to all alternatives would have negligible beneficial effects on riparian/wetland resources.

Livestock Grazing Management
Riparian and wetland systems 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 vegetative composition, cover, and vigor to maintain or achieve PFC in riparian and wetland systems. Implementing riparian exclosures would increase the density, age class, and cover of desirable riparian plants, including willow, cottonwood, and herbaceous riparian/wetland plants, within the exclosures. Livestock grazing would reduce vegetative cover and cause surface disturbance from hoof action and compact soils in localized areas. Reducing vegetative cover also would result in increased sediment and salt loads in localized areas, increased surface runoff, and less storage and retention of soil moisture. Management actions include developing and implementing appropriate livestock grazing management actions to achieve Wyoming Standards for Healthy

Rangelands, to improve forage for livestock, improve forage and habitat for wildlife, and enhance rangeland health. Management actions also include managing livestock grazing to sustain riparian, wetland, mountain mahogany, SSS, or other special habitats. Wyoming Standards for Healthy Rangelands standard 2 addresses the health of riparian and wetland vegetation to include structural, age, and species diversity, resiliency and capability to recover from natural and human disturbance, to provide forage and cover, capture sediment, dissipate energy, and provide groundwater recharge. Managing livestock grazing to meet this standard and sustaining special habitats would direct benefit hydrophilic systems over the short and long terms. Short-term management would address each growing season according to precipitation levels and adjust grazing levels if necessary (drought conditions); and long-term management and benefits would be for the term of the grazing lease, generally 10 years. Livestock grazing allotments contain greater than ten percent of all riparian/wetland communities in the planning area; therefore, management actions common to all alternatives for livestock grazing management will have major beneficial effects on riparian/wetland resources.

Special Designations

Areas of Critical Environmental Concern and Wilderness Study Areas

Management actions would emphasize primitive, nonmotorized activities to maintain current natural values. WSA management would prohibit surface-disturbing activities, and land use restrictions in ACECs would limit the extent of surface disturbance. This would directly benefit riparian and wetland systems over the long term because it would minimize potential adverse impacts to vegetation. ACECs and WSAs each contain less than one percent of all riparian/wetland communities in the planning area; therefore, management actions common to all alternatives for both ACECs and WSAs will have negligible beneficial effects on riparian/wetland resources.

Scenic or Back Country Byways and Wild and Scenic Rivers

It is anticipated that these designations would have minimal overlap with riparian and wetland systems. These special designation areas would be managed to maintain or enhance their natural characteristics, which would indirectly benefit any associated riparian and wetland systems over the long term. Although human use of these special designation areas could increase and have an adverse effect on riparian and wetland systems, the affect would be minimal. Scenic or BCBs and WSRs each contain less than one percent of all riparian/wetland communities in the planning area; therefore; management actions common to all alternatives for both scenic or back country byways and WSRs will have negligible beneficial effects on riparian/wetland resources.

Socioeconomic Resources

Social and Economic Conditions

Multiple entities depend on public lands for their livelihoods or a portion of their livelihoods. Public land natural resources also can add to quality of life and monetary benefits can be directly and indirectly derived from activities such as hunting, outfitting, fishing, and guided hunts and tours. These activities can be beneficial and adverse to riparian and wetland systems.

Health and Safety

Management actions designed to prevent accidental spills of hazardous materials would protect riparian and upland systems. Because hazardous materials (e.g., oil, oil and gas by-products, pesticides, and cleaning solvents) are being produced and transported in the planning area, there is

a threat of accidents or spills. If there was a spill, mitigation and cleanup would rarely succeed in recovering a riparian or upland area to its original condition; therefore, there would be long-term adverse effects.

The following sections describe impacts by alternative. These impacts would be in addition to the impacts common to all alternatives described above.

4.4.3.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended and maintained. This section describes potential impacts to riparian and wetland systems from management of other resources under Alternative A.

Vegetation – Riparian/Wetland Resources
Current management actions to prohibit surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams, unless the authorized officer waives the prohibition. This management action is adequate to protect these systems and waivers would only be granted as an exception. Waivers could allow direct, adverse effects on these systems and impact water quality over the short and long terms (days to years). Direct impacts result from surface-disturbing and other activities that cause removal of and/or mechanical damage to plants, soil medium, invertebrates, and biological soil crusts, both in terms of amount (overall biomass, density, cover) and in terms of diversity (species presence and richness). Direct impacts may also be the deposition of invasive species individuals or propagules (e.g., seeds or spores), soil compaction and/or erosion.

Physical Resources

Air Quality
The types of effects to riparian/wetland resources from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for air quality (vegetation conservation). In Alternative A, though, these impacts would be analyzed on a project specific basis. Without monitoring or oversight on a programmatic level, lack of consistency would cause the beneficial effects to likely only be negligible. Air quality resource management actions under Alternative A would have negligible beneficial effects on riparian/wetland resources.

Soil
Alternative A soils management would prohibit surface-disturbing activities in established timeframes and on slopes equal to or greater than 25 percent unless the authorized officer waives the prohibition. Waivers allow for inconsistent application of management. Restricting surface-disturbing activities on soils with poor reclamation suitability on a project-specific basis and the closure and reclamation of roads and trails if they are heavily eroded or washed out, or encouraging the use of other access roads in better condition if available are decisions that would direct benefit and protect soils and would therefore benefit and protect vegetative resources. Waivers from these decisions would allow disturbance of the soil surface and removal of or mechanical damage to plants and would have an direct and adverse effect over the long term. These restrictions could occur within greater than ten percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A for soils could have major beneficial effects on riparian/wetland resources.

Water Resources
Prohibiting surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams unless the authorized officer waives the prohibition would adequately protect these systems from erosion promoting activities, disturbance of habitat, and invasive species establishment. Waivers would be the exception but allow for inconsistent application of management and could allow activities at distances that could adversely affect water quality and quantity; remove or crush vegetation, thus reducing its ability to hold the soils and filter water. Alternative A does not include decisions addressing on-channel reservoirs; therefore, construction of on-channel reservoirs has become a common means of disposing of CBNG produced water and has resulted in direct adverse effects on vegetation and the overall watersheds. These sites are usually constructed on steep slopes where reclamation would be difficult, and the wetted areas below the dams are havens for invasive plant species such as Canada thistle and salt cedar. Prohibitions for water resources under Alternative A occur within greater than ten percent of all riparian/wetland communities in the planning area; therefore the management actions under Alternative A would have major beneficial effects on riparian/wetland resources. Without oversight on a programmatic level and specified criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Cave and Karst Resources
There area no management actions under Alternative A for cave and karst resources; therefore, there would be no effect to riparian/wetland resources.

Mineral Resources

Locatable Minerals
Under Alternative A, withdrawing the Amsden Creek, E.O. Taylor, and Kerns game ranges 4,583 acres from mineral location and restricting locatable minerals activities in the Fortification Creek, Gardner Mountain, and North Fork WSAs (approximately 28,931 acres) would have a direct, long-term, beneficial effect on riparian and wetland systems at these sites because surface-disturbing activities would not be permitted or would be restricted. Under the locatable minerals program for the planning area, it is estimated that BLM actions would disturb approximately 554 acres over the next 20 years (less than one percent of available acres). Reclamation would occur on 144 acres of BLM actions. Management actions under Alternative A would have negligible adverse effects on riparian/wetland resources.

Leasable Minerals – Coal
Surface-disturbing activities and would have a direct adverse effect on riparian and wetland systems in the areas of development. These impacts would be long term for the life of the project. Under Alternative A, coal exploration and development would occur within less than one percent of all riparian/wetland communities; therefore, management actions for coal under Alternative A would have negligible adverse effects on riparian/wetland resources.

Leasable Minerals – Fluids
Alternative A would continue to lease and allow development of federal oil and gas on 1,040,223 acres and would close the WSAs (28,931 acres) to leasing. Oil and gas wells avoid most riparian and wetland systems, but planning for linear construction projects such as pipelines, utility corridors, and roads does not avoid these systems. The road system, pipelines, and utility corridors would affect the frequency and magnitude of runoff, sediment transport, and surface hydrology by generating excess overland flow from road surfaces and cut slopes and

directing water into channels. Construction of reservoirs and ponds and other water disposal methods for CBNG development provide areas of soil disturbance and the perfect medium for establishment of invasive plant species, especially salt cedar. Under the leasable CBNG program for the planning area, overall it is estimated that BLM actions would disturb approximately 2,258 acres over the next 20 years (less than one percent of the total available acres). Reclamation will occur on 903 acres disturbed by BLM actions. Under the leasable oil and gas conventional program for the planning area, overall it is estimated that BLM actions would disturb approximately 8,317 acres over the next 20 years. Reclamation will occur on 5,575 acres disturbed by BLM actions (Appendix G (p. 1937)). Native grasses and forbs would dominate reclaimed sites initially, and forbs and shrubs would return over a longer period. Long-term disturbance, including roads that would be left in place after development, would have long-term effects on surface hydrology by removing vegetation and leaving bare ground, which would increase overland flow and sediment transport. There is no anticipated disturbance from geothermal-related activity. Under Alternative A, fluid mineral exploration and development could occur on greater than ten percent of all riparian/wetland communities; therefore, management actions for fluid minerals under Alternative A would have major adverse effects on riparian/wetland resources.

Salable Minerals

Alternative A would leave the entire planning area available for salable minerals leasing and the associated surface disturbance. This would have indirect and adverse effects on any riparian and wetland systems in these development areas for the term of the leases. However, this alternative prohibits salable minerals actions in the Fortification Creek, Gardner Mountain, and North Fork WSAs (approximately 28,931 acres) which is a direct benefit to those vegetative communities. Over the next 20 years, the estimated acres of salable minerals surface disturbance would be relatively small – 530 acres disturbed, 99 acres reclaimed, and 431 acres long-term disturbance (Appendix G (p. 1937)). Management actions for salable minerals under Alternative A would have negligible adverse effects on riparian/wetland resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)

Because they are wet, riparian and wetland systems are seldom affected by wildfire or prescribed fires, and certainly not to the degree as their upland counterparts. Over the next 20 years, approximately 14,000 acres are expected to be affected by prescribed fires and all acres are anticipated to be successfully reclaimed. Most of these acres would be grasslands and shrublands, but localized riparian/wetland systems could be affected. Applying different levels of suppression and restricting the use of some types of suppression equipment would have a direct beneficial effect on the vegetation and soils over the short term after any fire. If affected by fire, the short-term effects on vegetation and soils from the fire itself would be direct and adverse. Prescribed fires would be less severe than wildfires because the burn is conducted under controlled conditions (e.g., air and soil temperatures, wind conditions, and fuel types); however, the fires would still destroy any litter on the surface and the current year's growth. All acres affected by fire are expected to be successfully reclaimed. Overall, wildfires would have a minor adverse effect on riparian and wetland systems, and prescribed fires would have a negligible beneficial effect on riparian and wetland systems.

Biological Resources

Vegetation – Forests and Woodlands
No management actions are proposed under Alternative A; therefore no effects are anticipated from forests and woodlands.

Vegetation – Grassland and Shrubland Communities
Currently there are no management actions addressing grassland and shrubland communities. The past decade of energy development has disturbed vast acreages of public land. Reclamation of these lands has been difficult because of a lack of soil structures, limited precipitation, soil textures, inversion of spoil piles, unavailability of seed of preferred species, herbicide application to reclaimed sites, drought, and other reasons. The absence of protective management actions for the vegetative communities has a direct, adverse effect for the long term. Due to the challenges of these projects, energy-development companies have inquired about the use of non-native species (mostly sterile, small-grain cereal crops such as oats, triticale, and barley) for temporary cover on exposed soils until successful reclamation with native species is achieved. Use of non-native species could be a direct benefit by quickly establishing vegetation on sites and reducing the opportunity for erosion and invasive plant establishment. This could indirectly benefit riparian and wetland systems by reducing erosion potential. However, non-native species also could invade outside plant communities and outcompete native plants for water and soil nutrients, which would then make the non-native species an invasive plant. This would be a direct adverse impact. Grassland and shrubland communities indirectly affect (due to their adjacency) greater than ten percent of all riparian/wetland communities in the planning area; therefore, the lack of management actions addressing restoration of grasslands and shrublands would have a major adverse effect on riparian and wetland systems.

Invasive Species and Pest Management
Under Alternative A, control of invasive plant species and pests on public lands (approximately 8,000 acres annually) in cooperation with county weed and pest districts would have direct, short- and long-term, beneficial effects on riparian and wetland systems. Most control efforts include the use of chemical, mechanical and biological means. Controlling weeds by chemical and mechanical methods can directly and adversely affect other plant species. For example, if an herbicide is nonselective for all broadleaf plants, the chemical also could adversely affect forb species. If mechanical methods are used, any plant in the direct path of the application would be affected. Biological methods are generally species specific and effects are adverse, direct, and long term to the host species; other plants benefit indirectly through from improving the health of the vegetative community through the removal of host pest species. Pest control is primarily by chemical application and the effects would be to riparian and wetland systems would be indirect and short term. The quality of habitat may be diminished from vegetation removal by the pest species but the effect would be short term.

Fish and Wildlife Resources – Fish
Under Alternative A, enhancement of fisheries habitat is likely to have direct benefits to riparian and wetland systems. Less than one percent of all riparian/wetland communities in the planning area contain fish-bearing streams; therefore; management actions under Alternative A for fish would have a negligible beneficial effect on riparian and wetland resources.

Fish and Wildlife Resources – Wildlife
Under Alternative A, prohibiting surface disturbance and occupancy in the Ed O. Taylor, Kerns, Bud Love, and Amsden Creek Game Ranges, within 750 feet of sharp-tailed grouse leks, and within 0.5 mile of raptor nests, unless the authorized officer waives the prohibition has a beneficial effect for the long term. If the waiver is executed the surface-disturbing activities

would have a direct, adverse effect on any riparian and wetland systems in those areas, and the effects would continue for the duration of the project or permit (usually 10 or more years). The prohibitions/restrictions would occur in greater than ten percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A for wildlife would have major beneficial effects on riparian/wetland resources. Without oversight on a programmatic level and specified criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Special Status Species – Plants
Alternative A does not address the protection of special status plant species. Ute ladies'-tresses orchid can be found in riparian and wetland systems. Currently USFWS guidelines would be followed but there are no addition management actions to protect this or other potential sensitive plant species. Less than one percent of all riparian/wetland communities occur within special status plant habitats; therefore, management actions under Alternative A for special status plant resources would have negligible beneficial effects on riparian/wetland resources.

Special Status Species – Fish
Alternative A does not directly address the protection of special status fish species.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Providing and managing habitat for Threatened, Endangered, and special status wildlife species on all public lands in compliance with the ESA and BLM policy associated with management of habitat would have a direct, beneficial effect on riparian and wetland systems over the long term.

Prohibiting surface disturbance and occupancy with no exceptions would affect approximately 3,594 acres, and prohibiting surface disturbance except when the authorized officer waives the prohibition affects approximately 203,724 acres. Prohibitions leave the soil surface and plant communities intact. Waivers allowing surface-disturbing activities would mechanically damage soils and plants which could promote soil erosion, impair water quality, promote establishment of invasive species, loss of habitat and would have a direct, adverse effect on riparian and wetland systems in those areas, and the effects would continue for the duration of the project or permit (usually 10 or more years).

Establishing a year-round disturbance-free buffer zone for known bald eagle winter roosts would affect approximately 402 acres, and for activity zones for known roosts, would affect approximately 3,013 acres. This management would directly benefit riparian and wetland systems. Prohibiting surface disturbance or occupancy within a biologic buffer zone around active nests would affect approximately 28,437 acres, unless the authorized officer waives the prohibition. Prohibiting surface disturbance would protect plants and soils from mechanical damage, leaving plant communities intact and reducing the potential threat of soil erosion and invasive establishment. Waivers allowing surface-disturbing activities would have a direct adverse effect on riparian and wetland systems, and would the effects would continue for the duration of the project or permit (usually 10 or more years).

Alternative A does not address the protection of habitat for amphibians and reptiles. Not restricting or limiting surface-disturbing and disruptive activities would allow these habitats to be compromised, which would have a direct, adverse effect on riparian and wetland systems in these areas.

Overall, the prohibitions/restrictions under this alternative would encompass greater than ten percent of all riparian/wetland communities in the planning area; therefore, the management actions for special status wildlife species would have major beneficial effects on riparian/wetland resources. Without oversight on a programmatic level and specified criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Heritage and Visual Resources

Cultural Resources

Management actions that protect sites of cultural significance would conserve riparian/wetland vegetation that occurs within them. This would have an indirect, beneficial effect on riparian and wetland systems over the long term. Sites of cultural significance and their protective buffers encompass one to five percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A for cultural resources would have minor beneficial effects on riparian/wetland resources.

Paleontological Resources

No effects are anticipated from paleontological resources management actions.

Visual Resources

Under Alternative A, the BLM could prohibit or limit some surface-disturbing activities in VRM Class I and II areas and thereby protect any riparian and wetland systems in those areas. VRM Class III and IV areas would have minor limitations on surface-disturbing activities. Prohibitions on surface-disturbing activities for management of visual resources would have an indirect, beneficial effect on riparian and wetland systems over the long term. These visual resources classes encompass greater than ten percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A for visual resources would have major beneficial effects on riparian/wetland resources.

Land Resources

Forest Products

No effects are anticipated from forest products management actions.

Lands and Realty

The types of effects from Alternative A would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for lands and realty actions (habitat loss, fragmentation, and degradation). Under this alternative, lands available for tenure adjustments include those that contain one to five percent of all riparian/wetland communities in the planning area; therefore, the management actions under Alternative A for lands and realty would have minor adverse effects on riparian/wetland resources.

Renewable Energy

Alternative A does not establish guidelines for the development of renewable energy resources. Without management action related guidelines there are no protective measures in place for the resources. This would have an indirect, adverse effect on riparian and wetland systems due to potential loss of vegetation during facility construction. Renewable energy could be permitted within one to five percent of all riparian/wetland communities in the planning area;

therefore, management actions under Alternative A for renewable energy would have minor adverse effects on riparian/wetland resources.

Rights-of-Way and Corridors
Alternative A allows actions that would include installing linear surface-disturbing projects that can transect riparian and wetland systems. Disturbance is usually localized. This alternative could permit ROWs within one to five percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A would have minor adverse effects on riparian/wetland resources.

Travel and Transportation Management
Alternative A limits motorized vehicle use to existing roads and vehicle routes. Closing areas with saturated soils and with slopes equal to or greater than 25 percent to motorized vehicles would directly benefit vegetation, soils, and water quality over the long term. Prohibiting vehicular travel in certain areas, limiting vehicular travel to designated roads and trails in other areas, and seasonally closing areas to vehicular travel would have a direct, beneficial effect on riparian and wetland systems over the long term as it would conserve these vegetative communities. These prohibitions/restrictions would occur in less than one percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A for recreation would have negligible beneficial effects on riparian/wetland resources.

Recreation
Recreation site development often is close to perennial water or other natural water systems. Runoff from roads, trails, and established campgrounds results in direct adverse impacts over the long term. Vegetation is removed from these sites and is trampled in adjacent areas. These effects are direct, adverse, and long term. Development of recreation sites is anticipated to disturb approximately 5 acres. Although the estimated impacted acreage is small, the localized impact would be adverse for the long term. Recreational areas occur within less than one percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A for recreation would have negligible adverse effects on riparian/wetland resources.

Lands with Wilderness Characteristics
Alternative A does not manage for the protection of wilderness characteristics outside the three WSAs.

Livestock Grazing Management
With proper grazing management and implementation of rangeland improvement projects, the health of riparian and wetland systems can be sustained or improved. The degree and extent of grazing-related impacts to riparian and wetland systems over the long term are expected to continue to decrease. Improper livestock grazing practices adversely affect riparian and wetland systems through soil compaction, physical removal and destruction of vegetation, and trampling of stream banks, causing bank failure. Alternative A prohibits livestock grazing on approximately 10,000 acres where grazing has been determined to be incompatible with other resource uses, values, and locations. Excluding livestock grazing in these sensitive areas directly benefits vegetation. Most of these areas have fragile soil surfaces and steep slopes, and produce little vegetation. Under Alternative A, any permanent increases in the amount of forage produced would be considered for wildlife and watershed protection before additional livestock use is authorized. Providing increases in forage toward habitats and watershed protection would facilitate the healthy ecological state for these resources. This would directly benefit vegetation over the short term. Alternative A does not address the placement of livestock supplements to prevent them

from compromising other resource requirements. This alternative does not address proper rest periods from livestock grazing following prescribed fire and other vegetative treatments.

Estimations for surface disturbance in the planning area over the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately 4 acres, with successful reclamation on 2 acres and 2 acres of long-term disturbance. Pipelines are estimated to disturb 40 acres, with successful reclamation on 35 acres and 5 acres of long-term disturbances. Fences would disturb approximately 70 acres (80 miles), with successful reclamation on approximately 50 acres (57 miles) and 20 acres of long-term disturbance. Wells are estimated to disturb one acre, with successful reclamation (Appendix G (p. 1937)).

Overall, Alternative A management of livestock grazing would have a minor beneficial effect on riparian and wetland systems.

Special Designations

Areas of Critical Environmental Concern and Scenic or Back Country Byways
Currently there are no designated ACECs or scenic or BCBs. The lack of designations and lack of management actions leaves nothing to protect their natural values. Riparian and wetland systems can be a part of these special designated areas so a lack of protective management has an indirect adverse effect.

Wild and Scenic Rivers
The Middle Fork Powder River was determined to be eligible and suitable as a WSR and is managed to protect those values. Riparian and wetland systems are a part of the special designation area, the protective management has an indirect beneficial effect. WSRs occur in less than one percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A for WSRs would have negligible beneficial effects on riparian/wetland resources.

Wilderness Study Areas
Alternative A management action make WSAs unavailable for mineral leasing in the interim until Congress decides whether to designate the WSAs as Wilderness. Riparian and wetland systems can be found in WSAs, so protection from mineral leasing is a direct benefit long term, unless Congress designates otherwise. Current WSAs contain less than one percent of all riparian/wetland communities in the planning area; therefore, management actions under Alternative A would have negligible beneficial effects on riparian/wetland resources.

Socioeconomic Resources

No effects are anticipated from socioeconomic resources management actions.

4.4.3.4. Alternative B

This section describes management actions under Alternative B, which emphasizes resource conservation, and the likely impacts to riparian and wetland resources due to their implementation.

Vegetation – Riparian/Wetland Resources
Prohibiting surface-disturbing activities for minerals leasing within 500 feet of riparian and

wetland systems, aquatic habitats, and floodplains would directly benefit these systems by reducing the potential for soil and water erosion and the potential to impair water quality. Restoring vegetation on all CBNG-supported riparian and wetland systems, including areas receiving direct-discharge waters, would apply reclamation to all parts of the system. All systems are very susceptible to water-tolerant invasive species such as salt cedar and Canada thistle, and reclamation would establish competitive, native species that would keep the invasive species from establishing.

Physical Resources

Air Quality

Under Alternative B, air quality modeling would be performed on a project-specific basis. In addition, projects expected to approach or exceed emissions standards would be evaluated for potential mitigation strategies, which would have a major beneficial effect on riparian/wetland resources.

Soil

Alternative B soils management actions would include prohibiting surface-disturbing activities on slopes equal to or greater than 25 percent, on soils with a severe erosion hazard and on soils with poor reclamation potential, and on badlands, rock outcrops, or slopes susceptible to mass movement. All these actions would have a direct, beneficial effect on riparian and wetland systems over the long term as they would promote conservation of this vegetation. These prohibitions would occur in greater than ten percent of the riparian/wetland communities in the planning area; therefore, management actions under Alternative B for solid would have major beneficial effects on riparian/wetland resources.

Water Resources

Alternative B water management actions would prohibit surface disturbance within 500 feet of any natural or man-made water feature. This action would prohibit removal of vegetation and disturbance of soil which would reduce potential for soil runoff into nearby water systems; soil runoff could contribute to the impairment of water quality. Other management actions include prohibiting activities that would result in surface discharge of water and prohibiting construction of on-channel reservoirs that could adversely affect natural flow regimes. These actions would have a direct, beneficial effect on riparian and wetland systems by preventing the natural transition of plant species from dry land species to more wetland-tolerant species in riparian and wetland systems, and minimizing the opportunity for invasive plant species to establish on these sites. These prohibitions would encompass greater than ten percent of all riparian/wetland communities in the planning area; therefore management actions under Alternative B for water would have major beneficial effects on riparian/wetland resources.

Cave and Karst Resources

No effects are anticipated from cave and karst management actions.

Mineral Resources

Locatable Minerals

In addition to areas currently withdrawn or restricted from locatable minerals development, Alternative B includes a number of new areas to protect and preserve cultural, paleontological, recreation, lands with wilderness characteristics, and special designation resource values (ACECs, scenic or BCBs, WSRs, and WSAs). This would result in 618,256 public land acres withdrawn.

Existing withdrawals and restrictions were implemented to protect and preserve other resource values. Under Alternative B, withdrawing or restricting additional areas from locatable minerals development would have a direct beneficial effect on riparian and wetland systems over the long term. The majority of the disturbance will not take place in riparian/wetland vegetation types. The management actions for locatable minerals under Alternative B would have negligible adverse effects on riparian/wetland resources.

Leasable Minerals – Coal
Under Alternative B, approximately 28,738 acres would be available to exploration. Where development does occur, vegetation would be directly and adversely affected over the long term for the life of the project and would require successful reclamation to ensure the native vegetative component was reestablished to predisturbance conditions. Under this alternative, approximately 186,600 acres would be disturbed (existing leases and new leases), with reclamation occurring on approximately 120,600 acres, 36,500 acres being actively mined, and approximately 66,000 acres disturbed over the long term (Appendix G (p. 1937)). The majority of the disturbance will not take place in riparian/wetland vegetation types. Management actions under Alternative B for coal would have minor adverse effects on riparian/wetland resources.

Leasable Minerals – Fluids
Alternative B would make lands available for fluid minerals leasing and exploration in accordance with management identified to conserve other resources. This would result in 2,612,920 public land acres (41% of total public land) closed to minerals leasing. This would directly benefit riparian and wetland systems because more acreage would be protected from development over the long term. There is no anticipated disturbance from geothermal-related activities. Overall, Alternative B management of leasable fluid minerals would allow exploration and development in less than five percent of all riparian/wetland communities in the planning area; therefore, management actions for fluid minerals under Alternative B would have minor adverse effects on riparian/wetland resources.

Salable Minerals
Alternative B would close 3,218,690 acres of mineral estate to salable mineral activity. Although a large portion of public land is unavailable, development is localized and small-scale. Under the salable minerals program for the next 20 years, the estimated areas of surface disturbance would be small; 114 acres disturbed, 21 acres reclaimed, and 5,163 acres of long-term disturbance (Appendix G (p. 1937)). The majority of the disturbance will not take place in riparian/wetland vegetation types. Management actions for salable minerals under Alternative B would have negligible adverse effects on riparian/wetland resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and **Planned Fire (Prescribed Fire)**
Alternative B management actions involving the application of full suppression in areas where fire is undesirable would affect approximately 42,232 acres. Monitoring fire behavior only in areas where fire can be used as a management tool based on resource goals and objectives would directly benefit riparian and wetland systems. Limiting suppression vehicles to existing roads and trails unless they are in identified full suppression areas would affect approximately 739,910 acres, and rehabilitating all fire-related damage also would directly benefit vegetative communities over the short and long terms by reducing the potential for water and soil erosion. Alternative B protected acres would be the same as under Alternative A. Long term, the application of prescribed fire to support riparian and wetland systems and wildlife habitat

objectives is estimated to affect approximately 3,500 acres from BLM actions. All acres would be successfully reclaimed (Appendix G (p. 1937)). This management would have minor beneficial effects on riparian and wetland systems.

Biological Resources

Vegetation – Forests and Woodlands
No effects are anticipated from forests and woodlands management actions.

Vegetation – Grassland and Shrubland Communities
Under Alternative B, authorizing only native plant species for all reclamation activities would promote native species and eliminate or reduce the opportunities for non-native species to be introduced and possibly cross pollinate with native species, outcompete native species for water and soil nutrients, and possibly move off reclamation sites. Native plants can be more difficult to establish than non-native species. Overall, Alternative B management of grasslands and shrublands would have a moderate beneficial effect on riparian and wetland systems.

Invasive Species and Pest Management
Alternative B would control invasive plant species in cooperation with county weed and pest districts. Treating plants on the Wyoming Weed and Pest Control Act Designated List, the appropriate county lists, and other species of concern as determined by BLM resource specialists would treat all species that adversely affect native plant communities. Annual bromes (cheatgrass) are present throughout the planning area; therefore, a treatment management plan addressing cheatgrass should incorporate the entire planning area. Treatment of annuals would improve the ecological state of the vegetative communities. Application of herbicides can be beneficial and adverse, depending on the species being controlled and the herbicide itself. Nonselective herbicides could affect other broadleaf plants (forbs, SSS, and shrubs) along with the target species. Certain herbicides are safe for water application and others require certain buffers depending on application method (10 feet for hand, 25 feet for boom, and 100 feet for aerial are BLM standard buffer zones, unless the herbicide label recommends a wider buffer). The greater the buffer area around sensitive resources where chemicals are applied or mixed, the less potential for impacts associated with vegetation removal, soil disturbances, or chemical spills to the vegetative communities. Other implications for establishing buffers in wetlands, riparian systems, and aquatic habitats are the difficulty in treating invasive species in riparian and wetland systems. Invasive species left untreated have the potential to spread and could outcompete native species and potentially destroy riparian and wetland habitat. This would be a direct adverse impact. All other actions would have direct beneficial effects over the long term (Appendix G (p. 1937)). Overall, Alternative B invasive species and pest management would have a moderate beneficial effect on riparian and wetland systems.

Fish and Wildlife Resources – Fish
Alternative B management actions include introducing, protecting, and enhancing fish populations and habitats and maintaining or enhancing fish habitat with actions that affect perennial waters, reservoirs, and riparian systems to improve or enhance potential fisheries. Management also includes managing fish habitat toward DFC, restoring important instream segments for fish habitat, and designing crossings to allow fish passage. Actions that would improve habitat for fish would directly benefit riparian and wetland systems capable of supporting fish. Prohibiting surface-disturbing and disruptive activities within 0.25 mile of naturally occurring waterbodies would also conserve the riparian/wetland communities within these buffers. The prohibitions encompass less than one percent of all riparian/wetland communities in the planning area;

therefore, management action for fish under Alternative B would have negligible beneficial effects on riparian/wetland resources.

Fish and Wildlife Resources – Wildlife
Under Alternative B, a number of wildlife management actions could be implemented, including distance and timing limitations or prohibitions on surface disturbance or occupancy in and near established winter ranges or big game transition ranges, within traditional big game migration and travel corridors, and in calving areas. These actions would have a direct, beneficial effect by conserving riparian and wetland systems over the long term. These prohibitions/restrictions would encompass greater than ten percent of all riparian/wetland communities; therefore, management actions for wildlife under Alternative B would have major beneficial effects on riparian/wetland resources.

Special Status Species – Plants
Alternative B management actions would prohibit surface-disturbing or disruptive activities in designated areas that contain special status plant habitat. Limiting activities in habitats with known populations of special status plant species would have a direct, beneficial effect on less than one percent of all riparian and wetland systems over the long term. Management actions for special status plants under Alternative B would have negligible beneficial effects on riparian/wetland resources.

Special Status Species – Fish
Alternative B management actions would prohibit surface-disturbing activities, disruptive activities, impoundments, and instream structures on or near existing or potential fisheries sites and fish habitat. This would have a direct, beneficial effect greater than ten percent of all riparian and wetland systems over the long term through conservation of this vegetation. Management actions for special status fish species would have major beneficial effects on riparian/wetland resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative B maintenance or enhancement of special status wildlife species habitat would usually have a direct, beneficial effect on riparian and wetland systems unless protective measures compromised the health of the other native species, such as limiting or prohibiting control measures on invasive or pest species.

Alternative B management actions would prohibit renewable-energy projects in Greater Sage-Grouse nesting, brood-rearing, and winter concentration areas. Nesting and brood-rearing activities are often close to riparian and wetland systems. The larger the area protected from surface disturbances the greater the benefit to these vegetative communities. This management would have a direct, beneficial effect on any associated riparian and wetland systems over the long term.

The management action to allow no more than three percent removal of sagebrush habitats per 640-acre section might or might not benefit grassland and shrubland communities and any associated riparian and wetland systems in the affected areas, depending on the ecological condition of the systems and other resource objectives. Greater Sage-Grouse habitat restoration actions, though, would promote increased health of both grassland and shrubland and riparian/wetland systems.

The Alternative B management action to establish a year-round disturbance-free zone for bald eagle roosting and nesting corridors would affect approximately 12,937 acres. This management action would have a direct, beneficial effect on riparian and wetland systems over the long term.

Alternative B management actions that prohibit surface-disturbing and disruptive activities for the protection of special status amphibian and reptile species and their habitats would affect approximately 176,636 acres. This management would have a direct, beneficial effect on these preferred riparian and wetland sites over the long term.

Overall, prohibitions/restrictions for the conservation of habitats important to SSS wildlife would also conserve over ten percent of all the riparian/wetland communities in the planning area; therefore management actions under Alternative B for special status wildlife species would have major beneficial effects on riparian/wetland resources.

Heritage and Visual Resources

Cultural Resources

Prohibiting surface disturbance in areas with historic properties, or within 5 miles or the visual horizon (whichever is closer), would affect approximately 330,592 public land acres of historic properties. This would have a direct, beneficial effect on riparian and wetland systems over the long term through vegetation conservation. These areas of restrictions would encompass greater than ten percent of all riparian/wetland systems in the planning area; therefore, management actions for cultural resources under Alternative B would have major beneficial effects on riparian/wetland resources.

Paleontological Resources

Requiring paleontological field surveys to determine types and locations of classes, monitoring, and then initiating protective measures, including limiting or prohibiting surface-disturbing activities would protect vegetation from possible large-scale surface disturbance. This could affect up to 754,668 acres of public land. The effect on riparian and wetland systems would be direct and long term. Prohibitions could encompass five to ten percent of all riparian/wetland systems in the planning area; therefore management actions for paleontological resources under Alternative B would have moderate beneficial effects on riparian/wetland resources.

Visual Resources

Under Alternative B, the BLM could prohibit or limit some surface-disturbing activities in VRM Class II areas on about 217,021 acres and thereby protect riparian and wetland systems. VRM Class III and IV areas encompass approximately 276,107 and 258,866 acres respectively on which the BLM would allow surface-disturbing activities with minor limitations. Prohibiting or limiting surface-disturbing activities for management of visual resources would have a beneficial effect on riparian and wetland systems as it would promote the conservation of these vegetative communities. Visual resources class restrictions would encompass greater than ten percent of all riparian/wetland systems in the planning area; therefore management actions under Alternative B for visual resources would have major beneficial effects on riparian/wetland resources.

Land Resources

Forest Products

No effects are anticipated from forest products management actions.

Lands and Realty
No effects are anticipated from lands and realty management actions.

Renewable Energy
Alternative B management actions would exclude development in specific areas on about 730,530 acres of public land. Renewable energy and the related infrastructure, namely roads and pipelines, would likely transect riparian and wetland systems, since the preferred location for development is the higher elevations where the headwaters for riparian systems are located. Under the renewable-energy program for the planning area, overall it is estimated that approximately 5,000 acres would be disturbed over the next 20 years. Reclamation would occur on 4,500 acres, leaving 500 acres of long-term disturbance (Appendix G (p. 1937)). Renewable energy development could be permitted in five to ten percent of all riparian/wetland system in the planning area and would, therefore, have a moderate adverse effect on riparian and wetland systems.

Rights-of-Way and Corridors
Management actions include prohibiting ROW on slopes equal to or greater than 25 percent and on highly erodible soils to minimize impacts to soil resources. Requiring co-location of new communication sites within designated areas, authorizing transmission lines in identified corridors, and avoid constructing facilities along major transportation routes. Linear features such as ROW and utility corridors will transect riparian and wetland systems. Actions that would reduce surface disturbance would directly benefit vegetation over the long term by avoiding or limiting removal or mechanical damage to vegetation and reduce the potential for water and wind to erode soil. ROW development on public land would be excluded on 706,556 acres and avoided on 56,857 acres of public land. Under Alternative B, ROW disturbances for pipelines, communications sites, roads, and powerlines are estimated to affect approximately 32,536 acres (5,750, 28, 9,275, and 2,458 acres, respectively), with successful reclamation on approximately 8,685 acres (5,750, 0, 2,690, and 245 acres, respectively) and 8,826 acres (0, 28, 6,585, and 2,213 acres, respectively) of long-term disturbance (Appendix G (p. 1937)). ROWs and corridors could be permitted in greater than ten percent of all riparian wetland communities in the planning area; therefore, management actions under Alternative B for ROWs and corridors would have major adverse effects on riparian/wetland resources.

Travel and Transportation Management
Alternative B management actions would allow motorized vehicles off designated routes with a special use permit. Management actions would close 625,854 acres to motorized use, including areas with saturated soils or on slopes of 25 percent or greater, in habitat for SSS, special designation areas, and big game ranges during specific timeframes; and also limit travel to designated roads and trails on 137,126 acres. These actions would have a direct, long-term, beneficial effect on riparian and wetland systems by protecting the resources during conditions when soil and plants are highly susceptible to erosion. Prohibiting vehicular travel on saturated soils and requiring closure and reclamation of roads if they are heavily eroded, washed out, or if other access roads in better condition are available would directly benefit vegetative resources. Motorized access would be prohibited on 80 percent of the planning area and because SSS habitat has significant overlap with the riparian/wetland systems in the planning area, management actions for transportation and access under Alternative B would have direct, moderate, beneficial effects on riparian and wetland systems over the long term.

Recreation
Alternative B management actions to designate eight specified areas as SRMAs (55,529 acres) and prohibit surface disturbance in designated SRMAs unless the disturbance is for

administrative purposes would generally help protect, maintain, and enhance vegetative resources. However, the BLM promotes visitor use and access in SRMAs, which would increase the areas' popularity and visitation. This would increase vegetation disturbance from trampling and increase the potential for invasive plant species introduction and spread. The SRMAs would encompass less than one percent of all riparian/wetland systems in the planning area; therefore, management actions for recreation under Alternative B would have negligible beneficial effects on riparian/wetland resources.

Alternative B also proposes to close 372 acres along the Tongue River of the Welch Ranch Recreation Area to Grazing. In the short term this would increase vegetative cover in the riparian area. However, over the long term, vegetation diversity may actually decrease with the absence of grazing. Overall the recreation management actions would have a negligible beneficial effect on riparian/wetland resources.

Lands with Wilderness Characteristics
Alternative B includes management actions for the lands with wilderness characteristics areas, which would directly benefit vegetative communities by limiting surface-disturbing activities in those areas on approximately 12,237 acres. This management would encompass less than one percent of all riparian/wetland systems in the planning area; therefore the management actions for lands with wilderness characteristics under Alternative B would have negligible beneficial effects on riparian and wetland systems.

Livestock Grazing Management
Management actions include limiting or prohibiting livestock grazing where it has been determined to be incompatible with other resource values; locating livestock salt and mineral supplements a minimum of 0.5 mile from water sources, riparian systems, and aspen stands; and authorizing permanent increases in forage allocations to wildlife habitat and watershed protection as the first priority and to livestock grazing as the second priority. All these management actions benefit vegetative communities over the long term.

Estimations for surface disturbance over the planning area in the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately 4 acres, with successful reclamation on 2 acres and 2 acres of long-term disturbance. Pipelines are estimated to disturb 40 acres, with successful reclamation on 35 acres and 5 acres of long term-disturbance. Fences would disturb approximately 100 acres (120 miles), with successful reclamation on approximately 70 acres (84 miles) and approximately 30 acres of long-term disturbance. Wells are estimated to disturb one acre, with successful reclamation (Appendix G (p. 1937)).

Livestock grazing allotments encompass greater than ten percent of all riparian/wetland systems in the planning area. Alternative B livestock grazing management would have a major beneficial effect on riparian and wetland systems.

Special Designations

Areas of Critical Environmental Concern
Alternative B management actions include designating eight areas as ACECs, which would affect approximately 511,000 acres and between one and five percent of all riparian/wetland systems in the planning area. The associated management plans for these sites would initiate specific conservation measures to protect soils and vegetation from adverse effects. This management

would have a direct, minor beneficial effect on any riparian and wetland systems in these special designated areas over the long term.

Scenic or Back Country Byways
No effects are anticipated from scenic or BCB management actions.

Wild and Scenic Rivers
Under Alternative B, management would continue in accordance with the Middle Fork Interim Management Plan to retain its free-flowing characteristics and outstanding remarkable values until Congress acts to release or designate the Middle Fork Powder River as a WSR. The Middle Fork Powder River is within less than one percent of all riparian/wetland systems in the planning area. Continuing interim management would have an indirect, negligible, beneficial effect on riparian and wetland systems over the long term.

Wilderness Study Areas
There are three WSAs in the planning area totaling 28,931 acres, containing less than one percent of all riparian/wetland systems in the planning area. There are restrictions to preserve wilderness conditions in these areas until Congress acts on their Wilderness status. Designation of these areas and interim management is based on conservation of the natural resources, which would directly benefit vegetative communities and limit vehicular travel and surface-disturbing activities. This management would have a negligible beneficial effect on riparian and wetland resources.

Socioeconomic Resources

No effects are anticipated from socioeconomic resources management actions.

4.4.3.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource use, and the likely resulting impacts to riparian and wetland resources due to its implementation.

Vegetation – Riparian/Wetland Resources
Alternative C management actions would allow surface-disturbing and disruptive activities and apply standard lease terms for minerals leasing within 500 feet of riparian and wetland systems, aquatic habitats, and floodplains. These actions would remove any protective buffer and would directly and adversely affect riparian and wetland systems by promoting activities that lead to erosion of soils and water and impair water quality. Restoring vegetation only on direct CBNG disturbance areas (e.g., dams and reservoirs) rather than on all CBNG-supported riparian and wetland systems would apply reclamation only to a very small number and acreages of the affected systems. These systems would be a catalyst for water-tolerant invasive plant species such as salt cedar and Canada thistle. These management actions adversely effect riparian and wetland systems over the long term.

Physical Resources

Air Quality
There would be no air quality modeling under Alternative C. Industrial projects would be expected to approach or exceed emissions standards, and no mitigation strategies would be examined. This would have indirect adverse impacts to riparian/wetland vegetation. Vegetation is

possibly more sensitive to air pollutants than humans. In particular, acid rain has left areas barren or with severely damaged vegetation. Ground-level ozone and reactive nitrogen can cause discoloration, damage, and loss of leaves, which can reduce photosynthesis by as much as 50 percent. As a result, biologically significant quantities of reactive nitrogen are now reaching the highest places. At lower elevations in the western United States, introduced grasses stoked by nitrogen are overwhelming many ecosystems. Plants also become more vulnerable to attacks by pests, disease, and environmental disasters. Consequently, the plant's ability to store food, grow, and reproduce is hindered. Adverse impacts to vegetation would be major.

Soil
There would be no soils, slopes, or land-type restrictions under Alternative C. Allowing surface-disturbing activities over greater than ten percent of riparian/wetland systems in the planning area would directly remove and mechanically damage vegetation, remove soils and soil microbes, decrease forage availability, remove habitat, and increase the opportunity for invasive species to establish. This would have a direct, major, adverse effect on riparian and wetland systems over the long term.

Water Resources
There would be no constraints on surface disturbance around springs, reservoirs, water wells, and perennial streams or on-channel reservoirs under Alternative C. Damage to vegetation could be allowed within greater than ten percent of all riparian/wetland systems in the planning area. This would have a direct, major, adverse effect on riparian and wetland resources.

Cave and Karst Resources
No effects are anticipated from cave and karst management actions.

Mineral Resources

Locatable Minerals
Alternative C does not include recommendations for new withdrawals or restrictions on locatable minerals development. Lands open to mineral entry (open is about 3,305,032 acres and withdrawn are about 11,373 acres) are consistent with other resource values. Riparian and wetland systems would be directly and adversely affected by not protecting more areas from locatable minerals activities. Under the locatable minerals program for the planning area, overall it is estimated that approximately 1,455 acres would be disturbed over the next 20 years. Reclamation would occur on 378 acres. Of the areas disturbed only a small percentage will be in riparian/wetland systems. Alternative C management actions for locatable minerals would have negligible adverse effects on riparian and wetland resources.

Leasable Minerals – Coal
Alternative C would open all federal coal lands to availability for exploration. Development is only likely to occur in those areas identified as acceptable for further coal leasing consideration. Where development does occur there is a direct and adverse impact to the vegetation through removal and mechanical damage. Effects are long-term until successful reclamation is achieved. Allowing these surface-disturbing activities would have a direct, major, adverse effect on riparian and wetland systems.

Leasable Minerals – Fluids
Alternative C makes all lands administratively available for fluid mineral development. Development would include surface-disturbing activities at the production sites and all

necessary infrastructure. Surface-disturbing activities would have a direct and adverse effect on vegetation for the long term until successful reclamation is achieved. Linear infrastructure supporting these activities would directly and adversely affect riparian and wetland systems. Under the leasable CBNG program for the planning area, overall it is estimated that BLM actions would disturb 13,200 acres over the next 20 years. Reclamation will occur on 5,280 acres. It is estimated that leasable conventional oil and gas program actions would disturb approximately 9,055 acres over the next 20 years. Reclamation will occur on 6,070 acres. There is no anticipated disturbance from geothermal activities. Fluid mineral exploration and development could be permitted in greater than 10 percent of all riparian/wetland systems in the planning area. Alternative C management of leasable fluid minerals would have a major adverse effect on riparian and wetland systems.

Salable Minerals
Alternative C does not recommend new closures or restrictions. The existing closures and restrictions were imposed to protect and preserve other resource values. Not adding areas to be protected from these minerals activities would have a direct, adverse effect on riparian and wetland systems. For salable minerals over the next 20 years, the estimated areas of surface disturbance would be small; 2,090 acres disturbed, 392 acres reclaimed, and 1,698 acres long-term disturbance (Appendix G (p. 1937)). Of the areas disturbed only a small percentage will be in riparian/wetland systems. Management actions for salable minerals under Alternative C would have negligible adverse effects on riparian/wetland resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative C, management actions that involve full suppression regardless of other resource objectives would have a direct adverse effect on riparian and wetland systems. The use of heavy equipment with few constraints would have a direct adverse effect on vegetative communities over the short and long terms by increasing opportunities for water and soil erosion, soil compaction, and invasive plant species establishment. Long-term estimates for the application of prescribed fire to support vegetative communities and wildlife habitat objectives is estimated to affect approximately 42,000 acres. All acres are expected to be successfully reclaimed.

Biological Resources

Vegetation – Forests and Woodlands
No effects are anticipated from forests and woodlands management actions.

Vegetation – Grassland and Shrubland Communities
Under Alternative C, allowing non-native plant species, only if native species will not accomplish initial reclamation objectives, would provide another tool for achieving reclamation goals, but also would provide an opportunity for non-native species to cross pollinate with native species, outcompete native species for water and soil nutrients, and move outside the reclamation area and become an invasive species. Helping to achieve reclamation objectives would directly benefit surrounding plant communities. Overall, Alternative C management of grasslands and shrublands would have a major adverse effect on riparian and wetland systems.

Invasive Species and Pest Management
Under Alternative C, restricting aerial application to only insecticides would limit herbicide applications to motorized vehicle and hand application. This would restrict where application

could occur and the size of treatments, therefore allowing vast acreages (in the case of leafy spurge, which inhabits thousands of acres across multiple landscapes, plant communities, remote locations, and a variety of terrain) to go untreated. This would have a direct adverse effect on upland and hydric plant communities over the long term. Treatments over the next 20 years are estimated to affect approximately 10,000 acres from BLM actions; reclamation would occur on 8,500 acres (Appendix G (p. 1937)).

Annually treating only designated areas for cheatgrass would be ineffective because there would be only small, scattered treatments and most of the cheatgrass would be unaffected. This would have an adverse effect on riparian and wetland systems.

Fish and Wildlife Resources – Fish
Alternative C would not apply constraints on surface-disturbing and disruptive activities, and would apply only the standard lease terms for minerals leasing in naturally occurring waterbodies. This lack of constraints would directly and adversely affect these systems over the long term by promoting surface disturbance, establishment of invasive species, lowering the ecological condition of the sites, and degrading the riparian/wetland communities. These effects would be adverse and long-term. Less than one percent of all riparian/wetland system in the planning area are near fish-bearing streams; therefore, management actions for fish under Alternative C would have negligible adverse effects on riparian/wetland resources.

Fish and Wildlife Resources – Wildlife
Alternative C impacts to riparian/wetland resources from wildlife would be the same minor beneficial effects as described under Alternative A.

Special Status Species – Plants
Alternative C impacts to riparian/wetland resources from special status plant species would be the same negligible beneficial effects as described under Alternative A.

Special Status Species – Fish
Alternative C management actions would prohibit surface-disturbing and disruptive activities if impacts could not be mitigated. Other actions include designing impoundments and instream structures to minimize impacts on or near existing or potential sites and habitats. These actions would reduce, but not prevent, adverse effects. The prohibitions under Alternative C would encompass, and therefore conserve five to ten percent of all riparian/wetland systems in the planning area. Management actions for special status fish under Alternative C would have moderate beneficial effects on riparian/wetland resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative C impacts to riparian/wetland resources from special status wildlife species management would be the same minor beneficial effects as described under Alternative A.

Heritage and Visual Resources

Cultural Resources
Alternative C impacts to riparian/wetland resources from cultural resource management would be the same minor beneficial effects as described under Alternative A.

Paleontological Resources
Alternative C management actions that would require paleontological field surveys would affect 28,177 public land acres. Restricting protective measures, including limiting or

prohibiting surface-disturbing activities, would subject riparian and wetland systems to possible large-scale, direct, adverse effects making the benefits negligible.

Visual Resources
Under Alternative C, WSAs and WSRs are managed as VRM Class I, manage VRI Class II as VRM Class III, and manage all VRI Class III and IV areas as VRM Class IV. Management would be applied at a lower level of VRM class, therefore less surface-disturbing activities would be restricted which would have a direct, beneficial effect on vegetation over the long term. Surface-disturbing restrictions would occur in less than one percent of all riparian/wetland systems in the planning area; therefore, management actions for visual resources under Alternative C would have negligible beneficial effects on riparian/wetland resources.

Land Resources

Forest Products
No effects are anticipated from forest products management actions.

Lands and Realty
Under Alternative C, disposing of lands with agricultural potential, water, or important natural resource values would have a minor adverse effect on riparian/wetland resources. Alternative C does not consider these values on a project-specific basis and does not require that these lands be retained based on these important values. Disposal of these lands would dispose of one to five percent of all riparian/wetland systems in the planning area. Management actions for lands and realty under Alternative C would have minor adverse effects on riparian/wetland resources.

Renewable Energy
Alternative C would allow sites and areas for energy development, which would likely involve surface-disturbing activities. The majority of the disturbance would occur on upland sites but development could affect riparian and wetland systems in the southern Big Horn Mountains. This would have a minor adverse effect on riparian and wetland systems as it contains one to five percent of all riparian/wetland systems in the planning area. Under the renewable-energy program for the planning area, overall it is estimated that BLM actions would disturb approximately 40,000 acres over the next 20 years. Reclamation would occur on 22,500 acres. Management actions under Alternative C for renewable energy would have minor adverse effects on riparian/wetland resources (Appendix G (p. 1937)).

Rights-of-Way and Corridors
Alternative C management actions would not place constraints on the development of or the location of ROW and corridors. This management would have a direct adverse effect on vegetation over the long term since there would be no protective measures in place to prevent removal or damage to the vegetation. This could promote erosion of soils by water which in turn could impair water quality in the riparian and wetland systems. ROW disturbances from powerlines, pipelines, roads, and communications sites could occur in greater than ten percent of all riparian/wetland systems in the planning area. Alternative C management would have major adverse effects on riparian and wetland resources.

Travel and Transportation Management
Alternative C management actions would allow motorized vehicles within the stock driveways, on saturated soils and on slopes greater than 25 percent, and in special species habitat. Management actions would close or limit travel to designated routes to motorized vehicle use and would

implement winter closures (November 15 – April 30) on designated big game ranges. These actions would have a direct, long-term, adverse effect on riparian and wetland systems by not protecting the soil or vegetation resources. Transportation and access management actions would be permitted in less than one percent of all riparian/wetland systems in the planning area; therefore management actions for transportation and access would have negligible adverse effects on riparian/wetland resources.

Recreation
Alternative C management actions include designation six areas as SRMAs with no consideration to additional lands for SRMA designation, leasing minerals in accordance with management for areas surrounding SRMAs, and allowing surface disturbance and salable minerals development in the six designated SRMAs. This would have a direct, adverse effect on riparian and wetland systems. The proposed SRMAs encompass less than one percent of all riparian/wetland systems in the planning area; therefore, management actions under Alternative C for recreation would have negligible adverse effects on riparian/wetland resources.

Lands with Wilderness Characteristics
Alternative C management actions include managing the lands with wilderness characteristics areas the same as the surrounding areas. Effects on riparian and wetland systems from these actions would be indirect, negligible and adverse over the long term.

Livestock Grazing Management
Alternative C management actions include locating livestock salt or mineral supplements a minimum of 500 feet from water sources, riparian systems, and aspen stands; vegetative treatments would compromise the health of vegetative systems. Moving supplements only 500 feet away from these sensitive sites would not be adequate to protect these sites. This would have a direct adverse effect on riparian and wetland systems over the long term.

Estimates of surface disturbances in the planning area over the next 20 years for range improvement projects include spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately 4 acres, with successful reclamation on 2 acres and 2 acres of long-term disturbance. Pipelines are estimated to disturb 40 acres, with successful reclamation on 35 acres and 5 acres as long-term disturbance. Fences would disturb approximately 100 acres (120 miles), with successful reclamation on approximately 70 acres (84 miles) and 30 acres of long-term disturbance. Wells are estimated to disturb one acre, with successful reclamation (Appendix G (p. 1937)).

One to five percent of all riparian/wetland systems in the planning area would be protected by these smaller buffers, therefore, livestock grazing management actions under Alternative C would have a minor adverse effect on riparian and wetland resources.

Special Designations

Areas of Critical Environmental Concern
Alternative C would not designate ACECs. Lack of designation would allow these areas to be eligible for surface-disturbing activities and possibly other actions that could adversely alter or impair these systems. The lack of ACEC designation would fail to conserve vegetation in less than one percent of all riparian/wetland systems in the planning area; therefore management actions for ACECs under Alternative C would have negligible, adverse effects on riparian and wetland resources.

Scenic or Back Country Byways
No effects are anticipated from scenic or BCBs management actions under Alternative C.

Wild and Scenic Rivers
Alternative C management would be the same as management in the surrounding areas until Congress acts. Rather than developing a specific management plan for this area, these management actions would be generic. Riparian and wetland systems would indirectly benefit over the long term from this management action, but likely not to the same degree as the more protective measures under a specific management plan.

Wilderness Study Areas
There are three WSAs in the planning area totaling 28,931 acres. Alternative C management would be the same as management in surrounding areas, which would be generic and might not address all resource issues. This would have an indirect, negligible, adverse effect on riparian and wetland systems over the long term as these areas contain less than one percent of all riparian/wetland systems in the planning area.

Socioeconomic Resources

No effects are anticipated from socioeconomic resources management actions.

4.4.3.6. Alternative D

This section describes management actions under Alternative D, which utilizes a combination of resource conservation and resource use, and the likely impacts due to their implementation and potential impacts to riparian and wetland systems from those management actions.

Vegetation – Riparian/Wetland Resources
Alternative D would allow surface-disturbing activities and apply CSU stipulations for any mineral lease within 500 feet of springs, reservoirs, water wells, and perennial streams based on resource values if resource objectives can be met; this management would affect approximately 23,831 acres, greater than ten percent of riparian/wetland systems in the planning area. Reclaiming vegetation in all CBNG-supported riparian and wetland systems in accordance with ecological site protection would help return water-affected systems to their pre-CBNG natural state. This management would directly benefit riparian and wetland systems by limiting opportunities for invasive species to establish and spread. Reclaiming sites with appropriate native species would sustain vegetative communities over the long term. See Alternative B for systems capable of achieving DFC.

Physical Resources

Air Quality
Alternative D impacts to riparian/wetland resources from the air quality management would be the same beneficial as impacts under Alternative B (vegetation conservation). Under Alternative D, though, modeling would only occur on a project-specific basis and mitigation strategies would then be developed. The modeling and mitigation would likely occur within greater than ten percent of riparian/wetland systems; therefore, management actions for air quality under Alternative D would have major beneficial effects on riparian/wetland resources.

Soil
Surface-disturbing activities would be allowed under Alternative D in accordance when soil resource objectives can be met. Development on and disturbance of sensitive soils would have approved reclamation and stabilization plans and comply with CSU stipulations. Management actions under Alternative D would avoid surface disturbances on badlands, rock outcrops, and slopes susceptible to mass movement unless resource objectives could be met. Alternative D supported surface disturbance would have a direct, long-term, adverse effect on riparian and wetland systems. However, the established criteria under Alternative D would work toward ensuring projects are capable of being reclaimed before they are approved on greater than ten percent of all riparian/wetland systems in the planning area. Alternative D management actions would have a negligible adverse effect on riparian and wetland systems.

Water Resources
Alternative D water management actions would allow surface disturbance within 500 feet of any natural or man-made water feature in accordance when resource objectives can be met based on management decisions for other resource values; this would affect approximately 19,861 acres, greater than ten percent of all riparian/wetland systems in the planning area. Allowing disturbances in these areas would have a direct and adverse effect on vegetation and water quality at these sensitive sites. Effects would be long-term for the life of the project through approved reclamation. Alternative D would allow on-channel reservoirs. Under Alternative D, CBNG reservoirs would be evaluated to determine whether they could be converted to another use, or should be removed and reclaimed. All water management actions under Alternative D would have a direct, negligible adverse effect on riparian and wetland systems over the long term.

Cave and Karst Resources
No effects are anticipated from cave and karst management actions.

Mineral Resources

Locatable Minerals
In addition to areas currently withdrawn or restricted under Alternative A, Alternative D includes a number of new areas to conserve other resource values; this would leave 4,720,586 acres open to mineral entry, with 82,691 acres recommended for withdrawal from mineral entry in addition to the 11,373 acres of existing withdrawals. Riparian and wetland systems would directly benefit over the long term from the additional withdrawn acreage.

In riparian/wetland areas where development did occur, any related actions that disturbed the surface would have a direct and adverse effect until successful reclamation is achieved. Under the locatable minerals program for the planning area, overall, it is estimated that BLM actions would disturb approximately a total of 1,252 acres (0.2% of federal locatable minerals) over the next 20 years and reclamation would occur on 329 acres. Given the very small percentage of the planning are that is riparian/wetland vegetation, it is anticipated that the majority of the development would not occur in that vegetation type. Therefore, the long-term disturbance would have a direct negligible adverse effect on those areas.

Leasable Minerals – Coal
Under Alternative D would open all federal coal lands (federal mineral estate for coal retained by the federal government) to exploration. Though all acres are open, actual development is anticipated to occur only in areas identified as acceptable for further coal leasing consideration. A very small percentage of the planning area is riparian/wetland vegetation,

therefore it is anticipated that the majority of the development would not occur in that vegetation type. However, in areas where coal development does occur vegetation would be directly and substantially affected for the life of the project until reclamation goals and objectives are achieved. The long-term disturbance from coal would have a direct minor adverse effect on those riparian/wetland areas.

Leasable Minerals – Fluids
Alternative D would make lands available for fluid minerals leasing and exploration in accordance with management identified to conserve other resources. Effects of conventional oil and gas and CBNG development on riparian/wetlands systems could include: riparian zone soils becoming water logged, salt contamination of the plant root zone, and decrease in plant production. Reduction in plant growth can include grasses, hay crops such as alfalfa, and woody species like cottonwoods. There is no anticipated disturbance from geothermal activities under Alternative D.

This alternative would make a total of 101,214 acres of mineral estate closed to minerals leasing. Therefore, fluid mineral exploration and development could be permitted in greater than ten percent of all riparian/wetland systems in the planning area. However, given the very small percentage of the planning area that is riparian/wetland vegetation, it is anticipated that the majority of the development would not occur in that vegetation type. Also the impacts to riparian/wetland vegetation would be further reduced by applying a CSU stipulation to any fluid mineral lease within 500 feet of riparian/wetlands systems, and aquatic habitats (management action, Riparian – 4009). Therefore, overall the effects on riparian/wetland communities from fluid mineral development would be moderately adverse.

Salable Minerals
Alternative D would open 2,725,060 acres of federal minerals to salable minerals leasing (greater than ten percent of all riparian/wetland systems in the planning area) and close 623,061 acres. For salable minerals development over the next 20 years, the estimated areas of surface disturbance would be 1,193 acres disturbed (Appendix G (p. 1937)). Only a very small portion of this disturbance would impact riparian and wetland vegetation. Management actions for salable minerals under Alternative D would have negligible adverse effects on riparian/wetland resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative D, impacts to riparian/wetlands systems would be similar to effects under Alternative B. However, Alternative D would decrease adverse impacts through rehabilitation after fires on an as-needed basis only; this could result in an increase in natural regeneration of riparian/wetland systems.

Biological Resources

Vegetation – Forests and Woodlands
No effects are anticipated from forests and woodlands management actions.

Vegetation – Grassland and Shrubland Communities
Under Alternative D, allowing non-native plant species for initial reclamation practices would provide another tool for achieving reclamation goals. Non-native species would be used on those sites where soils, topography, and timing are not conducive to native plant seed establishment. It

is the anticipated that non-native species would be used on in the short term (1 to 3 years). Use of non-native species could have the direct benefit of quickly establishing vegetation on sites and reducing the opportunity for erosion and invasive species establishment. This would have a major, beneficial effect on riparian and wetland systems as the overall health of these communities would improve in greater than ten percent of all riparian/wetland systems in the planning area.

Invasive Species and Pest Management
Alternative D would allow aerial application in areas where topography, extent of infestation, target species, and timing limit other application methods. Areas with annual bromes would be designated and prioritized for treatment. These actions would have a direct, moderate, beneficial effect on riparian and wetland systems over the long term as the overall health of these communities would improve.

Fish and Wildlife Resources – Fish
Alternative D management actions that would prohibit or limit surface-disturbing activities and project construction, and the application of practices that would enhance fisheries by limiting soil erosion and improving water quality within greater than ten percent of all riparian/wetland systems in the planning area would have a direct, major, beneficial effect on riparian and wetland systems over the long term.

Fish and Wildlife Resources – Wildlife
Alternative D would prohibit surface disturbance and occupancy in established big-game winter ranges, without exception. Activities that enhance habitat for wildlife would likely have an indirect, moderate, beneficial effect on riparian and wetland systems over the long term.

Alternative D management actions would allow surface disturbance or occupancy within a biological buffer zone around nests of conservation concern raptor species with identified criteria. Surface-disturbing activities would be prohibited within USFWS recommended buffers and time periods. These limitations and prohibitions would protect vegetative resources and would have a beneficial effect over the long term.

Any limitations, restrictions, or prohibitions on surface-disturbing activities and motorized travel would directly benefit five to ten percent of all riparian/wetland systems in the planning area over the long term.

Special Status Species – Plants
Alternative D management actions would require plant surveys before placement of water developments, salt, and mineral supplements. Upon completion of surveys, surface-disturbing activities, mineral development, fire suppression activities (outside of human and property safety), and authorized ROWs, would be allowed in habitats but not in known populations. Currently the only known riparian and wetland system dependent sensitive plant species is Ute ladies'-tresses orchid, and these prohibitions would encompass eleven percent of all riparian/wetland systems in the planning area. Management actions for special status plant species under Alternative D would have a direct, long-term, major, beneficial effect on all riparian/wetland resources.

Special Status Species – Fish
Alternative D management actions would prohibit surface-disturbing and disruptive activities within 0.25 mile of any water that contains special status fish species (818 acres), also conserving vegetation in five to ten percent of all riparian/wetland systems in the planning area.

This action would have a direct, moderate, beneficial effect on riparian and wetland systems over the long term.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative D management actions would prohibit surface-disturbing and occupancy in established winter ranges; allow surface disturbance and disruptive activities only when resource objectives can be met; prohibit commercial renewable energy projects in big game winter range, calving areas and identified priority travel corridors. These management actions would be direct if the activities occurred in the riparian and wetland system and indirect if it occurred in the uplands. Effects would be beneficial and long term. Fluid mineral production and by-products are required to be piped out of crucial elk winter ranges and calving areas, unless a suitable alternative is developed. Construction of pipelines would have a direct and adverse effect on the vegetation for the long term.

Alternative D management actions would prohibit renewable-energy projects in Greater Sage-Grouse Priority Habitat Area. Actions also would prohibit or avoid surface-disturbing activities during specific periods within a specified distance from designated leks, identified nesting and early brood-rearing habitat, and Greater Sage-Grouse winter habitat. Inside current Priority Habitat Area are limitations on the amount of sagebrush removal and the number of disturbances allowed.

Alternative D management actions would prohibit surface disturbance and disruptive activities during nesting periods and around active nests for specific times for specific birds. Management actions also would include establishing a year-round disturbance-free buffer zone for known bald eagle winter roosts (402 acres), and a limited-activity zone for known roosts (3,013 acres). These actions would have an indirect, beneficial effect on riparian and wetland systems over the long term.

Alternative D management actions would allow surface-disturbing and disruptive activities only when resource objective can be met in known areas of special status amphibian and reptile species and their habitats. Known populations would be protected with an additional 1,640-foot (500 meter) buffer. This would affect approximately 176,636 acres, and would have a direct, beneficial effect on riparian and wetland systems over the long term.

Overall, management actions under Alternative D that prohibit or restrict surface-disturbing activities, also conserve greater than ten percent of all riparian and wetland systems in the planning area; therefore, they would have a major beneficial effect on riparian/wetland resources.

Heritage and Visual Resources

Cultural Resources
Alternative D would prohibit surface disturbance in areas with historic properties, or within three miles or the visual horizon (whichever is closer) of historic properties that retain their integrity of setting. This area would also conserve greater than ten percent of all riparian/wetland systems in the planning area and would have a direct, major beneficial effect on riparian and wetland resources over the long term.

Paleontological Resources
Paleontological resources of high importance that will be managed under Alternative D are not located within any riparian/wetland systems.

Visual Resources
Under Alternative D, VRI Class II areas and special emphasis areas (SRMAs, ACECs, etc.) would be managed as VRM Class II. All VRI Class III areas, plus the Powder River Breaks and Fortification Creek, would be managed as VRM Class III. VRM Class I and II areas could prohibit or limit some surface-disturbing activities. VRM Class III and IV areas would have minor limitations that could allow surface-disturbing activities. Overall, the management actions restricting surface-disturbing activities would encompass greater than ten percent of all riparian/wetland systems in the planning area and would have a direct, major, beneficial effect on riparian and wetland systems over the long term.

Land Resources

Forest Products
No effects are anticipated from forest products management actions.

Lands and Realty
No effects are anticipated from lands and realty management actions.

Renewable Energy
Alternative D management actions would exclude renewable-energy development in the southern Big Horn Mountains, areas closed to mineral leasing for fluids and solids, locatable, salables, ROW exclosures areas, and other areas where surface disturbance is prohibited for a total exclusion acreage of 352,068 public land acres. Renewable-energy development would also be avoided on 374,518 public land acres, leaving less than 6 percent of public land available for development (see Map 56 for specific locations). Under the renewable-energy program for the planning area, overall, it is estimated that BLM actions would disturb approximately 75,240 acres over the next 20 years within five to ten percent of all riparian/wetland systems in the planning area. Reclamation would occur on 50,240 acres (Appendix G (p. 1937)). This management would have a moderate adverse effect on riparian and wetland systems.

Rights-of-Way and Corridors
Alternative D management actions would exclude 79,777 acres from ROW development and avoid 321,149 acres. Newly proposed transmission lines and ground facilities would be allowed within existing ROW and other disturbance areas. ROW activities would be avoided on slopes equal to or greater than 25 percent and on highly erodible soils. All these actions would directly benefit vegetation. ROW disturbances are estimated to affect approximately 14,000 for pipelines and 56 acres for communications sites within five to ten percent of all riparian/wetland systems in the planning area during the planning period; successful reclamation is estimated to occur on all affected acres. Powerlines are estimated to affect approximately 4,916 acres (1,000 miles), with successful reclamation on approximately 491 acres, leaving 4,425 acres of long-term disturbance (Appendix G (p. 1937)). This management would have a moderate adverse effect on riparian and wetland systems.

Travel and Transportation Management
Like Alternative B, Alternative D would close special designation areas to motorized vehicle use. Motorized vehicle use in stock driveways would be allowed on designated routes. Motorized vehicle use would be allowed with travel management designations in SSS habitat and on saturated soils or on slopes 25 percent or greater. Alternative D would limit motorized vehicle travel to designated roads and trails, consistent with management of other resources and would seasonally prohibit travel in game ranges. Alternative D management actions would limit access

within five to ten percent of all riparian/wetland systems in the planning area and have a direct, moderate beneficial effect on riparian and wetland systems over the long term.

Recreation

Alternative D designates seven areas as SRMAs (54,160 acres) and eight ERMAs (349,663 acres). Prohibiting surface disturbance in designated SRMAs unless for administrative use would generally help protect, maintain, and enhance riparian and wetland resources. Alternative D allows additional recreation facilities consistent with other resource values which would have a direct adverse effect on vegetation in and around the facilities over the long term. Visitor use and access is promoted in SRMAs, which would increase popularity and visitation and increase vegetation disturbance from trampling and increase the potential for introduction and spread of invasive plant species. The SRMAs would encompass less than one percent of all riparian/wetland systems in the planning area; therefore, management actions for recreation under Alternative D would have negligible beneficial effects on riparian/wetland resources.

Lands with Wilderness Characteristics

Alternative D actions would include managing about 6,864 acres. Managing these lands would conserve vegetation in less than one percent of all riparian/wetland systems in the planning area and have an indirect, negligible, beneficial effect on riparian and wetland systems over the long term.

Livestock Grazing Management

Under Alternative D, range improvements would be developed in accordance with resource needs and livestock management objectives, rather than developing range improvements and then monitoring to detect undesirable changes (as under Alternative A). AMPs would continue to be developed, but increases in vegetative production would be allocated for watershed protection first, then forage and habitat, rather than allocated for wildlife first, then livestock use (as under Alternative A). Livestock grazing would be allowed on all public lands except for areas described under Alternative A, with the addition of evaluated areas determined to be incompatible with other resource uses or values such as entrances of caves, campgrounds, and culturally significant sites. Permanent increases in forage allocations would be considered for watershed protection, livestock grazing, wildlife habitat, and other resource values; under Alternative D, any permanent increases in forage would be considered for wildlife and watershed protection before additional livestock use. Rest and deferment following wildfires, prescribed fires, and vegetative treatments would continue until resource objectives were met. Other management actions that do not address previous decisions include locating livestock salt and mineral supplements as described under Alternative C. Construction of range improvements would have a direct adverse effect on vegetation for the life of the project. All other livestock-related actions would have an indirect, beneficial effect on riparian and wetland systems over the long term.

Estimations for surface disturbance over the planning area in the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. Spring developments are estimated to disturb approximately 4 acres, with successful reclamation on 2 acres and 2 acres of long-term disturbance. Pipelines are estimated to disturb 40 acres, with successful reclamation on 35 acres and 5 acres of long-term disturbances. Fences would disturb approximately 38 acres (150 miles), with successful reclamation on approximately 35 acres (140 miles) approximately 3 acres of long-term disturbance. Wells are estimated to disturb one acre, with successful reclamation (Appendix G (p. 1937)).

Restrictions for livestock grazing conserve greater than ten percent of riparian/wetland systems; therefore management actions for livestock grazing under Alternative D would have major beneficial effects on riparian/wetland resources.

Special Designations

Areas of Critical Environmental Concern
Alternative D management actions include evaluating four proposed areas as ACECs, which would affect approximately 2,849 acres, less than one percent of all riparian/wetland systems in the planning area. The associated management plans for these sites would initiate specific conservation to protect soils and vegetation from surface-disturbing activities and would have a direct, negligible, beneficial effect on riparian and wetland systems over the long term.

Scenic or Back Country Byways
No effects are anticipated from scenic or BCBs management actions.

Wild and Scenic Rivers
Under Alternative D, management would continue in accordance with the Middle Fork Interim Management Plan to retain its free-flowing characteristics and outstanding resource values until Congress acts to release or designate the Middle Fork Powder River as a WSR. Continuing interim management in less than one percent of all riparian/wetland systems in the planning area would have an indirect, negligible, beneficial effect on riparian and wetland systems over the long term.

Wilderness Study Areas
There are three WSAs in the planning area totaling 28,931 acres, less than one percent of all riparian/wetland systems in the planning area. There are restrictions to preserve wilderness conditions in these areas until Congress acts on these WSAs. Designation of these areas and interim management is based on conservation of the natural resources, which would limit vehicular travel and surface-disturbing activities. This management would have a negligible beneficial effect on riparian and wetland systems.

Socioeconomic Resources

No effects are anticipated from socioeconomics management actions.

4.4.3.7. Cumulative Impacts

The effects to riparian and wetland systems from past and present actions, BLM-administered and non-BLM projects are included as part of the affected environment. As with water resources in general, adverse impacts to riparian-wetland systems are a product of surface-disturbing activities associated with mineral resource development, motorized vehicle use, road construction, and agricultural land uses. These activities lead to increases in runoff and sedimentation into riparian-wetland areas.

Surface-disturbing activities such as mineral development and road construction impact localized areas of riparian-wetland systems, removing vegetation, compacting hydric soils, and creating a vector for runoff and invasive species establishment. BLM-administered development may have fewer impacts than non BLM-administered projects given the stipulations outlined in this RMP.

Livestock grazing can result in a direct adverse impact to riparian-wetland areas through the removal of vegetation, compaction of riparian-wetland soils, and reduction of bank stability. If prolonged, this activity can lead to a change in plant community that will not support riparian-wetland health and will create a non-functioning system as riparian-wetland-obligate species are replaced by upland species and more salt-tolerant communities. The cumulative impacts to riparian-wetland systems from these activities would vary widely, not only by alternative, but by the individual watershed in which these activities occur.

In forested riparian habitats, the greatest threat is catastrophic fire and the resulting erosion.

The large percentage of riparian/wetland areas on private lands means that actions by private landowners can have substantial impacts on the health of these systems and their performance of critical water quality protection functions. Programs and projects, such as those by County Conservation Districts, the NRCS, and county weed and pest districts, have had success in the implementation of proactive measures to improve riparian habitat and other vegetation and water sources. Cumulative effects on riparian habitats would be varied and site-specific due to the scattered land ownerships along most streams. Management changes implemented on BLM-administered lands to improve riparian conditions also could improve conditions on lands of other ownerships if the same management is applied to those lands.

To manage riparian/wetland areas that occur on BLM-administered lands, alternatives A, B, and D apply proactive management measures that reduce surface-disturbing activities. Active management may be required to meet, or make progress towards meeting resource objectives, such as PFC and *Wyoming Standards for Healthy Rangelands*.

4.4.4. Invasive Species and Pest Management

This section describes potential impacts to invasive species and pest management from management actions under other resource programs. Chapter 3 provides a general discussion and information about invasive species and pest management. Objectives are to maintain and improve the condition and trend in plant communities that conserve soil and water, and provide forage, wildlife habitat, SSS habitat, recreation, scenic, ecological, and scientific benefits for consumptive and nonconsumptive uses.

Most management activities on BLM-administered lands have the potential to introduce or promote the proliferation of invasive plants. Motor vehicles, animal movement, roads, motorized vehicles, livestock, wildlife, and recreation trails and all surface-disturbing activities increase the potential to introduce and spread invasive species.

Actions that contribute to the decline in abundance, distribution, or functionality of native vegetation and promote invasive species result in adverse effects. Conversely, beneficial effects result from activities that protect or restore proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

4.4.4.1. Methods and Assumptions

This section describes the methods and assumptions used in the impact analysis for invasive species and pest management.

Most management activities on BLM-administered lands have the potential to introduce or promote the proliferation of invasive plants. Impact analyses and conclusions are based on interdisciplinary team knowledge of resources in the planning area, best professional judgement, review of existing literature, and information provided by other agencies. Existing literature and analyses include the Buffalo RMP (BLM 1985c), the PRB EIS (BLM 2003c), Vegetation Treatment and Fuels Reduction on Western Public Lands EIS (BLM 2007h). Spatial analysis was performed using the ESRI ArcGIS Desktop 10.0 computer software. Effects are quantified where possible. In the absence of quantifiable data, best professional judgment was used. The term invasive species as used in this section refers to noxious and invasive weeds, including cheatgrass.

Allowable uses and management actions that could affect the spread and introduction of invasive species and pests include all surface-disturbing activities; concentrated livestock and native ungulate grazing; fire and fuels management; recreation, motorized vehicle use, and dispersed travel; and proactive management actions. As the management of invasive and pest species are affected by the alternatives, invasives and pests can, in turn, impact other resources.

Assumptions

- The introduction of invasive species can threaten the stability of ecosystems, create serious human health consequences, and cause substantial economic burdens.
- Surface-disturbing activities, recreation sites, and concentrated grazing (livestock and wildlife) contribute to the introduction and spread of invasive species.
- Invasive species occur in greatest density in areas of past or present surface disturbance. Reclaimed areas can continue to be host sites for these species.
- Invasive species and pest control would be carried out in coordination with the appropriate county weed and pest control district, owners of adjacent property, private industry, and other federal agencies.
- Annual bromes pose a major threat to most vegetative communities and habitats.
- Baseline inventory, establishment of planning units, and an integrated approach are needed for successful management of invasive species.
- Wetted areas provide a haven for invasive species.
- Transportation routes are directly proportional to the opportunities for invasive species to establish and spread.
- Grasshopper outbreaks generally cycle approximately every seven years, last approximately three years, and infest every land type.

Significance Criteria

- Extent of invasive species and pests exceeds the budget for controlling these species and pests.
- Activities or impacts that would encourage invasive species establishment or spread into or adjacent to SSS populations and habitat.
- Excessive limitations on control methods that prevent noxious weed treatment from occurring.

4.4.4.2. Impacts Common to All Alternatives

Management of **Visual Resources, Lands and Realty, Scenic and Back Country Byways, Wild and Scenic Rivers, Social and Economic Conditions, and Health and Safety** would have no effect on invasive species and pest management and are not further addressed in the *Invasive Species and Pest Management* sections.

Invasive Species and Pest Management

Invasive species management actions include efforts to minimize surface-disturbing activities and enforce the use of vegetation products certified to be free of weed seed on all BLM-administered projects and lands to reduce opportunities for invasive species to establish or spread. Pest management actions include managing designated pests on public lands using an IPM approach while working cooperatively with county weed and pest control districts, state agencies, private industry, grazing lessees, and other stakeholders, and working with APHIS as actions relate to insect and other pest control. These actions help mitigate adverse on invasive species and pest management because continued corporation and management of lands promotes restore proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

Physical Resources

Soil and Water Resources

Management actions to evaluate the effects on soils from a proposed surface-disturbing activity using NRCS Soil Survey data and onsite investigation, and actions to ensure authorized surface-disturbing activities will include reclamation plans would facilitate activities in locations where soils are capable of supporting the activities and have the potential to be successfully reclaimed. Both these actions would reduce the potential for invasive species to establish or spread. Management actions include preventing degradation of water quality for all waters and managing water resources to meet the Wyoming Standards for Healthy Rangelands, to achieve PFC, and to meet Wyoming water quality standards. Taking appropriate actions to improve the biological, chemical, and geomorphic conditions of streams affected by BLM-authorized actions and permitted activities would help vegetative and riparian/wetland communities by improving or maintaining the present health of these plant communities. These mitigation measures will help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. This would affect more than 10 percent of the area. All these actions would have a direct, major adverse effect on invasive species and pest management.

Cave and Karst Resources

Management actions to conduct cave inventories and significance determination would gather information important to making management decision on activities near or around cave and karst resources. This would affect less than one percent of BLM-administered lands. Management actions that protect or restore proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread would be negligible beneficial.

Mineral Resources

Locatable Minerals, Leasable Minerals – Coal, Leasable Minerals – Fluids, and Salable Minerals

No coal leases will be issued outside areas identified as acceptable for further coal leasing consideration (BLM 2001a). For other leasable minerals any lands not withdrawn from or closed to minerals exploration and development would be available to locatable, leasable, and salable minerals activities. Areas open to oil and gas leasing would be open to geothermal development. Minerals resource development includes surface-disturbing activities, which provide an opportunity for invasive plants to establish or spread. This would affect more than

10 percent of the area. All these actions would have a direct, major adverse effect on invasive species and pest management because surface-disturbing activity would allow for transport of invasive species seed, crush or removal of vegetation, and expose bare soils where invasive species could establish.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Management actions include rehabilitating firelines that were constructed using heavy equipment and firelines on steep slopes to prevent or control erosion. Rehabilitation would include, but not be limited to, water barring and reseeding. These actions would facilitate reclamation of soil disturbances, which would reduce the opportunity for invasive species to establish. Most wildfires are weather related and the primary ignition source is fine fuels (dormant grasses), especially cheatgrass. Cheatgrass responds positively (establishes and spreads) to burning and to surface-disturbing activities. The effects of wildfires are generally negligible because major events occur only every five to seven years. Rehabilitation and reclamation following wildfires, prescribed fires, surface disturbance associated with fireline construction and the use of heavy equipment, and other fire suppression activities are integral to protecting vegetative communities and watersheds from erosion. This would affect less than one percent of the area. This reduces the opportunity for invasive species to establish or spread, which would have an indirect, negligible, beneficial effect on invasive species and pest management.

Biological Resources

Vegetation – Grassland and Shrubland Communities
Managing vegetative communities (Map 25) in accordance with the Wyoming Standards for Healthy Rangelands and managing to protect, preserve, or enhance plant communities would reduce opportunities for and reduce existing impacts from invasive species. Managing the planning and development of travel routes, recreational uses, minerals exploration and development, ROW, siting of facilities and related infrastructure (e.g., utility corridors and roads) to reduce impacts to vegetative resources also would reduce opportunities for invasive species to establish or spread. Using an integrated management approach (e.g., mechanical, chemical, and biological treatments, prescribed fire, and grazing management techniques) to maintain, restore, and enhance the health and diversity of plant communities to achieve resource or multi-resource objectives, and developing a contingency plan to address catastrophic natural events all would help in managing invasives species. Working with landowners on split estate lands to reestablish disturbed sites to healthy plant communities in accordance with the ecological site potential includes control of invasive species. This would affect less than one percent of the area. All these actions would have a negligible beneficial effect on invasive species and pest management.

Vegetation – Riparian/Wetland Resources
Riparian and wetland systems are favored locations for invasive species due to prolonged or continuous wet conditions and nutrient-rich soils. Management actions to prioritize management and develop activity and implementation plans to manage riparian and wetland systems to be at or above, or continue to be improving toward, PFC while achieving the Wyoming Standards for Healthy Rangelands includes managing any invasive plant or pest species. Actions also include managing riparian and wetland systems to enhance forage conditions and improve water quality, managing all riparian systems with sensitive species concerns; and preventing degradation, loss, or destruction of riparian/wetland habitat. These actions would indirectly benefit the control of

invasive species and would minimize opportunities for invasive plant and pest species to establish and spread. This would affect less than one percent of the area. These negligible beneficial effects would be long term.

Fish and Wildlife Resources – Fish
Management actions address the introduction, protection, and enhancement of fish species, populations, and habitats. Actions also include managing harmful non-native riparian vegetation in river and stream systems; this would help to control the spread and establishment of invasive species. This will help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management. Treatment and application methods need to be analyzed for potential unwanted adverse effects on non-target species. Establishing motorized vehicle and walking trails to provide public access to fish-bearing waters would directly and adversely affect vegetation by trampling or removal, and increase opportunities for invasive species to establish or spread. This would affect less than one percent of the area. This would have a negligible adverse effect on invasive species and pest management.

Fish and Wildlife Resources – Wildlife
Management actions include developing appropriate mitigation for surface-disturbing and disruptive activities associated with wildlife habitat management through use of defined mitigation guidelines. Actions also include maintaining or improving important wildlife habitats through vegetation manipulations, habitat improvement projects, livestock grazing strategies, and providing, to the extent possible, suitable habitat and forage to support wildlife population objectives. Enhancement of habitats would reduce opportunities for invasive species establishment and spread. These will help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. Wildlife trails, bedding areas, and concentration areas have a direct, adverse effect on vegetation over the long term. These areas would be conducive to invasive species establishment and spread. This would affect less than one percent of the area.

Special Status Species (including Greater Sage-Grouse)
Management includes implementing actions in recovery plans, conservation measures, terms and conditions, and appropriate BMPs. These species would take priority in planning and implementing on-the-ground activities and projects that could conflict with or promote native vegetation. Actions that would enhance ecological health would indirectly benefit the management of invasive species. Managing habitats for SSS in a lower ecological state or in a degraded health condition could promote invasive species establishment or spread. Treatment and application methods would need to be analyzed for potential unwanted effects on non-target species. This would affect approximately four percent of the area. Management of SSS would have a major beneficial effect on invasive species and pest management because activities that protect or restore proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

Heritage and Visual Resources

Cultural Resources, Paleontological Resources, and Visual Resources
Management actions include completing site stabilization and implementing long-term protections for significant cultural and paleontological sites experiencing adverse effects, and managing

identified areas important to tribes to minimize disturbance. Designating WSAs and the Middle Fork Powder River WSR as VRM Class I areas would help keep these areas natural and pristine, including prohibiting or limiting surface-disturbing activities. This would affect less than one percent of the area. All these actions would have direct, long-term, negligible beneficial effects on invasive species and pest management by minimizing opportunities for their establishment and spread. Effects from management of visual resources would not differ by alternative and are not further addressed in this section.

Land Resources

Forest Products, Renewable Energy, Rights-of-Way and Corridors, Travel and Transportation Management, Recreation, and Lands with Wilderness Characteristics

Management actions include prohibiting timber harvest areas within 200 feet of surface waters. If this also prohibits associated roads, trails, and staging and work areas, then all actions would indirectly benefit invasive species management over the long term. Management actions also include: (1) limiting mechanical activity, recreation facilities and sites, and motorized vehicle activity in riparian/wetland areas; (2) prohibiting dispersed camping and commercial camps within 200 feet of surface water; (3) designating ROW corridors to minimize surface disturbance and impacts; (4) co-locating new ROW with existing ROW considering land use authorizations (e.g., permits and leases); (5) withdrawing areas from ROW and minerals development on a project-specific basis consistent with other resource objectives; (6) designing, constructing, and maintaining roads, including all BLM road easements, to meet or exceed BLM standards; and (7) determining road and trail closures, abandonments, reclamation, and needs for new roads. All prohibitions, reductions, and limitations on surface-disturbing and disruptive activities would have the direct benefit by reducing opportunities for invasive species to establish or spread. Increasing recreation opportunities could allow invasive species introduction and spread in new areas via vehicles, footwear, horses, dogs, clothing, and recreation equipment. Managing for wilderness characteristics likely would reduce opportunities for invasive species establishment and spread by prohibiting or limiting surface-disturbing activities in these areas over the long term. This would affect approximately eight percent of the area. Prohibiting or limiting surface-disturbing activities at recreation sites and special management areas would also have indirect benefits by limiting opportunities for invasive species establishment and spread over the long term. The effects would be moderate and beneficial.

Livestock Grazing Management

Livestock grazing management actions include achieving the Wyoming Standards for Healthy Rangelands; managing livestock grazing to sustain riparian, wetland, mountain mahogany, specials status species, or other special habitats; and implementing strategies that best protect rangeland resources during periods of drought. Proper livestock grazing can improve native vegetative cover and plant vigor, making plant communities more resistant to invasive species (Pittroff No Date). These management actions will help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because use of the lands promotes invasive species and pest establishment. Livestock can contribute to the introduction and expansion of invasive plant species by transporting seeds to new locations and disturbing soils and removing vegetation in areas of concentration, primarily around water sources, around supplement sites, and along trails. Range improvements that disturb large areas of soil surface could provide locations for invasive species to become established and spread if the areas are not properly reclaimed. This would affect less than one percent of the area. These actions would have indirect, negligible adverse effects on invasive species management over the long term.

Special Designations

Areas of Critical Environmental Concern and Wilderness Study Areas
Management actions for special designations can contribute to the establishment and spread of invasive species by enticing recreationists and others to these areas, which usually involves establishing access trails for foot, hoof, nonmotorized, or motorized travel. These actions can have indirect, long-term adverse effects on invasive species management. However, special designation areas often have prohibitions, limitations, or restrictions on surface-disturbing activities, which have a direct, long-term, moderate beneficial effect by minimizing opportunities for invasive species to establish and spread. This would affect approximately five percent of the area.

The following sections describe impacts by alternative. These impacts would be in addition to the impacts common to all alternatives described above.

4.4.4.3. Alternative A

Alternative A would continue invasive species and pest management in accordance with the 1985 RMP as amended and maintained.

Invasive Species and Pest Management
Alternative A management actions include working cooperatively with county weed and pest control districts to set annual and long-term treatment priorities. Weed control treatments occur every year to reduce and control weed infestations over the long term. The goals for treatment are to maintain weed seed-free, native communities to sustain their natural values. Lack of a complete invasive species inventory and an overall invasive species and pest management plan to prioritize species, locations, treatment types, and application methods has led to a “band-aid” type of approach to short-term (1 to 3 years) planning of treatments.

Most control efforts include chemical, mechanical, and biological methods. Controlling weeds by chemical and mechanical methods can directly harm other plant species. For example, if an herbicide is non-selective for all broadleaf plants, the chemical also could harm forb species. If mechanical methods are used, any plant in the direct path of the application would be affected. Biological methods generally are species specific and effects are direct, long term, and harmful to the host species; other plants indirectly benefit from improving the health of the vegetative community by removal of the host pest species.

Control measures on invasive species and pests on public lands are done in cooperation with county weed and pest control districts and private energy companies. Herbicides applied to areas under mineral permits or leases are the responsibility of the private energy company. Over the next 20 years, it is estimated that BLM invasive species and pest management actions would disturb approximately one percent BLM acres.

Invasion of cheatgrass has adverse effects on the grassland and shrubland communities. Exact acreages are not known, due to a lack of vegetative inventory, but professional judgment estimates canopy cover to be 15 percent to 20 percent of the planning area. Control treatments have not been pursued because cheatgrass is not on the Wyoming Weed and Pest Control Act Designated List and a lack of funding. Cheatgrass management has not been addressed and populations are increasing.

Pest species (grasshoppers and Mormon crickets) primarily impact grassland and shrubland species. Pest control is primarily by chemical application and the effects are direct and

beneficial to pest management, and indirect and beneficial to the host plants. Rangeland forage production can be drastically reduced if insect populations are above average. Annual rangeland forage production losses to grasshoppers average approximately 15 to 20 percent; in years of high grasshopper populations (15 or more grasshoppers per square yard for above-average economic impact) losses can increase to 50 to 70 percent of annual forage production (APHIS). Unsuccessful reclamation, improper grazing, and large pest populations can impede native vegetation and promote the establishment and expansion of invasive plants and pests.

Alternative A would help mitigate adverse effects and manage invasive species and pests. Alternative A management actions would have a direct, minor beneficial effect on invasive species and pest management.

Physical Resources

Soil

Alternative A soils management would prohibit surface-disturbing activities on soils with slopes greater than or equal to 25 percent and would restrict surface-disturbing activities on soils with poor reclamation suitability unless the authorized officer waives the prohibition. Allowing waivers would be the exception but results in inconsistent application of management, which would have a direct and adverse effect on vegetation and soil resources. The RFD predicts that a total of 37 percent of BLM-administered lands will be disturbed from BLM actions, 31 percent of BLM-administered lands will be reclaimed, and six percent of BLM-administered lands will be left with long-term disturbance.

Surface-disturbing activities can stress native vegetation and allow established invasive species to outcompete native plants for nutrients and water, thus allowing the locations and densities of invasive species to increase. Additionally, surface-disturbing activities can allow for the spread of invasive species through road and trail construction, vehicles, equipment, animals, and people. Prohibition or restriction of surface disturbance would help prevent spread of invasive species and pest management for the long term because factors that allow for invasive species and pests to spread would be removed.

Development on soils greater than or equal to 25 percent or with poor reclamation suitability could present reclamation challenges. Reclamation in these areas could be limited or unattainable which would allow for the spread of invasive species and pests.

Alternative A management would help mitigate adverse effects by prohibiting or restricting surface-disturbing but would still have an adverse effect on invasive species and pest management because continued development and multiple uses of the lands promote invasive species and pest establishment. Alternative A management actions would have a direct, moderate adverse effect on invasive species and pest management.

Water Resources

Alternative A water management would prohibit surface disturbance within 500 feet of springs, reservoirs, water wells, and perennial streams on 2.54 percent of the area unless the authorized officer waives the prohibition allows for inconsistent application of management. Disturbances could remove or crush vegetation and impact water quality and quantity. A reduction in habitat for numerous plant and animal species that inhabit these systems would occur and a reduction in potential SSS. This would allow for invasive species to establish and spread. Therefore, the

prohibition would have a direct beneficial effect for the long term. Waivers would be the exception in these areas. This would affect approximately three percent of the area.

Alternative A does not include decisions addressing on-channel reservoirs, which have become a common means of disposing of CBNG produced water. These sites are usually constructed on steep slopes where reclamation would be difficult, thus providing opportunities for invasive species to establish and spread, and the wetted areas below dams are havens for invasive plant species such as Canada thistle and salt cedar. If on-channel reservoirs are allowed there could be direct adverse effects.

Alternative A management actions would have a direct, minor beneficial effect on invasive species and pest management.

Cave and Karst Resources
There are no anticipated effects from cave and karst management actions.

Mineral Resources

Locatable Minerals
Alternative A management actions that do not withdraw or close lands make lands available for mineral leasing and development which promote surface-disturbing activities. Surface-disturbing activities can stress native vegetation and allow established invasive species to outcompete native plants for nutrients and water, thus allowing the locations and densities of invasive species to increase. Additionally, surface-disturbing activities can allow for the spread of invasive species through road and trail construction, vehicles, equipment, animals, and people. Under the locatable minerals program for the planning area, overall it is estimated that the BLM actions would disturb less than one percent of BLM-administered lands. This can have direct adverse effects over the long term by providing opportunities for invasive species to establish and spread during the life the lease or through surface-disturbing activities. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Leasable Minerals – Coal
Under Alternative A, on coal leases for which mining and reclamation plans have been approved, stipulate that oil and gas leases to regulate oil and gas operations that would interfere with approved coal mining. Under the leasable minerals (coal) program for the planning area, overall it is estimated that the BLM actions would disturb 25 percent of the area. Reclamation would occur on 15 percent of the area, leaving a total of 3.8 percent of the area of long-term disturbance. There is 5.8 percent of the area in active BLM mines. Those sites where development did occur would have impacts for the life of the project and would require successful reclamation to ensure the native vegetation component was reestablished to predisturbance conditions and to reduce the potential introduction and establishment of invasive species. This can have adverse effects on vegetation and soil resources by providing opportunities for invasive species to establish and spread during the life the lease or project through surface-disturbing activities that promote invasive species and pest spread. Alternative A management actions would have a direct, moderate adverse effect on invasive species and pest management.

Leasable Minerals – Fluids
Alternative A would continue to lease and allow for development of federal oil and gas minerals on but would close the WSAs to leasing. Surface disturbance from well sites, pipelines, and utility corridors would allow for transport of invasive species seed, crush or

removal of vegetation, and expose bare soils where invasive species could establish. Construction of reservoirs and ponds and other water disposal methods for CBNG development provide areas of soil disturbance and the perfect medium for establishment of invasive plant species, especially salt cedar. These reservoirs and ponds can provide breeding habitat for mosquitoes carrying the WNv. Under the leasable CBNG program for the planning area it is estimated that BLM actions would disturb less than one percent of the total available acres. Reclamation will occur on portions of that disturbance. Total CBNG and oil development would be less than one percent of the total available acres. The acres of long-term disturbance make these actions direct, negligible adverse effects on invasive species and pest management.

Salable Minerals

Under the salable minerals program, Alternative A would leave the entire planning area available for salable minerals leasing and the associated surface disturbance other that in the Fortification Creek, Gardner Mountain, and North Fork WSAs. Salables would involve surface-disturbance activities which would have direct, adverse effects on invasive species and pest management for the life of the project(s) because the disturbance associated with this action promotes the spread of invasive species and pests. Such actions include the creation of trails, crushing or removal of native vegetation, vehicle use, human presence, and equipment use. Over the next 20 years the estimated acres of salable minerals surface disturbance would be less than one percent of available acres. There is no anticipated disturbance from geothermal activities. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)

Under Alternative A, the application of different levels of suppression and restricting the use of some types of suppression equipment has the potential to allow for the spread of invasive species through road and trail construction, vehicles, equipment, and people. Even though there is potential to allow for the spread of invasive species rehabilitating fire and suppression damage would directly benefit invasive species and pest management over the long term, especially in vegetative communities where cheatgrass is a component because competitive native species would be established through rehabilitating fire and suppression. These plant communities help to prevent invasive species from establishing because they can outcompete invasive species for nutrients, space, and water. Implementing prescribed fires to support vegetation and wildlife habitat objectives also would have direct beneficial effects because burn conditions (air and soil temperatures, wind conditions, and fuel types) would be less severe than wildfires. However, in the short term, prescribed fire would still destroy any litter on the surface and the current year's growth. Improving ecological conditions through the application of prescribed fire and other vegetative treatments would directly benefit invasive species and pest management because through these actions healthier plant communities would be able to become established and help prevent invasive species from establishing. Long term, the application of prescribed fire to support plant communities and wildlife habitat objectives is estimated to affect approximately two percent of BLM-administered lands. All acres are expected to be successfully reclaimed. Prescribed fire would have minor beneficial effects on invasive species and pest management.

Unplanned fire would have adverse effects, with severity dependent on the fire sizes, soil types, types of vegetative communities, and burn conditions. Unplanned fire usually has more severe air and soil temperatures, wind conditions, and/or fuel types. Native vegetation can be destroyed

allowing for invasive species and pest to establish. Overall level of effect is anticipated to be moderate.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative A, forestry treatment actions in the planning area, including timber harvesting, firewood gathering, and other permitted activities related to forest products, could result in the introduction and spread of invasive species from road and trail construction, vehicles, equipment, animals, and people. The actions are estimated to affect less than one percent of BLM-administered lands. This would have a direct, adverse, negligible effect on invasive species and pest management over the long term.

Vegetation – Grassland and Shrubland Communities
Alternative A does not address grassland and shrubland communities. The past decade of energy development has disturbed tens of thousands of acres of public land. Reclamation of these lands has been difficult. Livestock and wildlife season-long and overgrazing can stress native vegetation and allow established invasive species to outcompete native plants for nutrients and water, thus allowing the locations and densities of invasive species to increase. At present, there are no management actions addressing grassland and shrubland communities. Approximately 16 percent of BLM-administered lands are grassland and shrublands. Disturbance on this area would be permitted although unlikely to occur on all 16 percent of BLM-administered lands. Alternative A management of grassland and shrubland communities would have a major adverse effect on invasive species and pest management because invasive species and pests have been able to establish in a variety of plant communities due to ongoing development and multiple uses of the lands that promote invasive species and pest establishment.

Riparian/Wetlands Communities
Current management actions prohibit surface-disturbing activities within 500 feet of springs, reservoirs, water wells, or perennial streams unless the prohibition is waived by the authorized officer. Surface-disturbing activities and continuous wildlife and livestock grazing in these wet areas can promote the establishment of invasive species and stress native plants, making it easier for invasive species to compete for nutrients, space, and water. This would affect three percent of BLM-administered lands. Alternative A management of riparian and wetland communities would have direct, minor, beneficial effects on invasive species and pest management over the long term because activities that promote invasive species and pest establishment are not allowed within 500 feet of riparian/wetlands communities.

Fish and Wildlife Resources
Fish and wildlife resources include fish, wildlife, upland game birds, raptors, migratory birds, and amphibians and reptiles and their habitats. Alternative A management actions include prohibiting, limiting, and restricting surface-disturbing activities unless waived by the authorized officer, and timing limitations for disruptive activities. Restriction of surface-disturbing activities would leave soils and plant communities intact which would limit the opportunity for invasive species to establish. Alternative A would help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development (from waivers, in surrounding areas, or with limited use) promote invasive species and pest establishment. The actions are estimated to affect less than one percent of acres. All acres are expected to be successfully reclaimed. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Special Status Species (including Greater Sage-Grouse)
Alternative A does not address invasive species and pests in habitats known to have populations of SSS with the exception of Greater Sage-Grouse, bald eagles, and special status raptor species. Under Alternative A, treatment of invasive species in known populations of SSS would not be likely unless analysis shows that the presence of the invasive plant or pest poses a greater threat to the SSS than the application of control methods. This would affect less than one percent of BLM-administered lands. Greater Sage-Grouse, bald eagles, and special status raptor species have surface-disturbance buffers unless waived by the authorized officer. Surface-disturbing activities can stress native vegetation and allow established invasive species to outcompete native plants for nutrients and water, thus allowing the locations and densities of invasive species to increase. Additionally, surface-disturbing activities can allow for the spread of invasive species through road and trail construction, vehicles, equipment, animals, and people. Approximately 33 percent of BLM-administered lands contain special status raptor species. Prohibition or restriction of surface disturbance would have a direct beneficial effect on invasive species and pest management for the long term because factors that allow for invasive species and pests to spread would be removed. Alternative A management actions for special status wildlife species would have a direct, major beneficial effect on invasive species and pest management. Special status plant and fish management would have a negligible beneficial effect due to their limited occurrence within the planning area.

Heritage and Visual Resources

Cultural Resources
Alternative A would apply NSO stipulations to mineral leases along the Bozeman Trail and within the Crazy Woman Battle Sites. Prohibition or restriction of surface disturbance would have a direct beneficial effect on invasive species and pest management for the long term because factors that allow for invasive species and pests to spread would be removed. The actions are estimated to affect less than one percent of BLM-administered lands. Alternative A management actions would have a direct, negligible beneficial effect on invasive species and pest management.

Paleontological Resources
Paleontological management actions were not addressed in Alternative A, therefore there are no protective measures for these sites and surface-disturbing activities would be allowed. This would allow for transport of invasive species seed, crush or removal vegetation, and exposure of bare soils where invasive species could establish. The actions are estimated to affect less than one percent of BLM-administered lands. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Land Resources

Forest Products
Alternative A management actions include prohibiting timber harvest within 200 feet of surface water. All other timber harvest is allowed in suitable areas. Surface-disturbing activities associated with timber harvest would have a direct adverse effect on invasive species and pest management because they could provide opportunities for invasive species introduction and spread. The development of trails and roads could crush or remove native vegetation. Vehicles, humans, and equipment could import invasive species. The application of forestry treatment actions is estimated to affect approximately up to one percent of BLM-administered lands. All

acres are expected to be successfully reclaimed. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Renewable Energy
Alternative A does not address renewable-energy development. Under Alternative A, activities that involve surface-disturbing activities would have a direct adverse effect on invasive species and pest management because they could provide opportunities for invasive species introduction and spread. The development of primitive motorized, hoof, and foot trails could crush or remove native vegetation and vehicles, animals (horses and dogs), humans, and equipment could import invasive species. Surface disturbance from BLM action would be approximately three percent of BLM-administered lands, with reclamation on approximately two percent of BLM-administered lands, with long-term disturbance of one percent of BLM-administered lands. Alternative A management actions would have a direct, minor adverse effect on invasive species and pest management.

Rights-of-Way and Corridors
Alternative A actions address ROW for pipelines, roads, powerlines communication sites, and other facilities. Under Alternative A, communication site locations would be prohibited on the North Middle Butte (Pumpkin Buttes area) unless necessary. Communication site locations would be allowed on the South Middle Butte only. Transmission lines would be within in identified corridors where feasible. Soil disturbance would be prohibited on slopes greater than or equal to 25 percent and timing stipulations on areas that are highly erodible. Surface-disturbing activities would have a direct adverse effect on invasive species and pest management because they could provide opportunities for invasive species introduction and spread.

Surface-disturbing activities can stress native vegetation and allow established invasive species to outcompete native plants for nutrients and water, thus allowing the locations and densities of invasive species to increase. Additionally, surface-disturbing activities can allow for the spread of invasive species through road and trail construction, vehicles, equipment, animals, and people. Alternative A would help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. BLM actions would disturb three percent of BLM-administered lands. Reclamation would occur on two percent of BLM-administered lands, leaving a total of one percent of BLM-administered lands with long-term disturbance. This can have direct adverse effects over the long term by providing opportunities for invasive species to establish and spread during the life the lease or project. Alternative A management actions would have a direct, minor adverse effect on invasive species and pest management.

Travel and Transportation Management
Under Alternative A vehicle travel on saturated soils and slopes greater than 25 percent would be prohibited and damage would result. There will be winter motor vehicle closures from November 15th to April 30th in North Fork, Barnum Mountain, Middle Fork, E.O. Taylor, and Fort Creek.

Surface-disturbing activities would have a direct adverse effect on invasive species and pest management because they could provide opportunities invasive species introduction and spread. Alternative A would help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. Surface-disturbing activities can stress native vegetation and allow established invasive species to outcompete native plants for nutrients and

water, thus allowing the locations and densities of invasive species to increase. Additionally, surface-disturbing activities can allow for the spread of invasive species through road and trail construction, vehicles, equipment, animals, and people. Prohibition or restriction of surface disturbances limit spread and establishment on invasive species and pests because factors that allow of invasive species and pests to spread and establish would be removed.

It is estimated that the BLM actions would disturb less than one percent of BLM-administered lands. Reclamation would not occur on the area leaving the area affected with long-term disturbance. This can have direct adverse effects over the long term by providing opportunities for invasive species to establish and spread during the life of the lease or project. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Recreation

Under Alternative A recreation would prohibit camping within 200 feet of surface water, prohibit livestock grazing within developed recreation sites, prohibit oil and gas development in Mosier Gulch, prohibit surface disturbance, and occupancy within 0.5 mile of Dry Creek Petrified Tree.

Surface-disturbing activities would have a direct adverse effect on invasive species and pest management because they could provide opportunities for invasive species introduction and spread.

Surface-disturbing activities can stress native vegetation and allow established invasive species to outcompete native plants for nutrients and water, thus allowing the locations and densities of invasive species to increase. Additionally, surface-disturbing activities can allow for the spread of invasive species through road and trail construction, vehicles, equipment, animals, and people. Prohibition or restriction of surface disturbance limits invasive species and pest spread and establishment because factors that allow for invasive species and pests to spread would be removed. Alternative A would help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment.

It is estimated that BLM actions would disturb less than one percent of BLM-administered lands. Reclamation would not occur on the area leaving the areas affected with long-term disturbance. This can have direct adverse effects over the long term by providing opportunities for invasive species to establish and spread during the life the lease or project. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Lands with Wilderness Characteristics

Alternative A does not address invasive species and pests in areas with wilderness characteristics. Activities in these areas involving surface-disturbing activities would have a direct, minor adverse effect on invasive species and pest management because they could provide opportunities for invasive species introduction and spread. The development of primitive motorized, hoof, and foot trails could crush or remove native vegetation and vehicles, animals (horses and dogs), humans, and equipment could import invasive species. It is estimated that BLM actions would disturb less than one percent of BLM-administered lands. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Livestock Grazing Management

Alternative A management actions include increasing available forage, implementing range improvements, and requiring rest following vegetative treatments. All these actions would

contribute to healthier ecological conditions that would make plant communities more resistant to invasive species. Alternative A would help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because livestock grazing of the lands promotes invasive species and pest establishment. It is estimated that BLM actions would disturb less than one percent of BLM-administered lands. Alternative A management actions would have a direct, negligible adverse effect on invasive species and pest management.

Special Designations

Areas of Critical Environmental Concern
Currently there are no designated ACECs in the planning area. The lack of designations and lack of management actions makes management of invasive species and pests easier to administer due to the absence of any constraints. Alternative A management actions would have a direct, negligible beneficial effect on invasive species and pest management.

Wilderness Study Areas
Alternative A management actions make WSAs unavailable for mineral leasing in the interim until Congress decides to designate the WSAs as wilderness or not. Protection from mineral leasing is a direct benefit long term, unless Congress designates otherwise. If Congress decides not to designate the WSAs as wilderness, Alternative A would allow leasing for minerals. This would allow for surface-disturbing activities of development and needed infrastructure. At present, there are no decisions addressing motorized travel in these areas. It is important to establish guidance for the protection of the natural resources in these areas. Limiting motorized travel would benefit invasive species management by reducing opportunities of invasive species to establish and spread even though it restricts the application of herbicides to control invasive species in the plant communities. Alternative A management actions would have a direct, minor beneficial effect on invasive species and pest management.

4.4.4.4. Alternative B

This section describes management actions under Alternative B, which emphasizes resource conservation, and the likely impacts to invasive species and pest management due to their implementation.

Invasive Species and Pest Management
In addition to the Alternative A management actions, Alternative B management actions include developing a pest management plan for the planning area. Specific management areas would be delineated based on native, invasive, and pest species, treatment methods, resource concerns, geographic features and limitations, and goals and objectives for each area. Treating plants on the State of Wyoming Designated Noxious Weed List, the appropriate county lists, and other species of concern as determined by BLM resource specialists would treat all species that adversely affect native plant communities and habitats. Cheatgrass is present throughout the planning area; therefore, the management plan would incorporate the entire planning area, including adjacent landowners and agencies. Goals would include improving the ecological condition of vegetative communities and wildlife and SSS habitat. The benefit of aerial application of pesticides would include treatment of large acreages for widely distributed species such cheatgrass, leafy spurge, grasshoppers and mountain pine beetle, access to remote locations, and lower rates of herbicide application. All these actions would have direct, minor beneficial effects on invasive species and pest management over the long term. Over the next 20 years it is estimated that BLM actions

would disturb approximately two percent of BLM-administered lands. Reclamation would occur on approximately two percent of BLM-administered lands, leaving less than one percent of BLM-administered lands with long-term disturbance. Alternative B management actions would have a direct, minor beneficial effect on invasive species and pest management.

Physical Resources

Soil

Alternative B soils management actions prohibit surface disturbing activities on soils with severe erosion hazard, prohibit surface-disturbing activities on soils with slopes greater than or equal to 25 percent, prohibit surface-disturbing activities on soils with poor reclamation suitability, prohibit surface-disturbing activities on badlands, rock outcrops, and slopes subject to mass failure, prohibit vehicle travel on saturated soils, and prohibit prescribed fire on highly erodible soils. The RFD predicts that a total of 30 percent of BLM-administered lands will be disturbed from BLM actions, 25 percent of BLM-administered lands will be reclaimed, and five percent of BLM-administered lands will be left with long-term disturbance. This would reduce the opportunity for the introduction of invasive species. Prohibiting surface-disturbing activities on soils with severe erosion hazard would reduce opportunities for invasive species to establish or spread.

Alternative B management would mitigate adverse effects by prohibiting or restricting surface-disturbing but would still have an adverse effect on invasive species and pest management because continued development and multiple uses of the lands promote invasive species and pest establishment. Alternative B management actions would have a direct, minor adverse effect on invasive species and pest management.

Water Resources

Alternative B water management actions would prohibit surface disturbance within 500 feet of any natural or man-made water feature and prohibit on-channel reservoirs. This would affect three percent of the area. Alternative B does not include the waiver option further helping invasive species and pest management because it reduces the opportunity for the introduction of invasive species. Alternative B management actions would result in a minor beneficial effect on invasive species and pest management.

Cave and Karst Resources

Alternative B cave and karst management actions would manage human activity in caves with significant resources through cave specific Cave Management Plans, prohibit surface-disturbing activities in areas containing cave and karst resources, prohibit timber harvest in areas containing cave and karst resources, and restrict livestock from entrances to significant caves. People using trails that lead to popular cave and karst areas could trample and remove vegetation, and possibly promote the introduction of invasive species. Livestock use can also trample and remove vegetation, and possibly promote the introduction of invasive species. Current management practices do not have any prohibitions or restrictions to cave and karst trails. Prohibiting surface-disturbing activities would prevent such activities from occurring and protect proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread. This would affect 13 percent of the area. Alternative B would have a direct, major beneficial effect on invasive species and pest management.

Mineral Resources

Locatable Minerals
Alternative B includes a number of new areas to protect and preserve cultural, paleontological, recreation, wilderness, and special designation resource values (ACECs, Scenic or BCBs, WSRs, and WSAs). These withdrawals and restrictions would be for the protection and preservation of other resource values. This would result in 12 percent withdrawn from mineral exploration and development. Existing withdrawals and restrictions were implemented to protect and preserve other resource values. Under Alternative B, withdrawing or restricting additional areas from locatable minerals would help to minimize the spread of invasive species and pests because by restricting or withdrawing these areas proper ecological conditions in vegetative communities and habitat types would remain intact and limit opportunities for invasive species establishment and spread. Locatable minerals management would affect less than one percent of the area. Alternative B management would help mitigate adverse effects by prohibiting or restricting surface-disturbing activities but would still have an adverse effect on invasive species and pest management because continued development promotes invasive species and pest establishment and spread. Alternative B management actions would have a direct, negligible adverse effect on invasive species and pest management.

Leasable Minerals - Coal
Under Alternative B, invasive species and pest management actions could include area- and/or species-specific treatment strategies, applied on a project-specific basis to public lands. Successful treatments will decrease the spread of undesirable species. However, where development does occur, vegetation would be directly and adversely affected over the long term for the life of the mining and would require successful reclamation to ensure the native vegetative component was reestablished to predisturbance conditions. Surface-disturbing activities have an adverse effect on invasive species and pest management because continued development and multiple uses of the lands in surrounding areas promote invasive species and pest establishment. Under this alternative, approximately 39 percent of solid leasable mineral acres would be disturbed from BLM actions (existing leases and new leases). Reclamation will occur on approximately three percent solid leasable mineral acres. One percent solid leasable mineral acres are actively being mined. Less than one percent solid leasable mineral acres would be disturbed over the long term. Alternative B management actions would have a direct, minor adverse effect on invasive species and pest management.

Leasable Minerals – Fluids
Alternative B would make lands available for fluid minerals leasing and exploration in accordance with management identified to conserve other resources. This would result in 2,612,920 acres of BLM-administered lands closed to minerals leasing. More acreage would be protected from development over the long term and would help native vegetation to remain intact. Under the leasable CBNG program for the planning area, overall it is estimated that BLM and non-BLM actions would disturb approximately less than one percent of available acres over the next 20 years. There is no anticipated disturbance from geothermal-related activities. Alternative B would help mitigate adverse effects but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. Alternative B management actions would have a direct, negligible adverse effect on invasive species and pest management.

Salable Minerals
Alternative B would make mineral materials unavailable in accordance with management identified to conserve other resources, would result in 3,218,690 federal mineral acres closed. Management under Alternative B would help mitigate adverse effects because the alternative

would protect additional acreage from development over the long term, but would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. Under the salable minerals program for the next 20 years, the estimated areas of surface disturbance less than one percent of available acres. Overall, Alternative B management would have a negligible adverse effect over the long term.

Fire and Fuels Management

Unplanned Fire (Wildfire) and **Planned Fire (Prescribed Fire)**
Alternative B management actions involving the application of full suppression of unplanned fires in areas where fire is undesirable would affect approximately six percent of the area. Full suppression in these areas would directly benefit vegetation communities by reducing the potential for soil erosion. These vegetation communities are important because they can outcompete invasive species. Additionally, limiting suppression vehicles to existing roads and trails unless they are in identified full suppression areas would reduce the opportunity for the introduction of invasive species. Rehabilitating all fire-related damage also would directly benefit vegetation communities over the short and long terms by reducing the potential for soil erosion. This management would have moderate beneficial effects.

Long term, the application of prescribed fire to improve the health of the vegetation community and/or enhance habitat is estimated to affect approximately less than one percent of BLM-administered lands. All acres would be successfully reclaimed. This management would have negligible beneficial effects over the long term because competitive native species would be established and prevent invasive species from establishing because they can outcompete invasive species for nutrients, space, and water.

Biological Resources

Vegetation – Forests and Woodlands
Alternative B management actions allowing fire and natural pathogens to take their natural course could result in massive destruction of vegetation. This would have a direct adverse effect on invasive species and pest management over the long term because invaders and fire would move regardless of land status and the economic impact could be massive. Non-native species could move out of their original niche and become an invasive species requiring control. The actions are estimated to affect less than one percent of BLM-administered lands. This management would have negligible adverse effects.

Vegetation – Grassland and Shrubland Communities
Alternative B authorizes only native plant species for all reclamation activities. Management actions for grassland and shrubland communities that would allow native plant species for initial reclamation practices would provide another tool for achieving reclamation goals. Timely reclamation (1 to 3 years) would limit opportunities for invasive species to establish and spread but not prevent them. Alternative B would help mitigate adverse effects on grassland and shrubland communities but would still have an adverse effect on invasive species and pest management because continued development and multiple uses of the lands promote invasive species and pest establishment. The actions are estimated to affect less than one percent of the area from BLM actions. This management would have negligible adverse effects.

Vegetation – Riparian/Wetland Resources
Alternative B prohibits surface-disturbing activities within 500 feet of springs, reservoirs, water wells or perennial streams in riparian and wetland communities. Alternative A allows waivers to this prohibition; not including the waiver option makes this alternative more restrictive than Alternative A. Additionally, restoring vegetation in all CBNG-supported riparian and wetland systems would have a direct beneficial effect on invasive species and pest management over the long term because it allows native plant species to develop and outcompete invasive species. These systems are very susceptible to water-tolerant invasive species such as salt cedar and Canada thistle. Under Alternative B, reclamation actions would have a direct, long-term, beneficial effect on invasive species and pest management by establishing competitive native species. This would affect three percent of BLM-administered lands. Overall, Alternative B vegetation management actions would have a minor beneficial effect on invasive species and pest management.

Fish and Wildlife Resources
Alternative B wildlife management actions apply appropriate wildlife seasonal restrictions on disruptive activities to maintenance and operation of developed projects. This alternative does not allow disruptive activity in crucial elk winter range between November 15 and April 30, and in elk calving areas from May 1 to June 30 (Map 29). Actions also prohibit disruptive activities within 0.5 mile of big game migration corridors. Treatment of invasive species and pests would be considered a disruptive activity. These specific locations and timing restrictions would encumber the management of invasive species and pests and would have a direct adverse effect. Timing restrictions could affect the effectiveness of the treatment and would increase costs. Prohibiting or limiting surface-disturbing activities in designated areas, improving the ecological condition of plant communities and associated habitats, and reducing fragmentation of grassland and shrubland communities would help mitigate adverse effects on grassland and shrubland communities but would still have an adverse effect on invasive species and pest management because it is likely these surface-disturbing activities would relocate to other plant communities or to soils at higher risk to invasive species and pest establishment. Continued development and multiple uses of the lands promote invasive species and pest establishment. The actions are estimated to affect less than one percent of BLM-administered lands. This management action would have a direct, negligible, adverse effect over the long term.

Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)
Alternative B management actions prohibit the aerial application of herbicides in areas with habitat for special status plant species. Invasive species would be allowed to thrive because of the potential for special status plants to be present. Surveys for special status plant species would be required prior to approving any project or activity that may impact the habitat for these species. By definition (Glossary) treatment of invasive species and pests would be considered a disruptive activity. The requirement to survey for special status plants prior to treatments, prohibiting aerial application of herbicide treatments within areas containing habitat, and the number of acres and locations encumbered by distances or date limitations would have a major adverse impact on the treatment management of invasive species and pests.

Management actions would also prohibit or restrict disruptive activities and occupancy in the perimeter of Greater Sage-Grouse leks, establish a disturbance-free zone in corridors consistently used by bald eagles, and prohibit or restrict disruptive activities raptors. Treatment of invasive species could affect Greater Sage-Grouse habitat. Preferred herbicides are not species specific, and other broadleaf plants (forbs) can be affected. Greater Sage-Grouse, especially chicks feed on forbs, these plants also attract insects upon which Greater Sage-Grouse do feed. The control of invasive species, including cheatgrass, would need to be assessed for the potential impacts

of treating versus the impacts of not treating areas with significant populations of Greater Sage-Grouse and in habitats where Greater Sage-Grouse dwell. Large populations and significant numbers will be defined depending on the USFWS status (Sensitive, Threatened, or Endangered) of the Greater Sage-Grouse at the time of assessment. Timing limitations that address disruptive activities could postpone invasive species treatments, which could diminishing the effectiveness of the treatment and increase the cost of treatments. This could affect up to 33 percent of BLM-administered lands. Overall, Alternative B management of special status plant and wildlife species would have a major adverse effect on invasive species and pest management.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources

Alternative B management actions would limit or prohibit salable minerals exploration and development in areas with significant paleontological resources and prohibit surface disturbance in areas with cultural or historic properties. Closing leasing, withdrawing lands from minerals development, and prohibiting surface-disturbing activities would have a direct, minor, beneficial effect on invasive species and pest management over the long term by keeping invasive species from establishing and spreading. The actions are estimated to affect less than one percent of the area from BLM actions. This management would have negligible beneficial effects.

Land Resources

Forest Products

Alternative B management actions would limit timber harvests to five acres per group harvest and manage product sales within ecologically sustainable limits. Timber harvest projects requiring the development of roads, trails, and staging and work areas, would increase the opportunities for invasive plant establishment and spread. The actions are estimated to affect less than one percent of the area from BLM actions. This management would have an indirect, negligible adverse effect on invasive species and pest management over the short term for the life of the project(s).

Renewable Energy

Alternative B management actions would exclude development in specific areas of public land. Exclusion or limiting energy development and the related infrastructure, namely utility roads and transportation pipelines, would limit surface disturbance. These actions would then limit the opportunity for invasive plant establishment and spread in these areas. Alternative B would help mitigate adverse effects in specific area but would still have an adverse effect on invasive species and pest management because development of renewable outside these specific area promote invasive species and pest establishment. Estimated renewable-energy development would disturb less than one percent of the area from BLM actions. This management would have negligible adverse effects.

Right-of-Way and Corridors

Management actions include prohibiting ROW on slopes equal to or greater than 25 percent and on highly erodible soils to minimize impacts to soil resources. Requiring co-location of new communication sites within designated areas, authorizing transmission lines in identified corridors, and avoids constructing facilities along major transportation routes. All these actions would reduce surface disturbance where ROWs are permitted and would help improve invasive plant management by limiting removal or mechanical damage to vegetation and reduce the opportunities for invasive plant establishment and spread. Mitigation measures will

help reduce the spread of invasive species and pests but not eliminate the potential for spread because disturbance for ROWs will occur in other areas. Alternative B would have an adverse effect on invasive species and pest management because development of ROWs promotes invasive species and pest establishment through removal of vegetation, soils, and invasive seed transport. ROW disturbances from BLM actions would be from pipelines, communications sites, roads, and powerlines. These disturbances are estimated to affect approximately one percent of BLM-administered lands. This would have a negligible adverse effect on invasive species and pest management.

Travel and Transportation Management

Alternative B management actions would allow motorized vehicles off designated routes with a special use permit. Management actions would close areas with saturated soils or on slopes of 25 percent or greater, in habitat for SSS, special designation areas (a total of 625,854 acres), and big game ranges during specific timeframes; also limit travel to designated roads and trails on 137,126 acres. These actions will help reduce the spread of invasive species and pests by protecting the resources during conditions when soil and plants are highly susceptible to erosion but not eliminate the potential for spread and may affect implementation of restoration projects. Alternative B would have an adverse effect on invasive species and pest management because invasive species and pest establishment would be promoted through removal of vegetation, soils, and increase invasive seed transport. These disturbances are estimated to affect less than one percent of BLM-administered lands. Alternative B management of transportation and access would have negligible adverse effects on invasive species and pest management.

Recreation

Alternative B management actions limiting recreation facilities and prohibiting surface disturbance in the eight designated SRMAs will help reduce the spread of invasive species and pests by protecting the resources in these areas. However, the BLM promotes visitor use and access in SRMAs; this would increase the popularity of and visitation to these areas, which would result in increased vegetation disturbance from trampling and increased potential for the introduction and spread of invasive plant species. These disturbances are estimated to affect less than one percent of BLM-administered lands. Alternative B would have negligible adverse effects on invasive species and pest management.

Lands with Wilderness Characteristics

Alternative B includes management actions for the lands with wilderness characteristics areas, which would directly benefit vegetative communities by limiting surface-disturbing activities in those areas. These disturbances are estimated to affect less than one percent of BLM-administered lands. This management would have a negligible beneficial effect over the long term.

Livestock Grazing Management

Alternative B management actions include providing a minimum of two years rest from livestock grazing, with additional rest if needed following prescribed fires and other vegetative treatments. This would improve the ecological condition of vegetative communities and help prevent the spread of invasive species and pests. Limiting or prohibiting livestock grazing where it would incompatible with other resource values, and locating salt, water sources, and mineral supplements a minimum of 0.5 mile away from sensitive sites would also help keep invasive species from establishing. Management actions base allotment objectives on allotment health and other resource objectives rather than on AUMs and forage allocations. This management emphasizes healthy habitat and ecological conditions, which would indirectly reduce the opportunities for invasive species to establish and/or spread. Annual plants (mustards) would be the first to take

root, followed by cheatgrass or other perennial invasive species. Successful reclamation would reduce opportunities for invasive species to establish and spread. These mitigation measures will help reduce the spread of invasive species and pests but not eliminate the potential for spread because disturbance will occur from livestock grazing. These disturbances are estimated to affect less than one percent of BLM-administered lands. Alternative B would have negligible adverse effects on invasive species and pest management.

Estimations for surface disturbance in the planning area over the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. These disturbances are estimated to affect less than one percent of BLM-administered lands. Overall, Alternative B management of livestock grazing would have a negligible adverse effect on invasive species and pest management.

Special Designations

Areas of Critical Environmental Concern
Alternative B management actions include designating eight areas as ACECs (511,000 acres), which would affect approximately 68.5 percent of BLM-administered lands. The associated management plans for these sites would initiate specific conservation to protect soils and vegetation from surface-disturbing activities, including minerals development, vehicular travel, ROW, and any other activity not compatible with retaining or enhancing the area's values. These restrictions would protect proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread. All these restrictions would have direct, moderate beneficial effects on invasive species and pest management over the long term.

Wilderness Study Areas
There are three WSAs in the planning area totaling four percent of BLM-administered lands. There are restrictions to preserve wilderness conditions in these areas until Congress acts on their wilderness status. Designation of these areas and interim management is based on conservation of the natural resources, which would directly benefit vegetative communities and limit vehicular travel and surface-disturbing activities. This management would have a minor beneficial effect on invasive species and pest management.

4.4.4.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource use, and the likely resulting impacts to invasive species and pest management due to its implementation.

Invasive Species and Pest Management
Alternative C would limit aerial application to just the use of insecticides and would restrict application methods for herbicides to motorized vehicles and foot travel. Large tracts of land would be inaccessible due to topography and would therefore go untreated. In the case of leafy spurge, which inhabits thousands of acres across multiple landscapes and plant communities, in remote locations, and in various terrains, Alternative C management would greatly limit where herbicides can be applied and the number of treated acres. This would have a direct, adverse effect on invasive species and pest management over the long term because invasive species would not be controlled and able to spread. Annually treating only designated areas for cheatgrass would not be effective and would leave large landscapes of this annual grass untreated having a direct,

adverse effect on native plant communities. Lack of constraints would increase opportunities for invasive species to establish and spread. Remote and sensitive areas and sites could transition to monocultures of invasive species. Over the next 20 years disturbances are estimated to affect less than one percent of BLM-administered lands. Alternative C management actions would have negligible adverse effects on invasive species and pest management.

Physical Resources

Soil

Under Alternative C, there would be no constraints on surface-disturbing activities, which would greatly increase the opportunity for invasive species infestation. Soils that have limiting factors such as severe erosion hazard, slopes greater than 25 percent, poor reclamation suitability, badlands, rock outcrops, and slopes susceptible to mass movement are especially susceptible to invasive species infestation because activities on these soils increase the potential for vegetation to be trampled or removed exposing bare soil. Bare soil is a prime area for invasive species to inhabit because there is a lack of native species to outcompete invasive species thus allowing the locations and densities of invasive species to establish and increase. Surface-disturbing activities would be allowed on 100 percent of the area. Although 100 percent of soils will be allowed to have surface-disturbing activities it is unlikely that 100 percent of these soils will utilized. The RFD predicts that 47 percent of BLM-administered lands will be disturbed from BLM actions, 38 percent of BLM-administered lands will be reclaimed, and nine percent of BLM-administered lands will be left with long-term disturbance. Alternative C management actions would have a direct, major adverse effect on invasive species and pest management over the long term.

Water Resources

Under Alternative C, there would be no constraints on surface-disturbing activities or on-channel reservoirs. Disturbances could directly and adversely affect water quality and quantity by removing or crushing vegetation. A reduction in habitat for numerous plant and animal species that inhabit these systems would occur and a reduction in potential SSS. This would allow for invasive species to establish and spread. This would affect less than three percent of the area. Alternative C would have a direct, minor adverse effect on invasive species and pest management over the long term.

Cave and Karst Resources

Alternative C management actions include establishing project-specific buffers (100 feet from entrances to significant caves) to minimize effects from surface-disturbing activities. People using trails that lead to popular cave and karst areas could trample and remove vegetation, and possibly promote the introduction of invasive species. Livestock use can also trample and remove vegetation, and possibly promote the introduction of invasive species. Alternative C management actions limit surface-disturbing activities thus reducing the opportunity for the introduction of invasive species. This would affect less than one percent of the area. Alternative C management actions would have a direct, negligible beneficial effect on invasive species and pest management.

Mineral Resources

Locatable Minerals

Alternative C does not include recommendations for new withdrawals or restrictions on locatable minerals development. Lands open to mineral entry are consistent with other resource values.

Alternative C would adversely affect invasive species management by allowing for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. Under the locatable minerals program for the planning area, overall it is estimated that BLM actions would disturb approximately less than one percent of BLM-administered lands over the next 20 years. Alternative C management of locatable minerals would have a negligible adverse effect on invasive species and pest management.

Leasable Minerals - Coal

Alternative C would stipulate fluid mineral leases when nominated within the areas identified as acceptable for further consideration for coal leasing (BLM 2001a) to require a mitigation plan allowing for maximization of both coal and oil and gas resources. Alternative C would adversely affect invasive species management by allowing for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. It is estimated that BLM actions would disturb approximately four percent of BLM-administered lands, reclaim approximately three percent of BLM-administered lands, and leave less than one percent of BLM-administered lands with long-term disturbance. One percent of BLM-administered lands are active mines. Alternative C management of leasable coal minerals would have a minor adverse effect on invasive species and pest management.

Leasable Minerals - Fluids

Alternative C would continue to lease and allow development of federal oil and gas. This would result in the disturbance of predominantly grassland and shrubland systems. Alternative C would adversely affect invasive species management by allowing for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. Most surface-disturbing activities, including linear infrastructure supporting oil and gas development, would require successful reclamation. Under the leasable CBNG program for the planning area, overall it is estimated that BLM actions would disturb less than one percent of acres over BLM leasable minerals over the next 20 years. There is no anticipated disturbance from geothermal activities. Alternative C management of leasable fluid minerals would have a negligible adverse effect on invasive species and pest management.

Salable Minerals

Alternative C does not recommend new closures or restrictions. The existing closures and restrictions were imposed to protect and preserve other resource values. Not adding areas to be protected from these minerals activities would have a direct adverse effect over the long term. Alternative C would adversely affect invasive species management by allowing for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. For salable minerals over the next 20 years, the estimated areas of surface disturbance would be less than one percent of acres over BLM minerals. Alternative C management of salable minerals would have a negligible adverse effect on invasive species and pest management.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)

Under Alternative C, management actions involving full suppression of wildfires and the use of heavy equipment with few constraints. Unplanned fire usually has more severe air and soil temperatures, wind conditions, and/or fuel types. Native vegetation can be destroyed allowing for invasive species and pest to establish. The use of heavy equipment increases the chance for invasive species to be spread in these areas. Unplanned fire with the use of heavy equipment with

few constraints would have a direct adverse effect on invasive species and pest management over the short and long terms. Unplanned fire would have moderate adverse effects, depending on the fire sizes, soil types, types of vegetative communities, and burn conditions.

Under Alternative C, the application of prescribed fire to support grassland and shrubland communities and wildlife habitat objectives is estimated to affect approximately five percent of BLM-administered lands. All acres would be successfully reclaimed. Even though there is potential to allow for the spread of invasive species rehabilitating fire and suppression damage would directly benefit invasive species and pest management over the long term because competitive native species would be established through rehabilitating fire and suppression. These plant communities help to prevent invasive species from establishing because they can outcompete invasive species for nutrients, space, and water. This would have a minor beneficial effect on invasive species and pest management.

Biological Resources

Vegetation – Forests and Woodlands
Alternative C management actions would include intensive tactics to reduce natural events and control pathogens; this could minimize the destruction of vegetation, which would directly benefit vegetation. The actions are estimated to affect less than one percent of the area from BLM actions. This would have a direct, beneficial, negligible effect on invasive species and pest management over the long term.

Vegetation – Grassland and Shrubland Communities
Management actions for grassland and shrubland communities that would allow non-native plant species for initial reclamation practices would provide another tool for achieving reclamation goals. Timely reclamation (1 to 3 years) would limit opportunities for invasive species to establish and spread. Successfully reclaiming disturbed areas would have a direct beneficial effect on invasive species and pest. The actions are estimated to affect less than one percent of the area from BLM actions. This would have a direct, beneficial, negligible effect on invasive species and pest management over the long term.

Vegetation – Riparian/Wetland Resources
Alternative C would apply no constraints on surface-disturbing and disruptive activities in riparian and wetland systems; this would have a direct adverse effect on these systems over the long term because the actions would allow for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. Restoring vegetation only on direct CBNG disturbance areas (e.g., dams and reservoirs) rather than on all CBNG-supported riparian and wetland systems would reclaim a very small portion of each system, and large acreages would not be reclaimed. This would have a direct adverse effect on the health of the riparian and wetland systems and an indirect adverse effect on adjacent grassland and shrubland communities, which also would be susceptible to invasive species establishment and spread. The actions are estimated to affect less than one percent of the area from BLM actions. This would have a direct, adverse, negligible effect on invasive species and pest management over the long term.

Fish and Wildlife Resources
Alternative C fish and wildlife management actions would not constrain any impacts to habitat of fish, big game animals, upland game birds, raptors, and migratory birds in designated areas, and during designated periods. Special areas would be managed to be consistent

with other resource values, rather than primarily for big game. Management actions would consider other resources a higher priority than fish and fish habitat in reservoirs, riparian and wetland systems, and perennial water management. This lack of constraints would directly and adversely affect these systems and habitats over the long term by promoting the establishment of invasive species, lowering the ecological condition of the sites, and degrading potential habitat. Surface-disturbing activities would impact less than one percent of BLM-administered lands. Lack of constraints for fish and wildlife management actions would have a negligible adverse effect on invasive species and pest management over the long term.

Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)
Alternative C would allow aerial application of herbicides in areas with habitat for special status plant species, and would restrict such treatments in areas of known special status plant populations. Restrictions in areas of known special status plant populations would encumber the management of invasive species and pests and would have a direct adverse effect on control of invasive species populations.

Alternative C management actions to provide habitat for prairie dogs or for SSS that depend on prairie dog colonies would maintain vegetation at a lower ecological condition and with a large cheatgrass component. Limiting constraints would allow surface-disturbing activities in prairie dog habitat, this would further adversely affect vegetation and increase the opportunity for resident cheatgrass to spread and other invasive species to establish because surface-disturbing activities would allow for the spread of invasive species seed, crush or remove vegetation, and exposing bare soils where invasive species could establish.

Surface-disturbing activities would affect less than one percent of BLM-administered lands. Overall, Alternative C management of special status plant and wildlife species would have a negligible adverse effect on invasive species and pest management because surface-disturbing activities would allow for the spread of invasive species seed and restricting treatments encumber the management of invasive species and pests.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources
Alternative C management actions would allow development in areas with significant paleontological resources and allow surface disturbance in areas with cultural or historic properties. BLM actions would disturb less than one percent of the total available acres. Allowing these surface-disturbing activities would have an indirect, negligible adverse effect on invasive species and pest management over the long term because surface-disturbing activities would allow for transport of invasive species seed, crush or remove vegetation, and exposure of bare soils where invasive species could establish.

Land Resources

Forest Products
Under Alternative C, timber harvests would not be limited and forest product sales would be conducted to maximize economic return. There would be an increase in roads, trails, and staging areas which would allow for seed transport. Vegetation would be crushed or removed and bare soils would be exposed allowing for species establishment. BLM actions would disturb approximately three percent of the total available acres. All areas are expected to be

reclaimed. These actions would have an indirect, minor, adverse effect on invasive species and pest management over the long term.

Renewable Energy

Alternative C management actions would allow renewable-energy development anywhere in the planning area consistent with other resource values. This lack of restrictions would have direct adverse effects on invasive species and pest management over the long term because it would allow for surface-disturbing activities that would allow for transport of invasive species seed, crush or remove vegetation, and exposure of bare soils where invasive species could establish. Under the renewable-energy program for the planning area, overall it is estimated that BLM actions would disturb approximately five percent of BLM-administered lands over the next 20 years. Reclamation would occur on three percent of BLM-administered lands, leaving a total of two percent of BLM-administered lands with long-term disturbance. These actions would have an indirect, moderate, adverse effect on invasive species and pest management over the long term.

Rights-of-Way and Corridors

Alternative C management actions would not constrain ROW and corridor locations. ROW disturbances from powerlines, pipelines, roads, and communications sites from BLM actions will adversely affect ROWs because they would allow for surface-disturbing activities that allow for transport of invasive species seed, crush or remove vegetation, and exposure of bare soils where invasive species could establish. Disturbances are estimated to affect approximately four percent of BLM-administered lands, with successful reclamation on approximately four percent of BLM-administered lands, leaving one percent of BLM-administered lands with long-term disturbance. This management would have a direct, minor adverse effect on invasive species and pest management over the long term.

Travel and Transportation Management

Alternative C management actions would allow motorized vehicles within the stock driveways, on saturated soils and on slopes greater than 25 percent, and in special species habitat. Management actions would close or limit travel to designated routes to motorized vehicle use and would implement winter closures (November 15 – April 30) on designated big game ranges. Travel and transportation will adversely affect ROWs because they would allow for surface-disturbing activities that allow for transport of invasive species seed, crush or remove vegetation, and expose of bare soils where invasive species could establish. Alternative C management actions would disturb less than one percent of the total of BLM-administered lands. These actions would have a direct, long-term, negligible, adverse effect by not protecting the soil or vegetation resources.

Recreation

Alternative C management actions include the establishment of six SRMAs with no consideration for more. Actions also included leasing of minerals in accordance with management for areas surrounding SRMAs, allowing surface disturbance and salable minerals development in designated SRMAs, and allowing additional recreation facilities. Alternative C management for recreation will adversely affect these areas because they would allow for surface-disturbing activities that allow for transport of invasive species seed, crush or remove vegetation, and expose of bare soils where invasive species could establish. Alternative C management would disturb less than one percent of the total available BLM-administered lands. These actions would have a direct, long-term, negligible, adverse effect by not protecting the protecting the soil or vegetation resources.

Lands with Wilderness Characteristics
Alternative C management actions include managing lands with wilderness characteristics areas the same as the surrounding areas. Alternative C management for lands with wilderness characteristics will adversely affect these areas because they would allow for surface-disturbing activities that allow for transport of invasive species seed, crush or remove vegetation, and expose of bare soils where invasive species could establish. Alternative C management would disturb less than one percent of the total available BLM-administered lands. These actions would have an indirect, long-term, negligible, adverse effect by not protecting the protecting the soil or vegetation resources.

Livestock Grazing Management
Alternative C would focus primarily on livestock management. Management actions include providing a minimum of 2 years rest from livestock grazing following prescribed fires and other vegetative treatments, which would improve the ecological condition of vegetative communities. Alternative C management would continue to limit or prohibit livestock grazing where it is currently not authorized, but would not consider limits or prohibitions in new areas. Locating salt, water sources, and mineral supplements a minimum of 500 feet away from sensitive sites would likely increase the presence of invasive species in these areas where livestock would congregate.

Estimations for surface disturbance in the planning area over the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. The actions are estimated to affect less than one percent of the area from BLM actions.

Overall, Alternative C management of livestock grazing would have a negligible adverse effect on invasive species and pest management.

Special Designations

Areas of Critical Environmental Concern
Alternative C would not designate ACECs. Lack of designation would allow these areas to be eligible for surface-disturbing activities and other actions. Surface-disturbing activities allow for transport of invasive species seed, crush or remove vegetation, and expose of bare soils where invasive species could establish. This would adversely affect approximately eight percent of BLM-administered lands. Alternative C management actions would have a direct, moderate adverse effect on management for invasive species and pests.

Wilderness Study Areas
Alternative C management would be the same as management in surrounding areas, which would be generic and might not address all resource issues. The lack of special management actions including treatments of existing invasive species would increase the opportunity for invasive species to spread and outcompete native species. There are three WSAs in the planning area totaling four percent of BLM-administered lands. Alternative C management of WSAs would have an indirect, minor, adverse effect on invasive species and pest management.

4.4.4.6. Alternative D

This section describes management actions under Alternative D, which balances resource use with resource enhancement and protection, and the potential impacts to invasive species and pest management from those management actions.

Invasive Species and Pest Management
Alternative D would allow aerial application of herbicides and pesticides in areas where topography, extent of infestation, target species, and timing limit other application methods. Pest management plans would be developed to establish long-range goals and set priorities in cooperation with stakeholders. Plants treated would include those identified under Alternative B. Annual bromes would be addressed as described under Alternative C. Over the next 20 years it is estimated that BLM actions would render approximately two percent of BLM-administered lands of treated disturbance. Reclamation would occur on one percent of BLM-administered lands from BLM actions, leaving less than one percent of BLM-administered lands with long-term disturbance. Control efforts would be beneficial because controlling invasive species and pest would prevent or hinder their growth and/or spread. Alternative D management actions would have a direct, minor beneficial effect on invasive species and pest management.

Physical Resources

Soil
Under Alternative D, surface-disturbing activities on soils with severe erosion hazard, with poor reclamation potential, and on slopes equal to or greater than 25 percent would have to have an approved reclamation and stabilization plan and comply with CSU stipulations. Alternative A would prohibit, but allow waivers on prohibitions, surface-disturbing activities on slopes equal to or greater than 25 percent, on soils with poor reclamation, potential, and on soils with severe erosion hazard. Alternative A does not address surface-disturbing activities in miscellaneous areas such as badlands, rock outcrops and slopes susceptible to mass movement. Alternative D addresses these areas as described above.

Alternative A prohibits or restricts development on these areas unless the authorized officer waives the prohibition or restriction. Alternative D would protect badlands, rock outcrops, and slopes susceptible to mass movement. Alternatives A and D both allow development, but Alternative D requires that certain criteria be met. The established criteria under Alternative D help ensure project disturbances are capable of being reclaimed before the project is approved. Alternative A has fewer restrictions on the locations and types of development, with no assurances of reclamation success. The criteria requirements would help control invasive species and pest spread but would not prevent spread. Surface-disturbing activities would adversely affect invasive species and pest management because continued development and multiple uses of the lands promote invasive species and pest establishment.

Surface-disturbing activities would be allowed on all other soils but it is unlikely that 100 percent of these soils will be utilized. The RFD predicts that 47 percent of BLM-administered lands will be disturbed from BLM actions, 37 percent of BLM-administered lands will be reclaimed, and nine percent of BLM-administered lands will be left with long-term disturbance. Alternative D management actions would have a direct, moderate adverse effect on invasive species and pest management over the long term.

Water Resources
All wet and water sites and systems have high potential for invasive species establishment and spread. Alternative D water management actions would allow surface disturbances within 500 feet of such sites in accordance with identified criteria and based on management decisions for other resource values. This would affect approximately three percent of BLM-administered lands. Allowing disturbances in these areas would have a direct adverse effect on vegetation and water quality in these sensitive areas; however, meeting the stipulations and criteria would reduce

the areas where development could occur and would minimize adverse effects. Alternative C would allow on-channel reservoirs. Under Alternative D, CBNG reservoirs would be evaluated to determine if they could be converted to another use or removed and reclaimed. This would reduce the areas where development occurs and would minimize adverse effects. Although Alternative D minimizes adverse effects surface-disturbing activities will still occur and adversely affect invasive species and pest management through activities that would allow for transport of invasive species seed, crush or remove vegetation, and exposure of bare soils where invasive species could establish. Alternative D water management actions would have a direct, minor adverse effect on invasive species and pest management.

Cave and Karst Resources

Alternative D stipulations include site-specific buffers around cave and karst resources for timber sales and surface-disturbing activities. People using trails that lead to popular cave and karst areas could trample and remove vegetation, and possibly promote the introduction of invasive species. Livestock use can also trample and remove vegetation, and possibly promote the introduction of invasive species. Disturbances around cave and karst resources would affect less than one percent of the area, the same as under Alternative C. Alternative D management of cave and karst resources would have a negligible beneficial effect on invasive species and pest management because by having site-specific stipulations limits surface-disturbing activities thus reducing the opportunity for the introduction of invasive species.

Mineral Resources

Locatable Minerals

In addition to areas currently withdrawn or restricted under Alternative A, Alternative D includes a number of new areas to conserve other resource values; this would leave 41 percent of leasable mineral acres open to mineral entry, with approximately 2 percent of leasable mineral acres recommended for withdrawal from mineral entry in addition to existing withdrawals. These areas would protect proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread. However, in areas where development did occur, any related actions that disturbed the surface would have a direct and adverse effect because surface-disturbing activity would allow for transport of invasive species seed, crush or removal of vegetation, and expose bare soils where invasive species could establish. Under the locatable minerals program for the planning area, it is estimated that BLM actions would disturb approximately less than one percent of leasable mineral acres over the next 20 years. Alternative D management actions would have a direct, negligible adverse effect on invasive species and pest management.

Leasable Minerals – Coal

Alternative D would stipulate fluid mineral leases when nominated over existing coal leases to allow for maximum recovery of the coal resources. Though all acres are open, actual development is anticipated to occur only in the higher potential areas of northwest Sheridan County and south central Campbell County. In areas where coal development does occur vegetation would be directly and adversely affected for the life of the project until reclamation goals and objectives are achieved. Alternative D would adversely affect invasive species management by allowing for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. It is estimated that BLM actions would disturb approximately four percent of BLM-administered lands, reclaim approximately three percent of BLM-administered lands, and leave less than one percent of

BLM-administered lands with long-term disturbance. One percent of BLM-administered lands are active mines. Alternative D management of locatable minerals would have a minor adverse effect on invasive species and pest management.

Leasable Minerals - Fluids
Alternative D would make lands available for fluid minerals leasing and exploration in accordance with management identified to conserve other resources. Alternative D would help mitigate adverse effects by being in accordance with management identified to conserve other resources communities but would still have an adverse effect on invasive species and pest management because continued development and multiple uses of the lands promote invasive species and pest establishment. Alternative D would adversely affect invasive species management by allowing for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. This would affect approximately less than one percent of leasable mineral acres over the next 20 years. There is no anticipated disturbance from geothermal activities under Alternative D. Alternative D management actions would have a direct, negligible adverse effect on invasive species and pest management.

Salable Minerals
Alternative D would open 2,725,060 acres of federal minerals to salable minerals leasing and close 623,061 acres. Alternative D would adversely affect invasive species management by allowing for transport of invasive species seed, crushing or removal vegetation, and exposure of bare soils where invasive species could establish. For salable minerals development over the next 20 years, the estimated areas of surface disturbance would be less than one percent of total salable mineral acres. Alternative D management actions would have a direct, negligible adverse effect on invasive species and pest management.

Fire and Fuel Resources

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Alternative D response to wildland fires would be the same as under Alternative B. Alternative A would restrict the use of some types of suppression equipment in some areas and Alternative D would prohibit heavy equipment use in specifically identified areas except when human safety is at risk or if the expected effects of fire would cause more resource damage than the use of heavy equipment. Prohibiting the use of heavy equipment would directly benefit vegetation over the short and long terms. Under Alternative D, full protection strategies and tactics would be used in designated areas, while priority suppression strategies and tactics would be used in Alternative A. All protection measures would directly benefit vegetation over the long term, unless fire would improve vegetative health. All fires would be evaluated for rehabilitation and severity of impacts. All rehabilitation efforts would have the direct beneficial effect of reducing invasive species, especially cheatgrass. Under Alternative A, only prescribed fire would be utilized to support vegetation and wildfire habitat objectives; Alternative D would use wildfire and other vegetative treatments to meet management objectives. Both unplanned fire and prescribed fire would affect less than one percent of the area. Alternative D management actions would have a direct, negligible beneficial effect on invasive species and pest management.

Biological Resources

Vegetation – Forests and Woodlands
Alternative D would implement intensive management tactics to reduce or circumvent events such as insect infestations, disease, and wildfire. This would affect less than one percent of the area. This management would have a direct, negligible beneficial effect on invasive species and pest management over the long term because these activities protect or restore proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

Vegetation – Grassland and Shrubland Communities
Alternative D management actions address the use of non-native species for initial reclamation as a portion of an approved reclamation plan. This would affect less than one percent of the area. This management would have a direct, negligible beneficial effect on invasive species and pest management over the long term because the use of some non-native species for initial reclamation can help native species to establish improving ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

Vegetation – Riparian/Wetland Resources
Alternative D would allow surface-disturbing activities with defined criteria. Reclaiming vegetation in all CBNG riparian and wetland systems in accordance with ecological site protection would return all water-affected systems to their pre-CBNG natural state. Alternative D would help mitigate adverse effects on riparian and wetland communities but would still have an adverse effect on invasive species and pest management because continued development and multiple uses of the lands promote invasive species and pest establishment. This would affect less than one percent of the area. These actions would have a direct, negligible, adverse effect on invasive species and pest management over the long term.

Fish and Wildlife Resources
Alternative D wildlife management actions allow surface-disturbing and disruptive activities to occur throughout the entire life of projects during seasons important for wildlife in accordance with identified criteria; criteria includes a resource protection plan which includes an IPM plan. Historic uses would be exempted from prohibitions in crucial big game winter range (and in elk calving areas). Disruptive activities within big game migration corridors would not be prohibited. Locations and timing restrictions would not encumber the management of invasive species and pests and would help limit opportunities for invasive species establishment and spread. Alternative D would help mitigate adverse effects on fish and wildlife resources but would still have an adverse effect on invasive species and pest management because continued surface disturbance promotes invasive species and pest establishment. This would affect less than one percent of the area. Alternative D management actions would have a direct, negligible adverse effect on invasive species and pest management.

Special Status Species (including Greater Sage-Grouse)
Alternative D SSS management actions include managing disruptive activities to mitigate impacts on special status wildlife species and their habitats, allowing disruptive activities within active prairie dog colonies on BLM-administered lands, in accordance with identified criteria, that do not adversely impact suitable habitat for SSS dependent upon prairie dog colonies, restricting disruptive activities and occupancy near occupied Greater Sage-Grouse leks, and prohibiting disruptive activities during specific timeframes. Alternative D would manage within occupied Greater Sage-Grouse habitat outside of Core Population Areas and Connectivity Corridors by restricting disruptive activities within the perimeter of occupied Greater Sage-Grouse leks. Prohibitions addressing raptor nests are as stated in Alternative B. Surveys would be required

for special status amphibian, reptile, and bat species prior to approving any project or activity that may impact the habitat for these species. Allow disruptive activities where special status amphibian, reptile, and bat species occur in accordance with defined criteria.

Prohibitions and limitations on these locations could help mitigate invasive species spread because it would limit activity that can spread invasive species seed. These actions would protect ecological conditions habitat types and limit opportunities for invasive species establishment and spread. Although these limitations can benefit invasive species management they could postpone invasive species treatments, which could diminishing the effectiveness of the treatment and increase the cost of treatments. Overall, prohibitions and limitations on these locations will benefit invasive species and pest management by preventing activity in these areas and therefore limiting the spread of invasive species. This would affect up to 23 percent of the area. Alternative D management actions would have a direct, beneficial effect on invasive species and pest management.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources

Alternative D management actions would place limitations, stipulations, mitigations, prohibitions, and allowances for surface-disturbing activities as part of cultural and paleontological resources management with defined criteria. These actions would protect ecological conditions habitat types and limit opportunities for invasive species establishment and spread. This would affect less than one percent of the area. Alternative D management actions would have a direct, negligible beneficial effect on invasive species and pest management.

Land Resources

Forest Products

Under Alternative D, timber harvest areas would be adapted to natural features and product sales would be ecologically sustainable while maximizing economic return. Any areas of surface disturbances would have to be reclaimed to their natural state. This management minimizes opportunities for invasive species to establish and spread. This would affect less than one percent of the area. Alternative D would help mitigate adverse effects on forest products but would still have an adverse effect on invasive species and pest management because uses of the lands promote invasive species and pest establishment. Alternative D management actions would have a direct, negligible adverse effect on invasive species and pest management.

Renewable Energy

Alternative D management actions would exclude renewable-energy development in the southern Big Horn Mountains, areas closed to mineral leasing for fluids and solids, locatables, salables, ROW areas, and other areas where surface disturbance is prohibited. Renewable-energy development would also be avoided on public lands leaving less than six percent of public land available for development. These restrictions would limit invasive species and pest management spread and establishment (see Map 56 for specific locations). Under the renewable-energy program for the planning area, overall it is estimated that BLM actions would disturb approximately 10 percent of BLM-administered lands over the next 20 years. Reclamation would occur on six percent of BLM-administered lands disturbed by BLM actions, leaving a total of three percent of BLM-administered lands with long-term disturbance. Alternative D would help limit adverse effects because where renewable energy is excluded proper ecological

conditions, vegetative communities, and habitat types will remain intact, limiting invasive species establishment and spread. Although adverse effects will be limited, Alternative D would still have an adverse effect on invasive species and pest management because continued development of the lands promotes invasive species and pest establishment. Alternative D management actions would have a direct, moderate adverse effect on invasive species and pest management.

Rights-of-Way and Corridors

Alternative D management actions would avoid on slopes equal to or greater than 25 percent and on highly erodible soils. Newly proposed transmission lines and ground facilities would be allowed within existing ROW and other disturbance areas. All these actions would limit spread of invasive species and pest because where ROWs are limited or avoided proper ecological conditions, vegetative communities, and habitat types will remain intact limiting invasive species establishment and spread. ROW disturbances from BLM actions and non-BLM actions are estimated to affect approximately three percent of BLM-administered lands, with successful reclamation on approximately two percent of BLM-administered lands and one percent BLM-administered lands left with long-term disturbance. Alternative D would help mitigate adverse effects on ROW corridors but would still have an adverse effect on invasive species and pest management because continued development of the lands promote invasive species and pest establishment and spread. Alternative D management actions would have a direct, minor, adverse effect on invasive species and pest management.

Travel and Transportation Management

Like Alternative B, Alternative D would close special designation areas to motorized vehicle use. Motorized vehicle use in stock driveways would be allowed on designated routes. Motorized vehicle use would be allowed with travel management designations in SSS habitat and on saturated soils or on slopes 25 percent or greater. Alternative D would limit motorized vehicle travel to designated roads and trails, consistent with management of other resources and would seasonally prohibit travel in game ranges. All these actions would limit spread of invasive species and pests because where ROWs are limited or avoided proper ecological conditions, vegetative communities, and habitat types will remain intact limiting invasive species establishment and spread. This would affect less than one percent of the area. Alternative D would help mitigate adverse effects TTM but would still have an adverse effect on invasive species and pest management because continued use of the lands promote invasive species and pest establishment and spread. Alternative D management actions would have a direct, negligible, adverse effect on invasive species and pest management.

Recreation

Alternative D management actions designate the eight areas as SRMAs, with possible consideration of additional lands for SRMA designation. Prohibiting surface disturbance in designated SRMAs unless for administrative use would generally help protect, maintain, and enhance vegetative resources. Alternatives C and D allow additional recreation facilities consistent with other resource values and would have a direct adverse effect on vegetation in and around the facilities over the long term. Visitor use and access is promoted in SRMAs, which would increase popularity and visitation and increase vegetation disturbance from trampling and increase the potential for introduction and spread of invasive plant species. This would affect less than one percent of the area. Alternative D management actions would have a negligible adverse effect on invasive species and pest management over the long term because there would be increased vegetation disturbance.

Lands with Wilderness Characteristics
Alternative D actions would include managing non-WSA lands with wilderness characteristics to emphasize vegetative health, natural values, and primitive recreational opportunities on about three percent of BLM-administered lands. Managing these lands to those standards would have an indirect, negligible beneficial effect on invasive species and pest management over the long term because Alternative D will protect or restore proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

Livestock Grazing Management
Alternative D management actions would add areas where livestock grazing is not allowed and would allow for rest or deferment following vegetative treatments. This would help invasive species and pest management by limiting opportunities of invasive species to establish and spread. Alternative D also allows for flexibility in livestock grazing practices both before and after vegetative treatments occur. This will increase opportunities to use livestock grazing management as a tool to build plant communities resistance to invasive species establishment and to control invasive species populations. Alternative D stipulations for locating livestock salt or mineral supplements would be the same as described for Alternative C. Alternative D would help mitigate adverse effects on where livestock grazing occurs but would still have an adverse effect on invasive species and pest management because continued development and multiple uses of the lands promote invasive species and pest establishment.

Surface disturbances from installation of range improvements, if not properly reclaimed, could have direct adverse effects on invasive species and pest management by providing opportunities for invasive species to establish and spread. Estimations for surface disturbance in the planning area over the next 20 years for range improvement projects consist of spring developments, pipeline developments, fence construction, and well developments. This would affect less than one percent of BLM-administered lands. Alternative D management actions would have a negligible, adverse effect on invasive species and pest management.

Special Designations

Areas of Critical Environmental Concern
Alternative D management actions designate two areas as ACECs, which would affect less than one percent of BLM-administered lands. The associated management plans for these sites would initiate specific conservation to protect soils and vegetation from surface-disturbing activities; this would have direct, minor, beneficial effects over the long term because protection from surface-disturbing activities would maintain proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

Wilderness Study Areas
There are three WSAs in the planning area totaling four percent of BLM-administered lands. There are restrictions to preserve wilderness conditions in these areas until Congress acts on these WSAs. Designation of these areas and interim management is based on conservation of the natural resources, which would limit vehicular travel and surface-disturbing activities. This management would have a minor beneficial effect on invasive species and pest management because conservation of the natural resources would maintain proper ecological conditions to vegetative communities and habitat types and limit opportunities for invasive species establishment and spread.

4.4.4.7. Cumulative Impacts

Chapter 4 describes effects to invasive species and pest management from past and present actions, federal and non-federal, as part of the affected environment. Non-federal actions will affect invasive species management similar to federal actions but mitigation for effects to vegetation resources would differ between federal and non-federal actions. The more activity on the public lands, the greater the chance for establishment and spread of invasive plants whether it be from motorized transportation, surface disturbance, animal or human activity. As the demands on public land increases from recreational needs, energy development, desire for open spaces, and economic livelihood; these demands can contribute to the spread or management of invasive species. Once a pest establishes, it is difficult to pinpoint the source, therefore responsibility of controlling or managing infestations is difficult. As an example, roads developed for energy development can also be used by hunters, recreationists, and ranchers. As more activities occur in more confined spaces, the likelihood of the presence of invasive plants increases. Motorized travel and recreational use of horses with feed can transport invasive species.

Pest species are usually more mother nature driven and proactive measures can be taken to reduce opportunities but most pest species management is reactive, addressing the pest once populations have reached an economic threshold. Pest management is often large scale and expensive to administer. The costs of preventing invasive species and pests is considered to be less than the costs of control.

4.4.4.8. Conclusion

In general, alternatives B and D management actions would be more conservative than management under alternatives A and C for soils, water, riparian and wetland communities, SSS, fish, wildlife, cultural and paleontological resources, ROW, grazing, recreation, and special designations. Alternatives B, C, and D do not include the waiver option included in multiple conservation management actions under Alternative A. Alternatives B and D include a number of restrictions on surface-disturbing and disruptive activities (e.g., timing and location). Increases in recreation sites, facilities, and opportunities under alternatives D and C would likely increase the presence and spread of invasive species.

Under alternatives B and D, motorized travel is limited to designated roads and vehicle routes and closing areas to motorized vehicles would reduce soil and vegetation disturbance and reduce opportunities for invasive species to establish and be transported. The use of designated roads and vehicle routes would result in closure (and reclamation) or road maintenance of existing roads in poor locations, which would eliminate or minimize degradation of vegetation in these areas and therefore decrease opportunities for invasive species to establish and spread.

Treatment of invasive plant species including cheatgrass and other annual grasses, as stated under alternatives B and D, would benefit vegetation systems and improve the habitat for the aquatic and terrestrial species that inhabit these plant communities. Alternative C limits application methods and the species to be treated.

Alternatives B and D allow aerial application of herbicides within areas containing special status plant species; Alternative D allows only narrow spectrum (selective) herbicide treatments.

Management actions associated with Alternative D would allow surfacing-disturbing activities if defined criteria can be met or there is an approved reclamation plan. Other management actions

would be allowed if project and resource objectives were met. Alternative D does not include the option for the authorized officer to waive prohibitions, and the management action must meet certain criteria to be allowed. There would be fewer acres of vegetation and soil disturbance under Alternative D than under Alternative A, more than under Alternative B, and fewer than under Alternative C. Leasing and permitting have few limitations under alternatives A and C, which would have an overall adverse effect on invasive species and pest management because there would be few limitations on surface disturbances.

Alternatives C and D locate salt or mineral supplements a minimum of 500 feet from defined sensitive sites and Alternative B states 0.5-mile distance from defined sensitive sites. These areas of livestock concentration can be sites where invasive species establish and spread.

SRMAs and other special designation areas would in most cases protect and enhance vegetative resources. More restrictive management under Alternative B and Alternative D with qualifiers, would reduce surface disturbance, which would reduce the opportunity for invasive species to be introduced or spread. Under Alternative C these areas would be available for minerals leasing and permitting thus subverting invasive species and pest management.

The following conclusions are based on meaningful differences in short- and long-term disturbance acreage; surface disturbance and limiting activities on highly erosive soils, on soils with a severe erosional potential, on soils with poor reclamation suitability, and on slopes equal to or greater than 25 percent; use of certified weed seed-free products, timing, and reseeding requirements in reclamation of disturbed areas; management of livestock, including areas unavailable for livestock grazing, for resource protection; motorized vehicle use limitations; and management of soil disturbance during fire suppression activities. Potential adverse impacts under Alternative A are anticipated to be the most adverse, followed by alternatives C and B, with impacts under Alternative D anticipated to be the least adverse regarding the introduction and spread of invasive species.

4.4.5. Fish and Wildlife Resources – Fish

Various management actions under the alternatives could affect fish in the planning area. This section describes potential effects on fish from management of other resources. See Map 28 for a depiction of the distribution of fish in the planning area. Effects would be adverse if they contribute to the decline in fish abundance or range; effects would be beneficial impacts if they increase fish population numbers or viability, protect habitats, or reduce the risk of harm to fish species in the planning area.

Surface-disturbing activities, water depletions, changes in stream hydrology, increased sedimentation, changes in water quality (including clarity), and introduction of exotic species (e.g., mussels or whirling disease) can adversely affect fish. The primary means by which fish could be directly affected are surface development (e.g., mining and urbanization), loss of sufficient upland and riparian/wetland vegetation that increases sedimentation; barriers to fish passage; discharged water; and storm water runoff. Indirect impacts to fish species would result from actions that aid or compromise the protection of these species. Indirect impacts to potential habitats for fish species also could occur when actions, such as those listed above, change habitats in a way that makes them unsuitable.

For purposes of this analysis, short-term impacts to fish species result from activities that contribute to the decline in abundance or distribution of a species within five years after the

activity. Long-term impacts to fish species plants require more than five years to manifest on the surface.

Effects to Fish from Sedimentation

Excessive sediments deposited on stream and lake bottoms can choke spawning gravels, impair sources of food for fish (macroinvertebrates), fill in rearing pools, and reduce the complexity of habitat instream channels. Large quantities of suspended sediment also can make it more difficult for fish to find prey and can cause direct physical harm, such as clogged gills. In some cases, man-made disturbances that result in hydrologic modifications can cause sediment deficits that create stream-channel scour and cause loss of habitat structure (EPA 1999). Erosion rates in stream channels increase along with instream flows, which can augment sedimentation in streams. Increased sedimentation can affect aquatic resources by filling interstitial (intergravel) spaces and pool habitats. This increase in sedimentation can reduce the availability of suitable spawning and rearing habitats. Aquatic macroinvertebrates also are highly dependent on interstitial spaces for different life stages, and sedimentation can cause large decreases in population and change species composition. Benthic invertebrates are excellent candidates for monitoring sediment conditions in streams because substrate is believed to be the most important factor in regulating invertebrate distribution and abundance at the local or reach scale (BLM 2003c). Changes in invertebrate communities caused by deposited sediment can be difficult to isolate and quantify because they often accompany other modifications in the stream, such as removal of riparian vegetation, alterations of flow and temperature regimes, and nutrient enrichment (BLM 2003c). These community changes can be detrimental to fisheries that depend on macroinvertebrates as primary food supplies and can change the abundance and diversity of fish populations. Increased sedimentation also can reduce the productivity of, or eliminate, rooted and unrooted aquatic vegetation upon which many species of macroinvertebrates and fish depend for food and habitat; this could reduce populations of fish and macroinvertebrates. An increase in sediment load in the streams in the planning area can impact fish and macroinvertebrates and their habitats. The density and taxa richness of benthic invertebrates substantially decreased in three of four Missouri study streams well before 30 percent deposited sediment was reached (BLM 2003c). As deposited sediment increases, the community structure and diversity also can be altered. Community changes generally involve a shift in dominance from Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) to Oligochaetes (worms) in general (BLM 2003c). Management of the riparian zone has a strong influence on the degree to which streams behave as sources or sinks of fine sediment (Rabeni and Smale 1995).

It is likely that an increase in sediment loads would favor such species as the black bullhead, common carp, flathead chub, northern plains killifish, plains minnow, goldeye, river carpsucker, sand shiner, sturgeon chub, and white crappie. Such species as the brassy minnow, common shiner, creek chub, mountain whitefish, northern redhorse, brown trout, brook trout, cutthroat trout, Yellowstone cutthroat trout, rainbow trout, smallmouth bass, and walleye could be adversely affected by an increase in sediment.

Proper management of soil, water, and vegetative resources would benefit fish. Implementing mitigation measures to protect soils, water, and vegetation on a project-specific basis, particularly in the riparian zones of watersheds, would reduce disturbance to fish habitats and aid in the recovery of aquatic habitats from permitted uses. Improper management of soil, water, and vegetative resources can lead to increased sediment loads in affected watersheds. Evaluating surface disturbance to soils, applying mitigation, relocating to better soils, and including reclamation plans would minimize sedimentation. Approximately 2,800,000 acres in fish-bearing

watersheds within the planning area have soils with poor reclamation potential that if disturbed could increase sediment loads.

Water Quality
Water management actions could be beneficial or detrimental to fish species. Depletions would almost always be detrimental, whereas increased flows would generally be beneficial. Actions that protect water quality would be beneficial. Increased salt concentrations can alter the algae and macroinvertebrate composition of streams and, if sufficiently elevated, can change the abundance and diversity of fish species. Parameters such as electrical conductivity, TDS, or salinity are used as a measure of the concentrations of common ions in fresh water (Mount et al. 1997). The toxicity of water high in TDS to some aquatic invertebrates depends on the specific ionic composition. Ion imbalance can result from the composition and concentration of anions and cations that make up salinity (Goodfellow et al. 2000). Toxicity is affected by the ionic composition of the effluent and the species and life history stage (Chapman et al. 2000; Pillard et al. 1999). The EPA Phase 1 Toxicity Identification Evaluation can be used to measure concentrations of specific inorganic ions. Based on cost and timing, most effluent toxicity testing methods generally do not attempt to segregate the effects of salinity or ionic strength on test and species performance. Mount et al. (1997) developed models to test individual and combined ion toxicity on invertebrates such as *C. dubia* and *D. magna* and vertebrates such as the *P. promelas* (fathead minnow). The models followed the general guidelines of the EPA for performing acute whole effluent toxicity tests (EPA 1994). These models can be used to project changes in toxicity that result from modifications in industrial processes, effluent treatment, or other remedial measures. As a general screening tool, the concentration of TDS can be high enough to adversely affect freshwater test species if the conductivity of a freshwater effluent is above 2,000 micro siemens per cubic meter (Goodfellow et al. 2000).

Water Temperature
Water temperature can affect growth, metabolism, reproduction, emergence, and the distribution of aquatic species (Vannote and Sweeney 1980). The magnitude and pattern of historical, annual, seasonal, and daily fluctuations in temperature can be important in selecting and maintaining a variety of aquatic insects in a stream reach (Vannote and Sweeney 1980). Sudden increases or decreases in water temperature could result in population- and community-level changes in aquatic insects in the planning area.

4.4.5.1. Methods and Assumptions

This section describes the methods and assumptions used in the analysis of impacts to fish. The assumptions and methods include, but are not limited to:

- The fish-bearing streams GIS layer used for analysis is representative of fish-bearing streams.
- The BFO waterbodies identified as perennial in the GIS layer support fish.
- The term “lake” refers to any impoundment (e.g., reservoir, pond, and natural lake); “fish” refers to any fish species.
- In general, analysis is performed on a watershed scale. Resource management actions which would result in surface disturbance occurring within 0.25 mile of a fish bearing stream would directly impact fish habitat, and are used to quantify acres impacted.
- Impacts to fish are representative of impacts to aquatic community health. Organisms at lower trophic levels (periphyton and invertebrates) respond more quickly to environmental stressors than fish. To detect changes in aquatic systems over 1 to 5 years, monitoring periphyton and

invertebrates would better allow for the implementation of management actions where there are impacts to fish.
- The total amount of new surface disturbance allowed by an alternative is an index of potential impacts to fish. Success of reclamation measures varies. It is assumed that BLM-applied reclamation will be successful in preventing impacts to fish.
- Activities that cause substantial disturbance to soils and vegetation can adversely impact water quality and quantity, which adversely impacts fisheries habitats.
- Surface disturbances accelerate runoff and sediment delivery to stream channels, which alters streamflows and reduces habitat quality for fish that require clear water, moderated streamflows, and clean substrates.
- Increasing sedimentation adversely affects fish adapted to clear-water systems (those originating from the Big Horn Mountains) in the planning area.
- Decreasing turbidity can adversely affect fish adapted to turbid waters (streams with prairie origins).
- Activities that affect water quantity are regulated by the WSEO.
- Activities that affect water quality are regulated by the Wyoming DEQ.
- Management toward DPC is assumed to exceed the requirements of managing toward PFC.
- The potential for sedimentation of streams and rivers is minimized through the implementation of BMPs.

Significance Criteria

In addition to the scale of impacts listed in the beginning of this chapter, an adverse impact on fish species as a result of project actions would be considered potentially significant if there was: (1) substantial loss of the biological integrity and habitat function of aquatic ecosystems that would make species eligible for listing under the ESA; (2) substantial loss (more than 10 percent) of habitat function or disruption of life history requirements of fish species that would preclude maintenance or improvement of their status; (3) a degrading change in the Wyoming DEQ classification for a stream or river reach.

4.4.5.2. Impacts Common to All Alternatives

This section describes management actions and resulting impacts to fish species common to all alternatives. The following paragraphs describe the sources and types of potential impacts. The section then describes management actions and impacts to fish from management of other resources. Management actions common to all alternatives that are administrative processes (e.g., development and prioritization of plans, providing outreach and education, updating existing habitat management plans (HMPs), and adherence to rules, regulations, and agreements such as MOUs) would have negligible to moderate beneficial effects.

Due to a lack of overlapping resources, management of **Air Quality** would not affect fish and is not further addressed in the **Fish and Wildlife Resources – Fish** section.

Fish and Wildlife Resources – Fish
Managing barriers to fish passage in cooperation with the WGFD and other stakeholders would have a beneficial effect on fish species because removing or bypassing these barriers can allow fish to move into new habitats, or complete critical life history requirements. Impacts from the management of activities potentially affecting native and desirable non-native fish species in

collaboration with the WGFD and other stakeholders should be beneficial as it would likely result in increased populations, protected habitats, and reduced risk of harm to fish.

Managing public access to fish-bearing waters that protect crucial habitats could have an adverse effect on fish. Future access routes would increase the likelihood of introducing whirling disease and invasive species to fish-bearing waters. These impacts could be mitigated to negligible through education and enforcement programs for fisheries.

Physical Resources

Soil

Evaluating the effects to soil resources from a proposed surface-disturbing activity using NRCS Soil Survey data and onsite investigation would help identify mitigation measures, relocate the activity to a more suitable soil type, or deny the authorization. Reclamation plans also would minimize impacts. This management of soil resources would reduce the risk of harm to fish on five to ten percent of the fish-bearing streams in the planning area; therefore, management actions Common to All Alternatives for soil would have a moderate beneficial effect on fish.

Water Resources

Water management actions would beneficially affect fish by reducing sedimentation, increasing aquatic vegetation and macroinvertebrates through (1) providing an alternative or "off-source" water supply (e.g., piping water to troughs, tanks, or ponds) in locations where BLM-authorized uses are fenced out of water sources; (2) installing flow-control devices on new and existing BLM-authorized water wells and spring developments and evaluating the need for additional flow-control devices on a project-specific basis; (3) managing water resources to meet the Wyoming Standards for Healthy Rangelands and achieve PFC; (4) taking appropriate actions to improve the biological, chemical, and geomorphic conditions of streams adversely affected by BLM-authorized actions and permitted activities; and (5) designing and managing land use and surface-disturbing activities to reduce channel and bank erosion and the associated loss of riparian habitats. All these actions influence greater than ten percent of the fish-bearing streams in the planning area and would have a major beneficial effect on fish.

Cave and Karst Resources

The management actions common to all alternatives for cave and karst resources are administrative and would have no effect on fish resources.

Mineral Resources

Locatable Minerals

Leaving lands open to locatable minerals exploration and development could lead to increased sedimentation, removal of riparian vegetation, changes instream channel morphology, and decreased water quality. This would have a major adverse effect on fish resources, depending on the scale of exploration and development. A 2009 MOU between the BLM and the U.S. Nuclear Regulatory Commission to address uranium development and reclamation activities would moderately benefit fish by increasing protections to fish-bearing streams from runoff and decreased water quality. Locatable minerals occur within 0.25 mile of greater than ten percent of the fish-bearing streams in the planning area; therefore the management actions Common to All Alternatives for locatable minerals would have a major adverse effect on fish resources.

Leasable Minerals – Coal
Making the federal coal estate areas identified as acceptable for further coal leasing consideration (BLM 2001a) available for exploration could impact five to ten percent of the fish-bearing streams in the planning area. If coal mining affected these streams, the effects (increased sedimentation and surface disturbances) could rise to a population or community level and have a moderate adverse effect.

Leasable Minerals – Fluids and Salable Minerals
Opening mineral estate to fluid minerals leasing and mineral materials exploration (unless the mineral estate is specifically identified as closed to minerals leasing) could adversely affect fish if fluid or other leasable minerals, and mineral materials were developed in fish-bearing watersheds.

In general, surface mining activities increase erosion and accelerate sedimentation into nearby lakes and streams. Streams could be dewatered or rechanneled to accommodate surface mines. Surface mining operations also have the potential to increase pollution that can enter streams through runoff and disrupt subsurface and surface water flow patterns. Bridges, culverts, and low-flow crossings are integral features to road development associated with surface mining. If improperly designed, these features also can interfere with fish migrations to spawning, feeding, rearing, and overwintering sites. Proper placement of these structures is critical to minimizing impacts to fish.

Increasing streamflows from produced water could have beneficial and adverse effects on aquatic species. Oil and gas produced water can be beneficial in enhancing or creating fish habitat, and adverse if water quality suffers, hydrologic regimes are modified to an extent that affects fish, or naturally turbid waters are clarified. The primary beneficial effect would be to provide habitat to fish and macroinvertebrates in areas that are normally dry. This new habitat could provide opportunities for population growth. Increased flows also could benefit fisheries where containment or flow-through ponds are developed for fisheries. With proper water quality, these ponds could serve as sport fisheries or be used for breeding native species.

Produced water can change turbidity, water quality, and the hydrography. Decreased water quality (for example increases in Sodium Absorption Ratio or TDS) can adversely impact fish. A change in streamflow translates to a change in the water depth and velocity for any specific location in a stream. Consequently, changes in streamflow can be regarded as modifications to the physical composition of the aquatic habitat (Bain and Finn 1988). Fish that inhabit streams in the planning area are frequently exposed to disturbances from floods and droughts, and must persist in environments characterized by fluctuating flows. Produced water can stabilize flows in a system adapted to fluctuations. Potential adverse effects to fish and invertebrates caused by changes in flow could be physical, behavioral, habitat, and food changes that could occur if streamflows change substantially, especially during spawning. Increased flows in rearing areas could make survival more difficult for young fish. Bain and Finn (1988) and Fausch and Bramblett (1991) reported that shallow- and slow-water fish were adversely affected by an artificially high variability in flow.

Streams and rivers receiving clear (low turbidity) discharge could become less turbid because produced water is relatively low in sediments. This decrease in turbidity could be detrimental to fish that depend on turbid waters and could allow changes to the fish community. Increased clarity provides an advantage to predatory fish such as centrarchids (e.g., bass and sunfish), resulting in higher predation rates to native fish adapted to turbid waters.

Leasable fluid minerals and salable minerals each occur within 0.25 mile of greater than ten percent of the fish-bearing streams in the planning area; therefore, the impacts described here would have major adverse effects on fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Adhering to the National Wildland Fire Management Policy and current FMP for the WHPD, ensuring all prescribed-fire activities comply with Wyoming DEQ standards and rules, and using a fire resource advisor would help reduce impacts to fish species to a minor level. Prohibiting the use of retardants or foam within 300 feet of surface water sources would reduce impacts to fish to a minor level. Some runoff into occupied stream segments would be likely, which would kill individual fish, but population-level effects are not anticipated. Implementation of the BLM Emergency Stabilization and BAR standards and rehabilitation of fire lines would reduce sedimentation from runoff to a minor level. Landscape treatments to enhance fuels management and restore fire-adapted ecosystems could result in a short-term, minor adverse effect on fish and fisheries from sedimentation during fire treatments. Long-term effects from treatments would be moderately beneficial because the threat of catastrophic wildfire would be reduced.

Fire affects fish populations through both physical and chemical changes (increased siltation, altered water quality [dissolved oxygen, pH, suspended and dissolved solids, total hardness, and turbidity], and changes in water temperature). Nutrient flow changes that adversely affect aquatic insect production also would affect fish populations. Although there is limited BLM surface estate congruent with fish streams (615 stream miles in the planning area on BLM-administered lands), the threat of adverse effects from unplanned ignitions and prescribed fires occurs on all lands surrounding fish streams, and therefore could affect any fish populations in BLM-administered streams. The extent of surface erosion after fire depends largely on the topography and soil types in the immediate area. Stream siltation can occur following fire. Siltation is a particular problem where severe burns occur on steep or moderate slopes, in riparian habitats, or where heavy equipment is used in fire suppression activities. Water temperature in cold-water fisheries, such as the upper forks of the Powder River and the Tongue River tributaries, could change if shading vegetation is removed from the sides of the stream. Generally, fish will rapidly recolonize fire-affected areas. Fuels management projects are designed and implemented in a non-emergency manner that minimizes impacts to aquatic resources. Competent planning and implementation would minimize the effects on fish from fuels treatments. For example, prescribed fires conducted in spring and fall are less likely to escape containment and are therefore less of a threat to riparian vegetation and less likely to contribute to erosion.

Biological Resources

Vegetation – Forests and Woodlands
No management actions common to all alternatives have been identified for forests and woodlands.

Vegetation – Grassland and Shrubland Communities
Managing vegetative communities in accordance with Wyoming Standards for Healthy Rangelands and siting facilities and related infrastructure, travel routes, recreational uses, mineral exploration and development, and ROW to reduce impacts to vegetative resources would minimize sedimentation and channel modifications within 0.25 mile of greater than ten percent

of the fish-bearing streams in the planning area. Maintaining sustainable forage levels for livestock and wildlife habitat would minimize sedimentation. Management actions common to all alternatives for grassland and shrubland communities would have major beneficial effects on fish resources.

Vegetation – Riparian/Wetland Resources
Prioritizing and developing activity and implementation plans to manage riparian and wetland systems to be at or above, or continue to be improving toward, PFC while achieving the Wyoming Standards for Healthy Rangelands would minimize sedimentation and channel modifications. Managing riparian and wetland systems to enhance forage conditions and improve water quality, to a succession stage appropriate for that system, including vertical and horizontal vegetative structure and composition, would minimize sedimentation and channel modifications. These actions would influence greater than ten percent of the fish-bearing streams in the planning area; therefore, they would have major beneficial effects on fish resources.

Invasive Species and Pest Management
BLM weed and pest control work on public lands adjoining deeded and state lands could have an adverse effect on fish if chemical applications encounter fish-bearing waters and alter the water quality in these areas. Proper use of chemicals, for example not applying them within 200 feet of fish-bearing waters, would minimize this risk. Specific, careful and appropriate grasshopper and Mormon cricket treatments can prevent over-utilization and thereby limit erosion, resulting in a beneficial effect in some areas. Moderate adverse impacts to fish resources will result from management actions common to all alternatives for invasive species and pest management.

Fish and Wildlife Resources – Wildlife
Management actions common to all alternatives support efforts to protect and improve riparian ecosystems. These actions include restoring fish habitats and managing harmful non-native riparian vegetation in river and stream systems important to fish species, and would have beneficial effects on fish. Management actions common to all alternatives support efforts to protect and improve various ecosystems throughout the planning area. These actions include managing vegetative diversity, minimizing disturbances to springs and riparian zones, and improving riparian plant communities.

Special Status Species – Plants
Management actions common to all alternatives for special status plant species include allowing treatments that would benefit the plant species. Special status plant species occur along five to ten percent of the fish-bearing streams in the planning area. Treatments that improve the health of vegetation would also improve the health of the neighboring stream; therefore, management actions common to all alternatives for special status plant species would have moderate beneficial effects on fish resources.

Special Status Species – Fish
Prioritizing special status fish species over other fish species in planning and management actions may be a minor adverse effect for those fish-bearing waters that are not identified as a priority as it would leave one to five percent of the fish-bearing streams as a lower priority.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Avoidance areas, whether for the application of broad-spectrum insecticides or for the protection of nesting bald eagles, would have a major beneficial effect on fish where these resources overlap. Due to the overlap of wildlife and fish habitats (greater than ten percent), the overall beneficial effects of habitat protection would be major.

Heritage and Visual Resources

Cultural Resources

Management actions include completion of site stabilization and long-term protection of significant sites. This would benefit fish through habitat conservation when the sites occur within close proximity to fish habitats. Currently, significant sites occur within 0.25 mile of less than one percent of the fish-bearing streams in the planning area. Management actions for cultural resources would have negligible beneficial effects on fish resources.

Paleontological Resources

Management actions common to all alternatives would occur on less than one percent of habitats important to fish species, and would have a negligible beneficial effect on fish resources by retaining public lands under the management of the BLM.

Visual Resources

Management of WSAs and the Middle Fork Powder River as VRM Class I could prohibit or limit some surface-disturbing activities in those areas, thereby protecting fish habitats. VRM Class IV areas have minor limitations. Managing visual resources would indirectly affect fish habitats, depending on the locations, types, and durations of approved projects. Beneficial effects under the management actions common to all alternatives would occur on less than one percent of habitats important to fish species, and would therefore have negligible beneficial effects on fish resources.

Land Resources

Forest Products

Prohibiting forest management areas within 200 feet of surface waters on approximately 10,318 acres will protect streams and rivers from sedimentation, soil erosion, and increased water temperatures, and result in a major beneficial effect to fish, as this would affect over 10 percent of fish-bearing streams.

Lands and Realty

Negotiating with willing landowners to obtain access across non-BLM-administered lands to isolated parcels of public land that contain fish would increase the risk of spreading whirling disease or unwanted species (e.g., zebra mussels). This could have an adverse effect on fish. Project-specific analysis of lands and realty actions, such as approval of R&PP permits, land use authorizations, and withdrawals and land disposals require NEPA analyses, which would identify any conflicts before adverse effects could occur. Potential lands and realty actions could occur along one to five percent of the fish-bearing streams in the planning area; therefore, management actions common to all alternatives would have minor adverse effects on fish resources.

Renewable Energy

Management actions common to all alternatives for renewable energy are administrative and will have no effect on fish resources.

Rights-of-way and Corridors

Reasonable access could be provided for ROWs and corridors within 0.25 mile of five to ten percent of the fish-bearing streams in the planning area. ROWs cause habitat degradation through vegetation removal and trampling. Adverse effects to fish-bearing waters from ROWs would occur when these accesses cause increased sedimentation in the streams.

Management actions common to all alternatives for ROWs and corridors would have moderate adverse effects on fish resources.

Travel and Transportation Management

Because roads typically are void of vegetation and exhibit impervious surfaces or compacted soil, they often promote increased surface runoff and lead to soil erosion and transport of pollutants to nearby streams, wetlands, or riparian areas. Inventory and evaluation of all existing roads and trails into one transportation plan would designate those to be upgraded, maintained, or abandoned. These actions would reduce erosion, protect and stabilize soils and vegetation, and reduce opportunities for invasive plants and weeds to establish. Restricting motorized vehicles and implementing temporary closures would contribute to stabilizing soils and reducing erosion. All new roads would be designed to minimize surface disturbance and surface runoff and erosion potential. Constructing new roads and trails have a direct, long-term adverse impact on fish-bearing streams. Roads and trails for motorized vehicles result in localized direct and adverse impacts on fish habitats, such as reducing vegetation cover and density and changing community compositions. Reclaiming abandoned roads and trails with appropriate herbaceous and shrubby vegetation and upgrades on utilized roads would promote soil stabilization and reduce opportunities for erosion and for invasive plant and weed species to establish; this would have a direct beneficial impact on fish resources over the long term. Overall, transportation and access could be permitted within 0.25 mile of greater than ten percent of the fish-bearing streams in the planning area; therefore, management actions for transportation and access would have major adverse effects on fish resources.

Recreation

There is minimal public access at present to BLM waters in the planning area that containing fish. The Middle Fork Powder River, North Fork Powder River, Pass Creek, Bear Trap Creek, Crazy Woman Creek, Poison Creek, Eagle Creek, Bachus Creek, Blue Creek, Tongue River, Belle Fourche River, and the main stem Powder River all have public access and fishing pressure. The South Fork Tongue (15 miles on the Bighorn National Forest), North Fork Powder (13.2 miles), and Middle Fork Powder (12.8 miles) are classified as Wyoming Game and Fish designated Blue Ribbon fishery - meaning a fishery of national importance. The Powder River segments include BLM-administered lands. The North Fork Tongue River (20.2 miles on the Bighorn National Forest), Tongue River (13 miles on mixed ownership), Sheely Creek (3.5 miles on National Forest Service land), Wolf Creek (6.7 miles on the Bighorn National Forest), South Fork Tongue River (7.2 miles on the Bighorn National Forest), Piney Creek (3.2 miles), Clear Creek (10 miles), North Fork Powder River (17.3 miles in two segments), Blue Creek (2.5 miles), and Buffalo Creek (10.5 miles) are classified by WGFD as Red Ribbon waters, a WGFD designation meaning a fishery of regional importance as trout fisheries. Only the last three include BLM-administered lands.

The primary adverse effect from recreation would be the introduction of diseases such as whirling disease, and invasive species such as zebra mussels. Humans, particularly fishermen, can transport infected sediments or water on boots, bait, boats, and other equipment. The effect on fish and fisheries from introducing diseases and invasive species can be adverse. Invasive species and disease introductions can be avoided and minimized through education, and educational opportunities will increase with increased recreational access to fisheries.

Avoiding riparian habitat or developing and managing recreation sites, recreation facilities, and recreation access in a manner that minimizes impacts to riparian habitats, and prohibiting dispersed camping and commercial camps within 200 feet of surface water would moderately benefit fish.

Lands with Wilderness Characteristics
Management actions common to all alternatives for lands with wilderness characteristics are administrative and will have no effect on fish resources.

Livestock Grazing Management
Improper livestock grazing management could adversely impact stabilization of riparian vegetation, which can lead to stream instability and an associated loss of habitat complexity, and 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. Dispersed grazing from construction of water developments for livestock use, will reduce impacts to riparian habitats. The degree of adverse impact, if any, would depend on livestock grazing timing and intensity, site characteristics, and species habitat requirements. Stock driveways and rests in riparian areas (Bear Trap Creek and Middle Fork Powder River for example) tend to concentrate high levels of livestock use that can cause degradation (e.g., near-complete removal of vegetation and soil compaction), impacting wildlife habitats. Beneficial impacts of proper grazing include reducing competition by removing encroaching woody plant cover; hoof action that keeps topsoil loose, increases litter and precipitation penetration, and incorporates seeds into soil; nutrient recycling; removing wildfire fuels; and controlling invasive plant and weed species with properly timed grazing rotations and species (e.g., goats). There are 779,034 acres of BLM surface lands in grazing allotments in the planning area, which occur along greater than ten percent of the fish-bearing streams in the planning area. Management actions common to all alternatives for livestock grazing would have moderate adverse and beneficial effects on fish resources.

Special Designations

Areas of Critical Environmental Concern
Management actions common to all alternatives for ACECs will have no effect on fish resources.

Scenic or Back Country Byways
Increased road maintenance and human activity on byways would have adverse impacts to fish habitat from dust, soil erosion, and spread of invasive species, adversely impacting water quality and aquatic plant communities. Management actions common to all alternatives associated with scenic or BCBs will have a negligible adverse effect on fish resources.

Wild and Scenic Rivers
Management actions common to all alternatives for WSRs will have no effect on fish resources.

Wilderness Study Areas
WSAs will be managed to preserve natural conditions and processes, and restrict motorized activities. These actions would occur on over ten percent of habitat important to fish species; however, WSAs are localized and few stream segments would be impacted. Management actions common to all alternatives for WSAs will have minor beneficial effects on fish resources.

Socioeconomic Resources

Social and Economic Conditions
Management actions common to all alternatives are administrative processes and will have no effect on fish resources. Impacts to social and economic resources will be quantified on a project

specific basis. Management actions that vary by alternative are also administrative; therefore, social and economic management actions will not be discussed further in this section.

Health and Safety
Management actions common to all alternatives are designed to control and mitigate threats to health and human safety and to the environment. Management actions designed to prevent accidental spills of hazardous materials or environmental contamination would have beneficial impacts to fish by protecting riparian and wetland areas and water quality across the resource area. Because hazardous materials (e.g., oil, oil and gas by-products, pesticides, and cleaning solvents) are being produced and transported in the planning area, there is a threat of accidents or spills. If there was a spill, mitigation and cleanup would rarely succeed in recovering a riparian or wetland area to its original condition over the short term; therefore, there would be localized long-term adverse impacts.

Only management actions common to all alternatives are identified; therefore, health and safety will not be discussed further in this section.

4.4.5.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended and maintained. This section describes management actions and potential impacts to fish from implementing Alternative A.

Fish and Wildlife Resources – Fish
Cooperating with the WGFD stocking programs and designing reservoirs to enhance fisheries where there is a potential to do so would benefit fish. Maintaining or improving reservoirs and riparian areas could increase population numbers or viability in one to five percent of the fish-bearing streams in the planning area and have a minor beneficial effect on fish resources.

Physical Resources

Soil
Under Alternative A, prohibiting surface-disturbing activities in areas with severe erosion hazard (215,496 acres) from March 1 through June 15, on slopes equal to or greater than 25 percent (170,590 acres), and on soils with poor reclamation potential (455,090 acres) would limit erosion and subsequent sedimentation. The scope of these actions, in combination with the limited timing restriction for areas with severe erosion hazard (i.e., allowing disturbance from June 16 through February 28) could result in increased sedimentation. These prohibitions/restrictions, in general, would reduce the risk of harm in greater than ten percent of the fish-bearing streams in the planning area and constitute a major beneficial effect on fish.

Water Resources
Under Alternative A, reservoir construction in historic or existing fish habitat would require site-specific analysis through BLM and EPA authorities. The management of produced water from oil and gas development does overlap with fish habitat. Current prohibitions regarding the placement of oil and gas wells and facilities prohibit these elements within 500 feet of streams and lakes. This prohibition reduces impacts to fish habitat from sedimentation.

Prohibiting surface disturbance within 500 feet of any spring, reservoir, water well, or perennial stream, unless the authorized officer waives the prohibition, would have a beneficial effect by

reducing sedimentation. Application of waivers without defined criteria can result in inconsistent application of management and unknown levels of protection. These prohibitions/restrictions currently contain greater than ten percent of the fish-bearing streams in the planning area; therefore, management actions for water under Alternative A would have major beneficial effects on fish resources. Without oversight on a programmatic level and specified criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Cave and Karst Resources
There are no management actions for cave and karst resources under Alternative A.

Mineral Resources

Locatable Minerals
Under Alternative A, withdrawing the Amsden Creek (525 acres), Ed O. Taylor (approximately 3,896 acres, and a Wyoming Game and Fish designated Blue Ribbon fishery - meaning a fishery of national importance), and Kerns game range (163 acres) from mineral locations and restricting locatable minerals activities in the approximately 28,931 acres of Fortification Creek, Gardner Mountain, and North Fork (a Wyoming Game and Fish designated Blue Ribbon fishery - meaning a fishery of national importance). Locatable mineral activities (causing surface disturbance and increased sedimentation) under Alternative A could be permitted within 0.25 mile of greater than ten percent of the fish-bearing streams in the planing area. Management actions for locatable minerals under Alternative A would have major adverse effects on fish resources.

Leasable Minerals – Coal
The management action listed under Alternative A will have no effect on fish resources.

Leasable Minerals – Fluids
Continuing to lease and allow development of federal oil and gas could adversely affect greater than ten percent of the fish-bearing streams in the planning area through increased sedimentation from surface disturbing activities near fish-bearing streams, changes instream hydrology and water quality from produced water discharge. Virtually all warm-water fish-bearing streams in the planning area are over surface with CBNG potential. Current knowledge of the distribution of coalbeds harboring natural gas indicate drainages containing fish-bearing waters would continue to be developed, potentially resulting in a major adverse effect on fish.

Salable Minerals
The types of effects from Alternative A would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for salable minerals (habitat degradation). Salable mineral development under Alternative A would be permitted within 0.25 mile of greater than ten percent of the fish-bearing streams in the planning area; therefore, salable mineral management actions under Alternative A would have major adverse effects on fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative A, limiting fire suppression on BLM-administered land where fire control would be very difficult or extremely hazardous to firefighting personnel could allow fires to

damage streams in occupied fish range. Suppressing unwanted wildland fires would prevent sedimentation from post-fire erosion. Use of fire retardants could adversely affect fish if the chemicals reach occupied streams. Rehabilitating fire and fire suppression damage would benefit fish by decreasing runoff and sedimentation. Conducting prescribed fires to support vegetation and wildlife habitat objectives would have either an adverse or beneficial effect on fish. Prescribed fires could increase runoff and sedimentation in the short term, adversely affecting fish; however, prescribed fires could benefit fish over the long term by removing invasive plant species and increasing streamflows. Overall, Alternative A fire and fuels management would have a minor adverse effect on fish.

Biological Resources

Vegetation – Forests and Woodlands

Treatments including cutting, thinning, and prescribed burning may pose an adverse short-term impact on fish resources resulting from soil erosion and potential sedimentation in streams and rivers. However, improved forest health (vegetation composition, soil stability, decreased risk of wildfire) resulting from the treatments would be beneficial. Actions would impact over ten percent of habitat important to fish species, having major beneficial effects on fish resources over the long-term.

Vegetation – Grassland and Shrubland Communities

There are no management actions for grassland and shrubland communities under Alternative A.

Vegetation – Riparian/Wetland Resources

Prohibiting surface-disturbing activities within 500 feet of springs, reservoirs, water wells, or perennial streams would benefit fish by preserving the riparian and adjacent upland communities of all the fish-bearing streams in the planning area. Management actions for riparian/wetland resources under Alternative A would have major beneficial effects on fish resources.

Invasive Species and Pest Management

IPM, as currently practiced and when appropriately applied in the planning area, complies with restrictions on chemical labels that provide adequate buffers from fish-bearing water. Aggressive treatment of invasive plants, particularly riparian plants, could adversely affect fish in the short term by increasing sedimentation and removing shade. Over the long term, these treatments would benefit fish by replacing invasive plants with native species that generally require less water and by increasing stream flow. Overall, Alternative A management of vegetative resources would result in a major beneficial effect on fish, but the short-term adverse effects reduce this to moderate.

Fish and Wildlife Resources – Wildlife

Under Alternative A, seasonally prohibiting surface disturbance and disruptive activities and limiting timber harvest in crucial elk ranges would have a beneficial effect on fish in the Fortification Creek drainage. Prohibiting surface disturbance or occupancy within a biologic buffer zone around active nests of raptor species of high federal interest unless the authorized officer waives the prohibition would limit surface disturbance and oil and gas activities in association with these nests. Approximately 303 miles, greater than ten percent, of fish-bearing streams intersect identified raptor buffers. Overall, Alternative A management of wildlife resources would have a major beneficial effect on fish.

Special Status Species – Plants and Fish
There are no management actions for special status plants or special status fish under Alternative A.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Managing vegetation resources to comply with the ESA and BLM policy associated with management of habitat for SSS would have beneficial effects to fish. Surface disturbance restrictions for Greater Sage-Grouse breeding grounds and raptors nests would have beneficial effects on fish. Protections afforded Threatened, Endangered, and sensitive species, such as oil and gas disturbance-free zones around bald eagle nests and roosts, would prevent surface disturbance and have beneficial effects on fish. Overall, these protection zones for special status wildlife habitats encompass greater than ten percent of the fish-bearing streams in the planning area. Management actions for special status wildlife species under Alternative A would have major beneficial effects on fish resources.

Heritage and Visual Resources

Cultural Resources
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for cultural resources (habitat conservation). NSOs are currently applied to the Bozeman Trail and Crazy Woman Battle Site only. These restrictions would be beneficial to any fish habitats they encompass as they would reduce the risk of harm to the fish resource. All other management of cultural resources is considered on a project specific basis. Under Alternative A, cultural resource protection would encompass less than one percent of the fish-bearing streams in the planning area. Management actions for cultural resources under Alternative A would have negligible beneficial effects on fish resources.

Paleontological Resources
Under Alternative A, management of lands containing paleontological resources would be considered on a site-specific basis. In areas where mineral development was not allowed, water quality would remain unchanged, having a negligible beneficial effect on fish resources.

Visual Resources
Management of VRM Class I and II areas could prohibit or limit some surface-disturbing activities and thereby protect fish habitats. VRM Class III and IV areas have minor limitations. Managing visual resources would indirectly affect fish habitats, depending on the locations, types, and durations of approved projects. Beneficial effects under the management actions associated with Alternative A would occur on approximately 67,089 acres, over ten percent of habitats important to fish resources and would therefore have major effects.

Land Resources

Forest Products
Management actions associated with Alternative A have the potential to have both adverse and beneficial impacts to fish. Sedimentation and soil erosion can result from access roads and techniques used to harvest forest products, reducing water quality. Limiting areas of clear cuts to 20 acres, rehabilitation of harvested areas, and protecting regeneration from over utilization will all serve to limit the amount of sedimentation, and will result in beneficial long-term effects to fish by increasing forest health (increased soil stability, plant community composition and structure). Management actions will occur on approximately 3,430 acres, five to ten percent of

habitat important to fish; however, beneficial effects to forest health would lessen the adverse effects to some of the habitat. Overall, a minor adverse effect to fish would result.

Lands and Realty
Lands identified for acquisition or disposal and pursuing easements to BLM-administered lands may impact fish resources by changing public access to fisheries. Acquisitions and easements would increase access to fisheries, while disposals would reduce public access. In both cases, potential increases in sedimentation and surface disturbance near fish-bearing streams would be negligible. Changes in land status current could occur along less than one percent of the fish-bearing streams in the planning area.

Renewable Energy
There are no management actions for renewable energy under Alternative A.

Rights-of-Way and Corridors
ROWs could be permitted, under this alternative, within greater than ten percent of the fish-bearing drainages in the planning area. ROW and corridor construction would cause surface disturbance and increase sedimentation. Management actions for ROWs and corridors under Alternative A would have major adverse effects on fish resources.

Travel and Transportation Management
Under Alternative A, there would be indirect effects on fish species from travel management and OHV use. OHV use on and off designated trails has the potential to destroy vegetation, compact soils, and lead to soil erosion and ponded water. By designating areas where OHV use is limited to designated roads and trails, adverse effects on fish habitats can be reduced. In cases where motorized vehicle use is closed for only portions of the year, these closures would not be as great a benefit to special status fish species. Regardless of intensity of management, OHV use is still anticipated to have an adverse effect on one to five percent of fish habitats. Management actions for TTM under Alternative A would have minor adverse effects on special status fish resources.

Recreation
Under Alternative A, pursuing easements to provide access to BLM-administered lands for recreation and administrative purposes could expose occupied fish streams to whirling disease, zebra mussels, or other introduced species and disease, which would have a moderate adverse effect on fish. Prohibiting surface disturbance and occupancy on slopes equal to or greater than 25 percent or more would minimize sedimentation. Areas where OHV use is limited to designated roads and trails would limit access to fisheries and reduce the potential for introduction of invasive species and disease. Prohibiting oil and gas leasing and development in the Mosier Gulch Recreation Area would provide some protection from the impacts of oil and gas development along a section of Clear Creek, which would have beneficial effect on fish. Recreational areas occur within 0.25 mile of less than one percent of the fish-bearing streams in the planning area. The overall management actions for recreation under Alternative A would have negligible beneficial effects on fish resources.

Lands with Wilderness Characteristics
No lands with wilderness characteristics have been identified. Lands would be evaluated and managed on a project-specific basis. Adverse impacts to fish resources would occur if surface-disturbing activities were permitted; however, the low potential for mineral development, commercial timber, and renewable-energy projects to be proposed in remote, road less areas would make these impacts negligible.

Livestock Grazing Management
Under Alternative A, suspending or adjusting livestock grazing use in areas where timber harvest has occurred whenever grazing would impair forest regeneration would moderately benefit the Billy Creek, North Fork Powder, and Pass Creek areas by reducing sedimentation.

Managing Category M allotments to continue the current authorized livestock use on 98 Category M allotments at 43,573 AUMs would continue to affect fish in some areas by continued livestock use of riparian habitats.

Alternative A management of Category I allotments would include performing baseline inventories; developing, implementing, and monitoring AMPs; and increasing available forage first to wildlife after range condition class has been upgraded to good on allotments now rated poor to fair, would benefit fish.

Under Alternative A, livestock grazing is not authorized on approximately 4,000 acres of public land in the canyons and slopes of the southern Big Horn Mountains because of rough terrain and steep slopes. Allowing livestock grazing on all public lands in the planning area except on approximately 6,000 acres (1%) where it has been determined to be incompatible with other resource uses or values would have an adverse effect on fish due to continued sedimentation, reduced water quality, removal of riparian habitat, and transport of invasive plant species.

Cumulatively the livestock grazing management actions could occur within 0.25 mile of greater than ten percent of the fish-bearing streams in the planning area. Management actions for livestock grazing under Alternative A would have major adverse effects on fish resources.

Special Designations

Areas of Critical Environmental Concern
There are no ACECs proposed under Alternative A.

Scenic or Back Country Byways
No scenic or BCBs are proposed near fish habitat under Alternative A.

Wild and Scenic Rivers
If Congress releases the Middle Fork Powder River from WSR designation, management will continue to retain free-flowing characteristics and outstanding resource values. This would be a negligible benefit to fish as it represents less than one percent of the fish-bearing streams in the planning area.

Wilderness Study Areas
Under Alternative A, if Congress decides not to designate the North Fork and Gardner Mountains WSAs as wilderness, there would be no effect to fish resources as oil and gas potential is low.

4.4.5.4. Alternative B

This section describes management actions under Alternative B, which emphasizes resource conservation, and the likely impacts to fish resources due to their implementation.

Fish and Wildlife Resources – Fish
Under Alternative B, prohibiting surface-disturbing and disruptive activities within 0.25 mile

of any waters rated by the WGFD as Blue or Red Ribbon streams (trout streams of national or statewide importance) would benefit these fisheries by minimizing sedimentation. Designing crossings of waterbodies identified as supporting fish to allow fish passage would benefit fish. Managing riparian and uplands in historically perennial systems to restore perennial flows or standing water could increase fish distribution and benefit fish. Restoring important instream segments for fish habitat in accordance with WGFD priorities could increase fish densities and distribution and benefit fish. Overall, these management actions would have a major beneficial effect on fish.

Physical Resources

Soil, Water Resources , and Cave and Karst Resources
Alternative B would analyze impacts to soil, water, and cave and karst resources on a project-specific basis. In addition, Alternative B would prohibit surface-disturbing activities or apply NSO stipulations to activities on badlands, rock outcrops, and slopes susceptible to mass movement, and prohibit prescribed fires on highly erodible soils; prohibit such activities as on-channel reservoirs, conversion of abandoned oil and gas wells to water supply wells, and activities within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated habitat; and prohibit activities in cave and karst areas. Under Alternative B, applying an NSO stipulation on soils with poor reclamation suitability, in badlands, on rocky outcrops, on slopes susceptible to mass movement, and on slopes equal to or greater than 25 percent would prevent sedimentation and have a major beneficial effect on fish. These soil types overlap almost all the fish-bearing drainages in the planning area. Prohibiting surface-disturbing activities for the protection of water resources under Alternative A would conserve all the fish-bearing drainages in the planning area. Prohibiting surface-disturbing activities for the protection of cave and karst resources under Alternative A would conserve vegetation in five to ten percent of the fish-bearing drainages in the planning area. Overall, Alternative B management of soils and water would result in major beneficial effects on fish resources and cave and karst resources would result in moderate beneficial effects on fish resources.

Mineral Resources

Alternative B recommendations to withdraw addition lands from minerals entry would protect portions of the Tongue River. Decreasing the availability of BLM-administered mineral reserves for leasable fluid minerals, leasable coal, and salable minerals would not affect fish if minerals were not developed or were developed with sufficient protective measures to prevent adverse effects.

Locatable Minerals, Leasable Minerals – Fluids, and Salable Minerals
Under Alternative B, 2,612,920 acres would be closed to minerals leasing; 1,225 acres would be subject to the standard lease terms and conditions; 124,467 acres would be subject to moderate constraints; and 642,232 acres would be subject to major constraints. These acreages do not all coincide with fish-bearing waters; however, the restrictions on surface disturbance are already in place in much of the Tongue River drainage and Middle and North Forks Powder River. These restrictions would mostly benefit cold water fish (trout) and most of the recreational fisheries in the planning area. Locatable minerals, leasable fluid minerals, and salable minerals could all be permitted within 0.25 mile of greater than ten percent of the fish-bearing streams in the planning area. Management actions for locatable, fluid, and salable minerals under Alternative B would have major adverse effects on fish resources.

Leasable Minerals – Coal
The management action listed under Alternative B will have no effect on fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative B, using full suppression in areas where fire would be undesirable to monitoring fire behavior in areas where fire could be used as a management tool based on resource goals and objectives; limiting the use of heavy equipment in certain areas; rehabilitating all fire-related damage; and using wildland fire and other vegetative treatments to restore fire-adapted ecosystems and reduce hazardous fuels would reduce sedimentation from catastrophic wildfires. This would have a moderate beneficial effect on fish.

Biological Resources

Vegetation – Forests and Woodlands
Using natural processes to manage forests and woodlands is a short-term beneficial impact to fish resources; however, managing forests and woodlands for old growth and climax vegetation communities may result in an increased risk of wildland fire which would result in unstable soil conditions and poor water quality having adverse impacts overall. Management actions would occur in over ten percent of habitat important fish species, however, wildland fire is unpredictable and likely to only occur in localized areas reducing those effects to minor.

Vegetation – Grassland and Shrubland Communities
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for grassland and shrubland communities (habitat improvement). Under Alternative B, native plant species would be the only type authorized for reclamation activities. This would be beneficial to fish habitats as it would promote natural reclamation and regeneration of vegetative communities in the fish-bearing drainages. Under Alternative B, native plant reclamation would occur within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for grassland and shrubland communities would have major beneficial effects on fish resources.

Vegetation – Riparian/Wetland Resources
Prohibiting surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would benefit fish by preserving the riparian and adjacent upland communities. Using produced water, where reasonable and practical, to develop and enhance waterfowl habitat and fisheries would benefit fish, provided water quality is adequate. Identifying and managing systems capable of achieving DFC could have a major beneficial effect on fish. Prohibitions for water would encompass all fish-bearing streams in the planning area. Management actions for riparian/wetland resources would have major beneficial effects on fish resources.

Invasive Species and Pest Management
Not limiting aerial application of pesticides and herbicides could decrease water quality and have a moderate adverse effect on fish populations in those waters.

Fish and Wildlife Resources – Wildlife
The types of effects to fish from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for wildlife. Under Alternative B, though, NSOs

prohibit or restrict surface-disturbance within greater than ten percent of fish-bearing drainages; therefore, management actions for wildlife would have major beneficial effects on fish resources.

Special Status Species – Plants
Management actions for special status plants that restrict grazing, herbicides and surface disturbance would benefit fish. Restricting fire suppression could result in larger fires that would increase sedimentation and create an adverse impact. Prohibiting disturbance within a mile of Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River would be considered a benefit to fish by reducing sources of sedimentation. Overall, these actions would occur within five to ten percent of the fish-bearing drainages in the planning area. Management actions for special status plants under Alternative B would have moderate beneficial effect on fish resources.

Special Status Species – Fish
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for special status fish resources (habitat improvement and conservation). Under Alternative B, stream segments important to special status fish species would be improved or enhanced and surface-disturbing restriction would be applied within 0.25 mile of water bodies containing special status fish species. These restrictions would also encompass five to ten percent of all fish-bearing streams in the planning area; therefore, special status fish species management actions under Alternative B will have moderate beneficial effects on fish resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Under Alternative B, protections for identified elk, bald eagles, big game ranges, raptor nests, Greater Sage-Grouse, special status reptiles and amphibians and T&E species would have a beneficial effect on fish. Establishing a year-round disturbance-free zone of at least 0.5 mile for Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River would reduce sedimentation and have a beneficial effect on fish.

Overall, Alternative B special status wildlife management actions would encompass greater than ten percent of the fish-bearing drainages in the planning area and would have a major beneficial effect on fish.

Heritage and Visual Resources

Cultural Resources
Management actions under Alternative B would have no effect on fish resources.

Paleontological Resources
Under Alternative B, areas with high quality paleontological resources do not overlap habitat important to fish species and would therefore have no effect on fish resources.

Visual Resources
Under Alternative B, management of VRM Class II areas could prohibit or limit some surface-disturbing activities and therefore protect fish habitats. VRM Class III and IV areas would have minor limitations. Alternative B visual resources management would benefit over ten percent of habitats important to fish resources; therefore, VRM actions under Alternative B would have major beneficial effects on fish resources.

Land Resources

Forest Products
Under Alternative B, limited harvest of forest products would occur and natural regeneration would be utilized on five to ten percent of fish habitat. Although less soil disturbance may occur, forest health would not be actively managed, and would have a moderate adverse effect on fish over the long-term.

Lands and Realty
Under Alternative B, retaining land identified for disposal (which occurs in less than one percent of fish-bearing drainages), but having important natural resource values, until all other lands identified for disposal are disposed of, regardless of difficulty or cost to manage, could have a negligible beneficial effect on fish by subjecting these lands to federal management, which would be more protective.

Renewable Energy
Alternative B would have the fewest adverse impacts to fish through the exclusion of renewable-energy development in areas also closed to other forms of energy development (minerals leasing, locatable minerals, salable minerals, ROW, and other areas where there are restrictions on surface disturbance). Renewable energy would be allowed on 6,131 acres. This would impact one to five percent of the fish-bearing drainages in the planning area; therefore renewable-energy management actions under Alternative B would have minor adverse effects on fish resources.

Rights-of-Way and Corridors
Requiring co-location of facilities and identifying and implementing specified utility corridors in coordination with the resource specialist would decrease the potential for adverse impacts to fish-bearing drainages by ensuring their complete avoidance. Acreages of ROW avoidance and exclusion areas would be greatest under this alternative. Excluding ROWs on slopes of 25 percent or greater and highly erodible soils would benefit fish through reduced erosion and sedimentation. Limiting linear ROW development to existing routes would protect habitat quality, minimize fragmentation in sensitive areas, and help protect riparian areas. Under Alternative B, ROWs and corridors would be permitted in five to ten percent of the fish-bearing drainages in the planning area; therefore ROW and corridor management actions under Alternative B would have moderate adverse effects on fish resources.

Travel and Transportation Management
Under Alternative B, closing areas with saturated soils or on slopes equal to or greater than 25 percent to motorized vehicles and closing areas in fish habitat, including activities related to fire suppression and geophysical exploration, would reduce sedimentation. This would have beneficial effect on fish. Limiting motorized vehicle use to designated routes within stock driveways would have a beneficial effect on fish by reducing sedimentation and nutrient loads. Allowing travel off designated routes in areas limited to designated routes only under a special use permit would reduce sedimentation and pollution, and have a beneficial effect on fish. Closing the Middle Fork Powder River area to motorized vehicle use to protect sensitive resources would limit the spread of invasive species; the importance of the Middle Fork Powder River fishery and the combination of all of the other management actions for transportation and access under Alternative B would have a moderate beneficial effect on fish.

Recreation
Limiting development of additional recreation facilities to SRMAs and other high-use areas would have a beneficial effect on fish by limiting fishing pressure and reducing the risk of

establishing invasive aquatic species. SRMAs proposed in Alternative B encompass less than one percent of the fish-bearing drainages in the planning area; therefore, management actions for recreation under Alternative B would have negligible beneficial effects on fish resources.

Lands with Wilderness Characteristics
Approximately 12,237 acres of BLM-administered lands has been identified for management of lands with wilderness characteristics under Alternative B, 3,596 acres of which occur near a fish bearing stream. Management actions include closing the area to solid mineral development, motorized use, ROWs, renewable energy development, commercial woodcutting, and all other surface-disturbing activities not compatible with retaining natural values. Emphasizing ecosystem health and retaining natural values will retain or enhance fish habitat and would have a beneficial effect on fish resources. Management actions would occur in five to ten percent of habitats important to fish, but effects would be localized, making the effects negligible.

Livestock Grazing Management
Under Alternative B, authorizing permanent increases in forage allocations to wildlife habitat and watershed protection as the first priority and livestock grazing as a second priority; locating livestock salt or mineral supplements a minimum of 0.5 mile away from water sources, riparian areas, and aspen stands; and providing a minimum of two years rest from livestock grazing following prescribed fires and other vegetative treatments would have a minor beneficial effect on fish as they will protect habitats and reduce the risk of harm to one to five percent of the fish-bearing drainages in the planning area.

Special Designations

Areas of Critical Environmental Concern
An ACEC designation at Welch Ranch on the Tongue River could have an adverse effect on that fishery. Additional human use could occur with ACEC designation, which would increase the potential for introduction of invasive aquatic species and illegal stocking, and the risk of fire in the riparian forest. These potential issues would be adequately mitigated through education. The designation would have indirect, long-term beneficial effects through public outreach and education regarding the rarity and value of prairie river riparian systems and would encompass less than one percent of the fish-bearing streams in the planning area; therefore, management actions for ACECs under Alternative B would have negligible beneficial effects on fish resources.

Scenic or Back Country Byways
Increased road maintenance and human activity on byways would have adverse impacts to fish habitat from dust, soil erosion, and spread of invasive species, adversely impacting water quality and aquatic plant communities. Approximately 48 miles of proposed byways intersect with habitat important to fish. Management actions in Alternative B for scenic or BCBs will have a negligible adverse effect on fish resources.

Wild and Scenic Rivers
If Congress releases the Middle Fork Powder River from WSR designation, management will continue to retain free-flowing characteristics and outstanding resource values. This would protect habitats and reduce the risk of harm to less than one percent of the fish-bearing streams in the planning area and would have a negligible benefit to fish resources.

Wilderness Study Areas
Under Alternative B, if Congress decides not to designate the North Fork and

Gardner Mountain WSAs as wilderness, there would be beneficial effects to fish as management would be consistent for lands with wilderness characteristics until a plan amendment has been completed. WSAs will be managed to preserve natural conditions and processes, and restrict motorized activities. These actions would occur on over ten percent of habitat important to fish species; however, WSAs are localized and few stream segments would be impacted. Management actions associated with Alternative B will have minor beneficial effects on fish resources.

4.4.5.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource use, and the likely resulting impacts to fish resources due to its implementation.

Fish and Wildlife Resources – Fish
Managing reservoirs and riparian areas to improve or enhance other resource values first and potential fisheries second, as well as managing for PFC would have an adverse impact to fisheries. Allowing surface disturbance within 0.25 mile of naturally occurring water bodies consistent with other resource values could have an adverse impact to fisheries if, for example, the mineral resource is determined to be of higher value and development increased sedimentation. The protections in Alternative C will only protect five to ten percent of the entirety of fish-bearing drainages in the planning area; therefore, moderate adverse effects are expected.

Physical Resources

Soil
Under Alternative C, allowing surface-disturbing activities on soils with a severe erosion hazard, on slopes equal to or greater than 25 percent, on soils with poor reclamation suitability, in badlands, on rock outcrops and on slopes susceptible to mass movement would increase sedimentation and adversely affect fish if those activities took place in drainages that support fish-bearing waters. Allowing the use of prescribed fire on highly erodible soils and allowing activities in these sensitive soil areas could have adverse effect son fish through increased sedimentation, changed streamflows, and increased water temperatures. Lack of soil restrictions would leave greater than ten percent of the fish-bearing drainages vulnerable to impacts from improper soil management. Management actions for soil under Alternative C would have major adverse effects on fish resources.

Water Resources
Under Alternative C, allowing on-channel stream reservoirs could inhibit fish passage and have an adverse effect on fish. Allowing surface-disturbing activities, or not applying an NSO stipulation to any mineral lease within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated riparian habitat would increase runoff and sedimentation in fish habitat, resulting in an adverse effect. This alternative would permit activities within greater than ten percent of the fish-bearing drainages in the planning area; therefore, management actions for water under Alternative A would have major adverse effects on fish resources.

Cave and Karst Resources
Under Alternative C, there would be no restrictions on activities in or around cave and karst resources. Five to ten percent of the fish-bearing drainages in the planning area also contain cave and karst resources. Lack of conservation of cave and karst resources would have a moderate adverse effect on fish resources as it would increase the potential for increased runoff and sedimentation.

Minerals Resources

Locatable Minerals

The types of effects from Alternative C would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for locatable mineral resources (habitat loss and degradation). Alternative C would open 3,319,535 acres to locatable minerals exploration and development and withdraw 11,373 acres from locatable mineral exploration and development. This would have an adverse effect on fish. Locatable mineral development could be permitted in greater than ten percent of the fish-bearing drainages in the planning area. Management actions for locatable minerals under Alternative C would have major adverse effects on fish resources.

Leasable Minerals – Coal

The management action listed under Alternative C will have no effect on fish resources.

Leasable Minerals – Fluids

The types of effects from Alternative C would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for fluid mineral resources (habitat loss and degradation). Consistent with other resources values, Alternative C would open 539,499 acres for fluid minerals leasing and exploration subject to standard lease terms and conditions; 2,472,472 acres subject to moderate constraints; and 303,601 acres subject to major constraints. Fluid mineral exploration and development could be permitted in greater than ten percent of the fish-bearing drainages in the planning area. Management actions for fluid minerals under Alternative C would have major adverse effects on fish resources.

Salable Minerals

The types of effects from Alternative C would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for salable mineral resources (habitat loss and degradation). Opening 3,290,908 acres to salable mineral exploration and development and closing 57,213 acres would cause an adverse impact where those areas open to salable minerals overlap fish-bearing watersheds. Salable mineral exploration and development could be permitted in greater than ten percent of the fish-bearing drainages in the planning area. Management actions for salable minerals under Alternative C would have major adverse effects on fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)

Under Alternative C, use of full protection strategies and tactics, heavy equipment with few tactical constraints, and rehabilitating only suppression-related damage would increase sedimentation from suppression activities and have a moderate adverse effect on fish. If suppression activities prevent catastrophic fires, this action could be beneficial over the long term.

Biological Resources

Vegetation – Forests and Woodlands

Under Alternative C, forests and woodlands would be managed to meet forest health objectives using silvicultural treatments and intensive management, and to reduce impacts from disease, insects, and wildfire. Methods such as cutting and thinning could adversely impact fish in the short-term, but would have an overall beneficial effect on fish resulting from improved forest

health. Management actions would occur on five to ten percent of habitat important to fish, however, short-term adverse impacts will offset some of the long-term benefits, making effects to fish resources minor.

Vegetation – Grassland and Shrubland Communities
Under Alternative C, allowing non-native plant species, only if native species will not accomplish initial reclamation objectives, would provide another tool for achieving reclamation goals, but also would provide an opportunity for non-native species to cross pollinate with native species, outcompete native species for water and soil nutrients, and move out side the reclamation area and become an invasive species. Helping to achieve reclamation objectives would directly benefit surrounding plant communities. Overall, Alternative C management of grasslands and shrublands would have a major adverse effect on the riparian vegetation within the fish-bearing drainages and therefore, have a major adverse effect on fish resources.

Vegetation – Riparian/Wetland Resources
Allowing surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams could have an adverse effect on fish by increasing sedimentation, changing hydrography, and decreasing water quality. Riparian/wetland areas contain greater than ten percent of the fish-bearing drainages in the planning area; therefore management actions under Alternative C for riparian/wetland resources would have major adverse effects on fish resources.

Invasive Species and Pest Management
Authorizing aerial application of pesticides in areas where topography, extent of infestation, target species, and timing limit other application methods could have a minor adverse effect on fish if appropriate buffers are not applied or applications drift/flow into waters.

Fish and Wildlife Resources – Wildlife
Under Alternative C, allowing surface disturbance and occupancy in the Ed O. Taylor, Kerns, Bud Love, and Amsden Creek winter ranges could increase sedimentation and invasive species establishment in the Middle Fork Powder River, Tongue River, and Little Bighorn River, which would have an adverse effect on fish in those drainages.

Protections for identified big game ranges, raptor nests, and elk would have beneficial effects on fish in the drainages that also support these species.

Because protections for some wildlife species remain in place and would conserve fish habitats under this Alternative, overall, Alternative C wildlife management would still have a major beneficial effect on fish.

Special Status Species – Plants
Alternative C impacts to fish resources from special status plant species would be the same negligible beneficial effects as described under Alternative A.

Special Status Species – Fish
Restoring or improving important stream segments for fisheries habitat, only for special status fish species, would have a beneficial impact on other (non-special status) fish that occupy the same drainages. Alternative C incorporates a smaller protective buffer, restricting surface-disturbing activities from within 500 feet of any waters containing special status fish species. This would conserve habitats within five to ten percent of all fish-bearing drainages in the planning area. Management actions for special status fish species would have moderate beneficial effects on fish resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Under Alternative C, protections for Greater Sage-Grouse and T&E species would have a beneficial effect on fish. Protections for bald eagle and other raptor nests have the greatest potential for reducing impacts to fish-bearing waters. Allowing surface-disturbing and disruptive activities in habitats for special status amphibian and reptile species, in identified 100-year floodplains, and within 500 feet of perennial waters would have an adverse effect on fish. Alternative C, protections for identified SSS raptor nests, Greater Sage-Grouse and the other special status wildlife would be limited, surface disturbing and disruptive activities would be generally allowed. However, management must comply with ESA and BLM's sensitive species policy which would supply some benefit to specials status wildlife species and indirectly fish. Overall, the protective buffers that exist in this alternative would conserve habitats in greater than ten percent of the fish-bearing drainages in the planning area; therefore, management actions for special status wildlife species would have major beneficial effects on fish resources.

Heritage and Visual Resources

Cultural Resources
Alternative C impacts to fish from cultural resources would be the same negligible beneficial effects as described under Alternative A.

Paleontological Resources
Under Alternative C, areas with high quality paleontological resources do not overlap habitat important to fish species and would therefore have no effect on fish resources.

Visual Resources
Under Alternative C, managing VRM Class II areas as VRM Class III would allow more surface-disturbing activities. This would reduce the beneficial effects of VRM on fish habitat by increasing opportunities for soil and water erosion and for invasive species to get established. Active management would now occur on less than one percent of habitats important to fish species; therefore, Alternative C management of visual resources would have a negligible beneficial effect on fish resources.

Land Resources

Forest Products
Alternative C would have an adverse impact on fish resources. Management actions focus on maximizing forest product harvest and sales, and on managing forests for economic benefit and would occur on five to ten percent of habitat important to fish. Sediment flow and soil erosion associated with increased disturbance and decreased forest health would have a moderate adverse effect to fish.

Lands and Realty
Management actions that dispose of lands with water, do not acquire lands that create large blocks of BLM, or do not pursue easements for access to BLM-administered lands would not increase public access to fish resources. Lands identified for disposal under this alternative contain or could provide access to one to five percent of the fish-bearing waters in the planning area. Management actions for lands and realty under Alternative C would have moderate adverse effects on the fish resources.

Renewable Energy
Allowing renewable-energy development anywhere in the planning area consistent with other resource values could have an adverse effect on fish if sedimentation occurs in fish-bearing drainages. Renewable energy could be permitted under this alternative within greater than ten percent of the fish-bearing drainages in the planning area. Management actions under Alternative C would have major adverse effects on fish resources.

Rights-of-Way and Corridors
Allowing ROW on slopes equal to or greater than 25 percent and on highly erodible soils would have an adverse effect on fish from sedimentation. ROWs could be permitted, under this alternative, within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for ROWs and corridors under Alternative C would have major adverse effects on fish resources.

Travel and Transportation Management
Alternative C would continue to open stock driveways to motorized vehicle use. Stock resting in Bear Trap Meadows and on the Middle Fork Powder River removes riparian vegetation, destabilizes banks, and increases sedimentation and nutrient loads in the respective waters and would cause an adverse effect to fish in those drainages. Allowing travel up to 300 feet off designated routes for necessary tasks if the travel would not damage resources would increase access and therefore the potential to spread invasive species and have an adverse effect on fish. Allowing motorized vehicle use in areas with saturated soils or on slopes equal to or greater than 25 percent consistent with travel management designations for those areas, and within habitat of SSS consistent with travel management designations for those areas could increase sedimentation have an adverse effect on fish. Overall, these actions would permit adverse effects within less than one percent of the fish-bearing drainages. Management actions for TTM would have negligible adverse effects on fish resources.

Recreation
Managing the entire planning area as the Buffalo ERMA and designating six SRMAs (totaling 30,570 acres) would have an adverse effect on fish through an increase in OHV use and resulting sedimentation. The six proposed SRMAs contain less than one percent of the fish-bearing drainages in the planning area. The management within these areas would conserve habitats surrounding the fish-bearing waters. Management actions for recreation under Alternative C, through designation of the six SRMAs, would have negligible beneficial effects on fish resources.

Lands with Wilderness Characteristics
Under Alternative C, lands with wilderness characteristics would not have any special restriction applied and would be managed in accordance with surrounding areas. Adverse impacts to fish resources would result from increased development; however, these impacts are likely to be negligible based on low potential for mineral development, commercial timber, and renewable energy projects to be proposed in remote, road less areas.

Livestock Grazing Management
Not including actions to reduce or eliminate potential impacts from livestock grazing to meet regeneration objectives following timber harvests would increase sedimentation in the Billy Creek, North Fork Powder River, and Middle Fork Powder River drainages. This would have an adverse effect on fish. Basing AMP goals and objectives on livestock management only in Category I allotments, authorizing permanent increases in forage allocations to livestock grazing as the first priority, allowing increases in livestock stocking rates as a result of vegetative

treatments would increase grazing use in riparian areas; some vegetative treatments, particularly when combined with water improvements, may draw livestock away from riparian areas due to an increase of palatable, nutritious forage, resulting in beneficial impacts for riparian areas and fish. This would have an adverse effect on fish by exposing all Category C and M allotments to heavier grazing pressure. Limiting or prohibiting livestock grazing only in areas where it is currently prohibited and locating livestock salt or mineral supplements a minimum of 500 feet from water sources, riparian areas, and aspen stands and providing a minimum of two growing seasons rest from livestock grazing after prescribed fire and vegetative treatments would have an adverse effect on fish due to increased sedimentation, reduced water quality, removal of riparian habitat, and transport of invasive plant species. Grazing allotments encompass greater than ten percent of the fish-bearing drainages in the planning area. All of the management actions under Alternative C for livestock grazing management would have major adverse effects on fish resources.

Special Designations

Areas of Critical Environmental Concern
No ACECs are proposed under Alternative C, therefore, there would be no effect to fish resources.

Scenic or Back Country Byways
Under Alternative C, no roads would be evaluated for inclusion as scenic or BCBs.

Wild and Scenic Rivers
If Congress releases the Middle Fork Powder River from WSR designation, management will follow the management within surrounding areas. The Middle Fork Powder River drainage contains less than one percent of the fish-bearing drainages in the planning area. This would be a negligible adverse impact to fish should surrounding management allow for increased sedimentation.

Wilderness Study Areas
Under Alternative C, if Congress decides not to designate the North Fork and Gardner Mountain WSAs as wilderness, there would be beneficial effects to fish as management would be consistent for lands with wilderness characteristics until a plan amendment has been completed. These actions would occur on over ten percent of habitat important to fish species; however, WSAs are localized and few stream segments would be impacted. Management actions associated with Alternative C will have minor beneficial effects on fish resources.

4.4.5.6. Alternative D

This section describes management actions under Alternative D, the Proposed RMP.

Fish and Wildlife Resources – Fish
Management actions for fish under Alternative D will benefit fish. Improving habitat at reservoirs and riparian areas, managing toward Desired Functioning Potential where possible, properly designing stream crossings, managing vegetation to restore perennial flows, and prohibiting surface disturbance near fish-bearing waters would improve habitats, prevent disturbance and sedimentation, maintain water quality and increase overall stream health. These actions would occur in all of the fish-bearing drainages, therefore, management actions for fish under Alternative D would have major beneficial effects on fish resources.

Physical Resources

Soil
Allowing surface-disturbing activities on soils without a severe erosion hazard, on slopes equal to or greater than 25 percent, and with reclamation potential and evaluating exceptions for areas with highly erosive soils, on slopes equal to or greater than 25 percent, and soils with poor reclamation potential has the potential for major adverse effects on fish from sedimentation. Waivers allow for activities to occur when mitigated appropriately for the fisheries resource. Surface disturbance associated with development of federal minerals on soils with poor reclamation potential could affect 1,514,445 acres in the planning area. Disturbances would require a reclamation plan. The intent of these plans is to avoid sedimentation. Disturbances could be permitted under this alternative within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for soil, under Alternative D would have major adverse effects on fish resources.

Water Resources
Under Alternative D, authorizing activities associated with the surface discharge of water produced during federal activities if erosive conditions, channel stability, soil characteristics, and other resource values would be adverse as it may still alter water quality. Allowing for on-channel stream reservoirs and surface-disturbing activities or not applying an NSO stipulation to any mineral lease within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated riparian habitat only by exception and in consideration of other resource values would have adverse effects on fish. For the impacts to be beneficial, the exceptions must be evaluated for site-specific impacts to wildlife and must not be granted where there would be conflicts. Disturbance, under this alternative, could be permitted within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for water, under Alternative D would have major adverse effects on fish resources.

Cave and Karst Resources
The cave and karst resource areas identified in Alternative D do not encompass any fish-bearing drainages, therefore, management actions for cave and karst resources under Alternative D would have no effect on fish resources.

Mineral Resources

The amount of minerals extraction under this alternative would create a substantial increase in land use intensity, and would result in a greater potential for increased sedimentation, produced water discharge, spills, and changes instream morphology.

Locatable Minerals
Alternative D locatable minerals management would have effects on fish similar to management under Alternative B, although Alternative D would open more area (4,720,586 acres) to locatable minerals entry. Locatable minerals entry would be permitted within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for locatable minerals, under Alternative D would have major adverse effects on fish resources.

Leasable Minerals – Coal
The management action listed under Alternative D will have no effect on fish resources.

Leasable Minerals – Fluids
Alternative D impacts associated with leasable fluid minerals management would

be the same as under Alternative C, with 3,314,254 acres open to oil and gas leasing. Fluid mineral exploration and development would be permitted within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for fluid minerals, under Alternative D would have major adverse effects on fish resources.

Salable Minerals
Alternative D impacts associated with salable minerals management would be the same as under Alternative C, with 2,725,060 acres open to salable minerals leasing. Salable mineral exploration and development would be permitted within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for salable minerals, under Alternative D would have major adverse effects on fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative D, impacts to wildlife would be similar to effects under Alternative B. However, Alternative D would decrease adverse impacts through rehabilitation after fires on an as-needed basis only; this could result in an increase in natural regeneration of riparian communities along fish-bearing waters.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative D, forests and woodlands would be managed to meet forest health objectives using silvicultural treatments and intensive management and to reduce impacts from disease, insects, and wildfire. Methods such as cutting and thinning could adversely impact fish in the short-term, but would have an overall beneficial effect on fish resulting from improved forest health. Management actions would occur on five to ten percent of habitat important to fish, however, short-term adverse impacts will offset some of the long-term benefits, making effects to fish resources minor.

Vegetation – Grassland and Shrubland Communities
Alternative D effects on fish resources from management of grassland and shrubland communities would be similar to effects under Alternative C, although Alternative D would place slightly more emphasis on multiple resource values than Alternative C. Alternative D would allow desirable non-native plant species for short-term reclamation activities, which would result in effects similar to Alternative B. Desirable non-native plant persistence could increase adverse impacts to fish resources if non-native proliferation causes loss of suitable riparian habitats along fish-bearing streams.

Vegetation – Riparian/Wetland Resources
Allowing surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams could have an adverse effect on fish by increasing sedimentation, changing hydrography, and decreasing water quality. Not identifying and managing systems capable of achieving DFC could also have an adverse effect on fish by allowing activities that impact riparian vegetation, resulting in increased water temperature and sedimentation. Impacts from the management of riparian/wetland resources will influence all of the fish-bearing streams in the planning area. Management actions for riparian/wetland resources under Alternative D would have major adverse effects on fish resources.

Invasive Species and Pest Management
Allowing aerial application of pesticides could impair water quality and have a moderate adverse effect on fish populations in those waters if the chemical is inappropriately applied or it drifts into fish-bearing water. Strict adherence to pesticide labels, which is anticipated, would minimize this to minor.

Fish and Wildlife Resources – Wildlife
Under Alternative D, prohibiting surface disturbance and occupancy in the Ed O. Taylor, Kerns, Bud Love, and Amsden Creek winter ranges could decrease sedimentation and invasive species establishment in the Middle Fork Powder River, Tongue River, and Little Bighorn River, which would have a beneficial effect on fish. Protections for elk would have a beneficial effect on fish resources in the Upper Fork Powder River. Protections for identified big game ranges and raptor nests would have a beneficial effect on fish. Overall, the protective buffers for wildlife would conserve riparian vegetation within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for wildlife under Alternative D would have major beneficial effects on fish resources.

Special Status Species – Plants
Allowing the placement of water developments and salt or mineral supplements in habitat for special status plant species would decrease water quality and increase sedimentation where these resources overlap (in Ute ladies'-tresses orchid habitat). Managing to comply with the ESA and BLM policy associated with special status plant species would have a negligible benefit to fisheries management as their occupied habitat is limited to less than one percent of the fish-bearing drainages in the planning area.

Special Status Species – Fish
Alternative D impacts on fish from special status fish management would be similar to those under Alternative B, except that Alternative D could allow activities by exception within a 0.25-mile CSU area around naturally occurring water bodies containing native and desirable non-native fish species. For the impacts to be the same as those under Alternative B, those exceptions would have to be evaluated for the presence of special status fish species or habitat suitability and would not be granted where there would be conflicts. Special status fish-bearing streams represent five to ten percent of all of the fish-bearing streams in the planning area. Management actions for special status fish species would have moderate beneficial effects on fish resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Under Alternative D, protections for raptor nests, Greater Sage-Grouse and T&E species would have a beneficial effect on fish. Establishing a year-round disturbance-free zone of at least 0.5 mile for riparian corridors (Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River) consistently used by bald eagles would have a beneficial effect on fish. Protections for elk would have a minor beneficial effect on fish resources in the Upper Fork Powder River. Prohibiting surface-disturbing and disruptive activities for the protection of special status amphibian and reptile species and their habitats in identified 100-year floodplains and within 500 feet of perennial waters would have a beneficial effect on fish. Protections for bald eagle and other raptor nests would have the greatest potential for reducing impacts to fish-bearing waters. Overall, protections for special status wildlife species would conserve vegetation within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for special status wildlife species would have major beneficial effects on fish resources.

Heritage and Visual Resources

Cultural Resources

Alternative D impact types associated with cultural resources management would be the same as those under Alternative B, except Alternative D would protect 15,382 acres through cultural resources NSO restrictions and 613,601 acres through cultural resources CSU restrictions. These areas of prohibitions or restrictions would also conserve vegetation within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for cultural resources would have major beneficial effects on fish resources.

Paleontological Resources

Under Alternative D, areas with high quality paleontological resources do not overlap habitat important to fish species and would therefore have no effect on fish resources.

Visual Resources

Under Alternative D, effects to fish resources from management actions associated with VRM would be the similar to those described under Alternative B; however, management actions would impact five to ten percent of habitat important to fish making the effects moderate.

Land Resources

Forest Products

Under Alternative D, forest product harvest would be maximized within the bounds of maintaining forest health. Harvested areas would be managed for regeneration, utilizing protection techniques where needed. Although some beneficial impacts to fish from improved water quality over the long-term may result, the focus of economic return and sales will result in increased disturbance. Management actions will occur on five to ten percent of habitat important to fish; however, beneficial effects to forest health would lessen the adverse effects to some of the habitat. Overall, a minor adverse effect to fish would result.

Lands and Realty

Under Alternative D, acquisitions and disposals could have beneficial or adverse effects on fish, depending on which lands are acquired or disposed of. Land acquisitions that block up existing BLM-administered lands would have a negligible effect on fish because most existing blocks of BLM-administered lands are not along drainages. All other lands identified for acquisition or disposal contain less than one percent of the fish-bearing drainages in the planning area. Management actions for lands and realty under Alternative D would have negligible beneficial effects on fish resources.

Renewable Energy

Under Alternative D, excluding renewable-energy development on 352,068 acres would have a beneficial effect on fish by avoiding sedimentation from construction. This would be particularly true in the southern Big Horn Mountains. Renewable energy would be permitted within greater than ten percent of the fish-bearing drainages in the planning area. Management actions for renewable energy under Alternative D would have major adverse effects on fish resources.

Rights-of-Way and Corridors

Avoiding ROW on slopes equal to or greater than 25 percent and on highly erodible soils would have a beneficial effect on fish. ROWs would be permitted within greater than ten

percent of the fish-bearing drainages in the planning area. Management actions for ROWs and corridors under Alternative D would have major adverse effects on fish resources.

Travel and Transportation Management

Alternative D impact to fish from management of travel and transportation would be similar to those under Alternative C, except that less than one percent of the fish-bearing drainages would be closed to motorized vehicle use. Allowing travel for dispersed camping and big-game retrieval up to 300 feet off designated routes, if it would not damage resources would have an adverse effect on fisheries. Management actions for TTM would have negligible adverse effects on fish resources.

Recreation

Designating seven SRMAs (totaling 54,160 acres) could have an adverse effect on fish. Allowing additional recreation facilities in areas where they are supported by recreational use and are consistent with other resource values could have an adverse effect on fish through increased fishing and the potential for increasing invasive aquatic species. Increased education would reduce these adverse impacts. Limiting motorized vehicle travel to designated roads and trails (other than within stock driveways) consistent with other resource values would have a beneficial effect on fish. Recreation management would occur within less than one percent of the fish-bearing drainages in the planning area. Management actions for recreation under Alternative D would have negligible adverse effects on fish resources.

Lands with Wilderness Characteristics

Approximately 6,864 acres of BLM-administered land has been identified for management of lands with wilderness characteristics under Alternative D, 2,313 acres of which occur near fish-bearing streams. Management actions include closing the area to solid mineral development, motorized use, ROWs, renewable energy development, commercial woodcutting, and all other surface-disturbing activities not compatible with retaining natural values. Emphasizing ecosystem health and retaining natural values will retain or enhance fish habitat and would have a beneficial effect on fish resources. Management actions would occur in one to five percent of habitats important to fish, but effects would be localized, making the effects negligible.

Livestock Grazing Management

Under Alternative D, including actions to reduce or eliminate potential impacts from livestock grazing to meet regeneration objectives following timber harvests would decrease sedimentation in the Billy Creek, North Fork and Middle Fork Powder River drainages. This would have a beneficial effect on fish. Performing baseline inventories; developing, implementing, and monitoring AMPs; and basing AMP goals and objectives in Category I and M allotments on resource protection and watershed health; considering any permanent increases in forage allocations for watershed protection, livestock grazing, wildlife habitat, and other resource values; locating livestock salt or mineral supplements a minimum of 500 feet away from water sources, riparian areas, and aspen stands; designating and managing future reserve common allotments as needed; providing rest and deferment from livestock grazing following wildfires, prescribed fires, and other vegetative treatments until resource objectives are met; and allowing increases in livestock stocking rates as a result of vegetative treatments when resource objectives are met would also have a beneficial effect on fish. Allowing livestock grazing on all public lands in the planning area, except where an evaluation has determined grazing would be incompatible with other resource uses or values, could have an adverse effect on fish due to increased sedimentation, reduced shading and bank stability, changes in water chemistry, and increased invasive plant species. Management of livestock grazing would occur in five to ten percent of the fish-bearing

drainages in the planning area. Management actions for livestock grazing management under Alternative D would have moderate beneficial effects on fish resources.

Special Designations

Areas of Critical Environmental Concern
An ACEC designation at Welch Ranch on the Tongue River could have an adverse effect on that fishery. Additional human use could occur with designation, which would increase the potential for introduction of invasive aquatic species and illegal stocking, and increase the risk of fire in the riparian forest. These potential issues would be mitigated through education. Designation would have beneficial effects through public outreach and education regarding the rarity and value of prairie river riparian systems. The proposed ACECs would encompass less than one percent of the fish-bearing drainages in the planning area. Management actions for ACECs would have negligible beneficial effects on fish resources.

Scenic or Back Country Byways
Effects to fish resources resulting from management actions in Alternative D, will be the same as those described in Alternative B.

Wild and Scenic Rivers
If Congress releases the Middle Fork Powder River from WSR consideration, management will continue to retain free-flowing characteristics and outstanding resource values. The Middle Fork Powder River drainage contains less than one percent of the fish-bearing drainages in the planning area. This would have a negligible beneficial effect to fish resources.

Wilderness Study Areas
Under Alternative D, if Congress decides not to designate the North Fork and Gardner Mountain WSAs as wilderness, there would be beneficial effects to fish as management would be consistent for lands with wilderness characteristics until a plan amendment has been completed. WSAs will be managed to preserve natural conditions and processes, and restrict motorized activities. These actions would occur on over ten percent of habitat important to fish species; however, WSAs are localized and few stream segments would be impacted. Management actions associated with Alternative D will have minor beneficial effects on fish resources.

4.4.5.7. Cumulative Impacts

Cumulative impacts to fish in the planning area would come from non-federal minerals development, non-BLM fire programs, and non-BLM-regulated recreation. In general, these actions can be grouped into actions that are apart from either BLM surface estate or BLM mineral estate. Most of the cold-water fisheries are on BLM or USFS lands, and actions on USFS lands would be similar to BLM actions regarding protective measures. In forested habitats of the cold-water fisheries, the greatest threat to fish is catastrophic fire and the resulting sedimentation and water temperature and chemistry changes. The Bighorn National Forest Plan addresses this threat with suppression efforts and forest health projects; however, the extent of diseased timber that could burn does represent a potential major adverse effect on fish.

Most fee minerals development has already occurred in the planning area. The potential for wind-energy projects on private lands that could affect fisheries is limited to the southern Big Horn Mountains and represents a moderate adverse effect.

Recreation off BLM surface would likely result in the transport and introduction of diseases and invasive species, which could have a major adverse effect on fish.

4.4.6. Fish and Wildlife Resources – Wildlife

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 sometimes difficult to determine whether impacts to wildlife result from any specific management action or from wildlife population changes caused by natural factors. Changes in stressors (e.g., increased human presence and noise) on habitat components such as vegetation, water, soil, or air are likely to cause direct and indirect impacts to wildlife.

Actions that remove, degrade, or fragment wildlife habitat would be adverse. Actions that conserve or improve habitats, such as crucial big game ranges, raptor nest sites, or grouse habitats would be beneficial.

Direct impacts to wildlife could result from the loss of habitats or key habitat features, such as nest sites or lek areas, or from the immediate loss of life. Human activities also can directly disturb wildlife and could cause wildlife to abandon nests, leks, or their home ranges. Disturbance during sensitive periods (e.g., winter and nesting) is known to adversely impact wildlife. Human activities such as OHV use, recreation, and noise from equipment associated with development and surface-disturbing activities impact some wildlife species. These activities are considered to be particularly detrimental to nesting and lekking grouse, nesting raptors, and wintering and calving big game.

Habitats can be lost and fragmented by activities such as vegetative treatments; fire and fuels management; minerals exploration and extraction; construction and maintenance of roads and trails; and development of renewable-energy resources. Indirect impacts to wildlife can occur by changing habitat characteristics or quality. Habitat quality can be impacted by various surface-disturbing activities and other actions that remove vegetation and disturb soil. Indirect impacts to wildlife habitats also could occur when specific actions change habitat in a way that would make it unsuitable for future habitation. Human disturbances from vehicular travel on roads, activities at drill sites or wellheads, or any other activity not associated with the natural environment (including noise from generators and compressors) can indirectly impact wildlife not accustomed to such disturbances.

Disturbance impacts range from short-term displacement and shifts in activities, to long-term abandonment of home ranges. For purposes of this analysis, short-term impacts to wildlife result from activities to which individuals or species respond immediately, but do not affect the population viability of the species. For example, many disturbance impacts are short-term because a species might temporarily abandon an area or nest, but return immediately following the cessation of the disturbance, such as a passing OHV. Short-term construction could cause an animal to abandon an area or nest, but the species is often able to return to the area and reproduce successfully the following season.

Long-term impacts to wildlife are those that would impact the viability of the population. These impacts include alteration of adequate habitats in size or health (direct loss, fragmentation, or degradation) for any or all life requirements (e.g., seasonal habitats), and activities that would affect reproductive success (e.g., activities that cause undue energy expenditure for prolonged periods, and removal of breeding grounds and nests). Human disturbance, whether from

harassment or by accident, results in increased energy cost to the disturbed animal, which incurs a physiological cost 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, survival, and reproductive potential. In addition, physical or psychological barriers lead to habitat fragmentation, 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 winter ranges and reproductive habitats (WGFD 2004).

4.4.6.1. Methods and Assumptions

This section describes the methods and assumptions used in the analysis of impacts to wildlife. The assumptions and methods include, but are not limited to the following:

- The BLM, in cooperation with state and other federal wildlife agencies, is responsible for managing habitat (e.g., quality, suitability, and usability), whereas state and federal wildlife management agencies (e.g., the WGFD and the USFWS) have primary authority for overseeing management of wildlife populations. Therefore, this analysis relies primarily on vegetation changes and loss of habitat use due to disruptive activities to estimate effects to wildlife habitats.
- High-quality habitats foster healthy and abundant biological communities appropriate to those habitats.
- The quality and quantity of seasonal ranges and migration corridors are generally considered to be the limiting factors on big-game populations in the planning area. The ability of these areas to support wildlife populations is a factor in determining population levels.
- Natural variability in wildlife health, population levels, and habitat conditions will continue. Periods of mild or severe weather and outbreaks of wildlife disease or insects and plant diseases that impact habitat could impact wildlife population levels.
- For each alternative, changes to vegetative types, either in quantity, quality, or increased fragmentation, are compared to baseline conditions. Adverse and beneficial impacts to vegetative types (e.g., wildlife habitats) are assumed to have a corresponding adverse or beneficial impact on wildlife species.
- Disturbance impacts to wildlife are evaluated by comparing them to current management practices in the planning area; increased protections in time or space are beneficial, reduced protections result in adverse impacts.
- Management actions aimed at benefiting specific wildlife species can have adverse or beneficial impacts on other wildlife species.
- Alternatives with more acres of wetlands restored or protected will provide a greater benefit to migratory game birds and other riparian/wetland wildlife species compared to alternatives with fewer acres of wetlands restored or protected.
- Alternatives with more acreage managed toward DPC will exhibit a correspondingly greater benefit to wildlife than alternatives managing fewer acres toward DPC. Management toward DPC is assumed to exceed the requirements of managing toward PFC.
- The more acreage of habitats protected from fragmentation, the greater the benefit to wildlife species.
- Surface disturbance causes adverse impacts to wildlife habitats. Less surface disturbance in wildlife habitats has correspondingly fewer adverse impacts to wildlife compared to more surface disturbance.

- The higher the road density and frequency of use in the planning area, the greater the potential to degrade adjacent wildlife habitat quality in the planning area.
- The exact locations of future surface-disturbing activities cannot be predicted at the RMP level. For purposes of analysis, surface-disturbing activities are assumed to occur in vegetative types in proportion to their availability in the planning area. Impact acreages for vegetative types are not absolute, but provide a means to compare relative impacts among alternatives.
- Human activity that disturbs wildlife during sensitive periods causes adverse impacts.
- "Prohibit" means specified activities or impacts to wildlife during identified periods or in designated habitat areas would not occur unless specific biological exception criteria are met.
- Prohibiting surface disturbance or occupancy is more restrictive and provides more protections for wildlife than avoiding surface disturbance or occupancy.
- All known raptor nests from the GIS database maintained by the BLM BFO were used in the analysis. Buffers associated with raptor nests were analyzed in accordance with USFWS recommended spatial buffers to protect nesting raptors. Nests of unknown raptor species were analyzed as golden eagle nests when located in trees and as ferruginous hawk nests when located on the ground.

4.4.6.2. Impacts Common to All Alternatives

Fish and Wildlife Resources – Wildlife

Management actions common to all alternatives that would impact wildlife include: (1) developing mitigation measures for surface-disturbing and disruptive activities; (2) maintaining and improving wildlife habitats; (3) providing suitable habitat and forage to support population objectives as defined by the WGFD; (4) protecting crucial habitats; and (5) constructing new fences in accordance with BLM Fencing Handbook 1741-1. These management actions would generally have major beneficial impacts to wildlife. Preparing and implementing HMPs would have a long-term beneficial impact because they would maintain or improve wildlife habitat through on-the-ground improvements or control of other activities.

Human disturbance near raptor nesting 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 might 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 recurrence and frequency of activity in relation 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, and sharp-shinned hawks appear to be much less tolerant, while buteos exhibit a wide range of acceptance levels. Raptors are less tolerant of disturbance when populations of prey species are at low levels (Romin and Muck 2002).

Under each alternative, wildlife in the planning area could be disturbed by activities proposed across a variety of resource programs. Appendix G (p. 1937) lists projected surface disturbance by alternative over the life of this plan.

Physical Resources

Management actions common to all alternatives for physical resources (e.g., complying with rules and regulations and filing for water rights) that are administrative processes will have no impact on wildlife.

Air Quality

Reducing dust emissions, if they are reduced throughout the entire planning area, would have minor beneficial impacts to wildlife. Dust that covers vegetation reduces the photosynthesis process, and blocks light and potentially water from reaching the plant cells. Travel on roads that are or will be surfaced with gravel or scoria, if untreated, would cause large amounts of dust to be forced into the air. This dust could settle on vegetation, thereby degrading the quality of wildlife habitat. Reducing dust emissions would help maintain suitable habitat for all wildlife species. The beneficial effects would be major as this would improve habitat mostly along roads, covering greater than ten percent of habitats important to big game, trophy game, small game birds, and non-game migratory birds (five to ten percent of habitats important to small game mammals, furbearers, and non-game mammals, one to five percent of habitats important to migratory game birds and less than one percent of habitats important to raptors), therefore the management actions common to all alternatives for air quality would have major beneficial effects on wildlife in the planning area.

Soil

Evaluating proposed surface-disturbing activities for effects on soil resources would have major beneficial impacts to wildlife. Inclusion of reclamation plans in any authorized surface-disturbing activity would have long-term, major, beneficial impacts to wildlife if implemented on every project as greater than ten percent of habitats important to any wildlife species will be impacted by surface-disturbing activities of some kind. The more surface disturbance on steep slopes or on highly erosive soils, the greater the potential for adverse impacts to wildlife habitats. Implementing mitigation measures to protect soils, and therefore avoid impacts to vegetation, throughout the planning area would reduce disturbance to wildlife habitats and aid in the recovery of habitat from permitted uses. Once surface disturbance occurs, the goal of interim reclamation is to avoid or minimize soils erosion. The longer the reclamation takes, the greater the adverse impacts to wildlife habitats and wildlife species.

Water Resources

Management actions and allowable uses that protect surface water from impacts associated with soil erosion and pollutants are anticipated to benefit wildlife habitats. Wildlife species that use water sources and riparian habitats benefit from management actions common to all alternatives that promote protecting, developing, restoring, and improving water sources. However, livestock use around water sources also could alter vegetative diversity in these mesic areas, potentially reducing habitat quality for a wide variety of wildlife species.

There are approximately 237 miles of riparian corridors in the planning area, all of which could support greater than ten percent of habitats important to small game birds (five to ten percent of habitats important to big game, trophy game, and raptors and one to five percent of habitats important to small game mammals, migratory game birds, predator species, furbearers, non-game mammals, and non-game migratory birds), therefore, the beneficial effects of the management actions common to all alternatives would be major.

Cave and Karst Resources

Cave inventories, if performed in conformance with WO IM 2010-181 and in a manner that prevents the spread of bat disease and infection (such as White-nose Syndrome

[WNS]), could benefit wildlife. Cave inventories include surveys for cave-inhabiting wildlife species. New information on populations could be acquired through these inventories. However, the geologic formations likely to contain caves are limited to the western edge of the planning area in the Big Horn Mountains and will provide only limited amounts of wildlife inventory information. The management actions common to all alternatives for cave and karst resources would beneficially affect greater than ten percent of habitats important to big game and trophy game, (less than one percent of habitats important to all other general wildlife species), therefore, cave inventories would have a major beneficial impact on wildlife.

Mineral Resources

Although 43 CFR 3161.2 directs the BLM to ensure that "all operations are conducted in a manner which protects other natural resources and the environmental quality," it also contains scenarios in which operators may continue to conduct activities without requesting exceptions. Many studies have shown that actions involving increased human presence adversely impact wildlife populations such as big game, raptors, and grouse.

The primary impacts to wildlife species from minerals development in the planning area are the reduction in usable wildlife habitat and disruption of migration corridors. Reductions would be particularly severe in areas with continuous surface disturbance. Subsequent crowding into non-affected areas from affected areas could have the density-dependent impact of reducing animal survival and damaging resources.

The impacts of human activity, including those related to minerals development, on wildlife 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. As reclamation and habitat succession change the habitat type, the species with more specific micro-habitat requirements could re-inhabit these areas.

Large seismic projects, particularly the use of thumper trucks, adversely impact sagebrush habitats because they provide trails for increased predator access; fragment sagebrush habitats; crush live sagebrush and understory grass and forb species; and could disrupt breeding and nesting activities of sagebrush-obligate and other wildlife species.

Energy development is anticipated to be the greatest single contributor to disturbance of wildlife habitat in the planning area. Beyond initial exploration, land clearing, and construction of permanent aboveground structures and facilities, continued human disturbance to wildlife can occur from activities such as equipment maintenance, which is especially disruptive to wildlife during crucial periods (wintering, breeding, and nesting). Increases in wildlife mortalities are also likely to occur as a result of collisions with haul trucks.

All of the impacts associated with minerals development would be adverse to wildlife over the long term.

Locatable Minerals

Mineral development fragments vegetative communities, alters plant community structure and diversity, and alters landscapes. Potential impacts to wildlife include temporary disturbance in localized areas, temporary loss of habitat, long-term degradation of habitat, and possible direct mortality of small rodents or nesting birds. Long-term impacts would result from habitat fragmentation associated with roads, utility corridors, and construction, and wildlife avoidance of development sites and facility locations. Locatable mineral development is likely to occur in

five to ten percent of habitats important to migratory game birds (one to five percent of habitats important to all other general wildlife species), therefore, the management actions common to all alternatives will have a moderate adverse effect on wildlife.

Leasable Minerals – Coal

Coal development occurs primarily in areas identified as acceptable for further coal leasing consideration (BLM 2001a), namely northern Sheridan and Campbell counties. These areas identified as acceptable for further coal leasing consideration occur in over ten percent of the entire planning area and would have a major adverse impact on wildlife through habitat loss if leased and developed.

Leasable Minerals – Fluids

Depending on the economic feasibility of development and fluctuations in market price, and because of the extensive oil and gas reserves and existing leases in the planning area, important habitat could be lost throughout the planning area. As densities of wells, roads, and facilities increase, habitats in and near well fields become progressively less effective until most animals no longer use these areas. Although vegetation and other natural features might remain physically unaltered, many wildlife species make proportionately less use of the 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.

Elk herds in the Big Horn Mountains and in the Fortification Creek area have not yet experienced a high level of drilling activity in their crucial winter or calving ranges. Research has shown that elk are displaced out of the high-quality winter ranges during drilling and construction activities and do not return until those activities were completed. Continued development in these areas could lead not only to native winter and calving range abandonment, but also to loss of high-quality forage until habitats recover. These impacts are expected to be more severe for the Fortification Creek elk herd where mineral exploration has recently begun and is expected to continue. Impacts would be far less for elk in the Big Horn Mountains, where mineral development potential is low.

Mule deer exhibit a stress response to disturbances associated with noise and activity up to 4.65 miles from the source (Sawyer et al. 2009). The greater mobility and adaptability of these species to human activity and disturbed areas likely would prevent long-term impacts to populations; however, it is feasible that mule deer and pronghorn behavior or populations in the planning area could be altered at some level of development.

Evaporation ponds built for produced water from natural gas wells contain waters that could be 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 excess weight, or they can suffer from cold stress resulting from the loss of insulation from their feathers (USFWS 2006; Ramirez 2005).

Fluid mineral development is likely to occur in greater than ten percent of habitats important to all wildlife species, except trophy game (less than one percent), therefore management action common to all alternatives will have major adverse effects on wildlife resources.

Salable Minerals

Salable minerals extraction would result in direct, long-term, 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 depend 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. The vegetative communities normally associated with these areas would be 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. Eyries for nesting birds, such as great blue herons, eagles, several raptor species, and habitat for numerous waterfowl and neotropical migrants that rely on many of these communities would be lost. Many other species (e.g., big game and small mammals) also rely on these areas during winter to provide cover from the elements.

Potential salable mineral development may occur in greater than ten percent of habitats important to small game mammals, predator species, furbearers, non-game mammals, non-game migratory birds and raptors (five to ten percent of habitats important to small game birds and migratory game birds; one to five percent of habitats important to big game; and less than one percent of habitats important to trophy game), therefore, the management actions common to all alternatives will have major adverse effects on wildlife in the planning area.

Fire and Fuels Management

Fire has both direct and indirect impacts and may have either beneficial and adverse impacts on wildlife and their habitats. Generally, the impacts on habitat are much greater than the impacts on resident animals. Short-term adverse impacts from fire on resident wildlife include displacement, disruption of reproductive activities, habitat modifications and occasional mortalities. However, populations of certain species can recover quickly if suitable habitat is available. Adverse impacts to individuals are generally offset by the benefits of habitat changes for future generations.

Unplanned Fire (Wildfire)
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 fire frequency or severity increases or decreases from pre-settlement patterns, habitat for many species would decline. Studies have shown a reorganization of animal communities in response to fire, with increases in some species and decreases in others. 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. Due to likely scattered nature of effects to all wildlife species in the planning area, the adverse effects of habitat removal from unplanned fire are likely to be minor.

Planned Fire (Prescribed Fire)
Prescribed fire where historical fire regimes occurred is a tool used to manage vegetative communities and can result in short-term adverse impacts with long-term beneficial impacts to wildlife and wildlife habitats. Prescribed fire, hazardous fuels reduction, and WUI projects that include fire would be considered beneficial practices. Preparing plans and coordinating with adjacent land owners before prescribed or wildland fires can provide important opportunities for taking advantage of the benefits wildland fire can provide to certain desirable wildlife habitats. These three efforts, usually planned on a project-specific basis, are generally

applied in the cooler seasons (spring, fall, and winter), and often involve adjacent land owners. 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.

Rehabilitation and reclamation of wildfires, prescribed fires, and surface disturbance associated with fire suppression activities are integral to protect vegetative communities and watersheds from erosion and reduce the opportunity for invasive plant species to establish or expand. Management actions associated with fire will have short-term, localized, impacts to wildlife, and long-term minor beneficial impacts on wildlife across the planning area.

Biological Resources

Management actions common to all alternatives that are administrative processes (e.g., development and prioritization of plans; providing outreach and education; updating plans; and compliance with rules, regulations, and agreements such as MOUs) would have negligible to no impact on wildlife.

Management actions common to all alternatives that promote balanced management of biological resources in the planning area would promote a natural landscape, thereby promoting healthy wildlife habitats. These management actions include managing for forage enhancement and implementing cooperative IPM programs, which would have beneficial impacts to wildlife.

Vegetation – Forests and Woodlands and Vegetation – Grassland and Shrubland Communities

Management actions common to all alternatives that would reduce impacts to vegetative resources, by nature, would reduce impacts to wildlife habitats and would have beneficial impacts on wildlife. Vegetation inventories on all lands (grasslands and shrublands and lotic and lentic riparian/wetland systems, and evaluation of CBNG-created riparian and wetland systems for retention or reclamation) would have beneficial impacts on wildlife. Forest, woodlands, grassland, and shrubland communities contain greater than ten percent of habitats important to big game, small game birds, migratory game birds, non-game migratory birds, and raptors (five to ten percent of habitats important to trophy game and less than one percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals), therefore, the management actions common to all alternatives will have major beneficial effects on wildlife in the planning area.

Vegetation – Riparian/Wetland Resources

Restoration of disturbed sites, including split estate lands, would promote recovery of habitat function. This would have a localized, beneficial impact to wildlife. Expansion and enhancement of riparian/wetland systems and habitat would equally provide these same long-term, beneficial impacts to wildlife that inhabit riparian/wetland ecosystems. There are 296,359 acres of suitable riparian wildlife habitat on split estate (federal fluid mineral) lands and 23,831 acres of suitable riparian wildlife habitat on BLM surface. Riparian/wetland resource areas provide greater than ten percent of habitats important to big game, trophy game, small game birds, migratory game birds, non-game migratory birds, and raptors (five to ten percent of habitats important to all other wildlife species), therefore the management actions common to all alternatives would have major beneficial effects on wildlife over the entire planning area.

Invasive Species and Pest Management

The spread of invasive plant species contributes to loss of certain desirable wildlife habitats,

increases soil erosion, reduces water quality and quantity, and reduces structural and species diversity. Controlling the spread of invasive species is necessary to maintain the carrying capacity of wildlife habitats. Comprehensive management plans, including controlling and monitoring the spread of invasive species, are anticipated to be effective in reducing the adverse impacts of invasive species. Targeting and eradicating invasive species particularly detrimental to certain wildlife habitats are anticipated to benefit wildlife. For example, salt cedar is an invasive species often found adjacent to or within water courses, wetlands, and riparian areas – habitats that are important to numerous wildlife species. If the spread of invasive species in the planning area continues, adverse impacts to wildlife habitats are anticipated to be commensurate with the amount of wildlife habitat affected.

Controlling grasshoppers and Mormon crickets on public lands would have an adverse impact to wildlife over the short term because these insects provide a food source for many wildlife species. However, controlling these pests could be beneficial to wildlife over the long term by improving vegetation health. These long-term beneficial impacts typically are localized, but occur over the entire planning area, making them major.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Impacts to wildlife from the management of activities potentially affecting native and desirable non-native fish species are not known at this time. It is difficult to predict the impacts to wildlife from these as-yet defined activities.

Managing public access to fish bearing waters and to protect crucial habitats could have adverse impacts on wildlife. Future access routes have the potential to adversely impact wildlife resources by stripping away vegetation as part of the access route creation, trampling or eliminating vegetation, compacting soils throughout the footprint of the access route, and increasing human presence. New access routes could fragment wildlife habitat. There are 30,280 acres of wildlife habitat on BLM-administered land close (165 feet) to fish-bearing waters. Constructing new fences, even in accordance with the BLM Fencing Handbook, would have the same potential adverse impacts to wildlife for the same reasons. These impacts are typically localized, but would occur on one to five percent of BLM-administered lands.

Through the NEPA and permitting processes, protecting fish habitat and special status fish species habitats, and mitigating impacts to fish and special status fish species would have beneficial impacts to wildlife. Special status fish species and non-special status fish species management actions common to all alternatives support efforts to protect and improve riparian ecosystems. These actions include restoring fish habitats and managing harmful non-native riparian vegetation in river and stream systems important to fish species; this would have beneficial impacts to other wildlife species inhabiting these riparian areas. Actions that include managing vegetation diversity and minimizing disturbances to springs and riparian zones help maintain natural landscapes. Fish and special status fish species resource areas contain greater than ten percent of habitats important to all wildlife, except trophy game and small game birds (five to ten percent), therefore, management actions common to all alternatives would have major beneficial impacts to all wildlife.

Special Status Species – Plants
Implementation of actions set forth in recovery plans, conservation measures, terms and conditions, and appropriate and reasonable and prudent measures within biological opinions for T&E species at this point in time, includes surface-disturbing restrictions for Ute ladies'-tresses orchids and their habitats, along with guidelines to prevent alteration of streamflow near known

populations. Management actions common to all alternatives also include allowing treatments within habitat for special status plant species and within known populations that are proven to benefit the species. These actions, including the prohibitions/restrictions encompass and therefore improve or conserve greater than ten percent of habitats important to big game and trophy game (one to five percent of habitats important to small game birds and less than one percent of habitats important to all other wildlife species); therefore, the management actions common to all alternatives would have major beneficial effects on wildlife resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Avoidance areas, whether for application of broad-spectrum insecticides or for the protection of nesting bald eagles, would have a beneficial impact to general wildlife where these resources overlap. Avoidance areas for other species would, by nature, be avoidance areas for general wildlife. Avoidance areas for broad-spectrum insecticide application are unknown at this time. There are 7,710 acres of suitable wildlife habitat within 0.5 mile of bald eagle nests (federal fluid mineral estate). These impacts are typically localized impacts, but would occur on less than one percent of BLM-administered lands in the planning area, making them negligible.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources
Maintaining and developing relationships with Native American tribes and maintaining federal ownership of areas important to Native Americans or with significant paleontological values are administrative processes and will not impact wildlife. Other cultural resources management actions common to all alternatives, such as the stabilizing and protecting of sites, are actions that would create avoidance areas to protect cultural resources and would, by nature, be avoidance areas for wildlife habitats. Avoidance areas for cultural and paleontological resources would conserve greater than ten percent of habitats important to all wildlife species in the planning area, except raptors (five to ten percent) and migratory game birds (less than one percent), therefore, management actions common to all alternatives for cultural and paleontological resources would have major beneficial effects on wildlife in the planning area.

Visual Resources
Management of VRM Class I and II areas could prohibit or limit some surface-disturbing activities and thereby protect grassland and shrubland communities and other wildlife habitats. VRM Class III and IV areas have minor limitations. Managing visual resources would indirectly affect wildlife habitats, depending on the locations, types, and durations of approved projects. Beneficial effects under the management actions common to all alternatives would occur on greater than ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (less than one percent of habitats important to all other wildlife species), and would therefore, be major effects.

Land Resources

Forest Products
Vegetative treatments, such as silviculture, are used to manage forests. This management can impact wildlife habitats. Forest clear cuts alter wildlife habitats more than any other silviculture treatments because they set plant succession back to an early stage, disturbing soil, altering microclimate conditions, and completely removing forest habitats. 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 neotropical bird migrants. Forest management actions that replicate natural historical disturbance regimes instead of or in addition to managing forest products are anticipated to benefit wildlife habitats. Those forest products management actions that increase vegetative diversity and age classes will benefit wildlife. Some wildlife species depend on young or open stands, periodic wildfires, and endemic levels of insects and disease outbreaks. Fire and disease regimes have changed through time.

Potential short-term impacts on elk from forest management include loss of security habitat and calving cover and displacement of elk to other portions of the habitat. Displacement of elk has been detected as far as four miles from areas of summer logging activity. Timber harvest also would have long-term impacts on security cover. Timber harvest practices could lead to increased human presence, wildlife harassment, and increased hunting vulnerability in elk habitats.

Personal use of forest products by the public could have major adverse impacts on wildlife. Access routes to retrieve the forest products have the potential to adversely impact wildlife habitat by stripping away vegetation as part of the access route creation, trampling or eliminating vegetation, and compacting soils throughout the footprint of the access route. There are 16,234 acres of suitable wildlife habitat on BLM-administered lands that also contain forest products. The impacts identified above are typically localized, but due to the lack of overlap (one to five percent of BLM-administered lands in the planning area), when projected over the entire planning area, adverse impacts would be minor.

Prohibiting timber harvest and recreational camping within 200 feet of surface water sources would create avoidance areas to protect surface water resources; these also would be avoidance areas for wildlife. There are approximately 5,584 acres of suitable wildlife habitat on BLM surface within 200 feet of surface water resources. These beneficial impacts are typically localized, but would occur on more than ten percent of BLM-administered lands in the planning area.

Lands and Realty

Lands acquisitions, pursuit of easements, and tenure adjustments would improve management of public lands overall. Impacts to the vegetation would vary depending on the type of action and would be project specific. Lands and realty actions would have indirect beneficial impacts on wildlife. Effects would be minor for individual projects but could be moderate to major if a large acquisition was pursued and completed. Vegetation on land proposed for disposal, exchange, or acquisition would be directly impacted by this action due to a change in ownership and management. Land exchanges and acquisitions could provide opportunities for the BLM to manage more land in a manageable land pattern to promote healthy habitats for those species, thus providing greater benefits to those species. Lands available for tenure adjustments contain greater ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (one to five percent of habitats important to small game birds, non-game migratory birds, and raptors and less than one percent of habitats important to big game, trophy game and migratory game birds), therefore, the beneficial effects from management action common to all alternatives on wildlife would be major.

Renewable Energy

Potential renewable-energy development would include site development, utility corridors, and access routes that would have direct and adverse impacts to wildlife habitats. If renewable-energy sources such as wind are developed in the planning area, there would be direct and indirect impacts on wildlife. Direct impacts would include disturbance during construction and maintenance

activities, mortality due to bird strikes on wind towers, and mortality of small, less mobile animals such as small mammals or nestling birds during construction. On the basis of mortality estimates at existing wind-energy projects in the western United States, the mid-range expected for passerine mortality would be approximately 1.2 to 1.8 birds per turbine per year (BLM 2005c). Wind-energy facilities would be sited to minimize bird strikes. Indirect impacts would include minor loss of habitat due to facility construction. Little renewable-energy development is anticipated on BLM-administered lands in the planning area, so actual impacts would be minimal and would not impact wildlife populations. Because the potential for renewable-energy projects in the planning area is low, adverse impacts on wildlife would be negligible.

Rights-of-Way and Corridors

ROW and corridors in the planning area would impact wildlife in various ways.
For example, utility poles benefit raptors and other birds by providing perching or nesting structures; however, these same utility structures can cause raptor mortality through electrocution and collisions (Romin and Muck 2002). In addition to raptors, other species, such as ravens, crows, magpies, small flocking birds, and wading birds, are subject to electrocution by utility structures (Romin and Muck 2002). Erecting artificial nest platforms on utility structures could benefit birds such as osprey, eagles, and hawks, and nest boxes constructed on utility structures could benefit cavity-nesting birds (e.g., bluebirds) and bats (Romin and Muck 2002).

There would be habitat loss, degradation, fragmentation, and species displacement from approved linear features (e.g., powerlines, roads, and pipelines) and other permitted facilities. 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 impacts mitigated. Impacts from buried pipeline construction could last from 30 to 40 years or more, depending on the time required for full reclamation of predisturbance 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 powerlines and communications sites would include increased injury to and death of bats, raptors, and other migratory birds as a result of collisions.

The designation of corridors for utility ROWs, the construction of new ROW projects adjacent to existing projects, a developmental plan to concentrate communications sites, approval of ROWs to access private lands, and a transportation management system would reduce the number of acres disturbed for these types of management actions. Acres disturbed would be directly and adversely impacted over the long-term (life of the projects). Concentrating these disturbances would reduce these adverse impacts to wildlife by reducing the potential for fragmentation.

Potential ROW and corridor development could be permitted within greater than ten percent of habitats important to all wildlife species in the planning area, except migratory game birds (one to five percent), therefore management actions common to all alternatives would have major adverse effects on wildlife resources.

Travel and Transportation Management

Roads and associated traffic have the greatest impact to wildlife and wildlife habitats. Roads remove vegetation and disturb soil when they are constructed and thereafter. Impacts to wildlife include mortality, habitat loss, and reduced habitat connectivity. Wildlife mortality and loss of habitats due to road construction are direct impacts; vehicle speeds and traffic volumes generally increase the mortality of wildlife due to wildlife collisions with vehicles. Road construction also causes habitat loss by converting wildlife habitats to permanent road surfaces and ROWs.

In addition, because roads typically are void of vegetation and exhibit impervious surfaces or compacted soil, they often promote increased surface runoff and lead to soil erosion and transport of pollutants to nearby streams, wetlands, or riparian areas. Roads also contribute to habitat fragmentation and can be barriers to some wildlife species. There are typically two wildlife responses to roads and their associated disturbances - avoidance of roads and numerical reductions in wildlife populations.

Inventory and evaluation of all existing roads and trails into one transportation plan would designate those to be upgraded, maintained, or abandoned. These actions would reduce erosion, protect and stabilize soils and vegetation, and reduce opportunities for invasive plants and weeds to establish. Restricting motorized vehicles and implementing temporary closures would contribute to stabilizing soils and reducing erosion. All new roads would be designed to minimize surface disturbance and surface runoff and erosion potential. Constructing new roads and trails have a direct, long-term adverse impact on wildlife. Roads and trails for motorized vehicles result in localized direct and adverse impacts on wildlife habitats, such as reducing vegetation cover and density and changing community compositions. Reclaiming abandoned roads and trails with appropriate herbaceous and shrubby vegetation and upgrades on utilized roads would promote soil stabilization and reduce opportunities for erosion and for invasive plant and weed species to establish; this would have a direct beneficial impact on wildlife over the long term.

Overall, travel and transportation actions would be conducted within greater than ten percent of habitats important to big game, trophy game, small game birds, and non-game migratory birds (five to ten percent of habitats important to small game mammals, predator species, furbearers and non-game mammals, one to five percent of habitats important to migratory game birds, and less than one percent of habitats important to raptors), therefore having major adverse effects to wildlife over the long term.

Recreation

Although many recreational activities are nonconsumptive, they can impact wildlife and their habitats. Increased human presence could result in habitat or water quality degradation or wildlife disturbance (e.g., dispersal or avoidance). If recreation activities took place in non-crucial 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, calving, breeding, nesting, and early brood rearing), recreation activities could significantly alter animal behavior and result in increased winter mortality or lowered reproductive success. In areas that are repeatedly used for camping sites, there could be minor, site-specific degradation of habitats.

The installation of recreation facilities, particularly in new areas, could disturb habitat during construction, permanently alter habitat, or lead to increased human presence that could disturb wildlife. Animal avoidance of developed areas would be similar to that for any other types of development in wildlife habitat.

In addition to the stressors from BLM-permitted activities, game animals (big game, small game, furbearers, and game birds) are hunted seasonally. Pursuit of game animals during hunting seasons could present 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 or maintain populations at or below sustainable habitat thresholds (carrying capacity). Though the BLM has no jurisdiction over hunting as a whole, use of BLM-administered lands for the purpose of hunting is promoted.

In general, OHV management decisions that result in increased human presence would have a localized impact on wildlife. Impacts would include increased displacement of wildlife, increased stress during critical periods, and degradation of habitats. The greater area and the higher the density of OHV use, the more adverse impacts to wildlife habitats. OHV use can alter the seasonal use patterns of many wildlife species. The use of over-snow vehicles on winter range could lead to excessive wildlife disturbance and cause additional stress, more rapid depletion of fat (energy) reserves, and in extreme cases, death. New roads created from the extensive use of OHVs could provide access to areas that normally do not experience human presence; degrade habitat through vegetation loss; provide access for predator species and create competition for species; and compact soil, which would cause accelerated erosion or prevent water infiltration.

Development of recreation opportunities, trails, maintenance of established sites, facility construction, and designating trails to caves all have the potential to adversely impact wildlife habitats. Recreational use of caves containing suitable bat habitat and development of cave management plans would consider the strategy described in WO IM 2010-181, reducing the threat of WNS spread.

Recreation management actions would occur within one to five percent of habitats important to big game, trophy game, small game mammals, predator species, furbearers and non-game migratory birds (less than one percent of habitats important to all other wildlife species); therefore, management actions common to all alternatives for recreation would have minor adverse effects on wildlife.

Lands with Wilderness Characteristics

Identified and designated areas would be managed to maintain suitability for preservation as wilderness. This management would help maintain or improve wildlife habitat by limiting surface disturbance. Closing or limiting motorized vehicles to designated roads and trails would have a beneficial effect on wildlife. Avoidance areas for other resource concerns would also be avoidance areas for wildlife. Lands with wilderness characteristics could potentially occur in one to five percent of habitats important to small game mammals, predator species, furbearers and non-game migratory birds, (less than one percent for all other wildlife species); therefore, management actions common to all alternatives for lands with wilderness characteristics would have minor beneficial effects on wildlife in the planning area.

Livestock Grazing Management

Impacts to wildlife habitat from livestock grazing include competition for forage and water and habitat use and alteration. Stock driveways tend to concentrate high levels of livestock use that can cause degradation (e.g., near-complete removal of vegetation and 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. Livestock grazing also can enhance forage and brood-rearing conditions for wildlife species. Wildlife could favor regrowth areas previously used by cattle because of the resultant increase in forage palatability. Historic and current trailing of livestock on the established stock driveways can contribute to soil disturbance, trampled vegetation, deposited manure, loss of plant cover, and localized areas dominated by annual, invasive, and other weed species. The major stock driveways (The Slip, Trabing Road, and Hazelton Road) are designated county roads; therefore, trailing contributes only a small portion of adverse impacts. Trailing is also short term, occurring only 2 to 3 weeks in spring and fall.

Improper livestock grazing management could adversely impact stabilization of riparian vegetation, which can lead to stream instability and an associated loss of habitat complexity, and 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. Early spring and late summer are periods when livestock are most likely to utilize shrubs, thereby reducing their availability to wildlife species. Browsing of shrubs could reduce their competitive ability against grasses, which could increase abundance and vigor of the herbaceous understory.

Livestock grazing in fall or early spring would remove the residual herbaceous understory and reduce its vertical structure, which reduces the visual security for upland nesting birds. This could lead to increased predation and lower nesting success. Removing 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. However, livestock fences create travel barriers, create stress, and could lead to decreased reproductive success (especially when constructed in big game migration corridors) and death from entanglement. Well planned, appropriate, range improvements may benefit wildlife by improving livestock management and distribution.

Placing 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 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 provide better forage for wildlife. Well-designed water developments (reservoirs) and associated riparian vegetation create nesting, feeding, and brood-rearing habitat for waterfowl 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 also could alter vegetative diversity in these mesic areas, potentially reducing habitat quality for a wide variety of wildlife species.

Beneficial impacts of proper grazing include reducing competition by removing encroaching woody plant cover; hoof action that keeps topsoil loose, increases litter and precipitation penetration, and incorporates seeds into soil; nutrient recycling; removing wildfire fuels; and controlling invasive plant and weed species with properly timed grazing rotations and species (e.g., goats). Rangelands provide open space and habitat for many wildlife species. Prolonged grazing during the growing season or summer months could reduce the vigor of desired species, change species richness, and increase the potential for invasion by annual grasses and invasive plant and weed species. Although there are BLM surface lands in the grazing allotments, most parcels are small and cannot be meaningfully managed for wildlife habitats. There are 779,034 acres of BLM surface in grazing allotments in the planning area, all of which are likely to support various wildlife species.

Overall, livestock grazing management would have minor adverse impacts on wildlife.

Special Designations

Areas of Critical Environmental Concern

Prohibiting surface-disturbing activities and implementing land use restrictions in ACECs would limit the extent of surface disturbance. This would have a direct beneficial impact on wildlife over the long term because it would minimize the potential for adverse impacts on habitat. ACECs could encompass as much as one to five percent of habitats important to big game, trophy game, small game mammals, predator species, furbearers, and non-game migratory birds (less than one percent of habitats important to all other wildlife species); therefore, management actions common to all alternatives for ACECs would have minor beneficial effects on wildlife species in the planning area.

Scenic or Back Country Byways and Wild and Scenic Rivers

Scenic or BCBs and WSRs would be managed to maintain or enhance their natural characteristics. These management actions would directly benefit wildlife over the long term. Although such areas could increase in popularity and increase impacts from human presence, impacts would be minimal. These actions would have a negligible effect on vegetative resources. Due to the large amounts of suitable wildlife habitat in the planning area and the localized impacts of Scenic or BCBs and WSRs, impacts to wildlife would be negligible.

Wilderness Study Areas

Management actions for WSAs would have beneficial impacts on wildlife habitat.
WSAs would be managed to emphasize primitive, nonmotorized activities to maintain existing natural values. Management of WSAs would prohibit surface-disturbing activities and implement land use restrictions, which would limit the extent of surface disturbances. WSAs could encompass as much as five to ten percent of habitats important to big game (one to five percent of habitats important to trophy game and small game birds and less than one percent of habitats important to all other wildlife species), therefore, management actions common to all alternatives for WSAs would have moderate beneficial effects on wildlife species in the planning area.

Socioeconomic Resources

Social and Economic Conditions

Management actions common to all alternatives are administrative processes and will have no effect on wildlife resources. Impacts to social and economic resources will be quantified on a project specific basis. Management actions that vary by alternative are also administrative; therefore, social and economic management actions will not be discussed further in this section

Health and Safety

Management actions common to all alternatives are designed to control and mitigate threats to health and human safety and to the environment. Management actions designed to prevent accidental spills of hazardous materials would have beneficial impacts to wildlife habitat by protecting riparian and upland areas. Because hazardous materials (e.g., oil, oil and gas by-products, pesticides, and cleaning solvents) are being produced and transported in the planning area, there is a threat of accidents or spills. If there was a spill, mitigation and cleanup would rarely succeed in recovering a riparian or upland area to its original condition over the short term; therefore, there would be localized long-term adverse impacts. Reclaiming abandoned mines would have indirect beneficial impacts on wildlife habitat on affected sites over the long term, although there would be short-term displacement of wildlife occupying those mines.

Only management actions in Common to All Alternatives are identified; therefore, health and safety will not be discussed further in this section.

4.4.6.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended and maintained. This section describes management actions and potential impacts to wildlife from implementing Alternative A.

Fish and Wildlife Resources – Wildlife
Under Alternative A, only habitats currently designated as crucial seasonal wildlife habitat (75,175 acres of crucial elk habitats, 27,222 acres of big-game priority migration corridors, and 1,195,815 acres within biologic buffers for raptor nests) would be protected. There is a moderate probability that habitat loss, increased physiological stress, and lower reproduction and survival would occur in priority wildlife populations because of the extensive land use now occurring in the planning area.

Seasonal restrictions on land uses would benefit wildlife by preventing disturbance during critical winter and calving periods. These seasonal restrictions would not prevent activities, but merely delay them. Seasonal restrictions alone are not sufficient to reduce impacts to many wildlife species; therefore, Alternative A couples additional disturbance-free buffer zones with these restrictions. This would have a long-term beneficial impact on wildlife. Other long-term beneficial impacts would result from restrictions on access roads, pipelines, and powerlines to corridors and from piping oil and gas products out of crucial winter range for elk.

Wildlife also would benefit from prohibiting surface occupancy for oil and gas activities, restricting off-road vehicle activities in big-game winter ranges and elk calving areas, retaining sufficient escape and foraging habitat adjacent to timber cutting units, and exchanging or selling scattered parcels of public land areas could be blocked up into manageable units. From past experience, it is estimated that restrictions on oil and gas exploration, ROWs, and other surface-disturbing activities through wildlife seasonal or NSO stipulations are inconsistently applied. Furthermore, under Alternative A, the authorized officer may waive prohibitions and restrictions without defined criteria; this has resulted in inconsistent application of management and has not been effective in protecting wildlife.

Management actions under Alternative A are generally expected to maintain existing conditions for big game in the planning area. Black bears are impacted by management actions in forest and woodland habitats; these management actions generally are not focused on providing habitats for black bears or mountain lions. Although there are no specific management actions for mountain lions under the alternatives, mountain lions benefit from management actions for mule deer and big-game habitats.

Under Alternative A, there are no specific management actions for furbearing animals, predators, small game, or nongame mammals, but these species are impacted by other management actions. Badger and bobcat are habitat generalists and are therefore, are impacted by actions in a variety of habitats. The BLM does not perform any specific habitat management activities for predatory animals. Regardless, BLM management actions for wildlife habitats would affect predatory animals. All of these animals are largely habitat generalists and would be impacted by actions for a variety of habitat types.

Under Alternative A, the BLM preserves, protects, and restores natural function in riparian areas. Alternative A does not allow surface disturbance within 500 feet of riparian and wetland areas, which benefits beaver, muskrat, and mink. Although there are no specific management actions for migratory game birds, these species are impacted by other biological resource management actions, particularly those pertaining to water and riparian and wetland habitats for waterfowl. Under Alternative A, the BLM manages riparian and wetland areas to preserve natural functions and implements buffers in these areas and within 100-year floodplains and perennial streams where surface disturbance should be avoided; this benefits migratory game birds.

Although there are no specific management actions for reptiles and amphibians under Alternative A, these species would be impacted by other biological resource management actions. Snakes occur in a variety of habitat types, while lizards typically occur in drier habitats, particularly those with rock outcrops and cliffs. Aquatic turtles and amphibians require riparian and wetland habitats. Impacts to these habitat type from management actions are discussed throughout this section.

Physical Resources

Air Quality

The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for air quality (habitat conservation). Under Alternative A, though, modeling and monitoring would be conducted only on a project-specific basis. The lack of direct management under Alternative A would make the beneficial effects to wildlife resources negligible.

Soil

The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for soil (habitat conservation). Surface-disturbing prohibitions and restrictions apply to areas of severe erosion hazards and areas having poor reclamation suitability. Under Alternative A, though, these prohibitions and/or restriction can be waived by the authorizing officer without specifying criteria that must be met for the waiver. In addition, these prohibitions/restrictions are considered only on a project-specific basis. Soil resource conservation under Alternative A would occur in greater than ten percent of habitats important to all wildlife species, except migratory game birds, therefore, soil management actions under Alternative A would have major beneficial impacts on wildlife resources. Without oversight on a programmatic level and specified criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Water Resources

The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for water (habitat conservation and improvement). Prohibition of surface disturbance within 500 feet of most water sources can be waived by the authorizing officer under Alternative A, and all other management is considered on a project specific basis only. Water resource management under Alternative A would occur in greater than ten percent of habitats important to small game birds, (five to ten percent of habitats important to big game, trophy game, and raptors and one to five percent of habitats important to all other wildlife species) therefore, water management actions under Alternative A would have major beneficial impacts on wildlife resources. Without oversight on a programmatic level and specified

criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Cave and Karst Resources
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for cave and karst resources (habitat conservation). Management of cave and karst resources is considered on a project-specific basis only. Cave and karst resource conservation under Alternative A would occur in greater than ten percent of habitats important to big game and trophy game (less than one percent of habitats important to all other wildlife species); therefore, cave and karst management actions under Alternative A would have major beneficial impacts on wildlife resources. Without oversight on a programmatic level, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Mineral Resources

Locatable Minerals
The types of effects from Alternative A would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for locatable minerals (habitat loss, fragmentation, and degradation). Locatable mineral development under Alternative A would be restricted (game ranges only) in one of habitats important to all wildlife species, except non-migratory birds and raptors (less than one percent). This means that locatable mineral development would be permitted in greater than ten percent of habitats important to all wildlife species in the planning area. The adverse effects would be major.

Leasable Minerals – Coal
The management action listed under Alternative A is administrative, and will have no effect on wildlife resources.

Leasable Minerals – Fluids
The types of effects from Alternative A would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for fluid minerals (habitat loss, degradation and fragmentation). Fluid mineral development under Alternative A would be permitted in greater than ten percent of habitats important to big game, small game birds, migratory game birds, non-game migratory birds, and raptors, (less than five percent of habitats important to all other wildlife species) therefore, fluid mineral management actions under Alternative A would have major adverse effects on wildlife resources.

Salable Minerals
The types of effects from Alternative A would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for salable minerals (habitat loss, degradation and fragmentation). Salable mineral development under Alternative A would be permitted in greater than ten percent of habitats important to non-game migratory birds and raptors, (five to ten percent of habitats important to small game birds and migratory game birds, one to five percent of habitats important to big game, and less than one percent of habitats important to all other wildlife species) therefore, salable mineral management actions under Alternative A would have major adverse impacts on wildlife species.

Fire and Fuels Management

Unplanned Fire (Wildfire)
Fire suppression removes vegetation and disturbs soil, and can have both short-term and long-term impacts to wildlife habitats. For example, using heavy equipment to construct fire lines can cause habitat loss, degradation, and fragmentation over the short term. Moreover, if not rehabilitated, these fire lines can cause erosion and provide opportunities for the spread of invasive species, thereby resulting in long-term adverse impacts to wildlife habitat. Therefore, timely rehabilitation following fire is important to maintaining the quality of wildlife habitats. Fire suppression agents contain chemicals that can be detrimental and poisonous to macroinvertebrates, which are a necessary food source for numerous wildlife species. Some of these fire suppression chemicals also are directly poisonous to some wildlife species. Due to the likely scattered nature of effects to all wildlife species in the planning area, the adverse effects of habitat removal from unplanned fire are likely to be minor.

Planned Fire (Prescribed Fire)
Long term, the application of prescribed fire to support grassland and shrubland communities and wildlife habitat objectives is estimated to affect approximately 14,000 acres from BLM actions. All acres are expected to be successfully reclaimed. All fires are suppressed; priority is given to areas with high value resources or where fires may spread to other land ownerships. Some types of suppression equipment is restricted in some areas, though not specified in this alternative. All fire and suppression damage is rehabilitated under Alternative A and vegetation treatments are used to support vegetation and wildlife habitat objectives. Prescribed fire under Alternative A is planned within greater than ten percent of habitats important to big game, trophy game, small game birds, and non-game migratory birds (five to ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals, one to five percent of habitats important to migratory game birds, and less than one percent of habitats important to raptors), therefore, prescribed fire management actions under Alternative A would have major adverse effects on wildlife resources.

Biological Resources

Alternative A actions that promote balanced management of biological resources in the planning area would promote a natural landscape, thereby promoting healthy wildlife habitats. These management actions include such things as managing vegetative resources for special status wildlife species, and controlling invasive species, which would have major beneficial impacts to wildlife habitat. There are 782,102 acres of BLM surface in the project area, all of which are assumed to provide suitable wildlife habitat for various wildlife species. Under Alternative A, the authorized officer may waive management actions without defined criteria, which has resulted in inconsistent application of management and has not been effective for protecting wildlife. Any beneficial effects that may be encountered through the use of habitat conservation measures are likely to manifest on half the anticipated scale as a consequence of their inconsistent application.

Vegetation – Forests and Woodlands
Forest management practices, which convert late-seral stage stands to early and mid-seral, would adversely affect wildlife adapted to late-seral forest types. Under Alternative A, vegetation treatment would be designed to meet overall resource management objectives and diseased old growth and overstocked forests would be managed in accordance with the Healthy Forest Restoration Act (HFRA). These actions would both promote the natural health of the forest and woodlands communities and would be beneficial to wildlife resources depending on them. Forest and woodlands contain five to ten percent of habitats important to big game and migratory game

birds (one to five percent of habitats important to trophy game and small game birds and less than one percent for all other wildlife species); therefore, management actions under Alternative A would have moderate beneficial effects on wildlife resources.

Vegetation – Grassland and Shrubland Communities
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for grassland and shrubland communities (habitat conservation and improvement). Under Alternative A, grassland and shrubland community conservation and improvements would occur in five to ten percent of habitats important to big game and migratory game birds (one to five percent of habitats important to trophy game and less than one percent of habitats important to all other wildlife species); therefore, grassland and shrubland management actions under Alternative A would have moderate beneficial impacts on wildlife resources.

Vegetation – Riparian/Wetland Resources
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for riparian/wetland resources (habitat conservation and improvements). Prohibition of surface disturbance within 500 feet of most water sources can be waived by the authorizing officer under Alternative A, and all other management is considered on a project-specific basis only. Under Alternative A, riparian/wetland conservation and improvements would occur in greater than ten percent of habitats important to small game mammals and birds, predator species, furbearers, non-game migratory birds, and raptors (five to ten percent of habitats important to all other wildlife species); therefore, riparian/wetland management actions under Alternative A would have major beneficial impacts on wildlife resources. Without oversight on a programmatic level and specified criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Invasive Species and Pest Management
The types of effects from Alternative A would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for invasive species and pest management (habitat loss and degradation). Noxious weeds would be controlled only on public lands and in cooperation with county weed and pest districts. Under Alternative A, invasive species and pest management would occur in five to ten percent of habitats important to small game birds and migratory game birds (one to five percent of habitats important to big game and non-game migratory birds and less than one percent of habitats important to all other wildlife species); therefore, invasive species and pest management actions under Alternative A would have moderate adverse effects on wildlife resources.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for fish (habitat improvements). Alternative A management dictates that reservoirs and riparian areas are sometimes maintained to improve or enhance fisheries. Fish habitat improvements would occur in greater than ten percent of habitats important to big game and migratory game birds (five to ten percent of habitats important to trophy game and small game birds, one to five percent of habitats important to non-game migratory birds and less than one percent of habitats important to all other wildlife species); therefore, fish and SSS fish management actions under Alternative A would have major adverse effects on wildlife resources.

Special Status Species – Plants
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for special status plant species (habitat conservation and improvement). Management of special status plant species is considered on a project-specific basis only. Under Alternative A, special status plant conservation would occur in greater than ten percent of habitats important to big game and trophy game (one to five percent of habitats important to small game birds and less than one percent of habitats important to all other wildlife species); therefore, special status plant species management actions under Alternative A would have major beneficial impacts on wildlife resources. Without oversight on a programmatic level, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Under Alternative A, special status wildlife species habitat management complies with ESA and BLM policy. Greater Sage-Grouse management includes requiring anti-perching devices on new powerlines within 0.5 mile of occupied Greater Sage-Grouse leks and nesting habitat; surface disturbing and occupancy restrictions within 0.25 mile of Greater Sage-Grouse leks and a 1.75 mile TLS outside of that. Bald eagle management allows for a 0.5 mile year-round disturbance-free buffer zone around nest sites and a TLS up to a mile from the nest. Raptor nest protection involves a biologic buffer disturbance or occupancy zone around active nests. Under Alternative A, though, these prohibitions and/or restrictions can be waived by the authorizing officer without specifying criteria that must be met for the waiver. Special status wildlife prohibitions/restrictions would also conserve greater than ten percent of habitats important to all general wildlife, except big game and trophy game (five to ten percent), therefore, special status wildlife species management actions under Alternative A would have major beneficial impacts on wildlife resources. Without specified criteria for waiving these restrictions, though, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Heritage and Visual Resources

Cultural Resources
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for cultural resources (habitat conservation). NSOs are currently applied to the Bozeman Trail and Crazy Woman Battle Site only. These restrictions would be beneficial to any wildlife habitats they encompass. All other management of cultural resources is considered on a project specific basis. Under Alternative A, cultural resource protection would occur in greater than ten percent of habitats important to big game and trophy game (one to five percent of habitats important to small game birds and less than one percent of habitats important to all other wildlife species); therefore, cultural resource management actions under Alternative A would have major beneficial impacts on wildlife resources.

Paleontological Resources
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for paleontological resources (habitat conservation). Management of paleontological resources is considered on a project specific basis. Under Alternative A, paleontological resource protection would occur in less than one percent of habitats important to all wildlife species; therefore, cultural resource management actions under Alternative A would have negligible beneficial impacts on wildlife resources.

Visual Resources

The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for visual resources (habitat conservation). There are no additional impacts anticipated from Alternative A management actions for visual resources for any specific wildlife species in the planning area.

Land Resources

Forest Products

The layout and timing of timber sales would largely determine the degree of impacts to wildlife. 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 all could have an effect 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. Projected over the entire planning area, the estimated occurrence of overlap would occur within one to five percent of habitats important to big game, trophy game, and migratory game birds (less than one percent for all other wildlife species); therefore, forest products management actions under Alternative A would have minor beneficial impacts on wildlife resources. Fencing of these regeneration areas would help allow the natural succession to return to each of the seral stages and promote the growth of suitable wildlife habitat.

Lands and Realty

Land tenure adjustments could impact wildlife, depending on the future use of the habitat. Even uses that maintain open spaces could have an impact if the habitat is altered. Approximately 108,243 acres have been identified as suitable for future consideration for disposal.

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 with riparian/wetland and aquatic resources could reduce available habitat for various species. An exchange could be beneficial if the acquired habitat is high quality and has a diversity of wildlife.

Land acquisitions could increase the overall quantity or quality of wildlife habitat in the planning area. Land exchanges to acquire state and private lands in crucial habitats in important and predominantly federal management areas likely would result in long-term habitat sustainability. Lands available for tenure adjustments under Alternative A contain greater than ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (one to five percent of habitats important to small game birds, non-game migratory birds, and raptors and less than one percent of habitats important to all other wildlife species); therefore management actions for lands and realty under Alternative A would have major adverse effects on wildlife resources.

Renewable Energy

Alternative A allows wind-energy development throughout the planning area, which would create collision hazards for bats and numerous avian species. Large wind-energy fields also involve surface disturbance, which could permanently change the habitat structure of the wildlife inhabitants. Management without defined criteria and evaluating renewable-energy projects on

project-specific basis has resulted in inconsistent application management and mitigation and has not been effective.

Renewable energy development potential in the planning area is low and not likely to occur. Renewable energy development within wildlife habitat or travel corridors may have adverse effects on wildlife.

Rights-of-Way and Corridors

Under Alternative A, routing linear ROWs (e.g., pipelines, powerlines, and 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 locations and heights of communications towers would reduce impacts on migratory birds, including collisions during periods of low visibility. Though these mitigations are implemented, ROWs occur in conflict with wildlife and habitat throughout the planning area. Currently, ROWs are permitted within greater than ten percent of habitats important to all wildlife species, except migratory game birds (one to five percent). Due to the scale of habitat fragmentation projected over the entire planning area, these adverse impacts would be major.

Travel and Transportation Management

Under Alternative A, there would be direct and indirect impacts on wildlife from travel management and OHV use. OHV use removes vegetation, disturbs soil, and transports invasive species, all of which degrade wildlife habitats. Higher, rockier terrain and remote areas are becoming more accessible over time as OHVs become more sophisticated and powerful, and as the human population in the planning area increases. In addition to the direct effects of vegetation removal and soil disturbance, disturbance to wildlife associated with OHV use includes movement and noise from vehicles and riders. This activity can cause noise that adversely impacts wildlife by increasing stress, can increase poaching, and can result in direct wildlife mortality from collisions with OHVs. By designating areas where OHV use is limited to designated roads and trails, these impacts can be reduced. In areas where motorized vehicle use is closed for only portions of the year, the closures would not have as great a benefit to wildlife as would a year-round closure. Allowing surface occupancy during any time of year would have an adverse impact to wildlife habitat. Current management protects resources in some areas (Middle Fork Canyon, Cantonment Reno, and Dry Creek Petrified Tree EEA). Transportation and access impacts would be allowed in greater than ten percent of habitats important to small game mammals, migratory game birds, furbearers, non-game mammals, and raptors (less than one percent of habitats important to all other wildlife species); therefore management actions for transportation and access management under Alternative A would have major adverse effects on wildlife resources.

Recreation

Recreational activities that result in increased human presence would have localized impacts on wildlife. These activities would include hiking, biking, camping, boating, fishing, hunting, and sightseeing. Although many recreational activities are nonconsumptive, they can affect wildlife and their habitats. Increased human presence could result in habitat or wildlife disturbance (e.g., dispersal or avoidance). If recreational activities occurred in non-crucial habitats or during seasons when sensitive wildlife species were not present and in compliance with recreation management actions, impacts likely would be negligible. During seasonally sensitive periods (e.g., winter, calving, breeding, nesting, and early brood rearing), recreational activities could significantly alter animal behavior and result in increased winter mortality or lowered reproductive success. Over the long term and where the two resources overlap,

recreational activities would have major adverse impacts on wildlife. Surface-disturbing restrictions/prohibitions are applied to Dry Creek Petrified Tree EEA and Mosier Gulch Recreation Area. The prohibitions/restriction for recreation under Alternative A conserves one to five percent of habitats important to big game, trophy game, small game mammals, predator species, furbearers, and non-game migratory birds (less than one percent for all other wildlife species); therefore, the adverse effects, over the entire planning area, would be minor.

Lands with Wilderness Characteristics
Alternative A does not include decisions for and therefore does not manage for areas with wilderness characteristics. BLM's 1979 wilderness inventory (BLM 1979) concluded that there were no lands within the planning area except for the three WSAs that contained wilderness characteristics. There would be no effect on wildlife.

Livestock Grazing Management
Maintaining livestock grazing AUMs in areas of intense industrial activity could increase big-game forage competition. Many of these industrialized areas correspond to sensitive wildlife habitats. Where wildlife are being displaced from important habitats by human activity and industrial development, it increases the competition with livestock for forage and could be detrimental to the local wildlife population. This would cause degradation of the range for both livestock and 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 winter. Loss of forage could cause wildlife redistribution, particularly big game, to areas that might be occupied by other big-game herds, to areas with 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 fish-bearing water or riparian/wetland areas would minimize soil compaction and subsequent runoff near surface waters.

Allocating forage increases realized from management prescriptions and range improvement practices to wildlife and livestock could benefit wildlife species. Forage increases achieved through vegetative treatment practices would be temporary if the vegetative community is successional. Active management of vegetative 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. Under this Alternative A, the degree of impact would depend upon the number of animals involved, and seasonal frequency of presence in wildlife habitat.

Under Alternative A, livestock grazing is not authorized on approximately 10,000 acres of public land where grazing has been determined to be incompatible with other resource values, specifically 4,000 acres in the canyons and slopes of the southern Big Horn Mountains. Management of livestock grazing, under Alternative A, occurs in greater than ten percent of habitats important to big game, trophy game, small game birds, migratory game birds, and raptors (five to ten percent of habitats important to non-game migratory birds and less than one percent for all other wildlife species); therefore, the adverse effects, over the entire planning area, would be major.

Special Designations

Areas of Critical Environmental Concern, Scenic or Back Country By-ways, and Wild and Scenic Rivers
Management actions for ACECs, scenic or BCBs and for WSRs would have no effect on wildlife resources.

Wilderness Study Areas
Under Alternative A, the types of impacts to wildlife species from management actions for special designations would be the same as described under *Impacts Common to All Alternatives*, except that the additional 28,931 acres within the three WSAs would be open to oil and gas development. Impacts Common to All Alternatives describes impacts to wildlife and wildlife habitat form oil and gas development. Table 4.34, "Important Wildlife Habitats in Wilderness Study Areas" (p. 1144) lists the three WSAs and their important wildlife habitats.

Table 4.34. Important Wildlife Habitats in Wilderness Study Areas

Wilderness Study Area	Important Wildlife Habitat				
	Big-game ranges	Within 750 feet of sharp-tailed grouse leks	Within 0.64 mile of sharp-tailed grouse leks	Raptor nest buffers	Amphibian and reptile habitats
Gardner Mountain	1,034 / 0.2%	0	0	0	3,484 / 0.1%
North Fork	2,150 / 0.5%	0	0	0	4,783 / 0.1%
Fortification Creek	12,184 / 3%	73 / 2%	1,318 / 1%	530 / 0.02%	477 / 0.01%

Source: BLM 2012f

Note: Percentages in table represent the percent of important wildlife habitat (columns) that overlaps wilderness study areas (rows).

% percent

4.4.6.4. Alternative B

This section describes management actions under Alternative B, which emphasizes resource conservation, and the likely impacts to wildlife resources due to their implementation. Prohibiting surface-disturbing activities for the protection of any other resource would have a major beneficial impact to wildlife where these resources overlap. (See Chapter 4 introduction for the definition of surface disturbance.) Avoidance areas for other resources would, by nature, be NSO areas for wildlife. An NSO stipulation would not prevent all disturbances. Activities that require surface disturbance to install underground facilities would still be allowed.

Fish and Wildlife Resources – Wildlife
Alternative B management actions for wildlife include modifying existing fences that prevent wildlife movement; applying restrictions on surface-disturbing and disruptive activities within various wildlife habitats (elk crucial winter range, biologic buffers for raptor nests, amphibian and reptile habitats); requiring burial of all new low-voltage powerlines and installation of perch-inhibiting devices on aboveground powerlines; limiting loss of elk security habitat; designating the Fortification Creek elk herd unit as a WHMA; and maintaining or enhancing various wildlife habitats throughout the planning area. This approach is the most conservative because it allows for the greatest protective measures for wildlife and wildlife habitats. This level of protection greatly increases the potential for future management decisions to expand the proliferation of these species through active management. Table 4.35, "Acres of Habitats Important to Wildlife in the Planning Area on BLM and Split Estate Lands" (p. 1145) lists the amount of habitats important to wildlife in the planning area on both BLM and split estate lands.

Table 4.35. Acres of Habitats Important to Wildlife in the Planning Area on BLM and Split Estate Lands

Surface	Big-game ranges	Big-game migration corridors with 0.5 mile buffer	Elk security habitat	Fortification Creek WHMA, including yearlong	Within 750 feet of sharp-tailed grouse leks	Within 0.64 mile of sharp-tailed grouse leks	Raptor nest biologic buffers	Within 1.5 miles of raptor nests	Amphibian and reptile habitats
BLM	4,583	9,587	132,148	54,300	323	7,607	255,129	429,328	176,636
Federal Minerals									
Coal	14,216	85,277	309,300	114,649	2,200	43,201	1,756,070	3,076,3964	734,288
Oil and Gas	14,216	85,462	315,139	114,652	2,200	35,736	1,195,815	2,023,118	1,217,959

Source: BLM 2012f

BLM Bureau of Land Management
WHMA Wildlife Habitat Management Area

Wildlife would benefit from conservative management of physical and biological resources. Alternative B management actions are anticipated to result in beneficial impacts to big game. These actions are anticipated to improve forest and woodland habitats, potentially providing improved habitat conditions that benefit black bears in the planning area. Under Alternative B, impacts to mountain lions are anticipated to be similar impacts to big game and big-game habitats. In addition, Alternative B would maintain or enhances large, contiguous blocks of aspen habitat.

Alternative B would manage all riparian areas toward mid- to late-successional stage vegetation, which would benefit riparian and wetland species such as beaver. This alternative places greater restrictions on surface disturbance in riparian and wetland areas by not allowing this type of disturbance within 0.25 mile of these areas and not allowing new permanent facilities in these areas. These actions are anticipated to ultimately result in riparian systems with increased vegetative and structural diversity throughout the planning area, with benefits to beaver, muskrat, mink, and other riparian and wetland species. Actions pertaining to water and riparian and wetland habitats also are anticipated to benefit migratory game birds. The buffer around wetlands, riparian areas, perennial streams, and 100-year floodplains where surface disturbance cannot occur would be large under Alternative B. These areas would be closed rather than avoided, which would benefit migratory game birds. In addition, management under Alternative B would reduce channel erosion, bank erosion, and channel incision, and restore damaged wetlands.

Restrictions around raptor nests are more extensive under Alternative B, because all buffers are 1.5 miles; resulting in fewer direct impacts to nesting raptors. Seasonal restrictions vary based on the species of raptor. Alternative B also would manage sagebrush, aspen, and mountain shrub communities in large, contiguous blocks and maintain connections among these communities. In addition, Alternative B would protect riparian areas and increase control of invasive species. These actions are anticipated to benefit birds and small mammals comprising raptor prey in the planning area.

Alternative B actions that would benefit different vegetative types in the planning area would benefit habitat generalists such as furbearing animals, predators, small game, or nongame mammals.

Impacts from conservative management of resources under Alternative B would, in some cases, be similar to those described for Alternative A and Impacts Common to All Alternatives. Where impacts to wildlife would vary in degree from impacts described for Alternative A, further rationale is provided below.

Physical Resources

Air Quality

Under Alternative B, air quality modeling would be performed on a project-specific basis. In addition, projects expected to approach or exceed emissions standards would be evaluated for potential mitigation strategies, which would have a major beneficial effect on wildlife.

Soil, Water Resources, and Cave and Karst Resources

Alternative B would analyze impacts to soil, water, and cave and karst resources on a project-specific basis. Human activity in caves would be managed through Cave Management Plans, developed considering direction described in WO IM 2010-181, which would reduce threats from WNS to bats. In addition, Alternative B would prohibit surface-disturbing activities or apply NSO stipulations to activities on badlands, rock outcrops, and slopes susceptible to mass movement, and prohibit prescribed fires on highly erodible soils; prohibit such activities as on-channel reservoirs, conversion of abandoned oil and gas wells to water supply wells, and activities within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated habitat; and prohibit activities in cave and karst areas. Prohibiting surface-disturbing activities for the protection of soil resources under Alternative B would conserve greater than ten percent of habitats important to all wildlife species. Prohibiting surface-disturbing activities for the protection of water resources under Alternative B would conserve greater than ten percent of habitats important to big game (five to ten percent of habitats important to trophy game, small game birds, non-game migratory birds, and raptors, and one to five percent of habitat important to all other wildlife species). Prohibiting surface-disturbing activities for the protection of cave and karst resources under Alternative B would conserve greater than ten percent of habitats important to big game (five to ten percent of habitats important to trophy game; one to five percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals; and less than one percent of habitats important to all other wildlife species). Overall, Alternative B management of soils, water, and cave and karst resources would result in major beneficial effects on wildlife.

Mineral Resources

Locatable Minerals

The types of effects from Alternative B would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for locatable mineral resources (habitat loss and degradation). Under Alternative B, 618,256 acres would be withdrawn from mineral entry and 2,686,776 acres of BLM surface would be left open to mineral entry. Locatable mineral entry could be permitted within one to five percent of habitats important to small game mammals, small game birds, migratory game birds, predator species, furbearers and non-game migratory birds (less than one percent of habitats important to all other wildlife species); therefore, locatable mineral management actions under Alternative B will have minor adverse effects on wildlife resources.

Leasable Minerals – Coal
The management action listed under Alternative B is administrative, and will have no effect on wildlife resources.

Leasable Minerals – Fluids
The types of effects from Alternative B would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for fluid mineral resources (habitat loss and degradation). Under Alternative B, all oil and gas exploration would be subject to license stipulations necessary to protect other resource values. Fluid mineral development, under Alternative B could be permitted within greater than ten percent of habitats important all wildlife species, except big game, migratory game birds, and raptors; therefore, fluid mineral management actions under Alternative B will have major adverse effects on wildlife resources.

Salable Minerals
The types of effects from Alternative B would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for salable mineral resources (habitat loss and degradation). Under Alternative B, 129,431 acres of BLM surface would be left open to salable mineral exploration. Salable mineral exploration, under Alternative B, could be permitted within greater than ten percent of habitats important to small game mammals, small game birds, predator species, furbearers, non-game mammals, and non-game migratory birds (five to ten percent of habitats important to migratory game birds and less than one percent of habitats important to all other wildlife species); therefore, salable mineral management actions under Alternative B will have major adverse effects on wildlife resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Alternative B would not limit the use of wildland fire as a tool for achieving objectives for vegetation, wildlife habitat, or forage. Alternative B would manage rehabilitation wherever there is fire-related damage. Adverse impacts to wildlife are expected from these actions. Alternative B would also restrict the use of heavy equipment to existing roads and trails. Unplanned fire management actions under Alternative B are likely to occur in greater than ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (five to ten percent of habitats important to migratory game birds and big game; one to five percent of habitats important to trophy game and non-game migratory birds, and less than one percent of habitat important to migratory game birds and raptors); therefore, unplanned fire management actions under Alternative B would have major adverse effects on wildlife resources.

Biological Resources

Vegetation – Forests and Woodlands
Alternative B forests and woodlands management would promote a natural landscape with little physical management or alteration of the forests and woodlands environment. In this natural environment, wildlife would likely thrive. Stochastic events that destroy large expanses of wildlife habitat would be more likely to occur under Alternative B without specific management to control insects, diseases, and wildfires, although treatment to prevent these events are just as likely to impact wildlife habitats as drastically over the short term.

Forest and woodland management actions under Alternative B are likely to occur in greater than ten percent of habitats important to big game, small game birds, non-game migratory birds,

and raptors (five to ten percent of habitats important to trophy game and migratory game birds and less than one percent of habitat important to all other wildlife species); therefore, forests and woodlands management actions under Alternative B would have major beneficial effects on wildlife resources.

Vegetation – Grassland and Shrubland Communities
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for grassland and shrubland communities (habitat improvement). Under Alternative B, native plant species would be the only type authorized for reclamation activities. This would be beneficial to wildlife habitats as it would promote natural reclamation and regeneration of vegetative communities. Under Alternative B, native plant reclamation would occur within greater than ten percent of habitats important to big game, small game birds, migratory game birds, non-game migratory birds, and raptors (five to ten percent of habitats important to trophy game and less than one percent of habitats important to all other wildlife species); therefore, grassland and shrubland community management actions under Alternative B will have major beneficial effects on wildlife resources.

Vegetation – Riparian/Wetland Resources
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for riparian/wetland resources (habitat improvement). Under Alternative B, natural riparian and wetland ecosystems would be restored and surface-disturbing restriction would be applied within 500 feet of riparian/wetland systems, aquatic habitat, and floodplains. These restrictions would also encompass greater than ten percent of habitats important to big game, trophy game, small game birds, migratory game birds, non-game migratory birds and raptors (five to ten percent of habitats important to all other wildlife species); therefore, riparian/wetland resource management actions under Alternative B will have major beneficial effects on wildlife resources.

Invasive Species and Pest Management
Not limiting aerial application of pesticides and treating cheatgrass on a landscape scale would provide an opportunity to apply large-scale treatments on a variety of topography. Over the long term this would benefit wildlife by improving the ecological condition of the treated sites. Over the short term this could greatly increase adverse effects on wildlife. The greater the distance from riparian and wetland areas that chemicals are applied, the less the potential for impacts associated with vegetation removal, soil disturbances, or chemical spills to these resources. Therefore, direct adverse impacts to wildlife habitat associated with management actions for invasive species and pests under Alternative B are expected to be negligible.

Fish and Wildlife Resources – Fish
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for fish resources (habitat improvement and conservation). Under Alternative B, reservoirs and riparian areas would be improved or enhanced and surface-disturbing restriction would be applied within 0.25 mile of water bodies containing native and desirable non-native fish. These restrictions would also encompass greater than ten percent of habitats important to all wildlife species, except trophy game and small game birds; therefore, fish resource management actions under Alternative B will have major beneficial effects on wildlife resources.

Special Status Species – Plants
The types of effects from Alternative B would be the same beneficial effects as

described in the *Impacts Common to All Alternatives* section for special status plant species (habitat improvement and conservation). Under Alternative B, livestock grazing would be managed to protect special status plant species and surface-disturbing restriction would be applied within habitat for special status plant species. These restrictions would also encompass greater than ten percent of habitats important to big game and trophy game (five to ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals; one to five percent of habitats important to small game birds and less than one percent of habitats important to all other wildlife species); therefore, special status plant species management actions under Alternative B will have major beneficial effects on wildlife resources.

Special Status Species – Fish
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for special status fish resources (habitat improvement and conservation). Under Alternative B, stream segments important to special status fish species would be improved or enhanced and surface-disturbing restriction would be applied within 0.25 mile of water bodies containing special status fish species. These restrictions would also encompass five to ten percent of habitats important to migratory game birds (one to five percent of habitats important to big game, trophy game, non-game migratory birds, and raptors and less than one percent of habitats important to all other wildlife species); therefore, special status fish species management actions under Alternative B will have moderate beneficial effects on wildlife resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for special status wildlife species (habitat improvement and conservation). Under Alternative B, wildlife habitats would be enhanced; wildlife migration corridors would be maintained; fences would be altered to reduce hazards to Greater Sage-Grouse; anti-perching devices would be required on all overhead powerlines; Greater Sage-Grouse habitat restoration would occur throughout the planning area; and surface occupancy prohibitions and surface-disturbing restrictions would be applied within habitat for numerous special status wildlife species. These improvements and restrictions would also occur in greater than ten percent of habitats important to all wildlife species; therefore, special status wildlife species management actions under Alternative B will have major beneficial effects on wildlife resources.

Heritage and Visual Resources

Cultural Resources
Under Alternative B, prohibiting surface-disturbing activities within 5 miles or the visual horizon of historical properties would have beneficial effects to wildlife habitat where these resources overlap. Cultural site avoidance areas would also conserve greater than ten percent of habitats important to all wildlife species, except raptors (five to ten percent) and migratory game birds (less than one percent), therefore, cultural resources management actions under Alternative B would have major beneficial effects on wildlife resources.

Paleontological Resources
Under Alternative B, identifying paleontological casual collection areas, would not occur. This has the potential to adversely impact wildlife and wildlife habitat by trampling or eliminating vegetation and compacting soils throughout the footprint of the access and general causal use of areas containing wildlife and wildlife habitats. Therefore, direct adverse impacts

to wildlife and wildlife habitat associated with the management actions for unidentified casual collection areas in Alternative B are anticipated to be major.

Visual Resources
Under Alternative B, management of VRM Class II areas could prohibit or limit some surface-disturbing activities and therefore protect wildlife habitats. VRM Class III and IV areas would have minor limitations. Alternative B visual resources management would benefit greater than ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (less than one percent of habitats important to all other wildlife species); therefore, VRM actions under Alternative B would have major beneficial effects on wildlife resources.

Land Resources

Forest Products
Limiting saw timber sales to specified forest areas and to limited acreage would lessen adverse impacts to wildlife and wildlife habitat. In coordination with wildlife specialists, important wildlife areas could be specified as saw timber sale avoidance areas during times of the year when it is most crucial for these species to remain undisturbed. Forest product harvest would be allowed in one to five percent of habitats important to small game mammals, migratory game birds, predator species, furbearers, and non-game mammals (less than one percent of habitats important to all other wildlife species); therefore, forest product management actions under Alternative B would have minor adverse effects on wildlife resources.

Lands and Realty
Under Alternative B, retaining lands with agricultural potential, water, or important natural resource values would benefit wildlife. These lands would be identified early and given a heightened level of importance, therefore retaining lands that might also be important to wildlife. Acquiring new lands also would benefit wildlife, because when new lands are acquired, management for wildlife and wildlife habitat on those lands would increase in intensity. Lands available for tenure adjustments under Alternative B contain greater than ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (one to five percent of habitats important to small game birds, non-game migratory birds, and raptors and less than one percent of habitats important to all other wildlife species); therefore, management actions for lands and realty under Alternative B would have major beneficial effects on wildlife resources.

Renewable Energy
Alternative B would have the fewest adverse impacts to wildlife through the exclusion of renewable-energy development in areas also closed to other forms of energy development (minerals leasing, locatable minerals, salable minerals, ROW, and other areas where there are restrictions on surface disturbance). Renewable energy would be allowed on 6,131 acres. This would impact greater than ten percent of habitats important to big game, trophy game, small game birds, non-game migratory birds and raptors (five to ten percent of habitat important to all other wildlife species); therefore, renewable energy management actions under Alternative B would have major adverse effects on wildlife resources.

Rights-of-Way and Corridors
Alternative B ROW and corridors management actions would benefit wildlife.
Requiring co-location of facilities and identifying and implementing specified utility corridors

in coordination with the wildlife specialist would decrease the potential for adverse impacts to wildlife and wildlife habitats by ensuring their complete avoidance. Acreages of ROW avoidance and exclusion areas would be greatest under this alternative. 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 protect riparian areas. Under Alternative B, ROWs and corridors would be permitted in greater than ten percent of habitats important to all wildlife species; therefore, ROW and corridor management actions under Alternative B would have major adverse effects on wildlife resources.

Travel and Transportation Management

Under Alternative B, allowing travel in areas other than those limited to designated routes only under a special use permit would benefit wildlife and wildlife habitats. Such permits specifically direct permit holders to avoid locations where the BLM has identified important wildlife habitats. Motorized travel would be closed in five to ten percent of habitats important to big game and trophy game, small game mammals, small game birds, predator species, furbearers, non-game mammals, and non-game migratory birds (one to five percent of habitats important to migratory game birds and less than one percent of habitats important to raptors). Transportation and access impacts could occur in the majority of wildlife habitats in the planning area; however, motorized vehicle use would only be allowed on designated roads and trails on approximately 20 percent of BLM-administered surface lands and restricted seasonally during critical periods for big game reducing impacts to wildlife where the BLM has discretion. Therefore, management actions for TTM under Alternative B would have minor adverse effects on wildlife resources.

Recreation

The types of impacts to wildlife under Alternative B from recreation management actions would be generally the same as under Alternative A, except Burnt Hollow, Cabin Canyon, Dry Creek Petrified Tree, Middle Fork Powder River, Mosier Gulch, Welch Ranch, Weston Hills, and Hole-in-the-Wall all would be managed as SRMAs. This action would reduce disturbance to wildlife and wildlife habitat on 55,529 acres, and 84,668 additional acres would be protected through the implementation of a 0.5-mile buffer surrounding SRMAs that would be closed to minerals leasing. These restrictions would conserve one to five percent of habitats important to all wildlife species except small game birds, non-game migratory birds, and raptor (less than one percent); therefore, recreation management actions under Alternative B would have minor beneficial effects on wildlife resources.

Lands with Wilderness Characteristics

Managing areas with wilderness characteristics and lands with wilderness characteristics areas to emphasize primitive recreational opportunities and natural values would benefit wildlife and wildlife habitat. Management would include closing areas to or limiting use of motorized vehicles, closing areas to minerals leasing, excluding ROWs, and prohibiting surface-disturbing activities not compatible with retaining or enhancing the areas' natural values. These prohibitions/restrictions would encompass one to five percent of habitats important to small game mammals, predator species, furbearers, and non-game migratory birds (less than one percent of habitats important to all other wildlife species); therefore, management actions for lands with wilderness characteristics would have minor beneficial effects on wildlife resources.

Livestock Grazing Management

Alternative B incorporates several actions to adjust livestock grazing management to achieve

multiple resource health and objectives. These measures would result in slightly less grazing pressure and trampling damage to wildlife habitat. Grazing livestock management under Alternative B would occur in greater than ten percent of habitats important to all wildlife species, except small game birds, non-game migratory birds, raptors (five to ten percent) and migratory game birds (one to five percent), therefore livestock grazing management actions under Alternative B would have major beneficial effects to wildlife resources.

Special Designations

Areas of Critical Environmental Concern

Under Alternative B, designating approximately 511,000 acres of ACECs in eight areas would protect sensitive habitats (see Table 4.36, " Habitats Important to Wildlife in ACECs under Alternative B" (p. 1152)).

Table 4.36. Habitats Important to Wildlife in ACECs under Alternative B

ACEC Designations	Habitats Important to Wildlife							
	Crucial big-game ranges	Big-game migration corridors	Elk security habitat	Fortification Creek WHMA, including yearlong	Within 750 feet of sharp-tailed grouse leks	Within 0.64 mile of sharp-tailed grouse leks	Raptor nest biologic buffers	Within 1.5 miles of raptor nests
Cantonment Reno	0	0	0	0	0	0	523 / 0.02%	523 / 0.01%
Burnt Hollow	0	365 / 0.03%	0	0	0	0	0	1,548 / 0.04%
Dry Creek Petrified Tree EEA	0	0	0	0	0	0	0	1 / 0.0%
Fortification Creek Elk Area	23,623 / 5%	0	20,308 / 2%	29,243 / 29%	74 / 2%	1,372 / 1%	7,134 / 0.3%	21,335 / 0.6%
Hole-in-the-Wall	75,909 / 17%	0	0	0	0	0	0	543 / 0.01%
Pumpkin Buttes	0	0	0	0	0	0	1,239 / 0.1%	1,691 / 0.04%
Welch Ranch	0	0	0	0	0	89 / 0.1%	48 / 0.0%	685 / 0.02%
Sagebrush Ecosystem	22,112 / 0.3%	4,035 / 0.05%	13,179 / 0.18%	15,871 / 0.22%	250 / 0.00%	3,581 / 0.05%	198,257 / 2.7%	317,613 / 4.32%

Source: BLM 2012f

Note: Percentages in table represent the percent of the habitats important to wildlife (columns) that overlaps ACECs (rows).

% percent
ACEC Area of Critical Environmental Concern
EEA Environmental Education Area
WHMA Wildlife Habitat Management Area

Measures identified for the proposed ACECs that would directly benefit wildlife and wildlife habitat include: (1) closing or limiting motorized vehicle use; (2) closing the areas to minerals leasing; (3) recommending withdrawal from locatable mineral entry; (4) closing the areas to salable minerals; (5) excluding ROWs; and (6) prohibiting all other surface-disturbing activities not compatible with retaining or enhancing the areas' values.

Scenic or Back Country Byways and Wild and Scenic Rivers
Management actions for scenic or BCBs and management actions for WSRs would have no effect on wildlife resources.

Wilderness Study Areas
Alternative B management of the three areas proposed to Congress as WSAs would provide an additional 28,931 acres of protection of sensitive habitats (Table 4.37, "Habitats Important to Wildlife in Wilderness Study Areas" (p. 1153)). This would have a minor beneficial effect on wildlife and wildlife habitats.

Table 4.37. Habitats Important to Wildlife in Wilderness Study Areas

Wilderness Study Areas	Habitat Important to Wildlife							
	Big-game ranges	Big-game migration corridors	Elk security habitat	Fortification Creek WHMA, including yearlong	Within 750 feet of sharp-tailed grouse leks	Within 0.64 mile of sharp-tailed grouse leks	Raptor nest buffers	Within 1.5 miles of raptor nests
Gardner Mountain	1,034 / 0.2%	204 / 0.2%	5,354 / 0.6%	12,417 / 12%	0	0	0	0
North Fork Powder River	2,150 / 0.5%	1,639 / 1%	10,019 / 1%	0	0	0	0	0
Fortification Creek	12,184 / 3%	0	11,233 / 1%	0	73 / 2%	1,318 / 1%	530 / 0.002%	7,212 / 0.2%

Source: BLM 2012f

Note: Percentages in table represent the percent of habitats important to wildlife (columns) that overlaps wilderness study areas (rows).

% percent
WHMA Wildlife Habitat Management Area

Measures identified for the WSAs that would directly benefit wildlife and wildlife habitat include: (1) closing the areas to minerals leasing; (2) recommending withdrawal from locatable minerals entry; (3) closing the areas to salable minerals; (4) excluding ROWs; (5) prohibiting all other surface-disturbing activities not compatible with retaining or enhancing the areas' values; and potentially (6) prohibiting all motorized and mechanized equipment.

4.4.6.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource use, and the likely resulting impacts to wildlife resources due to its implementation.

Fish and Wildlife Resources – Wildlife
Alternative C wildlife management actions include not modifying fences that prevent wildlife movements; not augmenting wildlife populations; not applying restrictions (seasonal or year-round) to surface-disturbing or disruptive activities, other than seasonal restrictions for raptor nests; and not requiring burial of new powerlines. This approach would protect only nesting raptors during incubation periods and would not protect other wildlife resources. Under Alternative C, activities allowed in suitable habitat could preclude the potential for future management decisions to expand or maintain the proliferation of these species through active management.

Alternative C impacts to wildlife would, in most cases, be similar to those described for Alternative A and under Impacts Common to All Alternatives. Where impacts to wildlife would vary in degree from impacts under Alternative A, further rationale is provided below.

Physical Resources

Air Quality

There would be no air quality modeling under Alternative C. Industrial projects would be expected to approach or exceed emissions standards, and no mitigation strategies would be examined. This would have indirect adverse impacts to wildlife. Vegetation is possibly more sensitive to air pollutants than humans. In particular, acid rain has left areas barren or with severely damaged vegetation. Ground-level ozone and reactive nitrogen can cause discoloration, damage, and loss of leaves, which can reduce photosynthesis by as much as 50 percent. As a result, biologically significant quantities of reactive nitrogen are now reaching the highest places. At lower elevations in the western United States, introduced grasses stoked by nitrogen are overwhelming many ecosystems. Plants also become more vulnerable to attacks by pests, disease, and environmental disasters. Consequently, the plant's ability to store food, grow, and reproduce is hindered. Adverse impacts to vegetation would directly correlate with adverse impacts to wildlife and would be major.

Soil

Under Alternative C, soils management actions would include allowing surface-disturbing activities on slopes equal to or greater than 25 percent and on soils with a severe erosion hazard, and allowing proposed activities in badlands, on rocky outcrops, and on slopes susceptible to mass movement, all of which would affect 218,928 acres. Alternative C would not limit vehicular travel on saturated soils or require closure and reclamation of roads if they are heavily eroded, washed out, or if other access roads in better condition are available. All these actions would allow activities on all soil types, regardless of soil-limiting properties. These actions would not protect soil resources and would promote soil and water erosion. This would have an indirect adverse impact on wildlife by reducing the health of the medium in which vegetation (wildlife habitat) grows. Surface-disturbing activities on soils would be permitted in greater than ten percent of habitats important to all wildlife species; therefore, management actions under Alternative C would have major adverse effects on wildlife resources.

Water Resources

Alternative C water management actions that would allow surface disturbances within 500 feet of natural or man-made water features would have a direct adverse effect on wildlife habitats where these resources overlap. Additional project-specific allowances for on-channel reservoirs, even though they could adversely affect natural flow regimes, could have an indirect adverse impacts to wildlife habitat by transitioning the plant species in those communities and providing the opportunity for invasive plant species to move into these sites, making habitat no longer suitable for native wildlife. Surface-disturbing activities would now also be allowed within greater than ten percent of habitats important to small game birds and migratory game birds (five to ten percent of habitat important to big game, trophy game, and raptors and one to five percent of habitats important to all other wildlife species); therefore, management actions for water under Alternative C would have major adverse effects on wildlife resources.

Cave and Karst Resources

Alternative C management actions for cave and karst resources include establishing project-specific buffers (100 feet, for a total of 11 acres of protection) from significant cave

entrances to minimize the effects of surface-disturbing activities in cave and karst areas. Implementation of a Cave Management Plan would directly benefit wildlife communities because it would limit disturbance of the vegetative community from minerals development or by people. Development of the plans considering direction described in WO IM 2010-181, would reduce threats to bats from WNS. Mineral activities would be managed near cave entrances. Alternative C would not restrict livestock grazing in areas with cave and karst resources. This would have direct adverse impacts on wildlife and wildlife habitat where these resources are adjacent to one other. Cave and karst areas encompass greater than ten percent of habitats important to big game and trophy game (less than one percent of habitats important to all other wildlife species); therefore the management actions for cave and karst resources under Alternative C should have major adverse effects to wildlife resources.

Mineral Resources

Locatable Minerals

At present, the Amsden Creek, Middle Fork Canyon, and Kerns game ranges are withdrawn from minerals location. Locatable minerals activities are restricted in the Fortification Creek, Gardner Mountain, and North Fork WSAs. Alternative C does not include recommendations for new withdrawals or restrictions. The existing withdrawals and restrictions were imposed for the protection and preservation of other resource values. Not protecting additional areas from minerals location would have a direct, minor adverse effect on wildlife and wildlife habitats. Locatable mineral activities would be permitted in greater than ten percent of habitats important to all wildlife species; therefore, management actions for locatable minerals under Alternative C would have major adverse effects on wildlife resources.

Leasable Minerals – Coal

The management action listed under Alternative C is administrative, and will have no effect on wildlife resources.

Leasable Minerals – Fluids

Under Alternative C, fluid mineral development would be permitted, under some constraints, on all but 30,520 acres in the planning area. This would allow development within greater than ten percent of habitats important to all wildlife species, except migratory game birds (five to ten percent) and trophy game (no effect), therefore, management actions for fluid minerals under Alternative C would have major adverse effects on wildlife resources.

Salable Minerals

3,290,908 acres of federal mineral estate would be open to salable mineral activities. Salable mineral development could occur in greater than ten percent of habitats important to all wildlife species, except small game birds and migratory birds (five to ten percent), big game (one to five percent), and trophy game (less than one percent), therefore, management actions under Alternative C would have major adverse effects on wildlife resources. There is no anticipated disturbance from geothermal activities.

Fire and Fuels Management

Unplanned Fire (Wildfire)

Management actions involving the application of full suppression regardless of other resource objectives would have a direct adverse impact to wildlife communities. The use of heavy equipment with few constraints would have a direct adverse impact over the short and long

terms by increasing opportunities for soil and water erosion and invasive plant establishment. Unplanned fire is likely to occur in five to ten percent of habitats important to small game birds, non-game migratory birds, and raptors (and one percent or less of habitats important to all other wildlife species); therefore, management actions for unplanned fire under Alternative C would have moderate adverse effects on wildlife resources.

Planned Fire (Prescribed Fire)
The adverse effects described in the unplanned fire portion above would also be the adverse effects of planned fire. Prescribed fires are planned, during the next 20 years, within greater than ten percent of habitats important to all wildlife species, except migratory game birds and raptors (five to ten percent), big game (one to five percent), and trophy game (less than one percent); therefore, management actions for planned fire under Alternative C would have major adverse effects on wildlife resources.

Biological Resources

Vegetation – Forests and Woodlands
Alternative C impacts to wildlife and wildlife habitat from forests and woodlands management would be the same as impacts under Alternative A, except that Alternative C would increase the removal of trees. This would open larger spaces in the forest, which would alter habitats for most of the forest-dwelling wildlife in the planning area. Forest and woodland management would impact five to ten percent of habitats important to big game and migratory game birds (one to five percent of habitat important to trophy game and less than one percent of habitats important to all other wildlife species); therefore, management actions for forest and woodlands would have moderate adverse effects on wildlife resources.

Vegetation – Grassland and Shrubland Communities
Under Alternative C, allowing desirable non-native plant species for initial reclamation activities would have an adverse impacts to wildlife and wildlife cover and forage. This action could promote the growth of non-native plant species that might out-compete the native plants that wildlife desire. This type of reclamation would occur in greater than ten percent of habitats important to big game (five to ten percent of habitats important to trophy game and migratory game birds and less than one percent of habitats important to all other wildlife species); therefore, management actions for grassland and shrubland communities under Alternative C would have major adverse effects on wildlife resources.

Vegetation – Riparian/Wetland Resources
Under Alternative C, management actions for riparian and wetland areas would have the same major adverse effects on wildlife resources as described in the *Water* section of Alternative C.

Invasive Species and Pest Management
Allowing aerial application to only insecticides would limit the application of pesticides to terrain accessible only by foot, which would mean only small acreages would be treated. This would have a short-term beneficial impact to wildlife because it would be less disruptive. However, there would be an adverse impact to vegetative communities over the long-term by giving invasive species a competitive advantage over native vegetation. Annually treating only designated areas for cheatgrass would be ineffective because there would be only small, scattered treatments; therefore, most of the cheatgrass would be unaffected. This would have a moderate adverse effect on wildlife habitat.

Fish and Wildlife Resources – Fish
Fish management actions under Alternative C include allowing surface-disturbing and disruptive activities within 0.25 mile of naturally occurring water bodies, but not within 500 feet of these areas. These management actions would not limit the number of projects and would apply a minimal distance for projects way from streams. Disturbing soil and vegetation increase the potential for soil and water erosion and indirectly contributes to the decline in water quality over the long term. These areas are also very susceptible to hydrophilic invasive species such as Canada thistle and salt cedar that would out-compete native vegetation, essentially removing riparian communities. This would reduce wildlife habitat protection zones by 703,581 acres compared to Alternative B. Prohibition/restrictions would encompass greater than ten percent of habitats important to big game and migratory game birds only (five to ten percent of habitats important to trophy game and small game birds, one to five percent of habitats important to non-game migratory birds, and less than one percent of habitats important to all other wildlife species); therefore, management actions for fish under Alternative C would have major beneficial effects on wildlife resources.

Special Status Species – Fish, **Special Status Species – Plants and Wildlife (including Greater Sage-Grouse)**
Under Alternative C, prohibitions on surface-disturbing activities for the protection of special status plant, fish, and wildlife species would reduce adverse impacts to all wildlife. This management would have a major beneficial impact to wildlife habitats where these resources overlap. Avoidance areas for other resources would, by nature, be NSO areas for important wildlife habitats. Prohibitions for special status fish species would also conserve one to five percent of habitats important to big game, trophy game and migratory game birds (less than one percent for all other wildlife species); therefore, management action for special status fish species would have minor beneficial effects on wildlife resources. Surface-disturbing prohibitions for special status plant species would also conserve greater than ten percent of habitats important to big game and trophy game (one percent or less for all other wildlife species) and, for special status wildlife species, greater than ten percent of habitats important to all wildlife species, except trophy game (five to ten percent) and non-game migratory birds (one to five percent); therefore, management actions for both special status plant and wildlife species would have major beneficial effects on wildlife resources.

Heritage and Visual Resources

Cultural Resources
Under Alternative C, allowing surface disturbance in areas with historic properties would impact wildlife habitat adversely by increasing opportunities for soil and water erosion, invasive species to establish, and direct removal of habitat. There are 330,592 acres of important wildlife habitats on BLM surface within 5 miles of historic properties in the planning area. Alternative C management actions for cultural resources would be the same as under Alternative A (major beneficial).

Paleontological Resources
Alternative C management actions that limit the requirement for paleontological field surveys to all PFYC Class 4 and 5 formations potentially affected by proposed activities would affect 28,177 acres. Not restricting surface-disturbing activities would subject wildlife habitats to possible large-scale surface disturbance. This would increase the opportunity for wildlife habitat to be directly removed and further fragmented. However, identifying

paleontological casual collection areas could reduce adverse impacts to wildlife and wildlife habitat from trampling or eliminating vegetation, compacting soils throughout the footprint of the access, and general disruption to wildlife from causal use of these areas. The greater the avoidance distance from riparian areas, wetlands, sand dunes, and other such habitats, the less the potential for impacts associated with vegetation and soil disturbances. Prohibitions/restrictions for paleontological resources would encompass one to five percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (less than one percent of habitats important to all other wildlife species); therefore, management actions for paleontological resources under Alternative C would have minor beneficial effects on wildlife resources.

Visual Resources

Under Alternative C, managing VRM Class II areas as VRM Class III would allow more surface-disturbing activities; 167,334 acres would be managed as VRM Class III. This would reduce the beneficial effects of VRM on wildlife habitat by increasing opportunities for soil and water erosion and for invasive species to get established. Active management would now occur on less than one percent of habitats important to all wildlife species; therefore, Alternative C management of visual resources would have a negligible beneficial effect on wildlife.

Land Resources

Forest Products

Alternative C impacts to wildlife from forest product management actions would be similar to effects under Alternative A, except that adverse impacts would be greater under Alternative C because the sale of forest products would no longer be limited to minor products without limits to acreage, and with the intent to maximize the removal of harvested products. Offering a greater array of products would intensify the adverse impacts. In addition, not fencing regeneration areas could subject wildlife habitat in these areas to grazing and potential loss. Forest product harvests could occur in greater than ten percent of habitats important to migratory game birds (one to five percent of habitats important to big game and trophy game and less than one percent of habitats important to all other wildlife species); therefore, management actions for forest products under Alternative C would have major adverse effects on wildlife resources.

Lands and Realty

Under Alternative C, disposing of lands with agricultural potential, water, or important natural resource values would have a major adverse effect on wildlife and wildlife habitats. Alternative C does not consider these values on a project-specific basis and does not require that these lands be retained based on these important values. Disposal of these lands would dispose greater than ten percent of habitats important to small game mammals, predator species, furbearers, and non-game mammals (one to five percent of habitats important to small game birds, non-game migratory birds, and raptors and less than one percent of habitats important to all other wildlife species); therefore, management actions for lands and realty under Alternative C would have major adverse effects on wildlife resources.

Renewable Energy and Rights-of-Way and Corridors

Renewable energy and ROWs and corridors management actions would not promote relocations of proposed new roads and access routes to those already in existence and would not prohibit renewable energy or ROWs and corridors on slopes equal to or greater than 25 percent and on highly erodible soils. Exclusion areas for ROWs, including renewable energy, would include 28,554 acres. Renewable energy and ROWS and corridors could be permitted within greater than ten percent of habitats important to all wildlife species, except small game migratory birds (one to

five percent), therefore, management actions for renewable energy and ROWs and corridors under Alternative C would have major adverse effects on wildlife resources.

Travel and Transportation Management
The types of effects from Alternative C would be the same adverse effects as described in Alternative A, TTM (habitat loss, degradation and fragmentation). Travel and transportation could be permitted within greater than ten percent of habitats important to all wildlife species, except migratory game birds (five to ten percent) and raptors (less than one percent), therefore, management actions for TTM under Alternative C would have major adverse effects on wildlife resources.

Recreation
Recreational activities that result in increased human presence would have localized impacts on wildlife. These activities would include hiking, biking, camping, boating, fishing, hunting, and sightseeing. Although many recreational activities are nonconsumptive, they can affect wildlife and their habitats. Increased human presence could result in habitat or wildlife disturbance (e.g., dispersal or avoidance). If recreational activities occurred in non-crucial habitats or during seasons when sensitive wildlife species were not present and in compliance with recreation management actions, impacts likely would be negligible. During seasonally sensitive periods (e.g., winter, calving, breeding, nesting, and early brood rearing), recreational activities could significantly alter animal behavior and result in increased winter mortality or lowered reproductive success. Surface-disturbing and salable mineral development activities would be allowed, where consistent with other resource values. The management actions under Alternative C would impact five to ten percent of habitats important to wildlife species. Over the long term and where the two resources overlap, recreational activities would have moderate adverse impacts on wildlife.

Lands with Wilderness Characteristics
Alternative C management actions include no specific management for wilderness characteristic. BLM's 1979 wilderness inventory (BLM 1979) concluded that there were no areas within the planning area that contained wilderness characteristics outside the three WSAs. Alternative C management of areas of wilderness characteristics would have no effect on wildlife and wildlife habitat.

Livestock Grazing Management
Livestock grazing management actions under Alternative C include allowing increases in livestock stocking rates as a result of vegetative treatments, and providing a maximum of two years rest following prescribed fire, wildfire (in lieu of an approved plan), and other vegetative treatments. These actions would compromise the health of wildlife habitat. Livestock are often attracted to new vegetation following vegetative treatments and fires. If not monitored, these sites can be overutilized, and if stocking rates are increased, could compound the issue. Two years of rest might not be enough to achieve preferred ecological condition and vegetation management goals. Alternative C also incorporates actions to adjust management of livestock grazing to make grazing the first priority. This measure would result in increased grazing pressure and trampling damage to wildlife habitat. Anticipated adverse impacts to wildlife from livestock grazing under Alternative C are anticipated to increase where grazing allotments contain suitable habitat for wildlife. (See the livestock grazing analysis under Alternative A for this overlap.) In addition, livestock salt or mineral supplements would be permitted within 500 feet of water sources, riparian areas, and aspen stands. This would decrease protection buffers for wildlife habitat in these areas by 19,861 acres throughout the planning area. Overall, livestock grazing management

under Alternative C would impact greater than ten percent of habitats important to all wildlife species; therefore, having major adverse effects on wildlife resources.

4.4.6.6. Alternative D

This section describes management actions under Alternative D, which employs a combination of resource conservation and resource use, and the likely impacts to wildlife resources due to their implementation and potential impacts to wildlife resources from those management actions.

Fish and Wildlife Resources – Wildlife
Alternative D impacts to wildlife would be similar to those under Alternative B, except that the following would be allowed by exception:

- Surface-disturbing and disruptive activities throughout the life of the project during seasons important for wildlife.
- Aboveground powerlines.
- Fluid minerals production and byproducts not be piped out of crucial elk winter range and calving areas.
- Aboveground facility development in elk crucial winter range and calving areas.
- Surface disturbance and occupancy within USFWS-recommended biologic buffer zones around active nests of raptor species of conservation concern.

A WHMA would not be designated for the Fortification Creek elk herd. In addition, although timber harvest would be allowed in crucial elk habitat and hiding cover, this activity would be performed in such a way as to maintain current amounts of functional habitat, and all other activities in elk seasonal ranges would remove or alter no more than 15 percent of the existing security habitat. These actions provide less protection for elk habitat, but would provide adequate elk habitat while allowing other uses on the landscape.

The types of impacts to wildlife associated with maintenance and reestablishment of travel corridors for big-game species would be the same as impacts under Alternative B, except that Alternative D would retain only identified priority travel corridors. This would result in 9,587 acres of travel corridor avoidance. Alternative D would prohibit surface-disturbing activities around plains sharp-tailed grouse leks on 3,601 acres, because the buffer under Alternative D would be within 0.25 mile of the perimeter of these leks.

Physical Resources

Air Quality
Alternative D impacts to wildlife from air quality management would be the same beneficial as impacts under Alternative B (habitat conservation). Under Alternative D, though, modeling would only occur on a project-specific basis and mitigation strategies would then be developed. The modeling and mitigation would likely occur within greater than ten percent of habitats important to big game, small game birds, migratory game birds, non-game migratory birds, and raptors (five to ten percent of habitats important to all other wildlife species); therefore, management actions for air quality under Alternative D would have major beneficial effects on wildlife resources.

Soil
Alternative D impacts on wildlife from soils management would be similar to impacts under Alternative B, except that Alternative D could allow activities by exception on 215,496 acres of highly erosive soils, 170,590 acres on slopes equal to or greater than 25 percent, on 455,090 acres

of soils with poor reclamation suitability, on a limited basis, on 218,928 acres of badlands, rock outcrops and slopes susceptible to mass movement. In addition, applying a CSU stipulation to oil and gas leases would protect wildlife on an additional 669,739 acres of highly erosive soils, 412,145 acres on slopes equal to or greater than 25 percent, 1,514,445 acres of soils with poor reclamation suitability, and on a limited basis, on 685,950 acres of badlands, rock outcrops and slopes susceptible to mass movement that might be associated with a federal mineral leases. For the impacts to remain the same as those described under Alternative B, these exceptions must be evaluated for site-specific impacts to wildlife and must not be granted where there would be conflicts. These CSU areas would encompass greater than ten percent of habitats important to all wildlife species; therefore, management actions for soil under Alternative D would have major beneficial effects on wildlife resources.

Water Resources

The following Alternative D water management actions would impact wildlife the same as Alternative A: prohibiting surface disturbance within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams, applying a CSU stipulation on oil and gas leases, and evaluating unneeded reservoirs. These CSU areas would encompass greater than ten percent of habitats important to big game (one to five percent of habitats important to trophy game and less than one percent of habitats important to all other wildlife species); therefore management actions for water under Alternative D would have major beneficial effects on wildlife resources.

Beneficial impacts to wildlife would be the same as described for Alternative B and result from management actions associated with water that encourage the use of alternative energy sources to power new water resource developments as opposed to overhead power or petroleum-based, and that manage riparian and upland areas to restore perennial flows or standing water. Conversely, adverse impacts to wildlife would be the same as described for Alternative C and result from management actions associated with water that allow on-channel reservoirs, surface water discharge, maintenance of existing water supply sources, and conversion of abandoned oil and gas wells to water supply wells.

Cave and Karst Resources

The types of impacts associated with Alternative D management of cave and karst resources would be generally the same types of impacts as Alternative A. In addition, implementation of a Cave Management Plan for the entire planning area would increase potential beneficial impacts to wildlife where these resource overlap. Human activity in caves would be managed through Cave Management Plans, developed considering direction described in WO IM 2010-181, which would reduce threats to bats from WNS. Cave and karst resources contain greater than ten percent of habitats important to big game (one to five percent of habitats important to trophy game and less than one percent of habitats important to all other wildlife species); therefore, management actions for cave and karst resources under Alternative D would have major beneficial effects on wildlife resources.

Mineral Resources

Locatable Minerals

Alternative D locatable minerals management actions would have effects on wildlife similar to management under Alternative B, although Alternative D would open more area (4,720,586 acres) to locatable minerals entry. Locatable minerals entry would be permitted within greater than ten percent of habitats important to small game mammals, predator species, furbearers and non-game mammals (five to ten percent of habitats important to migratory game birds, one to five

percent of habitats important to small game birds, and less than one percent of habitats important to all other wildlife species); therefore, management actions for locatable minerals under Alternative D would have major adverse effects on wildlife resources.

Leasable Minerals – Coal
The management action listed under Alternative D is administrative, and will have no effect on wildlife resources.

Leasable Minerals - Fluid, and Salable Minerals
Alternative D impacts to wildlife from the management of leasable minerals would be similar to impacts described under Alternative C, with 3,285,316 acres open to oil and gas leasing, and 2,725,060 acres open to salable minerals disposal. The amount of minerals extraction that would occur under this alternative would create a substantial increase in land use intensity, and would result in greater potential for loss or degradation of habitats that support various wildlife species. Leasable fluid minerals would be permitted in greater than ten percent of habitats important to all wildlife species, except migratory game birds (five to ten percent) and trophy game (no effect). Salable minerals would be permitted in greater than ten percent of habitats important to all wildlife species, except migratory game birds (five to ten percent), big game and trophy game (less than one percent). Management actions for coal, fluid minerals, and salable minerals would have major adverse effects on wildlife resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative D, impacts to wildlife would be similar to effects under in Alternative B. However, Alternative D would decrease adverse impacts through rehabilitation after fires on an as-needed basis only; this could result in an increase in natural regeneration of wildlife habitat communities.

Biological Resources

Vegetation – Forests and Woodlands
Alternative D effects on wildlife from management of forests and woodlands and grassland and shrubland communities would be similar to effects under Alternative C, although Alternative D would place slightly more emphasis on multiple resource values than Alternative C. Alternative D would allow desirable non-native plant species for short-term reclamation activities, which would result in effects similar to Alternative B. Desirable non-native plant persistence could increase adverse impacts to wildlife if non-native proliferation causes loss of suitable wildlife habitats.

Grassland and Shrubland Communities
Impacts to wildlife from grassland and shrubland communities management actions would be the same as *Forests and Woodlands* management actions, described above.

Vegetation – Riparian/Wetland Resources
Under Alternative D, activities may be permitted by exception within 500 feet of riparian/wetland systems and aquatic habitats. For impacts on wildlife to be the same as those described for Alternative B, exceptions would have to be evaluated for the presence of special status plant species presence or habitat suitability and would not be granted where there would be conflicts. The prohibitions/restrictions would encompass greater than ten percent of habitats important to small game birds and non-game migratory birds (five to ten percent of habitats important to all

other wildlife species), therefore, management actions for riparian/wetland resources under Alternative D would have major beneficial effects on wildlife resources.

Invasive Species and Pest Management
Under Alternative D, impacts to wildlife from management actions associated with invasive species and pest management would be the same as effects under Alternative A.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Alternative D impacts on wildlife from fish management, including special status fish species, would be similar to those under Alternative B, except that Alternative D could allow activities by exception within a 0.25-mile CSU area around naturally occurring water bodies containing native and desirable non-native fish species. For the impacts to be the same as those under Alternative B, those exceptions would have to be evaluated for the presence of special status fish species or habitat suitability and would not be granted where there would be conflicts. Restrictions for the protection of fish resources would conserve greater than ten percent of habitats important to small game birds and migratory game birds (five to ten percent of habitats important to all other wildlife species). Restrictions for the protection of special status fish species would conserve five to ten percent of habitats for migratory game birds (one percent of less for all other wildlife species). Management actions under Alternative D would have major beneficial effects on wildlife resources for fish resources and moderate beneficial effects on wildlife resources for special status fish resources.

Special Status Species – Plants
Alternative D impacts on wildlife from management of special status plant species would be the same as those under Alternative C, except that a CSU stipulation would be placed on mineral leases, which would require surveys before disturbance activities could be allowed.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative D impacts on wildlife from management of special status wildlife species would be similar to those under Alternative B, except that Alternative D could allow disturbance activities by exception in black-tailed prairie dog colonies (6,156 acres) and special status amphibian, reptile, and bat species habitat (176,636 acres). For the impacts to be the same as those under Alternative B, exceptions would have to be evaluated for the presence of special status wildlife species or habitat suitability and would not be granted where there would be conflicts. With habitat removal allowances under Alternative D, less acres of suitable Greater Sage-Grouse habitat would be protected than under Alternative B. Alternative D does provide surface occupancy restrictions for Greater Sage-Grouse leks in and outside of Core Population Areas and Connectivity Corridors (0.6 mile and 0.25 mile, respectively). In addition, Greater Sage-Grouse habitats would be restored throughout the planning area in areas meeting specified criteria. The prohibitions/restrictions would encompass greater than ten percent of habitats important to all wildlife species, except big game and trophy game (less than one percent). Therefore, management actions for special status wildlife species would have major beneficial effects on wildlife resources.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources
Alternative D impact types associated with cultural and paleontological resources management would be the same as those under Alternative B, except Alternative D would protect 15,382 acres through cultural resources NSO restrictions, 613,601 acres through cultural resources

CSU restrictions, and 860 acres through paleontological resources restrictions. Table 4.38, "Habitats Important to Wildlife that Overlap Heritage Resources" (p. 1164) identifies where these restrictions overlap areas currently identified as important to wildlife.

Table 4.38. Habitats Important to Wildlife that Overlap Heritage Resources

Heritage Resources	Habitats Important to Wildlife						
	WGFD big-game HMAs	Crucial big game ranges	Priority travel corridors for big game	Elk security habitat	Proposed Fortification Creek elk WHMA	Within 0.25 mile of plains sharp-tailed grouse leks	USFWS recommended buffer zones for raptor nests
Cultural NSOs	0	607 / 0.1%	590 / 0.0%	4,174 / 0.4%	0	0	12,140 / 0.6%
Cultural CSUs	12,095 / 45%	103,494 / 24%	40,268 / 34%	215,001 / 22%	0	996 / 2%	213,669 / 10%
Paleontological NSOs	0	0	0	0	0	0	524 / 0.0%

Source: BLM 2012f

Note: Percentages in table represent the percent of habitat important to wildlife (columns) that overlaps heritage resources (rows).

% percent
CSU Controlled Surface Use
HMA Habitat Management Area
NSO No Surface Occupancy
USFWS U.S. Fish and Wildlife Service
WHMA Wildlife Habitat Management Area
WGFD Wyoming Game and Fish Department

Visual Resources

Under Alternative D, effects to wildlife resources from management actions associated with VRM would be the same as the effects under Alternative B.

Land Resources

Forest Products

Temporary adverse impacts on wildlife and wildlife habitats would be the same under Alternative D as under all other alternatives, except that Alternative D would include forest products harvest with no area size limit, although managed within ecologically stable limits; those limits would be defined at the time of site-specific project development and would include involvement of wildlife resource needs. Long-term beneficial effects would be similar to those under alternatives B and C. Under Alternative D, conflicts between the harvest of forest products and management of suitable habitat for wildlife species could occur in one to five percent of habitats important to small game mammals, migratory game birds, predator species, furbearers, and non-game mammals (less than one percent of habitats important to all other wildlife species); therefore, management actions for forest products under Alternative D would have minor adverse effect to wildlife resources.

Lands and Realty

Impacts and the types of impacts to wildlife species and their habitat from the management of land and realty under this alternative would be similar to Alternative B.

Renewable Energy and Rights-of-Way and Corridors
The types of impacts on wildlife under Alternative D management of renewable energy would be the same as those under Alternative B, except that areas excluded from renewable-energy development would total 352,068 acres, areas to be managed as ROW exclusion areas would total 79,777 acres, and ROW avoidance areas would total 321,149 acres. Renewable energy and ROWs and corridors would be allowed within greater than ten percent of habitats important to all wildlife species; therefore, management actions for renewable energy and for ROWs and corridors would have major adverse effects on wildlife resources.

Alternative D could authorize new communications sites, transmission lines, and ground facilities outside existing disturbance areas or ROW corridors by exception. For the impacts to wildlife be same as those in Alternative B, exceptions would have to be evaluated for the presence of special status plant and wildlife species or habitat suitability and would not be granted where there would be conflicts.

Travel and Transportation Management
Alternative D impact to wildlife from management of travel and transportation would be similar to those under Alternative B, except that the following acres of areas currently identified as important to wildlife would be Closed to motorized vehicle use: one to five percent of areas within WGFD big-game Herd Management Areas (HMAs), crucial big-game ranges, priority travel corridors for big game, elk security habitat, and within 0.25 mile of plains sharp-tailed grouse leks and less than one percent of areas within USFWS-recommended biologic buffer zones for raptor nests. Travel and transportation would be permitted in greater than ten percent of habitats important to all wildlife species; therefore, management actions for TTM would have major adverse effects on wildlife resources.

Recreation
The types of effects on wildlife under Alternative D management of recreation would be the same as those under Alternative B, except that no additional buffer would be provided around SRMAs to prevent minerals leasing. Seven areas would be designated as SRMAs (54,160 acres), six of which contain areas important to wildlife. Table 4.39, "Habitats Important to Wildlife that Overlap Proposed Special Recreation Management Areas" (p. 1165) lists these SRMAs and CSU areas overlap with areas currently identified as important to wildlife.

Table 4.39. Habitats Important to Wildlife that Overlap Proposed Special Recreation Management Areas

Proposed Special Recreation Management Areas	Habitats Important to Wildlife				
	WGFD big-game HMAs	Crucial big-game ranges	Priority travel corridors for big game	Elk security habitat	USFWS recommended buffer zones for raptor nests
Dry Creek Petrified Tree	0	0	0	0	65 / 0.0%
Middle Fork Canyon	2,068 / 8%	1,041 / 0.2%	3 / 0.0%	1,985 / 0.2%	0
Mosier Gulch	0	374 / 0.09%	169 / 0.1%	278 / 0.03%	0
Welch Ranch	0	0	0	0	48 / 0.0%
Weston Hills	0	0	0	0	365 / 0.02%

Proposed Special Recreation Management Areas	Habitats Important to Wildlife				
	WGFD big-game HMAs	Crucial big-game ranges	Priority travel corridors for big game	Elk security habitat	USFWS recommended buffer zones for raptor nests
Hole-in-the-Wall	0	0	0	0	464 / 0.02%

Source: BLM 2012f

Note: Percentages in table represent the percent of habitat important to wildlife (columns) that overlaps Special Recreation Management Areas (rows).

% percent
HMA Habitat Management Area
USFWS U.S. Fish and Wildlife Service
WGFD Wyoming Game and Fish Department

Lands with Wilderness Characteristics

The types of effects on wildlife under Alternative D management of lands with wilderness characteristics would be the same as those under Alternative B, except that the overall acreage would be less (6,864 acres).

Livestock Grazing Management

Under Alternative D, the types of impacts to wildlife from management actions for livestock grazing would be the same as those under Alternative B, except in areas that have been identified as incompatible with livestock grazing due to recreation designation, steep slopes, etc. In addition, Alternative D would limit the placement of salt or mineral supplement, thereby avoiding trampling damage to habitat. Restrictions for livestock grazing conserve greater than ten percent of habitats important to all wildlife species, except small game birds, migratory game birds, non-game migratory birds, and raptors (five to ten percent), therefore management actions for livestock grazing under Alternative D would have major beneficial effects on wildlife species.

Special Designations

Areas of Critical Environmental Concern

The types of impacts to wildlife associated with ACEC management actions under Alternative D would be the same as under Alternative B, except that only the Pumpkin Buttes (1,731 acres) and Welch Ranch (1,116 acres) would be designated ACECs. Restrictions for these ACECs would encompass less than one percent of habitats important to all other wildlife species); therefore, management actions for ACECs under Alternative D would have negligible beneficial effects to wildlife resources.

Scenic or Back Country Byways and Wild and Scenic Rivers

Management actions for scenic and BCBs and for WSRs would have no effect on wildlife resources.

Wilderness Study Areas

WSA management actions and effects on wildlife under Alternative D would be the same as those under Alternative B.

4.4.6.7. Cumulative Impacts

Although the BLM proposes only minor amounts of sagebrush treatments on public lands, continued modification of sagebrush on other ownerships would cumulatively reduce the availability and quality of that habitat. Cumulative effects on riparian habitats would be much more localized and site-specific due to the scattered land ownership along most streams, although improper livestock grazing and upland vegetative treatments on all ownerships could lead to riparian habitat concerns. Management changes implemented on BLM-administered lands to improve riparian conditions also could improve conditions on lands of other ownerships if the same management is applied to those lands. If some uses are restricted or eliminated on BLM-administered lands, that could cause increased use on adjacent ownerships, which would lead to degraded riparian conditions on these lands.

Forest management activities could lead to timber harvest on adjacent private and State of Wyoming lands that would use roads left in place on BLM-administered lands if they suit the activity on adjacent lands. Such activities could reduce big-game hiding cover, increase road density, and increase the overall impacts of treatments on BLM-administered lands because they would effectively be larger in scale. There also could be some cases where vegetative treatments such as prescribed fires and fuel-reduction projects that might have similar cumulative impacts would extend to adjacent ownerships, because land owners would find it more economical to have their land treated at the same time as public lands.

Cumulative effects on raptors that would result from current, proposed, and future activities such as gas and minerals exploration and development, agriculture, and urban development could include increased disturbance to nesting raptors, degradation or destruction of nesting habitats, increased raptor collisions with powerlines, increased electrocutions, and increased vehicular collisions with raptors feeding on carrion. As development brings additional powerlines to the planning area, the availability of power poles, when built to most current Avian Power Line Interaction Committee (APLIC) standards, for use as perches could benefit raptors.

Effects on migratory birds described for each of the alternatives would be in addition to impacts that have already occurred and that would occur as a result of other activities in the planning area. Similar types of direct and indirect effects have already occurred, including direct mortality, habitat loss, displacement, habitat fragmentation, and population-level effects. Evaluating the cumulative impacts of past, ongoing, and reasonably foreseeable activities is difficult because of the general lack of data on migratory birds in the planning area and the range of effects that would occur in varying degrees to various species.

Cumulative effects on upland game from current, proposed, and future activities such as gas and mineral exploration and development, agriculture, and urban development could include increased mortality, especially from collisions with vehicles and powerlines; displacement and harassment; and physical degradation or destruction of leks and reproductive areas (nesting and brood-rearing areas).

4.4.7. Special Status Species – Plants

This section describes potential direct, indirect, short-term, and long-term effects on special status plant species under each alternative and whether those effects would be beneficial or adverse. Map 34 shows the distribution of special status plants in the planning area. Appendix

I (p. 2025) describes the effects of the Proposed RMP on Ute ladies'-tresses orchids, a threatened plant.

Direct impacts to special status plant species would result from actions that may cause the loss of individual special status plants. Surface-disturbing activities, urbanization, logging activities, quarrying, sand mining, herbivory, trampling, fire, and herbicide and pesticide application would be the primary means by which special status plants would be directly affected. Plant collection, improper grazing management practices, and OHV use also could remove vegetation and disturb soil, which would directly affect special status plant populations. Indirect effects to special status plants would result from actions that aid or compromise the protection of those plant species. The loss or degradation of suitable habitats for special status plant species would be an indirect effect. Indirect effects on potential habitats for special status plant species also could result when actions change habitats in a way that makes them unsuitable for future colonization. Alterations in stream function, demands for water, and competition from invasive plant species would be the primary sources of indirect effects on special status plant species.

For purposes of this analysis, short-term effects on special status plant species result from activities that contribute to the decline in abundance or distribution of a species and can be reversed within 5 years after the activities; long-term effects would require more than 5 years to restore.

Allowable uses and management actions that contribute to the decline in abundance or distribution of special status plant species would be adverse. Beneficial effects would result from activities that protect habitats or reduce the risk of harm to these special status plants. An increase in populations of special status plant species in response to enhanced habitat or the increased viability of a species would be beneficial.

4.4.7.1. Methods and Assumptions

This analysis and its conclusions are based on review of existing literature, interdisciplinary team knowledge of resources in the planning area, and information provided by other agencies. Existing literature and analyses include the 1985 Buffalo RMP (BLM 1985c), the 2003 PRB EIS (BLM 2003c), the Wyoming Natural Diversity Database (WYNDD), and WGFD Spatial Mapping and Analysis. Effects are quantified where possible. Spatial analysis was performed using the ESRI ArcGIS Desktop 10.0 computer software. In addition to literature review and in the absence of quantitative data, best professional judgement was used. Effects are sometimes described using ranges, or in qualitative terms if appropriate. Many effects are qualitatively assessed due to the unavailability of suitable data.

Analysis methods and assumptions and include, the following:

- Assumptions described in the *Vegetation – Riparian/Wetland Resources* section of this chapter are used to analyze effects on potential habitat for Ute ladies'-tresses orchid, an orchid not known to be present in the planning area, but which typically occurs in riparian and wetland habitat. Special status plant species present or with the potential to be present in riparian and wetland habitats could be affected by water quality or water use in the planning area.
- Consultation with the USFWS and following conservation measures identified in Appendix I (p. 2025) for all listed and sensitive species for the BLM Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States Final Programmatic EIS (BLM 2007h) are anticipated to mitigate most impacts to special status plant species.

- Actions that reduce the threat of establishment or spread of invasive species directly benefit special status plant species. IM 2006-073 (BLM 2006b) establishes policy and guidance for the use of certified weed seed-free products and mulch in restoration projects on public lands.
- Reclaiming areas of surface disturbance and reestablishing vegetation minimizes adverse effects on soils and therefore to special status plant species. The sooner vegetation is reestablished, the greater the benefit to special status plant species.
- Management actions that preclude or restrict development, including those not specifically aimed at conserving special status plant species, are assumed to benefit special status plant species where populations overlap management action boundaries.
- The total amount of new surface disturbance allowed under an alternative is an index of potential effects on special status plants. Success of reclamation measures prescribed as a condition of development is unknown, and could underestimate the potential effect of surface disturbance on special status plant populations.
- Surface-disturbing activities in special status plant habitat would adversely affect special status plant species.
- Because the densities and locations of special status plant species in the planning area are not entirely known and because the locations of potential actions under the different alternatives also are not known, the impact analysis is based on the amount of vegetation and soil disturbed, the threats identified for special status plant species in Chapter 3, and the level of restrictions placed on BLM actions that could adversely affect special status plant species.
- Existing provisions (e.g., presence/absence surveys by a qualified botanist during the appropriate phenological stage [e.g., blooming] for positive identification and performed before proposed actions) to protect special status plants species are implemented and conditional monitoring is performed (e.g., grazing and surface disturbance reclamation) to ensure special status plant species are not jeopardized.
- As more monitoring and survey data become available, it is possible that additional populations of existing special status plants could be found.

Significance Criteria

In addition to the significance criteria indicated in the beginning of this chapter, project actions would be considered potentially significant if the following occurred:

- Substantial loss of the biological integrity and habitat function of terrestrial and aquatic ecosystems that would make a species eligible for listing under the ESA.
- Decreased viability or increased removal of Threatened, Endangered, Proposed, or Candidate species, or adverse alteration of their critical habitats.
- Substantial loss of habitat function or disruption of life history requirements of special status plant species that would preclude improvement of their status.

4.4.7.2. Impacts Common to All Alternatives

Special Status Species – Plants

Implementing all actions prescribed in USFWS Biological Opinions for Threatened or Endangered plant species would have major beneficial effects on special status plants. Biological Opinions provide guidance for the protection and recovery of special status plant species.

Physical Resources

Air Quality
Adherence to rules and regulations and enhancing cooperative processes are administrative processes that would have no direct effect on SSS plants. Dust that covers vegetation reduces the photosynthesis process by blocking light and potentially water from reaching the plant cells. Travel on roads that are or will be surfaced with either gravel or scoria, if untreated, would force large amounts of dust into the air; this dust could settle on vegetation. Reducing dust emissions and overall air quality management throughout the planning area would have a major beneficial effect on special status plant species.

Soil
Evaluating proposed surface-disturbing activities for effects on soils also would allow for surveys of plant species. Through this process, more populations of special status plant species could be discovered and adverse effects on those species avoided. Including reclamation plans in any authorized surface-disturbing activity would have a major beneficial effect on special status plants, if implemented on every project, because these plants could be identified and avoided or enhanced during the reclamation process throughout the entire planning area.

Water Resources
Altering water quantity, including alternative water supplies and flow controls, or water quality in any known population of special status plant species could have an adverse effect on species that rely on the existing water regime. Altering water quantity and quality also could provide water in areas suffering from drought, thereby supplementing existing populations or creating habitat for special status plant species in new areas. This would have a beneficial effect on special status plant species. Reducing channel and bank erosion and associated loss of riparian habitats would have beneficial effects on special status plants that inhabit riparian areas. Erosional features such as these, if uncontrolled, would alter habitat, potentially making it unsuitable for populations of special status plant species to persist, or would destroy existing populations. There are 19,861 acres (BLM surface) of suitable habitat for special status plants within 500 feet of riparian waterway segments in the planning area. Management actions common to all alternatives occur within five to ten percent of special status plant habitats; therefore, they would have moderate beneficial or adverse effects on special status plant resources. Other water management actions common to all alternatives, such as filing for water rights and plugging unneeded wells would have no to negligible effects on special status plant species. Due to the potential adverse effects, the overall conclusion is that the water management actions would have a moderate adverse effect on special status plants.

Cave and Karst Resources
Cave inventories could benefit special status plant species. There are 101,455 acres (BLM surface) of suitable habitat for special status plants in the cave formations area. Cave inventories include surveys for special status plant species. New population information could be acquired through these inventories. However, the geologic formations likely to contain caves are limited to the western edge of the planning area in the Big Horn Mountains; this is also where special status plant species are likely to occur. Inventories would occur within greater than ten percent of special status plant habitats; therefore, management actions common to all alternatives would have major beneficial effects on special status plant resources.

Mineral Resources

Development of new and concurrence with existing MOUs between the BLM and other agencies are administrative processes that would not effect special status plant species.

Locatable Minerals
Fifty-five acres of special status plant species occur in areas open to locatable mineral extraction. Impacts would include removal of vegetation and loss of habitat, potentially including removal of individual plants and/or entire populations of special status plants. This is less than one percent of all special status plant habitats, therefore, the loss of habitat would be negligible.

Leasable – Coal
Coal leasing management actions common to all alternatives will have no effect on special status plant species. There are no special status plant species on existing leased coal parcels. The leasing process involves NEPA analysis, thereby identifying any conflicts for special status plant species before there could be adverse effects. This and any decisions for deferral of coal leasing would have a major beneficial effect on special status plant species.

Leasable Minerals – Fluids
A requirement that lessees perform operations in a way that minimizes adverse effects to other resources and other land uses and users would also minimize adverse effects and result in minor beneficial effects on special status plant species. There is one population of William's wafer-parsnip on leased parcels. Opening all oil and gas mineral estate to leasing would have a major adverse effect on this special status plant at this location. Management of any acquired mineral estate in accordance with management of the surrounding areas might or might not affect special status plant species. Management of any mineral estate should be to avoid effects on special status plant species, regardless of management of surrounding areas. Any decisions for closures to fluid mineral leasing would not affect special status plant species. Making geothermal resources available for leasing would have a negligible adverse effect on special status plant species. The potential for geothermal development in the planning area is low. Effects identified above would be localized, and would occur only where leasable fluid minerals and special status plant species overlap. Fluid mineral development could occur in one to five percent of special status plant habitats; therefore, the management actions common to all alternatives would have minor adverse effects on special status plant resources.

Salable Minerals
Salable minerals extraction would result in direct, long-term, impacts on special status plant species. Impacts would include removal of vegetation and loss of habitat, potentially including removal of individual plants and/or entire populations of special status plants. The level of impacts would depend on the size of the salable minerals area. Many sand and gravel areas are associated with riverine and alluvial plains. The vegetative communities normally associated with these areas would be significantly impacted by the extraction of salable minerals.

Fire and Fuels Management

Unplanned Fire (Wildfire)
Implementing the BLM Emergency Stabilization and Burned Area Rehabilitation standards and rehabilitating fire lines would reclaim areas faster, and therefore have a beneficial effect on special status plant species. Landscape treatments to achieve enhanced fuels management or restore fire-adapted ecosystems could result in short-term adverse effects through their removal during fire treatments. Long-term effects from treatments would be beneficial because the ecosystem would be returned to a more natural state in which these native plant species would thrive. In areas where these potential treatment areas and special status plant species directly overlap, there would be adverse or beneficial effects, respectively, on special status plant species. However, projected over the entire planning area, the locations where

wildfires are most likely to occur compared to locations of most of the populations of special status plant species in the planning area make these adverse effects negligible.

Planned Fire (Prescribed Fire)
Adhering to the current District FMPs and ensuring all prescribed fire activities comply with standards and rules are administrative processes that would have no effect on special status plant species. Consulting with a resource advisor on all wildland fires that involve or threaten BLM-administered lands would decrease the likelihood of effects on special status plant species. Resource advisors would be aware of known locations of special status plant species and would advise activities that would result in reducing risks to special status plant species as much as possible. These actions would have beneficial effects on special status plant species. Prohibiting the use of retardant or foam within 300 feet of surface water sources would have a beneficial effect. There is one population of Williams' wafer-parsnip within 300 feet of surface water resources in the planning area. There are approximately 10,762 acres (BLM surface) of suitable habitat for special status plant species within 300 feet of surface water resources. Special status plant species inhabiting riparian corridors surrounding surface water sources would be protected from the smothering effect of these chemicals. This protection would occur in one to five percent of SSS habitats; therefore, management actions common to all alternatives would have a minor beneficial effect on special status plant resources.

Biological Resources

Biological resources management actions common to all alternatives and that are administrative processes (e.g., development and prioritization of plans, providing outreach and education, updating plans, and adhering to rules, regulations, and agreements such as MOUs) would have no to negligible effects on SSS plants.

Management actions common to all alternatives that promote a balanced management of these resources in the planning area would promote a natural landscape, thereby promoting the growth of native plant species such as special status plant species. These management actions include such things as managing for forage enhancement, implementing cooperative IPM programs, and providing suitable wildlife habitat. These would have minor to major beneficial effects on special status plant species overall.

Vegetation – Forests and Woodlands
There are no management actions common to all alternatives for forests and woodlands.

Vegetation – Grassland and Shrubland Communities and Riparian/Wetland Resources
Reducing impacts to vegetative resources, by nature, would reduce impacts to special status plant species. Management actions common to all alternatives that would achieve this goal would have beneficial effects on special status plant species. Vegetation inventories on all lands (grasslands and shrublands and lotic and lentic riparian/wetland systems, and evaluation of CBNG-created riparian and wetland systems for retention or reclamation) would have beneficial effects on special status plant species. Inventories would help identify new populations and help monitor existing populations of special status plant species throughout the planning area. Knowledge of special status plant species locations and status would help the BLM make land management decisions. To date, there are 21 known populations of special status plant species (3 Porter's sagebrush 18 William's wafer-parsnip) on BLM-administered lands in the planning area. The effects identified would be localized, and would occur only where targeted vegetation and special status plant species overlap. Inventories for vegetation under these other resources would occur

within greater than ten percent of special status plant habitats; therefore, management actions common to all alternatives for grassland and shrubland communities would have major beneficial effects on special status plant habitats.

Restoring disturbed sites, including split estate lands, close to suitable habitat for special status plant species and known populations of such plants would increase suitable habitat and promote new, restore historic, or promote the spread and enhance the viability of known populations of special status plant species. This would have beneficial effects on special status plant species. Expansion and enhancement of riparian/wetland systems and habitat would have these same long-term beneficial effects on special status plant species that inhabit riparian/wetland ecosystems. There are three populations of Williams' wafer-parsnip on split estate lands in the planning area. There are 243,929 acres of suitable habitat for special status plant species on split estate lands (fluid minerals) in the planning area. Habitat restoration and enhancements for riparian/wetland systems would occur within greater than ten percent of special status plant habitats; therefore, management actions common to all alternatives for riparian/wetland resources would have major beneficial effects on special status plant habitats.

Invasive Species and Pest Management

Controlling grasshoppers and Mormon crickets on public lands would have adverse effects on special status plant species over the short term, but could prove to be beneficial over the long term. Initial treatment for grasshoppers and Mormon crickets could destroy flowering and fruiting special status plant species if pesticides were applied close to known populations of special status plant species while these plants were in bloom and these plants were trampled or otherwise destroyed during the application process. Reducing the numbers of these two pests would improve vegetative condition over the long term, thereby beneficially affecting special status plant species. In areas where these pesticide application and special status plant species overlap, there would be adverse effects on special status plants. However, projected over the entire planning area, the estimated amount of overlap would make these beneficial effects minor.

Fish and Wildlife Resources – Fish and Wildlife, and Special Status Species – Fish and Wildlife (including Greater Sage-Grouse)

Management of barriers to fish passage would have no effect on special status plant species because these barriers and populations of special status plant species are not present in the same locations. Effects on special status plant species from the management of activities potentially affecting native and desirable non-native fish species are not known at this time. It is difficult to predict impacts to special status plant species from these, at present, undefined activities.

Management of public access to fish bearing waters or to protect crucial habitats could have adverse effects on special status plant species. Future access routes have the potential to adversely affect special status plants and their habitats by stripping away vegetation as part of access route creation, trampling or eliminating vegetation, and compacting soils throughout the footprint of the access. Construction of new fences, even in accordance with the BLM Fencing Handbook, would have the same potential adverse effects on special status plant species for the same reasons. There are three known populations of Williams' wafer-parsnip on BLM-administered lands close to fish-bearing waters. There are 51,745 acres of suitable special status plant species habitat on BLM-administered lands close (within 0.25 mile) of fish-bearing waters. Access management and new fence construction is likely to occur within greater than ten percent of special status plant habitats.

The NEPA and permitting processes would be expected to result in indirect beneficial effects on special status plant species as a result of protecting fish and wildlife (including SSS), protecting fish and wildlife habitats, and mitigating impacts to fish and wildlife habitats (including habitats for SSS). Special status fish species and non-special status fish species management actions common to all alternatives support efforts to protect and improve riparian ecosystems. These actions include restoring fish habitats and managing harmful non-native riparian vegetation in river and stream systems important to fish species. This would have beneficial effects on special status plant species, in particular species that inhabit these same riparian corridors, such as Ute ladies'-tresses orchid. Special status wildlife species and non-special status wildlife species management actions common to all alternatives support efforts to protect and improve ecosystems of varying habitat types throughout the planning area. The actions that include managing vegetative diversity, minimizing disturbances to springs and riparian zones, and improving sagebrush plant communities are actions that would help maintain natural landscapes; this would have major beneficial effects on all special status plant species.

Avoidance areas, whether for application of broad-spectrum insecticides or protect nesting bald eagles, would have a beneficial effect on special status plant species where avoidance areas and populations of special status plant species overlap. Avoidance areas for other species would, by nature, be avoidance areas for special status plant species. Avoidance areas for fish, special status fish, wildlife, and special status wildlife will occur in greater than ten percent of special status plant habitats; therefore management actions common to all alternatives for fish, wildlife, and special status fish and wildlife will have major beneficial effects on special status plant resources.

Heritage and Visual Resources

Cultural Resources and Paleontological Resources

Maintaining and developing relationships with Native American tribes and maintaining federal ownership of areas important to Native Americans or with significant paleontological values are administrative processes and would have no effect on special status plant species. Other cultural resources management actions common to all alternatives, such as the stabilization and protection of sites, are actions that would create avoidance areas to protect cultural resources. These avoidance areas would, by nature, be avoidance areas for special status plant species. There are 12 populations of Williams' wafer-parsnip within 5 miles of significant cultural sites in the planning area. These avoidance ares occur within greater than ten percent of special status plant habitats, therefore, management actions common to all alternatives for cultural and paleontological resources would have major beneficial effects on special status plant resources.

Visual Resources

No effects are anticipated from VRM actions common to all alternatives.

Land Resources

Forest Products

Prohibiting timber harvest and recreational camping within 200 feet of surface water sources would create avoidance areas to protect surface water; these would, by nature, be avoidance areas for special status plant species. There is one population of Williams' wafer-parsnip within 200 feet of surface water resources in the planning area. There are approximately 5,584 acres (BLM surface) of suitable habitat for special status plant species within 200 feet of

surface water resources. Areas prohibited from timber harvests encompass one to five percent of special status plants habitats.

Personal use of forest products by the public could cause an adverse effect on special status plant species. Access routes to retrieve forest products have the potential to adversely affect special status plant species and their habitats by stripping away vegetation as part of access route creation, trampling or eliminating vegetation, and compacting soils throughout the footprint of the access. There are five populations of Williams' wafer-parsnip on BLM-administered lands with forest products. There are 16,234 acres of suitable habitat for special status plant species on BLM-administered lands with forest products. Forest products occur within five to ten percent of special status plant habitats; therefore, management actions common to all alternatives would have moderate adverse effects on special status plant resources.

Lands and Realty

Lands and realty management actions common to all alternatives would have no to negligible effects on special status plant species. Project-specific analysis of lands and realty actions, such as approval of R&PP permits, land use authorizations, and withdrawals and land disposals require NEPA analyses, which would identify any conflicts for special status plant species before adverse effects could occur.

Renewable Energy

Promotion and coordination of renewable-energy opportunities are administrative processes that would have no effect on special status plant species.

Rights-of-Way and Corridors

ROW and corridors management actions common to all alternatives that promote identified preferred locations and minimize surface disturbance, including transportation and communications site planning, in the planning area also require NEPA analyses. There are 21 known populations of two special status plant species (3 Porter's sagebrush and 18 Williams' wafer-parsnip) on BLM-administered lands in the planning area. There are 126,811 acres of suitable habitat for special status plant species on BLM-administered lands. ROWs and corridors may be permitted in greater than ten percent of special status plant habitats; therefore, management actions common to all alternatives would have major adverse effects on special status plant resources.

Travel and Transportation Management

Management of public access common to all alternatives that are administrative processes (negotiation across non-BLM-administered lands to isolated public parcels, a BLM transportation system, road and trail closures and abandonment decisions, including inventories of all roads and trails, completion of Recreation Area Management Plans (RAMPs), providing general or educational information to the public) would have no effect on special status plant species.

Future access routes (roads and trails to isolated parcels of public land, to caves, or for any other recreational purposes) would have the potential to adversely affect special status plants species plants and their habitats by stripping away vegetation as part of access route creation, trampling or eliminating vegetation, and compacting soils throughout the footprint of the access. Allowing casual use of all public lands would intensify this effect because access would then be undirected and there would be no protection for special status plant species or their habitats. There are 21 known populations of two special status plant species (3 Porter's sagebrush and 18 Williams' wafer-parsnip) on BLM-administered lands. There are 126,811 acres of suitable habitat for special status plant species on BLM-administered land in the planning area. Areas

where these future access routes may be created occur within greater than ten percent of special status plant habitat; therefore, management action common to all alternatives would have major adverse effects on special status plant resources.

Recreation
Minimizing recreation impacts in riparian habitats and providing for temporary or permanent closures for public health and safety reasons would have a beneficial effect on special status plant species. Avoidance areas for other resource concerns would, by nature, be avoidance areas for special status plant species. In areas where these avoidance areas and populations of special status plant species directly overlap, there would be beneficial effects on special status plant species. However, projected over the entire planning area, the estimated small amount of overlap would make these beneficial effects minor.

Lands with Wilderness Characteristics
Evaluations of BLM-administered lands for wilderness characteristics would likely include surveys for special status plant species. These inventories could provide new information on plant populations. There are three populations of Williams' wafer-parsnip in lands with wilderness characteristics. Areas with wilderness characteristics occur in five to ten percent of special status plant habitats; therefore, management actions common to all alternatives for lands with wilderness characteristics would have moderate beneficial effects on special status plant resources.

Livestock Grazing Management
Management actions common to all alternatives that promote balanced management of land resources in the planning area would promote a natural landscape, thereby promoting the growth of native plant species such as special status plants. These management actions include such things as adjusting grazing leases; implementing new AMPs; and managing livestock grazing to sustain riparian, wetland, mountain mahogany, and other habitats. These actions would have beneficial effects on special status plant species. There are 29 populations of two special status plant species (3 Porter's sagebrush and 26 Williams' wafer-parsnip) within BLM grazing allotments. There are 126,811 acres of suitable habitat for special status plant species within BLM grazing allotments. Livestock grazing allotments occur in greater than ten percent of special status plant species habitats; therefore, management actions common to all alternatives would have major beneficial effects on special status plant resources.

Special Designations

Areas of Critical Environmental Concern
Management actions common to all alternatives associated with ACECs would have no effect on special status plant species.

Wild and Scenic Rivers
The canyon of the Middle Fork Powder River that is suitable and eligible for WSR designation overlaps with potential special status plants habitat. Preserving the outstandingly remarkable values (ORVs) would limit disturbance and development within Middle Fork Canyon, resulting in a benefit to special status plant species. Because there are no known populations within Middle Fork Canyon, the overall benefit would be negligible to minor.

Scenic or National Back Country Byways
Increased road maintenance and human activity on byways would have adverse impacts to plant species from dust, soil erosion, spread of invasive species, and unauthorized plant collection.

Management actions common to all alternatives associated with scenic or BCBs will have a minor adverse effect on special status plant resources.

Wilderness Study Areas
There are three populations of Williams' wafer-parsnip in WSAs. There are 28,931 acres of suitable habitat for special status plant species in WSAs. WSAs contain five to ten percent of all of the special status plant habitats in the planning area; therefore, management actions common to all alternatives would have moderate beneficial effects to special status plant resources.

Socioeconomic Resources

Social and Economic Conditions
Management actions common to all alternatives are administrative processes and will have no effect on special status plant resources. Impacts to social and economic resources will be quantified on a project specific basis. Management actions that vary by alternative are also administrative; therefore, social and economic management actions will not be discussed further in this section

Health and Safety
Any health and safety management actions common to all alternatives would likely have an adverse effect on special status plant species. Emergency response activities are likely to involve efforts in which little to no time is allowed to adjust actions to avoid impacts to special status plant species. Special status plant species are likely to be trampled, bulldozed, or otherwise altered by hazardous waste cleanup, reclamation of abandoned mines, and contaminant spills. Actions related to human health and safety could occur at any location throughout the planning area. It is likely that these would occur on a small scale. There would be adverse effects on special status plant species in locations where human health and safety actions and populations of special status plant species overlap. However, projected over the entire planning area and over an extended period, these adverse effects would be negligible.

The following sections describe impacts by alternative. These impacts would be in addition to the impacts common to all alternatives described above. Only management actions common to all alternatives are identified; therefore, health and safety will not be discussed further in this section.

4.4.7.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended and maintained. This section describes potential impacts to special status plant species from management of other resources under Alternative A.

Special Status Species – Plants
Neither Alternative A nor other previous land use plans have included decisions for management of special status plant species. This lack of decision has left protections for special status plant species to be included in the analyses for individual projects. Thus far, this has provided adequate protections for known populations of special status plant species; however, absent surveys to discover new populations, there could have been activities that permanently altered habitat for these species or existing populations could have been missed and destroyed.

There are common themes throughout Alternative A for all resources. Where pertinent, these common themes are analyzed together.

Physical Resources

Air Quality

The types of effects to special status plant species from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for air quality (habitat conservation). In Alternative A, though, these impacts would be analyzed on a project specific basis. Without monitoring or oversight on a programmatic level, lack of consistency would cause the beneficial effects to likely only be negligible. Air quality resource management actions under Alternative A would have negligible beneficial effects on special status plant resources.

Soil

The types and magnitude of effects to special status plant species from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for soil (habitat conservation). In Alternative A, management actions for soil are beneficial where habitats are conserved through prohibitions of surface-disturbing activities and/or surface occupancy, both of which occur in greater than ten percent of special status plant habitats. Soil resource management actions under Alternative A would have major beneficial impacts on special status plant resources.

Water Resources

The types of effects to special status plant species from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for water resource management (habitat conservation and improvement). Management actions are beneficial when habitats are conserved through prohibitions of surface disturbance, which occurs in five to ten percent of special status plant habitats. Within Alternative A, the impacts to water resources are analyzed on a project-specific basis. Without oversight on a programmatic level, it is likely that the beneficial effects would be reduced by half, making the moderate beneficial effects only negligible.

Cave and Karst Resources

The types of effects to special status plant species from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for cave and karst (habitat conservation). Management actions are beneficial when habitats are conserved through prohibitions of surface disturbance, which occurs in greater than ten percent of special status plant habitats. Within Alternative A, the impacts to cave and karst resources are analyzed on a project-specific basis. Without oversight on a programmatic level, it is likely that the beneficial effects would be reduced by half, making the major beneficial effects only minor.

Mineral Resources

Effects to special status plant resources from management actions associated with all mineral resources in Alternative A would be the same as those described in the *Impacts Common to All Alternatives* section above.

Fire and Fuels Management

Unplanned Fire (Wildfire)

Under Alternative A, suppression efforts and restricting the use of some types of suppression equipment would have a direct, short-term beneficial effect on special status plant

species for the life of the fires. Long-term, the application of prescribed fire to support grassland and shrubland communities and wildlife habitat objectives is estimated to affect approximately 14,000 acres from BLM actions. Due to the potential long-term degradation of forest and woodland resources (limber pine habitats), but likely scattered nature of effects to all other special status plant habitats in the planning area, the adverse effects of habitat or individual removal from unplanned fire are likely to be minor.

Planned Fire (Prescribed Fire)
Impacts to SSS plants from management actions associated with planned (prescribed) fire in Alternative A would be the same as those described in the *Unplanned Fire* section above. Due to the locations of potential prescribed fire projects in the planning area, more than ten percent of limber pine habitats could be impacted. These actions also would have a direct beneficial effect on vegetation over the short and long terms because burn conditions (air and soil temperatures, wind conditions, and fuel types) would be less severe than in wildfires. Management actions for planned fire under Alternative A would have major beneficial effects on special status plant resources.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative A, forest management practices that convert late-seral stage stands to early and mid-seral stage would adversely affect special status plant species adapted to late-seral forest types. However, forest management practices would create a diversity of seral stages for different plant species habitat requirements, thereby increasing habitat for plant species diversity and richness. Temporary roads created for commercial timber harvesting would fragment habitat and possibly disturb existing populations of special status plant species for the life of the project. Reclaiming roads would decrease the amount of time it would take for native vegetation to reestablish, thereby facilitating special status plant species regeneration in the project area. Forests and woodlands contain five to ten percent of limber pine, William's waferparsnip, and Porter's sagebrush habitats; therefore management actions for forests and woodlands under Alternative A would have moderate beneficial effects on special status plant resources.

Vegetation – Grassland and Shrubland

Under Alternative A, reclamation seeds mixes are determined on a project-specific basis, allowing for site specific management of resource objectives and having a major beneficial effect to special status plant resources.

Vegetation – Riparian/Wetland Resources
Under Alternative A, surface-disturbing activities would not be prohibited within 500 feet of riparian and wetland areas, protecting special status plant species that inhabit these areas from direct loss. Site-specific management for desired species would allow for greater flexibility in restoring desired species and functionality to habitats. Management actions associated with Alternative A for riparian/wetland resources will have major beneficial effects on special status plant resources.

Invasive Species and Pest Management
Under Alternative A, invasive species and pest control projects are decided on an annual basis and in conjunction with the county weed and pest. Short-term beneficial effects on special status plant species would result from small-scale planning and less pesticide applications, with the ability to

prioritize areas annually. However, adverse effects to these plant species would be likely over the long term by giving invasive species a competitive advantage over the native special status plant species. Annually treating cheatgrass on a project-by-project basis would be ineffective, because only small, scattered treatments would occur; therefore, most of the cheatgrass would be unaffected. This would have an adverse effect on native special status plant species. Overall, Alternative A invasive species and pest management would have a minor beneficial effect on special status plant species.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Alternative A actions that promote balanced management of biological resources in the planning area would promote a natural landscape, thereby promoting the growth of native plant species such as special status plants. These management actions include such things as managing vegetative resources for special status wildlife species, and controlling invasive plant species.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)
Impacts to SSS plants from management actions associated with wildlife and SSS – wildlife in Alternative A would be the same as those described in the *Fish and Wildlife Resource – Fish* and *Special Status Species – Fish* section above. In addition, management actions for wildlife and special status wildlife include prohibitions of surface disturbance and/or surface occupancy for the protection of wildlife and special status wildlife resources. These prohibition areas also contain greater than ten percent of special status plant habitats; therefore, wildlife and special status wildlife management actions under Alternative A would have major beneficial effects on special status plant resources.

Heritage and Visual Resources

Impacts to SSS plants from management actions associated with all heritage and visual resources in Alternative A would be the same as those described in the *Impacts Common to All Alternatives* section above.

Land Resources

Forest Products
Under Alternative A, the layout and timing of timber sales would largely determine the degree of effects on special status plant species. Regeneration of commercial harvested areas begins with early successional stage vegetation, which provides habitat for plant species that depend on early successional habitats. The subsequent years would allow for natural seral-stage progression of the habitat and thereby provide habitat for various special status plant species that depend on different seral stages. This natural succession happens over an 80- to 100-year period. Over the short term and where the forest products and populations of special status plant species overlap, timber sales would have an adverse effect on such species. Over the long term and where the two resources overlap, natural regeneration would have a beneficial effect on special status plant species. Fencing the regeneration areas would help the natural succession to return to each of the seral stages and promote the growth of special status plant species. BLM-administered land with forest products also contains five to ten percent of special status plant habitats; therefore, management actions for forest products under Alternative A would have moderate beneficial effects on special status plant habitats.

Lands and Realty
No parcels available for land tenure adjustments contain special status plant habitats.

Renewable Energy and Rights-of-Way and Corridors
No areas suitable for renewable energy or ROWs and corridors contain special status plant habitats.

Travel and Transportation Management
Under Alternative A, there would be direct and indirect effects on special status plant species from travel management and OHV use. OHV use on and off designated trails has the potential to destroy vegetation, compact soils, and lead to soil erosion and ponded water. Special status plant species could be crushed and their habitats degraded. Higher, rockier terrain and remote areas are becoming more accessible over time as OHVs become more sophisticated and powerful, and as the human population in the planning area increases. These areas are also the areas where most of the special status plant species in the planning area are likely to be found. By designating areas where OHV use is limited to designated roads and trails, adverse effects on special status plants species can be reduced. In cases where motorized vehicle use is closed for only portions of the year, these closures would not be as great a benefit to special status plant species. Although this might prevent the removal of many special status plant species during their time of flowering or fruiting, it would not preclude removal of the vegetative layer as a whole. Allowing surface occupancy during any time of year would have an adverse effect on special status plant species. Regardless of intensity of management, OHV use is still anticipated to have a major adverse effect on special status plant species where OHV use and populations of such species overlap (greater than ten percent).

Recreation
Under Alternative A, there could be adverse effects on special status plant species from recreation activities. Hiking to or occasional repeated use of remote camp sites could have direct effects on special status plant species. Plants could be trampled or crushed, and soil could be compacted or disturbed. Holders of Special Recreation Permits are required to follow all rules and regulations, therefore, should avoid camping at locations where the BLM has identified populations of special status plant species. Given the low level of recreation use on most BLM-administered lands in the planning area, and the scattered, infrequent locations of populations of special status plant species, these adverse effects would mostly be minor.

Lands with Wilderness Characteristics
Alternative A does not identify any lands with wilderness characteristics, thus special status plant habitats are not affected.

Livestock Grazing Management
Livestock grazing has the potential to have major adverse effects on special status plant species through partial or complete removal of individual plants and through damage by trampling. The degree of effects would depend upon the number of animals involved and seasonal frequency of presence in special status plant species habitat. There are 29 populations of special status plant species (3 Porter's sagebrush and 26 Williams' wafer-parsnip) within BLM grazing allotments. There are 288,498 acres of suitable habitat for special status plant species within BLM grazing allotments, including 84 percent of all Williams' wafer-parsnip habitat in the planning area. Under Alternative A livestock grazing is not authorized on approximately 10,000 acres of public land where grazing has been determined to be incompatible with other resource values, specifically, 4,000 acres in the canyons and slopes of the southern Big Horn Mountains. Greater than ten

percent of special status plant habitats are present in the BLM grazing allotments; therefore, management actions for livestock grazing management would have major adverse effects on special status plant resources.

Special Designations

Areas of Critical Environmental Concern
Alternative A does not identify any ACECs, thus special status plant habitats are not affected.

Scenic and Back Country Byways
Alternative A does not identify any BCBs, thus special status plant habitats are not affected.

Wild and Scenic Rivers
Alternative A does not identify any management actions for WSRs, thus special status plant habitats are not affected.

Wilderness Study Areas
Vegetation inventories on all lands included in WSAs would have a moderate beneficial effect on special status plant species. Inventories would help identify new and help monitor existing subpopulations or populations of special status plant species throughout the planning area. Knowledge of special status plant species locations and status would help the BLM make land management decisions. There are four known populations of special status plant species in WSAs. There are 28,931 acres of suitable habitat for special status plant species in WSAs. WSAs contain five to ten percent of special status plant habitats; therefore, management actions for WSAs under Alternative A would have moderate beneficial effects on special status plant resources.

4.4.7.4. Alternative B

This section describes management actions under Alternative B, which emphasizes resource conservation, and the likely impacts to special status plant species due to their implementation.

Special Status Species – Plants
Alternative B management actions for special status plant species include prohibiting activities (surface disturbances, minerals exploration, motorized vehicle use, explosives and blasting, aerial application of herbicides, and use of fire suppression chemicals) in suitable habitat for special status plant species. This approach is the most conservative of all alternatives because it would allow for not only the protection of known populations of special status plant species populations, but would protect potential future populations. This type of protection greatly increases opportunities to expand the proliferation of these species through future active management decisions. There are approximately 126,811 acres (BLM surface) of suitable habitat for special status plant species in the planning area.

Impacts from conservative management of resources under Alternative B would, in most cases, be similar to impacts described for Alternative A and under *Impacts Common to All Alternatives*. Special status plant species would benefit from conscientious management of physical resources and biological resources. Where impacts to special status plant species vary in degree from impacts described for Alternative A, further rationale is provided below.

Physical Resources

Air Quality
Under Alternative B, air quality would be modeled and analyzed on a project-specific level as under Alternative A. However, under Alternative B, projects expected to approach or exceed emissions standards also would be evaluated for potential mitigation strategies. This would have a moderate beneficial effect on special status plant species.

Soil
Under Alternative B, effects on soil, resources would be analyzed on a project-specific basis. However, beneficial effects would be greatly increased under Alternative B through prohibiting surface-disturbing activities or applying an NSO stipulation to activities on badlands, rock outcrops, and slopes susceptible to mass movement and prohibiting prescribed fires on highly erodible soils. Avoidance areas for other resources would, by nature, be NSO areas for special status plant species. An NSO stipulation would not prevent all disturbances. Activities that require surface disturbance to install underground facilities would still be allowed. Allowing surface occupancy during any time of year in populations of special status plant species or suitable habitat for those species would have adverse effects on special status plant species. These areas of protection for soil resources also conserves greater than ten percent of special status plant habitats; therefore, Alternative B management actions for soil would have major beneficial effects on special status plant resources.

Water Resources
Under Alternative B, effects on water resources would be analyzed on a project-specific basis as under Alternative A. However, beneficial effects would be greatly increased under Alternative B through prohibiting surface-disturbing activities or applying an NSO stipulation to activities as on-channel reservoirs, conversion of abandoned oil and gas wells to water supply wells, and activities with 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated habitat. Avoidance areas for other resources would, by nature, be NSO areas for special status plant species. An NSO stipulation would not prevent all disturbances. Activities that require surface disturbance to install underground facilities would still be allowed. These areas of protection for water resources also conserves greater than ten percent of special status plant habitats; therefore, Alternative B management actions for water would have major beneficial effects on special status plant resources.

Cave and Karst Resources
Under Alternative B, effects on soil, resources would be analyzed on a project-specific basis as under Alternative A. However, beneficial effects would be greatly increased under Alternative B through prohibiting surface-disturbing activities or applying an NSO stipulation to activities in cave and karst areas. Avoidance areas for other resources would, by nature, be NSO areas for special status plant species. An NSO stipulation would not prevent all disturbances. Activities that require surface disturbance to install underground facilities would still be allowed. These areas of protection for cave and karst resources also conserves greater than ten percent of special status plant habitats; therefore, Alternative B management actions for water would have major beneficial effects on special status plant resources.

Mineral Resources

Locatable Minerals
Under Alternative B, closing 661,345 acres to leasing or exploration and development of mineral resources or to conserve other resource values would reduce disturbance to special status plant species and result in a restriction of locatable mineral development in one to five percent of

special status plant habitats. This means that, conversely, locatable mineral exploration and development could be permitted in greater than ten percent of special status plant habitats; therefore, management actions for locatable minerals under Alternative B would have major adverse effects on special status plant resources.

Leasable – Coal Minerals
The management action listed under Alternative B is administrative, and will have no effect on special status plant resources.

Leasable – Fluid Minerals
Alternative B limits the exploration and development of fluid mineral resources by closing 2,612,920 acres to leasing. Areas outside of this, where fluid mineral development could be permitted, contain greater than ten percent of special status plant habitats; therefore, management actions for fluid minerals under Alternative B would have major adverse effects on special status plant resources.

Salable Minerals
Alternative B limits the exploration and development of salable mineral resources by the making 661,345 acres (BLM surface) closed or restricted to salable mineral exploration and development. Salable mineral development would be open on 129,431 acres of BLM surface that also contain greater than ten percent of special status plant habitats; therefore, management actions for salable minerals under Alternative B would have major adverse effects on special status plant resources.

Fire and Fuels Management

Unplanned Fire (Wildfire)
Alternative B does not limit use of wildland fire as a tool for achieving management objectives for vegetation, wildlife habitat, or forage, and would manage rehabilitation wherever there is fire-related damage. Alternative B also restricts the use of heavy equipment to existing roads and trails. Adverse effects to special status plant species from this action would likely be minor.

Planned Fire (Prescribed Fire)
Effects to SSS plants from management actions associated with planned fire in Alternative B would be the same as those described in the *Unplanned Fire* section above.

Biological Resources

Though the majority of impacts to Biological Resources are analyzed on a project-specific basis within Alternative A, adverse impacts to special status plant species would be greatly reduced by prohibition of surface-disturbing activities for any other resources protection. This would have a major beneficial effect on special status plant species where targeted vegetation and special status plant species overlap. Avoidance areas for other resources would, in turn, be NSO areas for special status plant species. An NSO stipulation would not prevent all disturbances from occurring. Those activities that require surface disturbance to install underground facilities would still be permitted. Alternative B provides protections and minimizes effects.

Vegetation – Forests and Woodlands
Alternative B forests and woodlands management would promote a natural landscape with little physical management or alteration. This would minimize adverse effects on special status plant

species. In this natural environment, special status plant species would likely persist at current population levels, neither expanding nor decreasing in colony size. Stochastic events that kill entire populations of special status plant species would be more likely under Alternative B without specific management to control insects, disease, and wildfires. Stochastic events are unlikely to eliminate many special status plant populations; therefore, the overall effect is major beneficial due to the prohibitions of disturbance within special status plant habitat.

Vegetation – Grassland and Shrubland Communities
Reclaiming disturbed sites, including split estate lands, close to suitable habitat for special status plant species and known populations of such plants with only native plants would enhance the viability of known populations of special status plant species by decreasing risk of competition from non-native species. This would have beneficial effects on special status plant species. Reclamation of native plants would occur in five to ten percent of special status plant habitat, therefore; management actions for grassland and shrubland communities under Alternative B would have moderate beneficial effects on special status plant resources.

Vegetation – Riparian/Wetland Resources
Under Alternative B, NSOs prohibit surface-disturbing activities within 500 feet of riparian/wetland systems, aquatic habitats, and floodplains. Restoring disturbed sites, including split estate lands, close to suitable habitat for special status plant species and known populations of such plants would increase suitable habitat and promote new, restore historic, or promote the spread and enhance the viability of known populations of special status plant species. Expansion and enhancement of riparian/wetland systems and habitat would have these same long-term beneficial effects on special status plant species that inhabit riparian/wetland ecosystems. These areas also conserve greater than ten percent of special status plant habitats; therefore, management actions for riparian/wetland resources under Alternative B would have major beneficial effects on special status plant resources.

Invasive Species and Pest Management
Under Alternative B, not limiting aerial application of pesticides and treating cheatgrass on a landscape scale would provide an opportunity to apply large-scale treatments on a variety of topography. Over the long term, this management would benefit special status plant species by reducing competition from invasive species and improving the ecological condition of treated sites. Over the short term, this could greatly increase adverse effects on special status plant species. The farther away from riparian areas, wetlands, and special status plant species chemicals are applied, the less the potential for effects associated with vegetation removal, soil disturbances, or chemical spills to these resources. Overall, invasive species and pest management actions associated with Alternative B will be moderately beneficial to special status plant species.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
In addition to analyzing impacts to fish resources on a project-specific basis, Alternative B prohibits surface-disturbing activities and applies NSO stipulations that would directly protect populations of special status plant species and suitable habitat for those species. Surface-disturbing prohibitions for fish resources also conserve greater than ten percent of special status plants habitats. Surface-disturbing prohibitions for special status fish species also conserve five to ten percent of special status plant habitats. Management actions for fish under Alternative B would have major beneficial effects on special status plant habitats. Management actions for special status fish under Alternative B would have minor beneficial effects on special status plant habitats.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)

The types of effects to special status plant species from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for wildlife and SSS wildlife. Under Alternative B, though, NSOs prohibit or restrict surface disturbance within greater than ten percent of special status plant habitats; therefore, management actions for both wildlife and special status wildlife resources would have major beneficial effects on special status plant resources.

Heritage and Visual Resources

Cultural Resources

Though the majority of impacts to cultural resources are analyzed on a project specific basis within Alternative A, adverse impacts to special status plant species would be greatly reduced by prohibition of surface-disturbing activities for cultural resource protection in Alternative B. NSOs for cultural resources under Alternative B also conserve greater than ten percent of special status plant habitats; therefore, management actions for cultural resources under Alternative B would have major beneficial effects on special status plant resources.

Paleontological Resources

The types and magnitude of effects to special status plant species from Alternative B would be the same major beneficial effects as described in the *Impacts Common to All Alternatives* section for paleontological resources.

Visual Resources

The types and magnitude of effects to special status plant species from Alternative B would be the same major beneficial effects as described in the *Impacts Common to All Alternatives* section for visual resources.

Land Resources

Forest Products

Under Alternative B, limiting sawtimber sales to specified forest areas and to limited acreages would result in adverse effects on special status plant species. In coordination with resource specialists, special status plant species areas could be specified as sawtimber sale avoidance areas during times of the year when it is most crucial for these plants to remain undisturbed.

Lands and Realty

Under Alternative B, retaining lands with agricultural potential, water, or important natural resources would benefit special status plant species. These lands would be identified up front and assigned a higher level of importance, therefore retaining lands that could also be important for special status plant species. Acquiring new lands also would increase beneficial effects on special status plant species because management for such species on these lands would increase in intensity. Lands identified for tenure adjustments under Alternative B contain less than one percent of known special status plants habitats; therefore, until more inventory is completed, the management actions for lands and realty under Alternative B would have negligible beneficial effects on special status plant resources.

Renewable Energy

Alternative B would exclude renewable-energy development in areas also closed to other forms of

energy development (minerals leasing, locatable minerals, salable minerals, ROW, and other areas where surface disturbance restrictions are applied). This would have beneficial effects on special status plant species where areas with renewable-energy potential and populations of special status plant species overlap. Avoidance areas for other resources would, by nature, be NSO areas for these plant species. Renewable energy could be permitted under Alternative B in greater than ten percent of special status plant habitats; therefore, management actions for renewable energy under Alternative B would have major adverse effects on special status plant resources.

Rights-of-Way and Corridors

Alternative B management of ROW and corridors would benefit special status plant species. Requiring co-location of facilities and identifying and implementing specified utility corridor areas and recreation areas would be a processes that, in coordination with resource specialists, could protect special status plant species by ensuring they are completely avoided. Allowing any other travel in areas limited to designated routes only under a special use permit also would benefit these plant species because holders of special recreation permits are specifically directed via permit stipulation to avoid locations where the BLM has identified populations of special status plant species. However, ROWs and corridors could be permitted within greater than ten percent of special status plant habitats; therefore, management actions for ROWs and corridors under Alternative B would have major adverse effects on special status plant resources.

Travel and Transportation Management

Under Alternative B, motorized vehicle use would be closed in habitat for SSS, resulting in major beneficial effects. If travel was permitted in areas where SSS occur, effects may be similar to those adverse effects described in the *Rights-of-Way and Corridors* section above.

Recreation

Alternative B impacts to special status plant species from SRMA management actions would be the same as impacts under Alternative A, except that Alternative B would manage Burnt Hollow, Dry Creek Petrified Tree, Middle Fork Powder River, Mosier Gulch, Welch Ranch, Weston Hills, and Hole-in-the-Wall as SRMAs. This designation would protect 20,319 acres where special status plant species habitat occurs within the SRMA areas. Another 12,084 acres (fluid mineral estate) of special status plant habitat would be included with the institution of a 0.5-mile buffer surrounding the SRMAs that would be closed to mineral leasing. SRMAs conserve one to five percent of special status plant habitats; therefore, management actions for recreation under Alternative B would have minor beneficial effects on special status plant resources.

Lands with Wilderness Characteristics

Under Alternative B, managing lands with wilderness characteristics (12,237 acres) to emphasize primitive recreational opportunities and natural values would benefit special status plant species. Management would include closing areas to or limiting use of motorized vehicles, closing areas to minerals leasing, excluding ROW, and prohibiting surface-disturbing activities not compatible with retaining or enhancing the areas' natural values. Lands with wilderness characteristics contain one to five percent of special status plant habitats; therefore, management actions for lands with wilderness characteristics under Alternative B would have minor beneficial effects on special status plant resources.

Livestock Grazing Management

Alternative B incorporates several actions to adjust livestock grazing management to achieve multiple resource health and objectives. These measures would result in slightly less grazing pressure and trampling damage to special status plant species. The anticipated adverse effects on

special status plant species from livestock grazing under Alternative B would not occur around most known locations of special status plant species. However, due to the greater emphasis on multiple resource values under Alternative B direct and indirect adverse effects on unknown locations of special status plant species, such as Ute ladies'-tresses orchid, are anticipated to produce slightly fewer adverse effects on populations of special status plant species. Overall, Alternative B livestock grazing management would likely impact between five to ten percent of special status plant habitats and would therefore have moderate adverse effects on special status plant resources.

Special Designations

Areas of Critical Environmental Concern

Under Alternative B, designation of approximately 511,000 acres of ACECs in eight areas would provide additional protections for sensitive habitats and to known and undiscovered populations of special status plant species. Measures identified for the proposed ACECs that would directly benefit special status plant species include: (1) closing areas to or limiting motorized vehicle use; (2) closing areas to minerals leasing; (3) recommending withdrawal of areas from locatable minerals entry; (4) closing areas to salable minerals; (5) excluding ROW; and (6) prohibiting all other surface-disturbing activities not compatible with retaining or enhancing the areas' values. The eight ACECs contain five to ten percent of the special status plant habitats; therefore management actions for ACECs under Alternative B would have major beneficial effects on special status plant resources.

Scenic or National Back Country Byways

Increased road maintenance and human activity on byways would have adverse impacts to plant species habitat from dust, soil erosion, spread of invasive species, and unauthorized plant collection. Management actions associated with Alternative B will have minor adverse effects on special status plant resources.

Wild and Scenic Rivers

If Congress denies the nomination to designate the Middle Fork Powder River as a WSR, the river will be managed to maintain its natural characteristics, resulting in negligible beneficial effect to special status plant resources, as management would occur on less than one percent of special status plant habitat.

Wilderness Study Areas

Under Alternative B, ensuring protective management of WSAs would provide an additional 28,931 acres of protection for sensitive habitats and known and undiscovered population of special status plant species. Measures identified for the WSAs that would directly benefit special status plant species include: (1) closing the areas to minerals leasing; (2) recommending withdrawal of the areas from locatable minerals entry; (3) closing the areas to salable minerals; (4) excluding ROW; (5) prohibiting all other surface-disturbing activities not compatible with retaining or enhancing the areas' values; and potentially (6) prohibiting all motorized and mechanized equipment. The three WSAs contain five to ten percent of the special status plant habitats; therefore, management actions for WSAs under Alternative B would have moderate beneficial effects on special status plant species.

4.4.7.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource use, and the likely resulting impacts to special status plant species due to its implementation.

Special Status Species – Plants
Alternative C management actions for special status plant species include prohibiting activities (surface disturbances, minerals exploration, motorized vehicle use, explosives and blasting, aerial application of herbicides, and use of fire suppression chemicals) in known populations of special status plant species. This approach would protect only known populations of special status plant species populations. Although this is a protective approach for special status plant species, it would not protect potential future populations and, absent the conservative approach under Alternative B, activities allowed in suitable habitat for these plant species could preclude proliferation of these special status plant species through future active management decisions.

Impacts from management of resources under Alternative C would, in most cases, be similar to those described for Alternative A and under the *Impacts Common to All Alternatives* section. Where impacts to special status plant species would vary in degree from impacts under Alternative A, further rationale is provided below.

Physical Resources

Air Quality
Under Alternative C, there would be no air quality modeling. Industrial projects would approach or exceed emissions standards, and no mitigation strategies would be examined. This would have indirect adverse effects on special status plant species. Plants are perhaps more sensitive to air pollutants than humans. In particular, acid rain has left areas barren or with severely damaged vegetation. Entering leaves of plants from the stomata during normal gas exchange, both ground-level ozone and reactive nitrogen can cause discoloration, damage, and loss of leaves, reducing photosynthesis by as much as 50 percent. Reactive nitrogen increasingly wafts into the atmosphere from exhaust pipes, power plants and factories, and from fields doused with ammonia-based fertilizer and from manure piles associated with cattle feedlots. As a result, biologically significant quantities of reactive nitrogen are now reaching the highest places. In the Colorado Rockies, reactive nitrogen has increased the metabolic activity of certain soil microbes and overturned once-stable communities of algae in high-altitude lakes. Some species such as native bunchgrasses and alpine bluebells are responding favorably. Others, however, appear to be losing ground, among them a slow-growing bog sedge. At lower elevations in the western United States, introduced grasses stoked by nitrogen are overwhelming many ecosystems (Nash 2009). Plants also become more vulnerable to attacks by pests, disease, and other environmental disasters. Consequently, the plant's ability to store food, grow, and reproduce is hindered. The effect would be moderate and adverse.

Soil
Under Alternative C, soils management actions would include allowing surface-disturbing activities on slopes equal to or greater than 25 percent and on soils with a severe erosion hazard, and allowing proposed activities on badlands, rocky outcrops, or on slopes susceptible to mass movement. This would affect 218,928 acres. Alternative C would not limit vehicular travel on saturated soils or require closure and reclamation of roads if they are heavily eroded, washed out, or if other access roads in better condition are available. All these actions would allow activities

on all soil types, regardless of any soil-limiting properties. These actions would not protect soil resources and would promote soil and water erosion, which would have an indirect, major adverse effect on special status plant species by reducing the health of the medium in which plants grow. Surface-disturbing activities would be permitted within greater than ten percent of special status plant habitats; therefore, management actions from soil under Alternative C would have major adverse effects on special status plant resources.

Water Resources

Watershed management actions that would allow surface disturbances within 500 feet of any natural or man-made water feature would have a direct adverse effect on special status plant species where these resources overlap, and on water quality in these sensitive sites. Additional project- specific allowances for on-channel reservoirs even though they could adversely affect natural flow regimes could indirectly adversely affect special status plant species communities by transitioning the plant species in those communities and providing an opportunity for invasive plant species to move into these sites. Surface-disturbing activities would be permitted within greater than ten percent of special status plant habitats; therefore, management actions for water under Alternative C would have major adverse effects on special status plant resources.

Cave and Karst Resources

Management actions under Alternative C for cave and karst resources include establishing project-specific buffers from significant cave entrances to minimize the effects of surface-disturbing activities in cave and karst areas. Implementation of a Cave Management Plan would directly benefit special status plant species because it would limit disturbance of the vegetative community from minerals development or by people. The area of protection would be just at the cave entrances. Alternative C would not restrict livestock grazing in areas with cave and karst resources. Although known populations of special status plant species would be avoided, this would have a direct adverse effect on special status plant species where cave and karst resources and populations of special status plant species are adjacent to each other. Surface-disturbing activities would be permitted within five to ten percent of special status plant habitats otherwise protected by cave and karst resources. Management actions for cave and karst resources under Alternative C would have a moderate adverse effect on special status plant species.

Mineral Resources

Locatable Minerals

At present, the Amsden Creek, Middle Fork Canyon, and Kerns game ranges are withdrawn from minerals location. Locatable minerals activities are restricted in the Fortification Creek, Gardner Mountain, and North Fork WSAs. Alternative C does not include new recommendations for withdrawals or restrictions. The existing withdrawals and restrictions were imposed for the protection and preservation of other resource values. Effects to SSS plants associated with locatable mineral management actions in Alternative C would be the same as those described in Alternative A.

Leasable Minerals – Coal

The management action listed under Alternative C is administrative, and will have no effect on special status plant resources.

Leasable Minerals – Fluids

Continuing to lease and allow development of federal oil and gas would result in disturbance adjacent to 34 known populations of special status plant species and 243,929 acres

of suitable habitat for such species. Most surface-disturbing activities would require successful reclamation. Native grasses and forbs would dominate reclaimed sites initially, and forbs and shrubs would return over a longer period. Erosion and decreased vegetative cover would occur from soil compaction and the channelization of surface runoff in ruts and road ditches. There is no anticipated disturbance from geothermal activities.

Alternative C does not include new recommendations for withdrawals or restrictions. The existing withdrawals and restrictions were imposed for the protection and preservation of other resource values. Under Alternative C, not protecting additional areas would have an adverse effect on special status plant species.

Leasable fluid mineral development would be permitted within greater than ten percent of special status plant habitats; therefore, management actions for fluid mineral under Alternative C would have major adverse effects on special status plant species.

Salable Minerals
Effects to SSS plants associated with salable mineral management actions in Alternative C would be the same as those described in Alternative A.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Alternative C management actions involving the application of full suppression regardless of other resource objectives would have a direct adverse effect on populations of special status plant species. The use of heavy equipment with few constraints would have a direct adverse effect on these vegetative communities over the short and long terms by increasing opportunities for water and soil erosion and invasive plant establishment. Alternative C fire and fuels management would have a minor adverse effect on special status plant species.

Biological Resources

Vegetation – Forests and Woodlands
The removal of trees would increase under Alternative C. This would open larger spaces in the forest, which would alter the habitats of most of the special status plant species in the planning area. Forests and woodlands contain greater than ten percent of special status plant habitats; therefore, the management actions for forests and woodlands under Alternative C would have major adverse effects on special status plant resources.

Vegetation – Grassland and Shrubland Communities
Under Alternative C, allowing desirable non-native plant species for initial reclamation activities would have an adverse effect on special status plant species. Although reclamation of any kind is generally beneficial to special status plant species, this action could promote the growth of non-native plant species that could out-compete these special status plant species. This type of reclamation is likely to occur adjacent to greater than ten percent of populations of special status plants; therefore, management actions for grassland and shrubland communities would have major adverse effects on special status plant resources.

Vegetation – Riparian/Wetland Resources
Under Alternative C, management actions for riparian and wetland communities would allow surface-disturbing and disruptive activities and apply standard lease terms for mineral leasing

within 500 feet of riparian/wetland systems, aquatic habitats, and floodplains. This would have a direct adverse effect on the adjacent grassland and shrubland communities by promoting activities that would lead to erosion of soils and water. Restoring vegetation only on direct CBNG disturbance areas (e.g., dams and reservoirs) rather than on all CBNG-supported riparian and wetland systems would apply reclamation only to a very small number of the systems overall. The larger systems would be very susceptible to water-tolerant invasive species such as salt cedar and Canada thistle. Surface-disturbing activities would be permitted within greater than ten percent of special status plant habitats; therefore, the management actions for riparian/wetland resources under Alternative C would have major adverse effects on special status plant resources.

Invasive Species and Pest Management

Under Alternative C, restricting aerial application to only the use of pesticides would limit the application of pesticides to terrain accessible only by foot. This would mean only small acreages would be treated. This would have a short-term beneficial effect on special status plant species because it would be less likely that populations of these species would receive any pesticide application. However, adverse effects to these plant species would be likely over the long term by giving invasive species a competitive advantage over the native special status plant species. Annually treating only designated areas for cheatgrass would be ineffective, because only small, scattered treatments would occur; therefore, most of the cheatgrass would be unaffected. This would have an adverse effect on native special status plant species. Overall, Alternative C invasive species and pest management would have a minor beneficial effect on special status plant species.

Fish and Wildlife Resources – Fish and Special Status Species – Fish

Fish management actions under Alternative C include allowing surface-disturbing and disruptive activities within 0.25 mile of naturally occurring water bodies or WGFD Class 1 or 2 trout streams, but not within 500 feet of these areas. This management would not limit the number of activities and would apply a minimal project distance from streams. Disturbing soils and vegetation increases the potential for soil and water erosion and indirectly contributes to the decline in water quality over the long term. These areas also are very susceptible to hydrophilic invasive species such as Canada thistle and salt cedar that would out-compete special status plant species, essentially removing populations of these plant species communities. Surface-disturbing activities would be permitted in one to five percent of special status plant habitats; therefore, management actions for fish and special status fish resources under Alternative C would have minor adverse effects on special status plant resources.

Fish and Wildlife Resources – Wildlife and Special Status Species – Wildlife (including Greater Sage-Grouse)

A number of wildlife management actions would be implemented on a project-specific basis under Alternative C. There would be no limitations on distance and timing for projects. There would be no prohibitions on surface disturbance and occupancy in or near big game or other wildlife areas. Traditional migration and travel corridors would be managed in coordination with other resources and there would be no effort to introduce or augment wildlife species. Not prohibiting or limiting surface-disturbing activities in designated areas and during designated periods would increase opportunities for soil and water, provide additional large-scale opportunities for invasive species to establish, decrease the ecological condition of communities of special status plant species and associated habitats, and augment fragmentation of these plant communities. This would have an indirect adverse effect on communities of special status plant species over the long term. Surface-disturbing activities would be permitted within greater than ten percent of special status plant habitats; therefore, management actions for wildlife and special status wildlife resources would have major adverse effects on special status plant resources.

Heritage and Visual Resources

Cultural Resources

Alternative C would allow surface disturbance in areas with historic properties, or within 5 miles of historic properties. This would adversely affect special status plant species by increasing opportunities for soil and water erosion, invasive species to become established, and for direct removal of special status plant species. Surface-disturbing activities would be permitted within greater than ten percent of special status plant habitats; therefore, management actions for cultural resources under Alternative C would have major adverse effects to special status plant resources.

Paleontological Resources

Management actions limiting the requirement for paleontological field surveys to all PFYC Class 4 and 5 formations potentially affected by proposed activities would affect 28,177 acres. Not restricting surface-disturbing activities would subject the vegetation for possible large scale surface disturbance. This would increase the opportunity for undocumented special status plant species to be directly removed. Alternative C would have adverse impacts to special status plant species. Conversely, though, by identifying paleontological casual collection areas, Alternative C effects could reduce the potential of trampling or eliminating vegetation and compacting soils throughout the footprint of the access and general casual use areas. The greater the distance from riparian areas, wetlands, sand dunes, and other such habitats containing special status plants are avoided, the lesser the potential for effects associated with this vegetation and soil disturbance. It is likely that one to five percent of special status plant habitats would be impacted; therefore, direct minor adverse effects to special status plant species would occur from paleontological management actions associated with Alternative C.

Visual Resources

VRM Class I and II areas could prohibit or limit some surface-disturbing activities and thereby protect potential special status plant communities. VRM Class III and IV areas have minor limitations. Managing VRI Class II as VRM Class III would manage more permissively, thus allowing more surface-disturbing activities to occur which would adversely affect special status plant species by increasing the opportunities for soil and water erosion and invasive species to get established; 167,334 acres would be managed as VRM Class III. Thirty-three special status plant species populations (greater than ten percent of all known populations) are contained in areas currently classified as VRM Class II. The effects of this management would be major and adverse.

Land Resources

Forest Products

Alternative C effects special status plant species from forest product management actions would be similar to effects under Alternative A, except management under Alternative C would increase adverse effects because the sale of forest products would no longer be limited to minor products, there would be no acreage limits, and the intent would be to maximize the removal of harvested products. Offering an greater array of products would intensify the adverse effects described for Alternative A. In addition, not fencing regeneration areas would subject special status plant species that would colonize these areas to grazing and potential removal. Alternative C management of forest products would increase the adverse effects from the moderate effects identified in Alternative A to major for Alternative C.

Lands and Realty

Under Alternative C, disposing of lands with agricultural potential, water, or important natural

resource values would likely reduce beneficial effects on special status plant species compared to Alternative A or B, which either considers these values on a project-specific basis or requires the retention of these lands based on these important values, respectively.

Renewable Energy
Alternative C would allow renewable-energy development in areas open to other forms of energy development (minerals leasing, locatable minerals, and salable minerals). This would have an adverse effect on special status plant species where areas with renewable-energy potential and populations of special status plant species overlap. Renewable energy would be permitted in less than one percent of special status plant habitats; therefore, management actions for renewable energy under Alternative C would have negligible adverse effects on special status plant resources.

Rights-of-Way and Corridors
Alternative C ROW and corridors management actions would greatly increase potential adverse effects on special status plant species. Management actions would not relocate proposed new roads and access routes to those already in existence and would not prohibit ROW on slopes equal to or greater than 25 percent or on highly erodible soils. Not limiting surface disturbance and not avoiding activities on slopes equal to or greater than would have an adverse effect on vegetation by increasing the potential for soil and water erosion. (See the *Soil* section above for a description of direct adverse effects on special status plant species from this management.)

Travel and Transportation Management
Effects to SSS plants from management actions associated with travel and transportation in Alternative C would be similar to those described in the *Rights-of-Way* section above. The area available for motorized recreation would have an adverse effect on vegetative resources, including special status plant species habitat.

Recreation
Under Alternative C, there could be adverse effects on special status plant species from management actions specific to recreation. Hiking to or occasional repeated use of remote camp sites could have direct effects on special status plant species. Plants could be trampled or crushed, and soil could be compacted or disturbed. Holders of Special Recreation Permits are required to follow all rules and regulations, therefore, should avoid camping at locations where the BLM has identified populations of special status plant species. Lands will be managed in accordance with other resource values, including surface disturbing activities and placement of recreational facilities, which should alleviate some impacts to special status plant species. Given the low level of recreation use on most BLM-administered lands in the planning area, and the scattered, infrequent locations of populations of special status plant species, these adverse effects would mostly be minor.

Lands with Wilderness Characteristics
Alternative C actions include managing areas with wilderness characteristics consistent with management for the surrounding areas; there would be no specific management objectives for these areas. Alternative C would result in no effect on special status plant species.

Livestock Grazing Management
Livestock grazing management actions under Alternative C include allowing increases in livestock stocking rates as a result of vegetative treatments and providing a minimum of two years rest following prescribed fire, wildfire (in lieu of an approved plan), and other vegetative treatments. These actions would compromise the health of vegetative communities, potentially

including special status plant species. Livestock are often attracted to new vegetation following vegetative treatments and fires. If not monitored, these sites can be over utilized, and increasing stocking rates could compound the issue. Two years of rest might not be sufficient to achieve preferred ecological condition and vegetation management goals. Grazing of young seedling plants would reduce their competitiveness toward more aggressive type plants, which often are invasive or less-preferred species. This could prevent the restoration of populations of special status plant species or spread of existing plant populations, or permanently change the vegetative composition of suitable habitat for special status plant species. By not allowing for a more natural landscape in areas important to special status plant species, Alternative C would have fewer beneficial effects on these species, although increases in adverse effects are not discernible. Alternative C also incorporates actions to adjust livestock grazing management to make livestock grazing the first priority. This measure would result in increased grazing pressure and trampling damage to special status plant species. The anticipated adverse effects on special status plant species from livestock grazing under Alternative C would likely increase in grazing allotments that contain suitable habitat for special status plant species. (See Alternative A for this overlap.) In addition, Alternative C would allow livestock salt or mineral supplements within 500 feet of water sources, riparian areas, and aspen stands. Overall, Alternative C livestock grazing management would have a major adverse effect on special status plant species.

Special Designations

Areas of Critical Environmental Concern and Scenic or Back Country Byways
Impacts to SSS plants associated with special designations management actions for ACECs and scenic or BCBs in Alternative C would be the same as those described in Alternative A.

Wild and Scenic Rivers
Under Alternative C, if Congress decides not to designate the Middle Fork Powder River as a WSR, then its flee-flowing and natural characteristics will not be maintained. Increased surface disturbance near the river could impact flow regime, water quality, and riparian vegetation communities could occur on less than one percent of habitat important to special status plants, resulting in negligible adverse impacts.

Wilderness Study Areas
Effects to special status plant resources from management actions for WSAs in Alternative C will be the same as those described in Alternative A.

4.4.7.6. Alternative D

This section describes management actions under Alternative D, which employs a combination of resource conservation and resource use, and the likely impacts to special status plant species resources due to their implementation and potential impacts to special status plant species from those management actions.

Special Status Species – Plants
Similar to Alternative B, Alternative D management actions for special status plant species include prohibiting activities in known populations of special status plant species. Alternative D would allow aerial application of narrow-spectrum herbicides to protect habitat areas from invasive species encroachment. Use of fire suppression chemicals would be allowed consistent with the biology of the plant or where human safety or property is at risk. In addition, a CSU stipulation would be applied to mineral leases in SSS plant habitat, and livestock grazing

would be managed in a way to protect special status plants. Before the BLM approved any project or activity that could affect habitat for these species (as modeled by the WYNDD or the BLM), surveys for potential SSS plants would be performed. Through this management, there should be no adverse effects on existing populations of special status plant species. However, this approach would not protect future populations. Absent the conservative approach of Alternative B, activities allowed in suitable habitat for special status plant species could preclude proliferation of these species through future active management decisions. Overall, Alternative D would have a minor beneficial effect on special status plant species.

Impacts from management of resources under Alternative D would, in most cases, be similar to those described for Alternative A and under Impacts common to all alternatives. Where impacts to special status plant species would vary in degree from impacts under Alternative A, further rationale is provided below.

Physical Resources

Air Quality

Impacts to SSS plants associated with air quality management actions in Alternative D would be the same as those described in Alternative B.

Soil

Alternative D effects on special status plant species from soils management actions would be similar to impacts under Alternative B, except that Alternative D could allow activities by exception on 215,496 acres of highly erosive soils, 170,590 acres on slopes equal to or greater than 25 percent, 455,090 acres of soils with poor reclamation suitability and, although on a limited basis, on 218,928 acres of badlands, rock outcrops, and slopes susceptible to mass movement. In addition, applying a CSU stipulation to oil and gas leases could result in effects on special status plant species: 669,739 acres of highly erosive soils, 412,145 acres on slopes equal to or greater than 25 percent, 1,514,445 acres of soils with poor reclamation suitability and, although on a limited basis, on 685,950 acres of badlands, rock outcrops, and slopes susceptible to mass movement that could be associated with a federal mineral lease. For Alternative D effects to be he same as those under Alternative B, these exceptions would have to be evaluated for the presence of special status plant species or suitable habitat, and would be granted where there would be conflicts. CSU stipulations would overlap greater than ten percent of special status plant habitats; therefore, Alternative D soils management would have major beneficial effects on special status plant species.

Water Resources

Alternative D water management actions would allow surface disturbance within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams; would apply a CSU stipulation on oil and gas leases; and would evaluate unneeded reservoirs. There is no identified habitat for special status plant species habitat within the CSU areas. Under Alternative D, beneficial effects on special status plant species would be the same as under Alternative B, and would result from water management actions that encourage the use of alternative energy sources to power new water resource developments rather than overhead power or petroleum-based power and actions that manage riparian and upland areas to restore perennial flows or standing water and consider other resource values. Overall water management actions in this alternative will have a major beneficial effect on special status plant species.

Cave and Karst Resources
Under Alternative D, the types of effects associated with cave and karst resource management actions would, in general, be the same as effects under Alternative A, except that Alternative D would restrict livestock from cave entrances. This would decrease the potential for impacts caused by trampling or grazing of special status plant species. In addition, implementing a Cave Management Plan for the entire planning area would increase potential beneficial effects on special status plant species where cave and karst resources overlap such species. Cave and karst resources in the planning area overlap greater than ten percent of suitable habitat for special status plant species. Overall, Alternative D cave and karst management would have a major beneficial effect on special status plant species.

Mineral Resources

The amount of minerals extraction that would occur under this alternative would substantially increase land use intensity, and would result in a greater potential for loss or degradation of riparian and other habitats that support SSS plants. Alternative D would have a major adverse effect on special status plant species.

Locatable Minerals
Alternative D management actions for locatable minerals would have effects on special status plant species similar Alternative B, although Alternative D opens more area (4,720,586 acres) to locatable minerals entry. This would have a moderate adverse effect on special status plant species.

Leasable Minerals – Coal
The management action listed under Alternative D is administrative, and will have no effect on special status plant resources.

Leasable Minerals – Fluids
Alternative D effects on special status plant species from fluid minerals management would be the same as effects under Alternative C, with 3,314,254 acres open to oil and gas leasing. The areas open to fluid mineral development could affect greater than ten percent of special status plant habitats; therefore, management actions for fluid minerals under Alternative D would have major adverse effects to special status plant resources.

Salable Minerals
Alternative D effects on special status plant species from salable minerals management would be the same as effects under Alternative C, with 2,725,060 acres open to salable minerals disposal. The areas open to salable mineral development could affect greater than ten percent of special status plant habitats; therefore, management actions for salable minerals under Alternative D would have major adverse effects to special status plant resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative D, effects on special status plant species would be similar to the effects under Alternative B, except that Alternative D would increase beneficial effects through rehabilitating fire damage on an as-needed basis only. This could result in an increase in natural (re)occurrences of special status plant species.

Biological Resources

Allowing desirable non-native plant species for short-term reclamation activities and managing riparian and wetland systems capable of achieving DFC are actions included in Alternative D vegetation management. The persistence of desirable non-native plants could have more adverse effects on special status plants if proliferation of non-native plants caused loss of suitable habitat for SSS plants. In addition, under Alternative D, activities could be allowed by exception on greater than ten percent of habitat for special status plant species within 500 feet of riparian/wetland systems and aquatic habitats. For Alternative D effects to be the same as effects under Alternative B, these exceptions would have to be evaluated for the presence of special status plant species or suitable habitat, and would not be granted where there would be conflicts.

Vegetation – Forests and Woodlands
The types of effects to special status plant species from Alternative D would be the same beneficial effects as described in the Alternative C, *Forests and Woodlands* section.

Vegetation – Grassland and Shrubland Communities
Allowing use of desirable non-native plant species for short-term reclamation activities will result in better soil stabilization and reclamation success over the long-term. Following up with native plants will benefit special status plants species by decreasing the risk of competition with non-native species. Overall, management actions associated with Alternative D for grassland and shrubland communities will have major beneficial effects on special status plant species.

Vegetation – Riparian/Wetland Resources
Under Alternative D, both adverse and beneficial effects to special status plant species will occur. Allowing surface disturbance within 500 feet of riparian and wetland areas could result in adverse impacts to potential habitat for special status plant species; however, a CSU on fluid mineral leases and restoration of CBNG supported habitats according to ecological site potential will allow for management of DPCs and control over surface disturbing activities. Overall, management activities for riparian/wetland resources associated with this alternative will have a major beneficial effect on special status plant species.

Invasive Species and Pest Management
Effects to SSS plants associated with invasive species and pest management actions in Alternative D would be the same as those described in Alternative B.

Fish and Wildlife Resources – Fish and Special Status Species – Fish
Alternative D effects on special status plant species from fish management, including SSS fish, would be similar to effects under Alternative B. Under Alternative D, though, activities could be permitted by exception within greater than ten percent of suitable habitat for special status plant species within 0.25 mile of naturally occurring water bodies that contain native and desirable non-native fish species; therefore, management actions for fish and special status fish resources would have moderate beneficial effects on special status plant resources.

Fish and Wildlife Resources – Wildlife
Alternative D effects on special status plant species from wildlife management actions would be similar to those under Alternative B. Alternative D, though, could allow aboveground facilities by exception on the 75,175 acres of elk crucial winter range and calving areas that overlap currently identified SSS plant habitat, and could allow disturbance by exception on greater than ten percent of SSS plant habitat; therefore, management actions for wildlife under Alternative D would have

major beneficial effects on special status plant resources. For Alternative D effects to be the same as those under Alternative B, exceptions would have to be evaluated for the presence of special status plant species or suitable habitat, and would not be granted where there would be conflicts.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Alternative D effects on special status plant species from wildlife management would be similar to those under Alternative B. Alternative D, though, could allow disturbance activities by exception on 6,156 acres of black-tailed prairie dog colonies and 176,636 acres of special status amphibian, reptile, and bat species habitat that overlaps currently identified habitat for special status plant species plant. For these effects to be the same as those under Alternative B, exceptions would have to be evaluated for the presence of special status plant species or suitable habitat, and would not be granted where there would be conflicts. In addition, under this alternative, the NSO stipulations for special status raptor species would increase or decrease compared to other alternatives because the buffers would be species specific; these raptor buffers overlap 17,417 acres of suitable habitat for special status plant species.

With its habitat removal allowances, compared to Alternative B, Alternative D would protect 56,516 fewer acres of suitable habitat for special status plant species present in areas with suitable nesting habitat for Greater Sage-Grouse and 13,016 fewer acres of suitable habitat for special status plant species present in areas of suitable winter habitat for Greater Sage-Grouse.

Overall, surface-disturbing activity restrictions for special status wildlife resources would conserve greater than ten percent of special status plant habitats; therefore, management actions for special status wildlife resources would have major beneficial effects on special status plant resources.

Heritage and Visual Resources

Cultural Resources
The types of effects under Alternative D cultural resources management would be the same as those under Alternative B, except that Alternative D would protect one to five percent of suitable habitat for special status plant species through cultural resources NSO restrictions and greater than ten percent through cultural resources CSU restriction. This would have a major beneficial effect on special status plant species.

Paleontological Resources
Effects to SSS plants associated with paleontological resource management actions in Alternative D would be the same as those described in Alternative B.

Visual Resources
Effects to SSS plants associated with VRM actions in Alternative D would be the same as those described in Alternative B.

Land Resources

Forest Products
Under Alternative D, short-term adverse effects on special status plant species and their habitats would be the same as under all other alternatives. However, Alternative D would allow harvest with no limit on area size managed within ecologically stable limits. Long-term beneficial effects would be similar to those under alternatives B and C. Under Alternative D, there would

be conflicts between the harvest of forest products and management five to ten percent of suitable habitat for special status plant species. This would have a minor adverse effect on special status plant species.

Lands and Realty
Impacts to SSS plants associated with lands and realty management actions in Alternative D would be the same as those described in Alternative B.

Renewable Energy
The types of effects associated with renewable energy management under Alternative D would be the same as those under Alternative B, except that Alternative D would exclude greater than ten percent of suitable habitat for special status plant species from renewable energy development and would manage greater than ten percent as ROW exclusion or avoidance areas. New communications sites, transmission lines, and ground facilities outside existing disturbance areas or ROW corridors could be allowed by exception. For these effects to be the same as those under Alternative B, exceptions would have to be evaluated for the presence of special status plant species or suitable habitat, and would not be granted where there would be conflicts.

Rights-of-Way and Corridors
Effects to SSS plants from management actions associated with ROWs in Alternative D would be the same as those described in the *Renewable Energy* and *Travel and Transportation Management* sections.

Travel and Transportation Management
Alternative D effects on special status plant species plants and their habitat from the management of transportation and access would be similar to Alternative B, except that Alternative D would allow motorized vehicle use in SSS habitat, but not within known populations. Travel would be restricted to designated roads and trails, consistent with other resource values. Motorized travel within special status plant habitat may reduce suitability through soil and water erosion, resulting in adverse impacts in over ten percent of habitat important to special status plants species. However, designating routes outside occupied habitat would reduce the effects to minor.

Recreation
The types of effects from Alternative D management of recreation would be the same as those under Alternative B. Alternative D would designate seven areas, three of which contain a total of one to five percent of suitable all habitat for special status plant species, as SRMAs. Therefore, management actions for recreation under Alternative D would have minor adverse effects on special status plant resources.

Lands with Wilderness Characteristics
The types and magnitude of effects to special status plant species from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for wilderness characteristics.

Livestock Grazing Management
Under Alternative D, the types of effects on special status plant species from management actions associated with livestock grazing management would be the same as those under Alternative B. Alternative D identifies areas that are incompatible to livestock grazing (recreation, steep slopes, etc.) that also coincides with five to ten percent of suitable habitat for special status plant species. Alternative D would also prohibit the placement of salt or mineral supplements on greater than ten percent of suitable habitat, which would avoid trampling damage. Unrestricted livestock

grazing could be permitted in greater than ten percent of special status plant habitats; therefore, management actions for livestock grazing management would have major adverse effects on special status plant resources.

Special Designations

Areas of Critical Environmental Concern
Under Alternative D, no ACECs are proposed that overlap with known SSS habitat, therefore management actions would have no effect. If special status plants are found within designated ACECs in the future, then management actions would be beneficial.

Scenic and Back Country Byways
Effects to special status plant species associated with scenic and BCBs management actions in Alternative D would be the same as those described in Alternative B.

Wild and Scenic Rivers
Effects to special status plant species associated with WSRs management actions in Alternative D would be the same as those described in Alternative B.

Wilderness Study Areas
Effects to SSS plants associated with WSA management actions in Alternative D would be the same as those described in Alternative B.

4.4.7.7. Cumulative Impacts

Cumulatively, adverse effects on Threatened, Endangered, Proposed, Candidate, and Sensitive species are expected in the planning area. There would be many cumulative short- and long-term disturbances to these species, which would stem from several sources. Included in the cumulative effects evaluated are the direct effects of oil and gas (CBNG and non-CBNG) extraction and development of new oil and gas wells on adjacent lands. Oil and gas development would occur on a mix of federal, state, private, and split estate lands. Additional activities that occur on all of these lands and contribute to cumulative effects on special status plant species in the planning area include coal mining; uranium mining; sand, gravel, and scoria mining; ranching; agriculture; construction of roads and railroads; recreation; and development of rural and urban housing.

The primary uses and management practices on lands adjacent to BLM-administered lands would have the greatest potential to affect special status plant populations and their habitats. Adjacent ownerships that have been converted to hayland or cropland or that are overgrazed provide little opportunity for populations of special status plant species to expand.

Dewatering of streams for irrigation and development of springs and headwaters of small streams for livestock watering alters the hydrologic cycle and contributes to a reduction in riparian and wetland habitat that supports special status riparian plants. Trampling of spring sources and stream banks by livestock and wildlife also contributes to lowered water tables and a diminution of wetland habitat. Loss of riparian and wetland habitat would likely result in population declines of species such as the Ute ladies'-tresses orchid.

4.4.8. Special Status Species – Fish

This section describes potential direct, indirect, short-term, and long-term effects on special status fish species under each alternative and whether those effects would be beneficial or adverse. The Yellowstone cutthroat trout is the only special status fish found in the planning area. Map 28 shows the distribution of special status fish in the planning area.

Actions that contribute to the decline in special status fish abundance or range would result in adverse effects. Conversely, beneficial effects would result from actions that increase special status fish population numbers or viability, protect habitats, or reduce the risk of harm to these species in the planning area.

For purposes of this analysis, short-term impacts to special status fish species would result from activities that contribute to the decline in abundance or distribution of a species, but which recover within five years of after the activities. Long-term effects would require more than five years for recovery.

Surface-disturbing activities, water depletions, sedimentation, changes instream hydrology, increased sedimentation, changes in water quality, and introduction of exotic species (e.g., mussels or whirling disease) could affect special status fish. The primary means by which direct impacts to special status fish could occur are surface development (e.g., mining and urbanization), loss of sufficient upland and riparian vegetation that increases sedimentation, and discharge or runoff of poor-quality water. Indirect effects on SSS would result from actions that aid or compromise the protection of special status fish species. Indirect effects on potential habitats for special status fish species also could result from actions, such as those listed above, that change habitats in a way that makes them unsuitable.

Erosion can lead to increased turbidity and sedimentation, which can inhibit feeding and spawning success. Sedimentation can suffocate or starve bottom-dwelling insects, an important food source for fish. Developing eggs can be smothered in sediment, and newly hatched fry can be killed by sediment that prevents emergence from spawning gravels and interferes with respiration. Suspended sediments can inhibit respiration. Developing fish eggs and larvae need a constant supply of cold, oxygen-rich water that flows through the interstitial spaces instream gravels. Embedded sediments limit essential winter habitat used by juvenile fish for feeding and cover from predators. The filling of pools with sediment further limits overwintering sites for juvenile and adult fish.

A second, potentially major adverse impact to Yellowstone cutthroat trout is the introduction of diseases, such as whirling disease, and invasive species, such as mussels. Humans, vehicles, water haul trucks or aircraft, and livestock, can transport infected sediments or water. The effects of introduced species such as mussels or whirling disease can be major. Managing to protect against introduced species or disease is problematic. The only practical way to mitigate this issue is through outreach and education.

4.4.8.1. Methods and Assumptions

This section describes the methods and assumptions used in impact analysis. The assumptions and methods include the following:

- The analysis is on a watershed scale.

- Management actions that preclude or restrict development, including those not specifically aimed at conserving special status fish species, are assumed to benefit those species where populations overlap management action boundaries.
- The total amount of new surface disturbance allowed under each alternative is an index of potential impacts to special status fish. The success of reclamation measures would vary. It is assumed that BLM-applied reclamation would be successful in preventing impacts to special status fish.
- Surface-disturbing activities in special status fish habitat would result in adverse effects.
- Implementing all actions prescribed in USFWS Biological Opinions for Threatened or Endangered species would have a beneficial effect on sensitive fish species.

Significance Criteria

In addition to the scale of impacts listed in the beginning of this chapter, an adverse impact on fish species as a result of project actions would be considered potentially significant if there was: (1) substantial loss of the biological integrity and habitat function of aquatic ecosystems that would make species eligible for listing under the ESA; (2) decreased viability or increased removal of Threatened, Endangered, Proposed, or Candidate species, or adverse alteration of their critical habitats; and (3) substantial loss of habitat function or disruption of life history requirements of SSS that would preclude improvement of their status.

Management of **Air Quality, Forest Products, Lands with Wilderness Characteristics, Back Country Byways, Wild and Scenic Rivers**, and **Wilderness Study Areas** would have no effect on special status fish species and are not further addressed in the **Special Status Species – Fish** section.

4.4.8.2. Impacts Common to All Alternatives

Physical Resources

There would be beneficial effects on special status fish species from proper management of soil and water resources. Implementing mitigation measures to protect soils and water on a project-specific basis, particularly in riparian zones of watersheds, would reduce disturbance to fish habitats and help in the recovery of aquatic habitats from permitted uses. Improper management of soil and water resources can lead to increased sediment loads in affected watersheds.

Soil
Evaluating the effects on soil resources from a proposed surface-disturbing activity using NRCS Soil Survey data or onsite investigations would help in the application of mitigation measures, relocate the activity to a more suitable soil type, or deny the authorization. This management of soil resources would influence greater than 10 percent of the special status fish habitats in the planning area; therefore, management actions common to all alternatives for soil would have a major beneficial effect on special status fish resources.

Water Resources
Water resources management actions would beneficially affect special status fish by reducing sedimentation, increasing aquatic vegetation and macro-invertebrates through (1) providing an alternative or "off-source" water supply (e.g., piping water to troughs, tanks, or ponds) in

locations where BLM-authorized uses are fenced out of water sources; (2) installing flow-control devices on new and existing BLM-authorized water wells and spring developments and evaluating the need for additional flow-control devices on a project-specific basis; (3) managing water resources to meet the Wyoming Standards for Healthy Rangelands and achieve PFC; (4) take appropriate actions to improve the biological, chemical, and geomorphic conditions of streams adversely affected by BLM-authorized actions and permitted activities; and (5) design and manage land use and surface-disturbing activities to reduce channel and bank erosion and the associated loss of riparian habitats. All these actions influence greater than 10 percent of the special status fish habitats in the planning area and would have a major beneficial effect on special status fish resources.

Cave and Karst Resources
Management actions common to all alternatives for cave and karst include inventories of cave and karst resources. This would have no effect on special status fish resources.

Mineral Resources

Instream reaches where there is Yellowstone cutthroat trout habitat congruent with BLM-administered lands, mineral rights are held by the federal government. Most streams representing Yellowstone cutthroat trout habitat are administered by the USFS, with the BLM holding the federal mineral estate. In such situations, minerals development would require a permit from the USFS for surface disturbance and a permit from the BLM for the federal mineral. Mining on National Forest System lands could affect Yellowstone cutthroat trout and its habitat on BLM-administered lands.

In general, surface mining activities increase erosion and accelerate sediment production and input into nearby lakes and streams. Streams can be dewatered or rechanneled to accommodate surface mines. Surface mining operations also have the potential to increase pollution that could enter streams through runoff and disrupt subsurface and surface water flow patterns. Bridges, culverts, and low-flow crossings are integral features in road development associated with surface mining. If not properly designed, these features also can interfere with fish migrations to spawning, feeding, rearing, and overwintering sites. Proper placement of these structures is critical to minimizing impacts to fish.

Locatable Minerals
Leaving lands open to locatable minerals exploration and development could adversely affect Yellowstone cutthroat trout through increased sedimentation, removal of riparian vegetation, changes in stream channel morphology, and decreased water quality. Locatable minerals could occur within the drainages of one to five percent of the special status fish habitat in the planning area; therefore, the management actions common to all alternatives for locatable minerals would have a minor adverse effect on special status fish resources.

Leasable Minerals – Coal
Occupied stream segments are outside areas with the potential for coal development. Making federal coal lands identified as acceptable for further coal leasing consideration (BLM 2001a) in north central Sheridan County available for exploration could affect streams in the historic range for Yellowstone cutthroat trout, such as the Tongue River, Little Earley Creek, Youngs Creek, and Ash Creek. These waters are not occupied and currently do not have water temperatures conducive to trout populations. Yellowstone cutthroat trout could occupy these waters seasonally. If coal mining affected these stream segments, effects on Yellowstone

cutthroat trout would not rise to a population level. Overall, potential coal development could occur within greater than 10 percent of the special status fish habitats in the planning area; therefore, management actions common to all alternatives for coal would have major adverse effects on special status fish resources.

Leasable Minerals – Fluids
Surface disturbance from fluid minerals development in Yellowstone cutthroat trout drainages could increase sedimentation. Produced water from oil and gas wells could pollute streams if untreated water reaches them. Opening all oil and gas mineral estate to fluid minerals leasing could influence greater than 10 percent of the streams identified as special status fish habitat. Management actions common to all alternatives for fluid minerals would have major adverse effects on special status fish resources.

Salable Minerals
Opening all salable minerals exploration, unless the estate is specifically identified as administratively unavailable for minerals leasing during the planning period, could affect Yellowstone cutthroat trout if those minerals are discovered in western Sheridan County. At present, there are no identified minerals of these types that overlap populations of Yellowstone cutthroat trout. Salable mineral potential, though, does exist within one to five percent of the drainages identified as Yellowstone cutthroat trout habitat; therefore, the management actions common to all alternatives for salable minerals would have minor adverse effects on special status fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Fire affects fish populations through physical and chemical changes (increased siltation, altered water quality [dissolved oxygen, pH, suspended and dissolved solids, total hardness, turbidity], and water temperature changes). Nutrient flow changes that adversely affect aquatic insect production also would affect fish populations. Although there is limited BLM surface estate congruent with Yellowstone cutthroat trout streams, the threat of wildfire and prescribed fire occurs on all lands surrounding Yellowstone cutthroat trout streams, and could affect any populations in streams on BLM-administered lands.

The extent of surface erosion after a fire depends largely on the topography and soil types in the immediate area. Stream siltation can occur following fire. Siltation is a particular problem where severe burns occur on steep or moderate slopes, in riparian habitats, or where heavy equipment is used in suppression activities. There could be changes in water temperature in cold-water fisheries, such as Yellowstone cutthroat trout habitat, if shading vegetation is removed from the side of the stream. Fish will generally re-invade fire-affected areas rapidly from areas upstream of the affected area, surrounding watersheds, and mainstem rivers where migration is not limited. Fuels projects are designed and implemented in a non-emergency manner that minimizes impacts to aquatic resources.

Competent planning and implementation will minimize the effects of fuels treatments on special status fish. Prescribed fires in spring and fall are less likely to escape containment and are therefore less of a threat to riparian vegetation and less likely to contribute to erosion. To protect water quality and the diversity of habitats for fish, amphibians, and other aquatic organisms, standard operating procedures are in place to protect the PFC of riparian areas and stream characteristics.

The impacts of erosion from fire suppression would likely be localized, and could be minimized by rapid rehabilitation after the fire is under control, although improperly located bulldozer fire lines could greatly increase local stream sediment loads. Uncontrolled fires more than likely would create more erosion than the suppression activities. The use of certain types of fire retardant in or near fish-bearing streams would be a serious threat to these aquatic ecosystems. The by-products of the retardant can be toxic to fish and would result in fish kills.

Adhering to the National Wildland Fire Management Policy and current FMP for the WHPD, ensuring all prescribed-fire activities comply with Wyoming DEQ standards and rules, using a resource advisor and prohibiting the use of retardants or foam within 300 feet of surface water sources would reduce impacts to fish. Some runoff into occupied stream segments would be likely, which would kill individual fish, but population-level effects are not anticipated. Implementation of the BLM Emergency Stabilization and Burned Area Rehabilitation standards and rehabilitation of fire lines would reduce sedimentation from runoff. Landscape treatments to enhance fuels management and restore fire-adapted ecosystems could result in a short-term, adverse effect on fish and fisheries from sedimentation during fire treatments. Long-term effects from treatments would be beneficial because the threat of catastrophic wildfire would be reduced.

Overall, management actions common to all alternatives for planned and unplanned fire would have minor adverse effects on special status fish resources.

Biological Resources

Vegetation – Forests and Woodlands
No management actions common to all alternatives have been identified for forests and woodlands.

Vegetation – Grassland and Shrubland Communities
Managing vegetative communities in accordance with the Wyoming Standards for Healthy Rangelands, and siting facilities and related infrastructure, travel routes, recreational uses, mineral exploration and development sites, and ROW to reduce impacts to vegetative resources would keep sedimentation and channel modifications, and their resultant impacts to sensitive fish species, to a minor level. Maintaining sustainable forage levels for livestock and wildlife habitat would minimize sedimentation. The management actions common to all alternatives for grassland and shrubland communities would have minor beneficial effects on special status fish resources.

Vegetation – Riparian/Wetland Resources
Prioritizing and developing activity and implementation plans to manage riparian systems to be at or above, or continue to be improving toward PFC while achieving the Wyoming Standards for Healthy Rangelands would reduce sedimentation and channel modifications, and their resultant impacts to sensitive fish species. Managing riparian and wetland systems to enhance forage conditions and improve water quality to a succession stage appropriate for that system, including vertical and horizontal vegetative structure and composition, would also reduce sedimentation and channel modifications, and their resultant impacts to sensitive fish species. These management actions would influence greater than 10 percent of the special status fish habitat in the planning area. Management actions common to all alternatives for riparian/wetland resources would have major beneficial effects on special status fish resources.

Invasive Species and Pest Management
BLM weed and pest control work on public lands adjoining deeded and state lands could have

an adverse effect if chemical applications encounter occupied habitat. Proper use of chemicals, for example not applying them within 200 feet of fish-bearing water, would minimize this risk. Specific, careful and appropriate grasshopper and Mormon cricket treatments can prevent overuse, as well as management of invasive plant species, and thereby limit erosion, resulting in a beneficial effect. These actions should reduce impacts to all identified special status fish habitats. Management actions common to all alternatives for invasive species and pest management would have major beneficial effects on special status fish resources.

Fish and Wildlife Resources – Fish

Management actions common to all alternatives that are administrative processes (e.g., development and prioritization of plans; providing fisheries outreach and education; updating existing HMPs; and adherence to rules, regulations, and agreements such as MOUs) would have no effects on special status fish species. Managing barriers to fish passage in cooperation with the WGFD and other stakeholders would have a beneficial effect on sensitive fish species because these barriers can be used to allow Yellowstone cutthroat trout to move into new habitats or keep competitor fish, such as rainbow trout, out of cutthroat trout waters. Effects from managing activities that could affect native and desirable non-native fish species in collaboration with the WGFD and other stakeholders should benefit special status fish species.

Managing public access to fish-bearing waters or to protect crucial habitats could have major adverse effects. Future access routes would increase the likelihood of introducing whirling disease or invasive species into Yellowstone cutthroat trout waters. These impacts could be mitigated to minor through education programs for fishermen. Constructing new fences, even in accordance with the BLM Fencing Handbook, could reduce sedimentation by excluding livestock from riparian areas that support Yellowstone cutthroat trout. Management actions common to all alternatives support efforts to protect and improve riparian ecosystems. These actions include restoring fish habitats and managing harmful non-native riparian vegetation in river and stream systems important to fish species, and will have beneficial effects on Yellowstone cutthroat trout.

Management actions for fish would encompass all Yellowstone cutthroat trout habitats. Management actions for fish would have major beneficial effects on special status fish resources.

Fish and Wildlife Resources – Wildlife

Management actions common to all alternatives support efforts to protect and improve riparian ecosystems. These actions include restoring fish habitats and managing harmful non-native riparian vegetation in river and stream systems important to fish species, and would have beneficial effects on fish. Management actions common to all alternatives support efforts to protect and improve various ecosystems throughout the planning area. These actions include managing vegetative diversity, minimizing disturbances to springs and riparian zones, and improving riparian plant communities within one to five percent of the drainages identified as containing Yellowstone cutthroat trout habitat. Management actions Common to all Alternatives for wildlife would have minor beneficial effects on special status fish resources.

Special Status Species – Plants

Management actions common to all alternatives for special status plant species include allowing treatments that would benefit the plant species. Special status plant species occur along five to 10 percent of the special status fish habitats in the planning area. Treatments that improve the health of vegetation would also improve the health of the neighboring stream; therefore, management actions common to all alternatives for special status plant species would have moderate beneficial effects on special status fish resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Avoidance areas, whether for the application of broad-spectrum insecticides or to protect nesting bald eagles, would have a beneficial effect on Yellowstone cutthroat trout where these resources overlap. These avoidance areas encompass greater than 10 percent of identified Yellowstone cutthroat trout habitat. Management actions for special status wildlife species would have major beneficial effects on special status fish resources.

Heritage and Visual Resources

Cultural Resources
Management actions include completion of site stabilization and long-term protection of significant sites. This would benefit fish through habitat conservation when the sites occur within close proximity to fish habitats. Currently, significant sites occur within greater than 10 percent of identified Yellowstone cutthroat trout habitat in the planning area. Management actions for cultural resources would have major beneficial effects on special status fish resources.

Paleontological Resources
Management actions common to all alternatives would have a negligible beneficial effect on special status fish resources by retaining public lands under the management of the BLM.

Visual Resources
Special status fish resources are not present in any WSAs or WSRs identified in the resource area. VRM Class IV areas have minor limitations on surface-disturbing activities. Managing visual resources would indirectly affect special status fish habitats, depending on the locations, types, and durations of approved projects. Beneficial effects under the management action common to all alternatives would occur on less than one percent of habitats important to special status fish species, and would therefore have negligible beneficial effects on special status fish resources.

Land Resources

Lands and Realty
Lands and realty management actions common to all alternatives would have a negligible effect on special status fish species. Project-specific analyses of lands and realty actions, such as approval of R&PP permits, land use authorizations, land withdrawals, and land disposals require NEPA analysis, thereby identifying any conflicts in order to limit adverse effects on special status fish.

Renewable Energy
Management actions common to all alternatives for renewable energy are administrative and will have no effect on special status fish resources.

Rights-of-way and Corridors
Reasonable access could be provided for ROWs and corridors within the drainages of one to five percent of the Yellowstone cutthroat trout habitat in the planning area. ROWs cause habitat degradation through vegetation removal and trampling. Adverse effects to fish-bearing waters from ROWs would occur when these accesses cause increased sedimentation in the streams. Management actions common to all alternatives for ROWs and corridors would have minor adverse effects on special status fish resources.

Travel and Transportation Management
Negotiating with willing landowners for access across non-BLM-administered lands to isolated

public land parcels that have streams with Yellowstone cutthroat trout would increase the risk of spreading whirling disease or unwanted introduced species. Introduction of disease or unwanted species could have adverse effects on Yellowstone cutthroat trout. TTM could influence one to five percent of the streams identified as Yellowstone cutthroat trout habitat. Management actions common to all alternatives for TTM would have minor adverse effects on special status fish resources.

Recreation
Avoiding riparian habitat or developing and managing recreation sites, recreation facilities, and recreation access in a manner that minimizes impacts to riparian habitats, and prohibiting dispersed camping and commercial camps within 200 feet of surface water would benefit Yellowstone cutthroat trout.

Yellowstone cutthroat trout are pursued as a recreational game fish. At present, there is no public access to BLM-administered lands that have streams containing Yellowstone cutthroat trout. BLM access on the Tongue River at Welch Ranch is downstream from occupied habitat. It is possible Yellowstone cutthroat trout seasonally occupy that portion of the river, but there are no records of occupation. Recreational access to Yellowstone cutthroat trout in the Bighorn National Forest is common and could affect populations and habitat in streams on BLM-administered lands. Over-fishing would not occur on BLM-administered lands because of poor access to streams with Yellowstone cutthroat trout. Overall, these impacts are likely to occur in one to five percent of the identified Yellowstone cutthroat trout habitats. Management actions common to all alternatives for recreation would have minor beneficial effects on special status fish resources.

Livestock Grazing Management
Improper livestock grazing management could adversely impact stabilization of riparian vegetation, which can lead to stream instability and an associated loss of habitat complexity, and 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 would depend on livestock grazing timing and intensity, site characteristics, and species habitat requirements. Livestock driveways impact wildlife habitats because they reduce vegetation and compact soils. Stock driveways and rests in riparian areas tend to concentrate high levels of livestock use that can cause degradation (e.g., near-complete removal of vegetation and soil compaction). Beneficial impacts of proper grazing include reducing competition by removing encroaching woody plant cover; hoof action that keeps topsoil loose, increases litter and precipitation penetration, and incorporates seeds into soil; nutrient recycling; removing wildfire fuels; and controlling invasive plant and weed species with properly timed grazing rotations and species (e.g., goats). There are 779,034 acres of BLM surface in grazing allotments in the planning area, which occur along one to five percent of the identified Yellowstone cutthroat trout habitat in the planning area. Management actions common to all alternatives for livestock grazing would have minor adverse effects on special status fish resources.

Special Designations

Areas of Critical Environmental Concern
Management actions common to all alternatives associated with ACECs would evaluate and mitigate adverse impacts to them. This would benefit the special status fish resources as the integrity of Welch Ranch would be maintained. Welch Ranch encompasses less than one percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions

common to all alternatives for ACECs would have negligible beneficial effects on special status fish resources.

Socioeconomic Resources

Social and Economic Conditions
Management actions common to all alternatives are administrative processes and will have no effect on special status fish resources. Impacts to social and economic resources will be quantified on a project-specific basis. Management actions that vary by alternative are also administrative; therefore, social and economic management actions will not be discussed further in this section.

Health and Safety
Management actions common to all alternatives are designed to control and mitigate threats to health and human safety and to the environment. Management actions designed to prevent accidental spills of hazardous materials or environmental contamination would have beneficial impacts to special status fish by protecting riparian and wetland areas and water quality across the resource area. Because hazardous materials (e.g., oil, oil and gas by-products, pesticides, and cleaning solvents) are being produced and transported in the planning area, there is a threat of accidents or spills. If there was a spill, mitigation and cleanup would rarely succeed in recovering a riparian or wetland area to its original condition over the short term; therefore, there would be localized long-term adverse impacts.

Only management actions in common to all alternatives are identified; therefore, health and safety will not be discussed further in this section.

4.4.8.3. Alternative A

Alternative A would continue management in accordance with the 1985 RMP as amended and maintained. This section describes management actions and potential impacts to sensitive species fish from implementing Alternative A. Current management allows the authorized officer to waive restrictions for surface disturbance activities, resulting in non-application of some restrictions in some locations.

Special Status Species – Fish
Currently, there are no management actions addressing the impacts of any action on special status fish resources. Impacts are evaluated on a project-specific basis. Without oversight on a programmatic level and specified criteria for evaluation and application of restrictions, special status fish are likely to experience adverse effects. The lack of management actions for special status fish under Alternative A would have major adverse effects on them.

Physical Resources

Soil
Under Alternative A, prohibiting surface-disturbing activities in areas of severe erosion hazard from March 1 through June 15, on slopes equal to or greater than 25 percent, and on soils with poor reclamation suitability would reduce but not prevent erosion and subsequent sedimentation. These prohibitions/restrictions, in general, would influence greater than 10 percent of the Yellowstone cutthroat trout habitats in the planning area and constitute a major beneficial effect on special status fish resources.

Water Resources
Under Alternative A, reservoir construction within historic Yellowstone cutthroat trout habitat would require site-specific analysis through BLM and EPA authorities. The potential for on-channel reservoirs in these locations is remote. If on-channel reservoirs were pursued in historic Yellowstone cutthroat trout habitat, effects likely would be adverse because such reservoirs would prevent fish passage.

Management of produced water from oil and gas development would not overlap with Yellowstone cutthroat trout habitat. Current prohibitions on placement of oil and gas wells and facilities prohibit these elements within 500 feet of streams. This prohibition protects Yellowstone cutthroat trout habitat from sedimentation reducing the adverse effects. These actions would influence greater than 10 percent of the identified Yellowstone cutthroat trout habitat. Management actions for water under Alternative A would have major beneficial effects on special status fish resources.

Cave and Karst Resources
There are no management actions for cave and karst resources under Alternative A.

Mineral Resources

Locatable Minerals
Under Alternative A, withdrawing the Amsden Creek (525 acres), Ed O. Taylor (approximately 3,896 acres), and Kerns (163 acres) game ranges from mineral locations and restricting locatable minerals activities in the Fortification Creek, Gardner Mountain, and North Fork WSAs (approximately 28,931 acres) would not alter the effects on Yellowstone cutthroat trout described in the *Common to All Alternatives* section. Locatable mineral exploration and development is currently permitted within one to five percent of the identified Yellowstone cutthroat trout habitat in the planning area. Management actions for locatable minerals under Alternative A would have minor adverse effects on special status fish species.

Leasable Minerals – Coal
The management action listed under Alternative A will have no effect on special status fish resources.

Leasable Minerals – Fluids
Under Alternative A, continuing to lease and allow development of federal oil and gas could adversely effect Yellowstone cutthroat trout. Current knowledge of the distribution of coalbeds harboring natural gas indicate that there would be no development in occupied Yellowstone cutthroat range. Fluid mineral exploration and development could occur, though, within greater than 10 percent of the identified Yellowstone cutthroat trout habitat in the planning area. Management actions for fluid minerals under Alternative A would have major adverse effects on special status fish resources.

Salable Minerals
Alternative A salable minerals management would not be likely to affect occupied Yellowstone cutthroat trout habitat. Most of the trout's occupied range is on National Forest System lands, and any action that could affect Yellowstone cutthroat trout would undergo a site-specific analysis of potential effects. Should salable minerals be developed in occupied Yellowstone cutthroat trout drainages, the effects could extend to the stream reach/population level. The entirety of identified habitat for this species, though is larger and salable mineral development could currently occur

within one to five percent of the identified habitat. Management actions for salable minerals under Alternative A would have minor adverse effects on special status fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire)

Limited suppression of wildfires on BLM-administered land where fire control is very difficult or extremely hazardous to firefighting personnel could allow stream-damaging fires in occupied Yellowstone cutthroat trout range. Suppressing unwanted wildland fires would prevent sedimentation from post-fire erosion. Use of fire retardant could adversely affect Yellowstone cutthroat trout if the chemicals reached occupied streams. Rehabilitating fire and suppression damage would minimize effects on Yellowstone cutthroat trout by decreasing runoff and sedimentation. Overall, Alternative A management of unplanned fires would have a minor adverse effect on special status fish species.

Planned Fire (Prescribed Fire)

Using prescribed fire to support vegetation and wildlife habitat objectives could have adverse or beneficial effects on Yellowstone cutthroat trout. Prescribed fire could increase runoff and sedimentation (an adverse effect) or could increase streamflows by removing invasive plants (a beneficial effect). Long term, the effects would be minor beneficial.

Biological Resources

Vegetation – Forests and Woodlands

Treatments including cutting, thinning, and prescribed burning may pose an adverse short-term impact on fish resources resulting from soil erosion and potential sedimentation in streams and rivers. However, improved forest health (vegetation composition, soil stability, decreased risk of wildfire) resulting from the treatments will have beneficial effects on special status fish resources over the long term. Management actions under this alternative would benefit over 10 percent of habitats important to special status fish species, making the effects major.

Vegetation – Grassland and Shrubland Communities

There are no management actions for grassland and shrubland communities under Alternative A.

Vegetation – Riparian/Wetland Resources

Prohibiting surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would benefit Yellowstone cutthroat trout by preserving the riparian and adjacent upland communities of all the identified Yellowstone cutthroat trout habitat in the planning area. Management actions for riparian/wetland resources under Alternative A would have major beneficial effects on special status fish resources.

Invasive Species and Pest Management

IPM, as currently practiced and when appropriately applied in the planning area, complies with restrictions on chemical labels that provide adequate buffers from fish-bearing water. Aggressive treatment of invasive plants, particularly riparian plants, could adversely affect Yellowstone cutthroat trout over the short term by increasing sedimentation and removing shade. Over the long term, these treatments would benefit the trout by replacing invasive plants with native species that generally require less water, and increasing streamflow.

Fish and Wildlife Resources – Fish
Cooperating with the WGFD to reintroduce native and desirable non-native fish in the planning area where there is potential habitat could benefit Yellowstone cutthroat trout. Due to the limited BLM surface in suitable Yellowstone cutthroat trout habitat, this beneficial effect would be minor.

Fish and Wildlife Resources – Wildlife
Prohibiting surface disturbance in the Kerns and Amsden Creek big game winter ranges, and elk crucial winter range would result in a benefit to Yellowstone cutthroat by reducing erosion and sedimentation; however, the ability to grant waivers and implementing seasonal restrictions for the ranges reduces this benefit. These restrictions for wildlife also conserve vegetation within greater than 10 percent of identified Yellowstone cutthroat trout habitat. Without oversight on a programmatic level and specified criteria for waiving these restrictions, it is likely that beneficial effects would be reduced by half, reducing the major beneficial effects listed above to minor.

Special Status Species – Plants
There are no management actions for special status plants or special status fish under Alternative A.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Managing vegetation resources to comply with the ESA and BLM policy associated with management of habitat for special status wildlife species would have beneficial effects to special status fish species. Surface disturbance restrictions for Greater Sage-Grouse breeding grounds and raptors nests would have beneficial effects on fish. Protections afforded Threatened, Endangered, and sensitive species, such as oil and gas disturbance-free zones around bald eagle nests and roosts, would prevent surface disturbance and have beneficial effects on fish. Overall, these protection zones for special status wildlife habitats encompass five to 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for special status wildlife species under Alternative A would have moderate beneficial effects on special status fish resources.

Heritage and Visual Resources

Cultural Resources
The types of effects from Alternative A would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for cultural resources (habitat conservation). These restrictions would be beneficial to any fish habitats they encompass as they would reduce the risk of harm to the fish resource. All other management of cultural resources is considered on a project specific basis. Under Alternative A, cultural resource protection would encompass less than one percent of the special status fish-bearing streams in the planning area. Management actions for cultural resources under Alternative A would have negligible beneficial effects on special status fish resources.

Paleontological Resources
Under Alternative A, management of lands containing paleontological resources would be considered on a site-specific basis. In areas where mineral development was not allowed, water quality would remain unchanged, having a negligible beneficial effect on special status fish resources.

Visual Resources
Management of VRM Class I and II areas could prohibit or limit some surface-disturbing

activities and thereby protect special status fish habitats. VRM Class III and IV areas have minor limitations. Managing visual resources would indirectly affect fish habitats, depending on the locations, types, and durations of approved projects. Beneficial effects under the management actions associated with Alternative A would occur on over 10 percent of habitats important to special status fish resources, and would therefore have major effects.

Land Resources

Lands and Realty

Under Alternative A, land acquisitions or disposals should not affect Yellowstone cutthroat trout. Pursuing easements that would provide access to BLM-administered lands for recreation and administrative purposes could expose occupied Yellowstone cutthroat trout streams to whirling disease, mussels, or other introduced species and disease. This could result in a moderate adverse effect, but the probability of occurrence would be remote and therefore overall a minor impact.

Renewable Energy

There are no management actions for renewable energy under Alternative A.

Rights-of-Way and Corridors

No areas suitable for ROWs and corridors under Alternative A contain special status fish habitats.

Travel and Transportation Management

Under Alternative A, there would be indirect effects on special status fish species from travel management and OHV use. OHV use on and off designated trails has the potential to destroy vegetation, compact soils, and lead to soil erosion and ponded water. By designating areas where OHV use is limited to designated roads and trails, adverse effects on special status fish habitats can be reduced. In cases where motorized vehicle use is closed for only portions of the year, these closures would not be as great a benefit to special status fish species. Regardless of intensity of management, OHV use is still anticipated to have an adverse effect on one to five percent of special status fish habitats. Management actions for TTM under Alternative A would have minor adverse effects on special status fish resources.

Recreation

Under Alternative A, pursuing easements to provide access to BLM-administered lands for recreation and administrative purposes could expose occupied fish streams to whirling disease, zebra mussels, or other introduced species and disease, which would have a adverse effect on fish. Prohibiting surface disturbance and occupancy on slopes equal to or greater than 25 percent or more would minimize sedimentation. Areas where OHV use is limited to designated roads and trails would limit access to fisheries and reduce the potential for introduction of invasive species and disease. Recreational areas occur within less than one percent of the identified Yellowstone cutthroat trout habitats in the planning area. The overall management actions for recreation under Alternative A would have negligible beneficial effects on special status fish resources.

Livestock Grazing Management

Improper grazing management at Welch Ranch on the Tongue River could adversely affect Yellowstone cutthroat habitat potential. Under Alternative A, any permanent increases in the amount of forage produced are considered for wildlife and watershed protection before additional livestock use is allowed. This should have a beneficial effect on Yellowstone cutthroat trout. Currently, livestock grazing allotments contain one to five percent of the identified

Yellowstone cutthroat trout habitats in the planning area. Management actions for livestock grazing management under Alternative A would have minor beneficial effects on special status fish resources.

Special Designations

Areas of Critical Environmental Concern
There are no ACECs proposed under Alternative A.

4.4.8.4. Alternative B

This section describes management actions under Alternative B, which emphasizes resource conservation, and the likely impacts to special status fish species due to their implementation.

Special Status Species – Fish
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for special status fish resources (habitat improvement and conservation). Under Alternative B, stream segments important to special status fish species would be improved or enhanced and surface-disturbing restrictions would be applied within 0.25 mile of water bodies containing special status fish species. These restrictions have major beneficial effects on special status fish resources.

Physical Resources

Soil, Water Resources, and Cave and Karst Resources
Alternative B would prohibit surface-disturbing activities or apply NSO stipulations to activities on badlands, rock outcrops, and slopes susceptible to mass movement, and prohibit prescribed fires on highly erodible soils; prohibit such activities as on-channel reservoirs, conversion of abandoned oil and gas wells to water supply wells, and activities within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated habitat; and prohibit activities in cave and karst areas. Under Alternative B, applying an NSO stipulation on soils with poor reclamation suitability, in badlands, on rocky outcrops, on slopes susceptible to mass movement, and on slopes equal to or greater than 25 percent would prevent sedimentation and have a beneficial effect on special status fish habitat. These soil types overlap greater than 10 percent of the identified Yellowstone cutthroat trout habitat in the planning area. Prohibiting surface-disturbing activities for the protection of water resources under Alternative B would conserve all the identified Yellowstone cutthroat trout habitat in the planning area. Prohibiting surface-disturbing activities for the protection of cave and karst resources under Alternative B would conserve vegetation in greater than 10 percent of the identified Yellowstone cutthroat trout habitat in the planning area. Overall, Alternative B management of soils, water, and cave and karst resources would result in major beneficial effects on special status fish resources.

Mineral Resources

Locatable Minerals and Leasable Minerals – Coal
The management action listed under Alternative B will have no effect on special status fish resources.

Leasable Minerals – Fluids
Under Alternative B, no fluid mineral exploration or development would occur in Yellowstone cutthroat trout habitats. Management actions for fluid minerals under Alternative B would have no effects on special status fish resources.

Salable Minerals
Alternative B limits the exploration and development of salable mineral resources by the making 661,345 acres closed or restricted to salable mineral exploration and development. Salable mineral development would be open on 129,431 acres of BLM surface that also contain greater than 10 percent of identified Yellowstone cutthroat trout habitats; therefore, management actions for salable minerals under Alternative B would have major adverse effects on special status fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Using full suppression in areas where fire is undesirable, monitoring fire behavior in areas where fire can be used as a management tool based on resource goals and objectives, limiting heavy equipment usage in areas, rehabilitating all fire-related damage, and use of wildland fire and other vegetative treatments to restore fire-adapted ecosystems and to reduce hazardous fuels would reduce sedimentation. This would have a minor beneficial effect on Yellowstone cutthroat trout habitats.

Biological Resources

Vegetation – Forest and Woodlands
Using natural processes to manage forests and woodlands is a short-term beneficial impact to fish resources; however, managing forests and woodlands for old growth and climax vegetation communities may result in an increased risk of wildland fire which would result in unstable soil conditions and poor water quality having adverse impacts overall. Management actions for forests and woodlands under Alternative B would adversely impact over 10 percent of habitat important to special status fish. Overall, the offset of benefits from reduced disturbance and the dynamic nature of wildfire would reduce impacts to minor adverse.

Vegetation – Grassland and Shrubland Communities
The types of effects from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for grassland and shrubland communities (habitat improvement). Under Alternative B, native plant species would be the only type authorized for reclamation activities. This would be beneficial to Yellowstone cutthroat trout habitats as it would promote natural reclamation and regeneration of vegetative communities in the drainages. Under Alternative B, native plant reclamation would occur within greater than 10 percent of the identified Yellowstone cutthroat trout habitat in the planning area. Management actions for grassland and shrubland communities would have major beneficial effects on special status fish resources.

Vegetation – Riparian/Wetland Resources
Prohibiting surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams would benefit Yellowstone cutthroat trout by preserving the riparian and adjacent upland communities. Identifying and managing systems capable of achieving DFC could have a beneficial effect on Yellowstone cutthroat trout habitats. Prohibitions for water would encompass all identified Yellowstone cutthroat trout habitat in the planning area. Management

actions for riparian/wetland resources would have major beneficial effects on special status fish resources.

Invasive Species and Pest Management
Aerial application of pesticides and herbicides, if applied inappropriately, could expose occupied Yellowstone cutthroat trout populations to impaired water quality, this would have a moderately adverse effect. IPM, as currently practiced and when appropriately applied in the planning area, complies with restrictions on chemical labels that provide adequate buffers from fish-bearing water. Aggressive treatments of invasive plants, particularly riparian plants, could adversely affect Yellowstone cutthroat trout over the short term by increasing sedimentation and removing shade. Over the long term, these treatments would benefit the trout by replacing invasive plants with native species that generally require less water, and increasing streamflow.

Fish and Wildlife Resources – Fish
Alternative B management actions for fish would benefit Yellowstone cutthroat trout by cooperating with WGFD for stocking and stream restoration, managing riparian areas to improve fisheries and reach desired functional condition. Imposing a 0.25 mile no surface disturbance buffer around all fish-bearing waters would benefit Yellowstone cutthroat trout habitat by reducing erosion from development of federal minerals in all identified Yellowstone cutthroat trout habitat. Management actions for fish under Alternative B would have major beneficial effects on special status fish resources.

Fish and Wildlife Resources – Wildlife
The types of effects to special status fish from Alternative B would be the same beneficial effects as described in the *Impacts Common to All Alternatives* section for wildlife. Under Alternative B, though, NSOs prohibit or restrict surface disturbance within greater than 10 percent of identified Yellowstone cutthroat trout habitat; therefore, management actions for wildlife would have major beneficial effects on special status fish resources.

Special Status Species – Plants
Management actions for special status plants that restrict grazing, herbicides and surface disturbance would benefit special status fish. Restricting fire suppression could result in larger fires that would increase sedimentation and create an adverse impact. Prohibiting disturbance within a mile of Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River would be considered a benefit to special status fish by reducing sources of sedimentation. Overall, these actions would occur within five to 10 percent of the identified Yellowstone cutthroat trout habitat in the planning area. Management actions for special status plants under Alternative B would have moderate beneficial effects on special status fish resources.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Protections for identified raptor nests, Greater Sage-Grouse, and T&E species would have a beneficial effect on Yellowstone cutthroat trout. Prohibiting surface disturbance and occupancy within a biologic buffer for raptor nests would reduce erosion and subsequent sedimentation on lands over federal minerals, resulting in a beneficial impact. Prohibiting surface-disturbing and disruptive activities for the protection of special status amphibian and reptile species and their habitats, in identified 100-year floodplains, and within 500 feet of perennial waters would have a beneficial effect on Yellowstone cutthroat trout. Establishing a year-round disturbance-free zone of at least 0.5 mile for bald eagles on the Tongue River would be a beneficial effect when applied to the federal mineral estate. Overall, the prohibitions or restrictions for special status wildlife species occur within greater than 10 percent of the identified Yellowstone cutthroat trout habitat

in the planning area. Management actions for special status wildlife species would have major beneficial effects on special status fish resources.

Heritage and Visual Resources

Cultural Resources

Though the majority of impacts to cultural resources are analyzed on a project-specific basis within Alternative A, adverse impacts to special status fish species would be greatly reduced by prohibition of surface-disturbing activities for cultural resource protection in Alternative B. NSOs for cultural resources under Alternative B also conserve greater than 10 percent of special status fish habitats; therefore, management actions for cultural resources under Alternative B would have major beneficial effects on special status fish resources.

Paleontological Resources

Under Alternative B, areas with high quality paleontological resources do not overlap with fish habitat and management actions would have no effect on special status fish resources.

Visual Resources

Under Alternative B, management of VRM Class II areas could prohibit or limit some surface-disturbing activities and therefore protect special status fish habitats. VRM Class III and IV areas would have minor limitations. Alternative B visual resources management would benefit over 10 percent of habitats important to special status fish resources; therefore, VRM actions under Alternative B would have major beneficial effects on special status fish resources.

Land Resources

Lands and Realty

Approximately 120,722 acres of BLM-administered lands are identified for disposal (see Map 54). These areas have priority consideration for exchange, public sale, or transfer of jurisdiction to another agency, subject to disposal criteria. The six BLM-administered parcels that intersect Yellowstone cutthroat trout habitats account for 164 acres. Transferring these lands out of federal control would not directly affect Yellowstone cutthroat trout. However, future management actions could be less protective than federal management in less than one percent of identified Yellowstone cutthroat trout habitat. Management actions for lands and realty under Alternative B would have negligible adverse effects on special status fish resources.

Renewable Energy

No areas suitable for renewable energy under Alternative B contain special status fish habitats.

Rights-of-Way and Corridors

No areas suitable for ROWs and corridors under Alternative B contain special status fish habitats.

Travel and Transportation Management

Under Alternative B, closing areas with saturated soils, on slopes equal to or greater than 25 percent and in habitat for SSS to motorized vehicle use, including activities related to fire suppression and geophysical exploration, would reduce sedimentation. This would have a beneficial effect on Yellowstone cutthroat trout. Limiting travel to designated routes and allowing travel off designated routes only under a special use permit would reduce sedimentation. This would also have a beneficial effect on Yellowstone cutthroat trout. Allowing travel off designated

routes in areas limited to designated routes only under a special use permit would reduce sedimentation and pollution, and have a beneficial effect on special status fish. These actions would influence one to five percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for travel and transportation under Alternative B would have a minor beneficial effect on special status fish resources.

Recreation
Increasing recreation facilities under Alternative B could increase the risk of disease or invasive species colonizing Yellowstone cutthroat trout habitats. Limiting development of additional recreation facilities to SRMAs and other high-use areas would have a beneficial effect on fish by limiting fishing pressure and reducing the risk of establishing invasive aquatic species. SRMAs proposed in Alternative B encompass less than one percent of the identified Yellowstone cutthroat trout habitats in the planning area; therefore, management actions for recreation under Alternative B would have negligible beneficial effects on special status fish resources.

Livestock Grazing Management
Authorizing permanent increases in forage allocations to wildlife habitat and watershed protection as the first priority and livestock grazing second; locating livestock salt or mineral supplements a minimum of 0.5 mile away from water sources, riparian areas, and aspen stands; and providing a minimum of two years rest from livestock grazing following prescribed fires and other vegetative treatments would have a minor beneficial effect on Yellowstone cutthroat trout.

Special Designations

Areas of Critical Environmental Concern
An ACEC designation at Welch Ranch on the Tongue River could have a minor adverse effect on that fishery. Additional human use could occur with ACEC designation, which would increase the potential for introduction of invasive aquatic species and illegal stocking, and the risk of fire in the riparian forest. These potential issues would be adequately mitigated through education. The designation would have indirect, long-term beneficial effects through public outreach and education regarding the rarity and value of prairie river riparian systems and would encompass less than one percent of the identified Yellowstone cutthroat trout habitats in the planning area; therefore, management actions for ACECs under Alternative B would have negligible beneficial effects on special status fish resources.

4.4.8.5. Alternative C

This section describes management actions under Alternative C, which emphasizes resource use, and the likely resulting impacts to special status fish species due to its implementation.

Special Status Species – Fish
Restoring or improving important stream segments for fisheries habitat, only for special status fish species, would have a beneficial impact on them. Alternative C incorporates a smaller protective buffer, restricting surface-disturbing activities within 500 feet of any waters containing special status fish species. This would conserve habitats within all identified Yellowstone cutthroat trout habitats in the planning area. Management actions for special status fish species would have major beneficial effects on special status fish resources.

Physical Resources

Soil
Under Alternative C, allowing surface-disturbing activities on soils with a severe erosion hazard, slopes equal to or greater than 25 percent, soils with poor reclamation suitability, badlands, rock outcrops, and slopes susceptible to mass movement would increase sedimentation and adversely affect Yellowstone cutthroat trout if those activities take place in occupied Yellowstone cutthroat trout habitat. The approximately 260 acres (40 on South Fork Little Tongue, 180 on East and Middle Forks Pass Creek, and 40 in Red Gulch) of BLM-administered lands that drain into occupied Yellowstone cutthroat habitat are steep, with no roads or development. Allowing the use of prescribed fire on highly erodible soils could have an adverse effect if BLM-administered lands that drain into occupied Yellowstone cutthroat habitat (260 acres) were burned. Lack of soil restrictions would leave greater than 10 percent of the identified Yellowstone cutthroat trout habitats vulnerable to impacts from improper soil management. Management actions for soil under Alternative C would have major adverse effects on special status fish resources.

Water Resources
Allowing on-channel reservoirs would inhibit fish passage and have an adverse effect on Yellowstone cutthroat trout. Allowing surface-disturbing activities, or not applying an NSO stipulation to any mineral lease within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated riparian habitat would increase runoff and sedimentation in Yellowstone cutthroat habitat. This alternative would permit activities within greater than 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area; therefore, management actions for water under Alternative C would have major adverse effects on special status fish resources.

Cave and Karst Resources
Under Alternative C, there would be no restrictions on activities in or around cave and karst resources. Greater than 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area also contain cave and karst resources. Lack of conservation of cave and karst resources would have a major adverse effect on special status fish resources as it would increase the potential for increased runoff and sedimentation.

Mineral Resources

Locatable Minerals
The types of effects from Alternative C would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for locatable mineral resources (habitat loss and degradation). Alternative C would open 3,319,535 acres to locatable minerals exploration and development and withdraw 11,373 acres from locatable mineral exploration and development. Locatable mineral development could be permitted in one to five percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for locatable minerals under Alternative C would have minor adverse effects on special status fish resources.

Leasable Minerals – Coal
The management action listed under Alternative C will have no effect on special status fish resources.

Leasable Minerals – Fluids
The types of effects from Alternative C would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for fluid mineral resources (habitat loss and degradation). Consistent with other resources values, Alternative C would open 539,499

acres for fluid minerals leasing and exploration subject to standard lease terms and conditions; 2,472,472 acres subject to moderate constraints; and 303,601 acres subject to major constraints. Fluid mineral exploration and development could be permitted in greater than 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for fluid minerals under Alternative C would have major adverse effects on special status fish resources.

Salable Minerals
The types of effects from Alternative C would be the same adverse effects as described in the *Impacts Common to All Alternatives* section for salable mineral resources (habitat loss and degradation). Opening 3,290,908 acres to salable mineral exploration and development and closing 57,213 acres would cause an adverse impact where those areas open to salable minerals overlap identified Yellowstone cutthroat trout habitats. Salable mineral exploration and development could be permitted in five to 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for salable minerals under Alternative C would have moderate adverse effects on special status fish resources.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
Under Alternative C, use of full protection strategies and tactics, heavy equipment with few tactical constraints, and rehabilitating only suppression-related damage would increase sedimentation. This would have a minor adverse effect on Yellowstone cutthroat trout.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative C, forests and woodlands which occur near streams bearing special status fish would be managed similarly to Alternative B. No overlap occurs between important special status fish habitat and forest management areas identified under this alternative, and active management will not occur.

Vegetation – Grassland and Shrubland Communities
Under Alternative C, allowing non-native plant species, only if native species will not accomplish initial reclamation objectives, would provide another tool for achieving reclamation goals, but also would provide an opportunity for non-native species to cross pollinate with native species, out-compete native species for water and soil nutrients, and move outside the reclamation area and become an invasive species. Helping to achieve reclamation objectives would directly benefit surrounding plant communities. Overall, Alternative C management of grasslands and shrublands would have a major adverse effect on the riparian vegetation within the identified Yellowstone cutthroat trout habitats and, therefore, have a major adverse effect on special status fish resources.

Vegetation – Riparian/Wetland Resources
Allowing surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams could have an adverse effect on Yellowstone cutthroat trout by increasing sedimentation and decreasing water quality. Not identifying and managing systems capable of achieving DFC could have an adverse effect on Yellowstone cutthroat trout. Riparian/wetland areas contain all of the identified Yellowstone cutthroat trout habitats in the planning area; therefore management actions under Alternative C for riparian/wetland resources would have major adverse effects on special status fish resources.

Invasive Species and Pest Management
Aerial application of insecticides, if applied inappropriately, could expose occupied Yellowstone cutthroat trout populations to impaired water quality. This would have a moderate adverse effect on the trout.

Fish and Wildlife Resources – Fish
Alternative C management actions for fish would result in an adverse impact to Yellowstone cutthroat trout by allowing surface disturbance within 0.25 mile of fish-bearing waters, increasing erosion from development of federal minerals in all identified Yellowstone cutthroat trout habitats. Management actions under Alternative C for fish resources would have major adverse effects on special status fish resources.

Fish and Wildlife Resources – Wildlife
Allowing surface disturbance in the Kerns and Amsden Creek big game winter ranges, and elk crucial winter range would result in an adverse impact to Yellowstone cutthroat trout by increasing erosion and sedimentation. Seasonal wildlife restrictions would not prevent erosion from federal mineral development and could result in an adverse impact. Protections for identified big game ranges, raptor nests, and elk would have beneficial effects on greater than 10 percent of the identified Yellowstone cutthroat trout habitats that also support these species. Because protections for some wildlife species remain in place and would conserve identified Yellowstone cutthroat trout habitats under this alternative, overall, Alternative C wildlife management actions would still have a major beneficial effect on special status fish resources.

Special Status Species – Plants
No areas of known special status plant species populations contain special status fish habitats; therefore, management actions for special status plant species under Alternative C would have no effect on special status fish species.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Establishing a year-round disturbance-free zone of at least 0.5 mile around known bald eagle roosts on the Tongue River would be a beneficial effect when applied to the federal mineral estate. Allowing surface-disturbing and disruptive activities for the protection of special status amphibian and reptile species and their habitats, in identified 100-year floodplains, and within 500 feet of perennial waters would have an adverse effect on Yellowstone cutthroat trout. Because protections for some special status wildlife species remain in place and would conserve five to 10 percent of identified Yellowstone cutthroat trout habitats under this alternative, overall, Alternative C special status wildlife management actions would have a moderate beneficial effect on special status fish resources.

Heritage and Visual Resources

Cultural Resources
No areas containing historic properties occur within special status fish habitats; therefore, management actions for cultural resources under Alternative C would have no effect on special status fish species.

Paleontological Resources
Under Alternative C, lands containing high quality paleontological resources do not overlap with fish habitat and management actions under this alternative would have no effect on special status fish resources.

Visual Resources
Under Alternative C, managing VRM Class II areas as VRM Class III would allow more surface-disturbing activities. This would reduce the beneficial effects of VRM on special status fish habitat by increasing opportunities for soil and water erosion and for invasive species to become established. Active management would not occur in habitats important to special status fish species; therefore, Alternative C management of visual resources would have no effect on special status fish resources.

Land Resources

Lands and Realty
Approximately 120,722 acres of BLM-administered lands are identified for disposal (see Map 54). These areas have priority consideration for exchange, public sale, or transfer of jurisdiction to another agency, subject to disposal criteria. The three BLM-administered parcels that intersect Yellowstone cutthroat trout occupancy account for 972 acres. Transferring these lands out of federal control would not directly affect Yellowstone cutthroat trout. However, future management actions could be less protective than federal management.

Renewable Energy
Allowing renewable-energy development anywhere in the planning area consistent with other resource values could have an adverse effect on special status fish if sedimentation occurs in identified Yellowstone cutthroat trout habitats. Renewable energy could be permitted under this alternative within five to 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions under Alternative C would have moderate adverse effects on special status fish resources.

Rights-of-Way and Corridors
Allowing ROW on slopes equal to or greater than 25 percent and on highly erodible soils would have an adverse effect on special status fish from sedimentation. ROWs could be permitted, under this alternative, within five to 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for ROWs and corridors under Alternative C would have moderate adverse effects on special status fish resources.

Travel and Transportation Management
Allowing motorized vehicle use in areas with saturated soils, on slopes equal to or greater than 25 percent, and in habitat for SSS consistent with travel management designations for those areas could increase sedimentation. This would have an adverse effect on one to five percent of identified Yellowstone cutthroat trout habitats. Management actions for TTM under Alternative C would have minor adverse effects on special status fish resources.

Recreation
Managing the entire planning area as the Buffalo ERMA and designating six SRMAs (totaling 30,570 acres) would have an adverse effect on fish through an increase in OHV use and resulting sedimentation. The six proposed SRMAs contain less than one percent of the identified Yellowstone cutthroat trout habitats in the planning area. The management within these areas would conserve habitats important to fish. Management actions for recreation under Alternative C, through designation of the six SRMAs, would have negligible beneficial effects on special status fish resources.

Livestock Grazing Management
Authorizing permanent increases in forage allocations to livestock grazing as the first priority; locating livestock salt or mineral supplements a minimum of 500 feet away from water sources, riparian areas, and aspen stands; not designating reserve common allotments; allowing increases in livestock stocking rates as a result of vegetative treatments; and providing a minimum of two growing seasons rest from livestock grazing, prescribed fires, and vegetative treatments would have a minor adverse effect on Yellowstone cutthroat trout by degrading the habitats and increasing potential for sedimentation.

Special Designations

Areas of Critical Environmental Concern
No ACECs are proposed under Alternative C, therefore, there would be no effect to fish resources.

4.4.8.6. Alternative D

This section describes management actions under Alternative D, the Proposed RMP.

Special Status Species – Fish
Alternative D impacts from special status fish management would be similar to those under Alternative B, except that Alternative D could allow activities by exception within a 0.25-mile CSU area around naturally occurring water bodies containing native and desirable non-native fish species. For the impacts to be the same as those under Alternative B, those exceptions would have to be evaluated for the presence of special status fish species or habitat suitability and would not be granted where there would be conflicts. Management actions under Alternative D would have major beneficial effects on special status fish resources.

Physical Resources

Soil
Alternative D would allow surface-disturbing activities on soils with a severe erosion hazard, slopes equal to or greater than 25 percent, soils with poor reclamation suitability, badlands, rock outcrops, and slopes susceptible to mass movement. This could increase sedimentation and adversely affect Yellowstone cutthroat trout if those activities took place in occupied Yellowstone cutthroat trout habitat without adequate reclamation plans. Alternative D would allow development within greater than 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area, but projects must meet specific criteria before they are approved. However, the established criteria under Alternative D would work toward ensuring projects are capable of being reclaimed before they are approved. Overall, management actions for soil under Alternative D would have major adverse effects on special status fish resources.

Water Resources
Alternative D would allow on-channel reservoirs in occupied Yellowstone cutthroat trout streams, which would have an adverse effect on this sensitive species because such reservoirs could impede fish passage. Impacts from discharge of produced water into Yellowstone cutthroat trout habitat would depend on water quality, which is administered by the State of Wyoming and will not be allowed to diminish the water quality of a receiving stream. Allowing surface-disturbing activities, or not applying an NSO stipulation to any mineral lease, within 500 feet of springs, non-CBNG reservoirs, water wells, and perennial streams and associated riparian habitat could

increase runoff and sedimentation in all Yellowstone cutthroat trout habitat. Alternative D would allow development within greater than 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area when resources objectives can be met. Overall, management actions for water under Alternative D would have major adverse effects on special status fish resources.

Cave and Karst Resources
The cave and karst resource areas identified in Alternative D do not encompass any identified Yellowstone cutthroat trout habitats, therefore, management actions for cave and karst resources under Alternative D would have no effect on special status fish resources.

Mineral Resources

Locatable Minerals
Alternative D effects on Yellowstone cutthroat trout from management of locatable minerals would be the same minor adverse effects as described under Alternative A.

Leasable Minerals – Coal
The management action listed under Alternative D will have no effect on special status fish resources.

Leasable Minerals – Fluids
Alternative D impacts associated with leasable fluid minerals management would be the same as under Alternative C, with 3,314,254 acres open to oil and gas leasing. Fluid mineral exploration and development would be permitted within greater than 10 percent of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for fluid minerals, under Alternative D would have major adverse effects on special status fish resources.

Salable Minerals
There is no identified conflict between salable mineral potential and Yellowstone cutthroat trout habitat. Yellowstone cutthroat trout habitat has been identified as closed to salable minerals exploration and development.

Fire and Fuels Management

Unplanned Fire (Wildfire) and Planned Fire (Prescribed Fire)
The effects for fire and fuels management under Alternative D would be the same minor beneficial effects as those described under Alternative B.

Biological Resources

Vegetation – Forests and Woodlands
Under Alternative D, effects to special status fish would be similar to those identified under Alternative C.

Vegetation – Grassland and Shrubland Communities
Alternative D effects on special status fish resources from management of grassland and shrubland communities would be similar to effects under Alternative C, although Alternative D would place slightly more emphasis on multiple resource values than Alternative C. Allowing the use of non-native species for initial reclamation could have a beneficial effect on Yellowstone cutthroat trout through reduced sedimentation after surface disturbance. Desirable non-native

plant persistence could increase adverse impacts to special status fish resources if non-native proliferation causes loss of suitable riparian habitats along fish-bearing streams. Overall, management actions for grassland and shrubland communities would have major beneficial effects on special status fish species.

Vegetation – Riparian/Wetland Resources
Allowing surface-disturbing activities within 500 feet of springs, reservoirs, water wells, and perennial streams could have an adverse effect on special status fish by increasing sedimentation, changing hydrography, and decreasing water quality. Not identifying and managing systems capable of achieving DFC could also have an adverse effect on special status fish by allowing activities that impact riparian vegetation, resulting in increased water temperature and sedimentation. Impacts from the management of riparian/wetland resources will influence all of the identified Yellowstone cutthroat trout habitats in the planning area. Management actions for riparian/wetland resources under Alternative D would have major adverse effects on special status fish resources.

Invasive Species and Pest Management
Limiting aerial application to defined situations would protect Yellowstone cutthroat trout habitat and result in a minor beneficial effect.

Fish and Wildlife Resources – Fish
Alternative D management actions would consider fish and fish habitat in reservoir, riparian and wetland systems, and perennial water management. Alternative D would apply constraints on surface-disturbing and disruptive activities providing protection of vegetation, soils, and soil microbial activity from surface-disturbing activities within all of the identified Yellowstone cutthroat trout habitats in the planning area; therefore, the management actions for fish under Alternative D would have major beneficial effects on special status fish resources.

Fish and Wildlife Resources – Wildlife
Under Alternative D, prohibiting surface disturbance and occupancy in the Ed O. Taylor, Kerns, Bud Love, and Amsden Creek winter ranges could decrease sedimentation and invasive species establishment in the Tongue River which would have a beneficial effect on special status fish. Protections for identified big game ranges and raptor nests would have a beneficial effect on fish. Overall, the protective buffers for wildlife would conserve riparian vegetation within greater than 10 percent of the identified Yellowstone cutthroat habitats in the planning area. Management actions for wildlife under Alternative D would have major beneficial effects on special status fish resources.

Special Status Species – Plants
Allowing the placement of water developments and salt or mineral supplements in habitat for special status plant species would decrease water quality and increase sedimentation where these resources overlap. Managing to comply with the ESA and BLM policy associated with special status plant species would have a moderate benefit to fisheries management as their occupied habitat occurs in five to 10 percent of the identified Yellowstone cutthroat habitats in the planning area.

Special Status Species – Wildlife (including Greater Sage-Grouse)
Under Alternative D, protections for raptor nests, Greater Sage-Grouse, and T&E species would have a beneficial effect on special status fish species. Establishing a year-round disturbance-free zone of at least 0.5 mile for riparian corridors (Clear Creek, Crazy Woman Creek, Piney Creek, Powder River, and Tongue River) consistently used by bald eagles would have a beneficial effect

on special status fish species. Prohibiting surface-disturbing and disruptive activities for the protection of special status amphibian and reptile species and their habitats in identified 100-year floodplains and within 500 feet of perennial waters would have a beneficial effect on special status fish species. Protections for bald eagle and other raptor nests would have the greatest potential for reducing impacts to identified Yellowstone cutthroat habitats. Overall, protections for special status wildlife species would conserve vegetation within greater than 10 percent of the identified Yellowstone cutthroat habitats in the planning area. Management actions for special status wildlife species would have major beneficial effects on special status fish resources.

Heritage and Visual Resources

Cultural Resources

Alternative D impacts associated with cultural resources management would be the same as those under Alternative B, except Alternative D would protect 15,382 acres through cultural resources NSO restrictions and 613,601 acres through cultural resources CSU restrictions. These areas of prohibitions or restrictions would also conserve vegetation within greater than 10 percent of the identified Yellowstone cutthroat habitats in the planning area. Management actions for cultural resources would have major beneficial effects on special status fish resources.

Paleontological Resources

Under Alternative D, lands containing high quality or important paleontological resources do not overlap with fish habitat and management actions would have no effect to special status fish resources.

Visual Resources

Under Alternative D, effects to fish resources from management actions associated with VRM would be the same as the effects under Alternative B.

Land Resources

Lands and Realty

Proposed land disposals that could affect Yellowstone cutthroat trout total 164 acres (less than one percent of the identified Yellowstone cutthroat habitats). Disposing of these lands could result in fewer restrictions on surface disturbances. This could increase sedimentation and pesticide applications, which would result in reduced water quality and have a negligible adverse effect on Yellowstone cutthroat trout.

Renewable Energy

Under Alternative D, excluding renewable-energy development on 352,068 acres would have a beneficial effect on special status fish by avoiding sedimentation from construction. Renewable energy would be permitted within less than one percent of the identified Yellowstone cutthroat habitats in the planning area. Management actions for renewable energy under Alternative D would have negligible adverse effects on fish resources.

Rights-of-Way and Corridors

Avoiding ROW on slopes equal to or greater than 25 percent and on highly erodible soils would have a beneficial effect on special status fish. ROWs would be permitted within less than one percent of the identified Yellowstone cutthroat habitats in the planning area. Management actions for ROWs and corridors under Alternative D would have negligible adverse effects on special status fish resources.

Travel and Transportation Management
Alternative D impacts to special status fish from management of travel and transportation would be similar to those under Alternative C, except that one to five percent of the identified Yellowstone cutthroat habitats would be closed to motorized vehicle use. Allowing travel for dispersed camping and big-game retrieval up to 300 feet off designated routes if it would not damage resources would have an adverse effect on fisheries. Management actions for TTM would have minor adverse effects on special status fish resources.

Recreation
Allowing additional recreation facilities in areas where they are supported by recreational use and are consistent with other resource values could have an adverse effect on fish through increased fishing and the potential increasing the risk of disease or invasive species colonizing Yellowstone cutthroat trout habitats. Increased education would reduce these adverse impacts. Limiting motorized vehicle travel to designated roads and trails (other than within stock driveways) consistent with other resource values would have a beneficial effect on special status fish. Recreation management would occur within one to five percent of the identified Yellowstone cutthroat habitats in the planning area. Management actions for recreation under Alternative D would have minor adverse effects on special status fish resources.

Livestock Grazing Management
Authorizing increases in forage for watershed protection first, then for forage and habitat; locating livestock salt or mineral supplements a minimum of 500 feet away from water sources, riparian areas, and aspen stands; designating reserve common allotments; allowing increases in livestock stocking rates as a result of vegetative treatments; and providing a minimum of two growing seasons rest from livestock grazing, prescribed fires, and vegetative treatments (in lieu of an approved plan) would have a minor beneficial effect on Yellowstone cutthroat trout by improving the health of the stream system.

Special Designations

Areas of Critical Environmental Concern
An ACEC designation at Welch Ranch on the Tongue River could have an adverse effect on identified Yellowstone cutthroat habitats. Additional human use could occur with designation, which would increase the potential for introduction of invasive aquatic species and illegal stocking, and increase the risk of fire in the riparian forest. These potential issues would be mitigated through education. Designation would have beneficial effects through public outreach and education regarding the rarity and value of prairie river riparian systems. The proposed ACECs would encompass less than one percent of the identified Yellowstone cutthroat habitats in the planning area. Management actions for ACECs would have negligible beneficial effects on special status fish resources.

4.4.8.7. Cumulative Impacts

Cumulative impacts to special status fish species in the planning area would come from non-federal minerals development, non-BLM fire programs, and non-BLM-regulated recreation. In general, these actions can be grouped into actions that are apart from either BLM surface estate or BLM mineral estate. Most cold-water fisheries in the planning area are on BLM or USFS lands, and actions on USFS lands would be similar to BLM actions regarding protective measures. In forested habitats of the cold-water fisheries, the greatest threat to special status fish

would be catastrophic fire and the resulting sedimentation and water temperature and chemistry changes. The Bighorn National Forest Plan addresses this threat with suppression efforts and forest health projects; however, the extent of diseased timber that could burn does represent a potential major adverse effect on fish.

Wind-energy projects on non-BLM-administered lands would not impact Yellowstone cutthroat trout.

Recreation off BLM surface would likely result in the transport and introduction of diseases and invasive species, which could have a major adverse effect on special status fish species.

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