EXECUTIVE SUMMARY

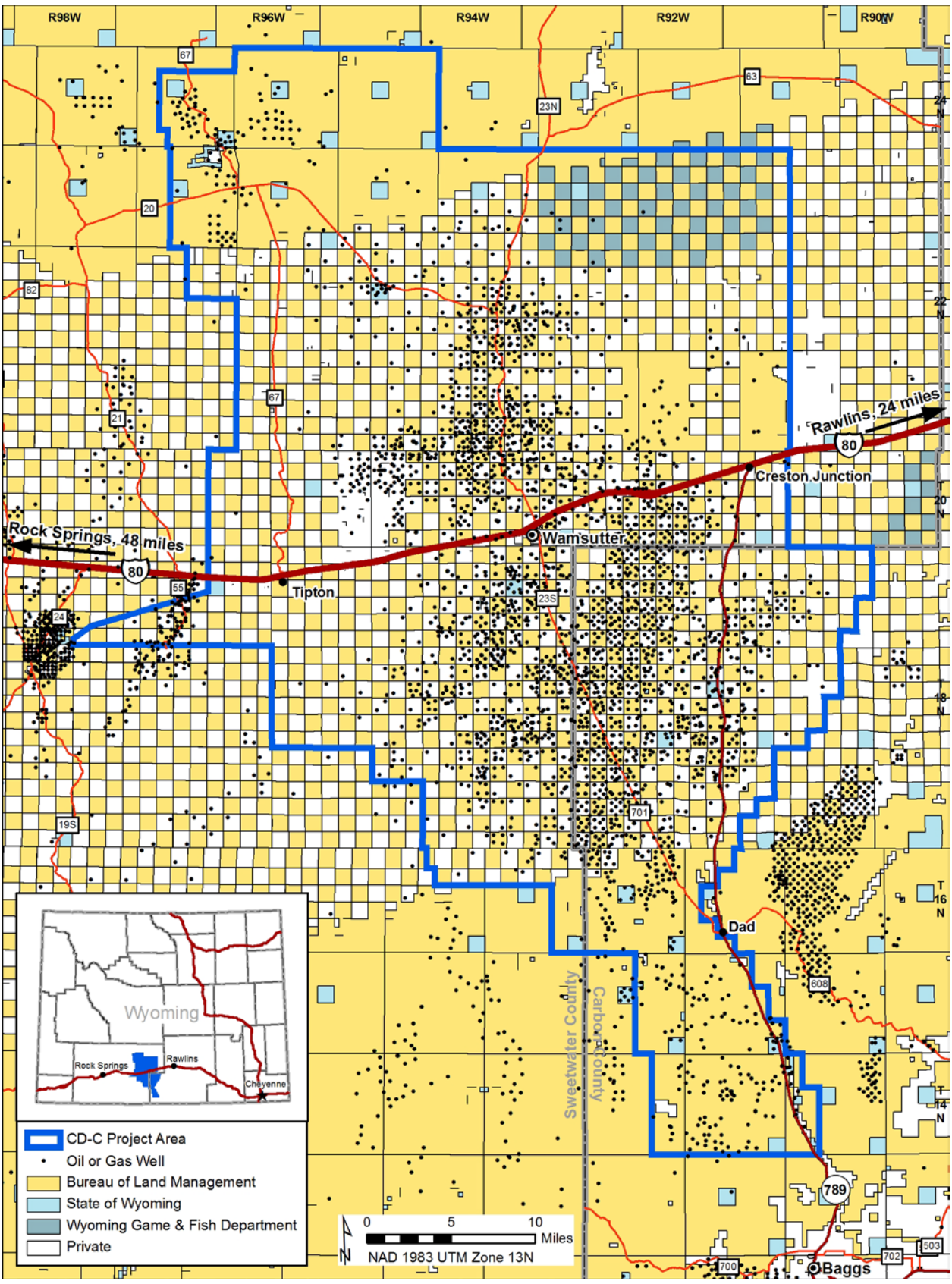
BP America Production Company (BP), representing itself and more than 20 other natural gas development companies (collectively referred to as the "Operators"), has submitted a proposal to the U.S. Department of the Interior (USDI) Bureau of Land Management (BLM) Rawlins Field Office (RFO) to expand development of natural gas and condensate resources within two previously developed project areas described as the Continental Divide/Wamsutter II and Creston/Blue Gap project areas. The BLM has designated the new consolidated proposal the Continental Divide-Creston (CD-C) Natural Gas Development Project.

The RFO has determined that the proposed project constitutes a major federal action requiring preparation of an Environmental Impact Statement (EIS) under the National Environmental Policy Act of 1969 (NEPA). This EIS serves the purpose of disclosing and analyzing impacts resulting from the development proposed within the CD-C project area with consideration of identified and applied Best Management Practices (BMPs) and Conditions of Approval (COAs). A summary of these BMPs and COAs is included in **Appendix C**. This EIS is a development plan-level document; site-specific development proposals would be subject to tiered NEPA analysis.

The CD-C project area consists of approximately 1.1 million acres (1,672 square miles) in an existing gas-producing region between Rock Springs and Rawlins, Wyoming and bisected by Interstate 80 (**Map ES-1**). The project area is located on lands administered by the federal government (626,932 acres, 58.6 percent) and the State of Wyoming (48,684 acres, 4.5 percent), as well as private lands (394,470 acres, 36.9 percent) in Carbon and Sweetwater Counties. The central portion of the CD-C project area has a checkerboard pattern of mixed land ownership produced by grants made by the federal government in the 19th century to the Union Pacific Railroad Company to spur construction of the transcontinental railroad.

The Operators propose drilling up to 8,950 infill natural gas wells with a potential surface disturbance of 47,200 acres (4.4 percent of the project area). The precise locations of the wells have not been identified at this time but the Operators propose drilling at well densities of up to one well per 40 acres. Wells may be drilled conventionally with a single vertical bore on a well pad or with multiple directional bores from a well pad. The proposed project includes construction and operation of ancillary facilities including roads; gas, water, and condensate-gathering pipelines; overhead and buried power lines; and separation, dehydration, metering, and fluid-storage facilities.

More than 4,700 wells have already been drilled within the CD-C project area under previously authorized drilling programs; over 500 of those have been plugged and abandoned. Supporting infrastructure associated with the existing development includes access roads, compressor stations, a central gas-processing plant, water management facilities (fresh-water wells and evaporation pits, recycling facilities, and injection wells for produced water disposal), gas and water pipelines, and electric power lines. Total existing surface disturbance in the project area, including that associated with natural gas and other development, is estimated at 60,176 acres (5.6 percent of the project area).



Map ES-1. Project boundary and existing oil and gas development (EIS Map 1-1)

No warranty is made by the BLM for use of the data for purposes not intended by the BLM.

PURPOSE AND NEED FOR THE ACTION

The need for a BLM action is to respond to this proposal and to evaluate action on future plans and applications related to this proposal. The Federal Land Policy and Management Act (FLPMA) of 1976 (Public Law 94-579, 43 United States Code [USC] 1701 et seq.) recognizes oil and gas development as one of the "principal" uses of the public lands. Federal mineral leasing policies (Mineral Leasing Act of 1920, 30 USC 188 et seq.) and the regulations by which they are enforced recognize the statutory right of lease holders to develop federal mineral resources to meet continuing national needs and economic demands. The purpose of this EIS is to facilitate the BLM decision-making process of whether to approve, approve with modifications, or disapprove the proposed project or project components based on an evaluation of the expected impacts. Through this process, the BLM's purpose is to minimize or avoid environmental impacts to the extent possible while allowing the proponents to exercise their valid lease rights.

PUBLIC INVOLVEMENT

Scoping. The BLM conducted two public and internal scoping processes to solicit input and identify environmental issues and concerns associated with the proposed project. The first responded to a proposal by operators of the Creston/Blue Gap project to expand drilling in that project area, under what was titled the Creston/Blue Gap II project. A Notice of Intent (NOI) for the Creston/Blue Gap II proposal was published in the *Federal Register* on September 8, 2005. A public meeting was held at the Jeffrey Center in Rawlins on October 13, 2005, and the official scoping period ended November 15, 2005.

Shortly after the Creston/Blue Gap II scoping process was completed, BP submitted a proposal for additional drilling in the Continental Divide/Wamsutter II project area. The BLM decided to combine the two projects and prepare a single EIS. The NOI for the combined Continental Divide-Creston Natural Gas Development Project was published in the *Federal Register* on April 3, 2006. The BLM prepared a scoping notice and provided copies to the public, other government agencies, and Tribes. The notice included information on scoping and announcement of an open house, which was held at the Jeffrey Center in Rawlins on April 6, 2006. The official scoping period ended May 5, 2006.

The BLM also invited other federal, state, and local government agencies to participate in the EIS process as cooperating agencies. The State of Wyoming, Carbon County, the Little Snake River Conservation District, Sweetwater County, the Sweetwater County Conservation District, and the Town of Wamsutter requested and received Cooperating Agency status.

Written comments received during both public scoping periods consisted of 50 comment letters from federal and state agencies, non-government organizations, and one Tribe, as well as individuals and private corporations.

The BLM identified ten key issues based primarily upon the potential quantity, intensity, or duration of an impact, and/or the degree of agency or public interest in the issue. The range of alternatives was developed in response to these key issues. More detailed information on these issues is presented in **Appendix A, Summary of Scoping Comments by Category**.

- **Air Quality**: Potential project and cumulative impacts on air quality, including Air Quality Related Values (AQRV).
- **Cultural resources:** Potential impacts to historic trails in the project area.
- **Hydrology:** Degradation of water quality by project construction and drilling activities through sedimentation and issues related to disposal of coalbed methane-produced water.
- **Land Ownership:** Much of the project area is in the checkerboard pattern of land ownership, greatly complicating management of impacts.

- **Non-native, Invasive Plant Species:** The current and projected presence of non-native, invasive plant species should be evaluated.
- **Range Resources:** Potential loss of livestock forage and project-associated hazardous conditions to area livestock/livestock operations.
- **Special Status Species**: Impacts to the Threatened and Endangered (T&E) and BLM Sensitive wildlife species that could be impacted by the project.
- **Socioeconomics:** Define the impact of the project on traditional socioeconomic indicators and examine the question of technical versus economic recoverability of the resource.
- **Surface disturbance/reclamation:** The extent of existing and proposed surface disturbance and its effects on all resources in the project area.
- **Wildlife Habitat:** The project has the potential to further fragment wildlife habitat and seriously diminish the value of that habitat for many species.

Draft CD-C EIS Comments. The Draft EIS was released in November 2012 and received over 8,000 comments during the 90-day comment period. Comments were received from state, federal, and local agencies, environmental advocacy groups, leaseholders, oil and gas companies, and the general public. The majority of comments were received via email as a form letter**.** The BLM reviewed the comments and responded to substantive comments. Substantive comments and responses are included in **Appendix L**.

Issues and concerns identified during the Draft EIS comment period include:

- Questions about the interpretation of the far-field and near-field air quality analyses;
- The difficulty of complying with the requirements of Alternative B;
- The difficulty of achieving the reclamation goals of Alternative C;
- The lack of clear reclamation guidance;
- The need to minimize the impacts on the wildlife found in the project area, especially Special Status Species;
- Unclear requirements for wildlife monitoring and protection;
- Minimizing the effects on surface water quality, especially in the Muddy Creek watershed;
- Assertions that the EIS fails to recognize that some of the alternatives would reduce the project's economic benefits. The alternatives include provisions that are technologically difficult and would increase costs and therefore reduce the amount of drilling; and
- The lack of an identified preferred alternative.

Substantive comments from the public, the BLM interdisciplinary team, and cooperators were used to develop the BLM's Preferred Alternative (Alternative F) and to modify, clarify, and correct the EIS, as appropriate.

PROPOSED ACTION AND ALTERNATIVES

Chapter 2 of the EIS describes the Operators' Proposed Action and the five alternatives that are analyzed in the Final EIS. Three alternatives considered but not carried forward for detailed analysis in the Final EIS are also described.

Proposed Action. Under the Proposed Action, up to 8,950 additional natural gas wells would be drilled from an estimated 6,126 well pads. Spacing of well pads would vary according to location within the project area. An estimated 42 percent of the future wells would be located on multi-well pads where multiple wells would be drilled to formation directionally from a single well pad. To fully develop the targeted resources, the Operators would collectively drill the new wells at the average rate of

approximately 600 wells per year over a period of 15 years. The productive life of each well is estimated to be 30 to 40 years. Combining well life with a 15-year production period produces a potential project life of 45 to 55 years. In support of the new wells, the Operators would construct additional access roads, pipelines, overhead and buried electric power lines, a gas processing facility, water management and disposal facilities, and equipment storage facilities. The total new surface disturbance for the Proposed Action is an estimated 47,200 acres, or about 4.4 percent of the project area.

Alternative B: Enhanced Resource Protection. The premise of this alternative is that some resources may be more at risk from intensive natural gas development and thus may require protections and mitigations beyond the basic measures ordinarily applied. The alternative identifies the following resources that may be more at risk from natural gas development:

- Mule deer crucial winter range and migration corridors,
- Pronghorn crucial winter range and migration corridors,
- Ferruginous hawk nesting habitat,
- The Muddy Creek and Bitter Creek corridors and watersheds,
- Chain Lakes alkaline wetland communities and other playas, and
- Livestock forage.

Each resource has basic protections provided by RFO Resource Management Plan (RMP) requirements, BMPs, COAs, and terms and conditions on right-of-way grants. This alternative would add enhanced protections to each Application for Permit to Drill (APD) or right-of-way grant on BLM-administered lands and federal mineral estate in the appropriate habitat or area of the identified sensitive resource. One of the enhanced protections would require that APDs in most of the identified habitats above be submitted as part of a development plan, the aim of which would be to limit overall impacts. For some resources, further protections and mitigations would be applied only if a threshold were reached. These thresholds are defined as a specific percentage of habitat loss—5 or 10 percent of a lease—or as a reduction of a species population to an unacceptable level.

The estimated surface disturbance for the Enhanced Resource Protection Alternative is 45,516 acres (about 4.3 percent of the project area), slightly less than the Proposed Action.

Alternative C: Surface Disturbance Cap – High and Low Density Development Areas. Under this alternative, the portions of the CD-C project area that have seen the most intensive natural gas development to date would be designated as high-density development areas (**Map 2-2** in the EIS). The amount of unreclaimed surface disturbance allowed at any one time per section of public land in these areas would be capped at 60 acres. The remainder of the project area would be designated as low-density development areas, with an unreclaimed surface disturbance cap of 30 acres per section at any one time. The 60-acre cap represents the disturbance associated with a 9-well per section drilling program (80-acre spacing) achieved with vertical wells only, a typical development in the high-density area; a 30-acre cap represents the disturbance associated with a 16-well per section drilling program (40-acre spacing) achieved with directional drilling. All prior natural gas surface disturbance committed to long-term use for roads or on-pad production facilities and all disturbance that had not been successfully reclaimed would count against the cap. Successfully reclaimed acreage would not count against the cap. **Appendix M** would be used to guide reclamation if Alternative C were to be selected.

About 44 percent of the CD-C project area would be within the high-density development area. The average historic surface disturbance within the high-density area is 33 acres per section, with an average of 5 wells per section. In the low-density areas, the average disturbance is 4.5 acres per section with an average of less than one well per section. About 24 percent of the CD-C project area has had no development to date.

Only BLM-administered lands and mineral estate in the CD-C project area would be subject to the cap. The estimated surface disturbance of this alternative is 42,955 acres (about 4 percent of the project area), a 9-percent decrease from the Proposed Action.

Alternative D: Directional Drilling. This alternative would require all future natural gas wells on BLM-administered lands and federal mineral estate to be drilled from existing or new multi-well pads. In areas with no existing oil and gas development, one multi-well pad would be permitted per section (or per lease if the lease area is less than a section). A single access corridor would be permitted for required roads, pipelines, and electrical power distribution for each new multi-well pad. In sections with existing oil and gas development, enlargement of one existing well pad would be permitted and that pad would serve as the multi-well pad for all future drilling in that section.

Proposals for access across federal lands for oil and gas development on adjacent private and state lands would continue to be considered by the BLM. Operators may request that an APD be exempted from the general rule when an extraordinary situation exists that could limit full development of the natural gas resource.

It is assumed that this alternative would result in a 20-percent reduction in the number of wells drilled to federal minerals. Such a reduction would reduce overall well numbers by 12 percent to 7,894 instead of the 8,950 wells proposed by the Operators. The estimated surface disturbance for this alternative is 33,658 acres (about 3.1 percent of the project area), a 29-percent decrease from the Proposed Action.

Alternative E: No Action. Under the No Action Alternative, the BLM would deny the Proposed Action for natural gas development on federal lands and federal minerals in the CD-C project area. For the purposes of this analysis, it is assumed that development of the portion of the Proposed Action that involves private and state fluid mineral leases, an estimated 485,819 acres (45.4 percent) of the project area, would take place, as the BLM does not have jurisdiction over private and state fluid minerals. The result would be an estimated 4,063 wells on 2,783 well pads. The rate of drilling over the 15-year development period would decrease from 600 wells per year to 270 wells per year.

Surface disturbance on private and state mineral leases is estimated at 21,440 acres (about 2 percent of the project area), a 54.6-percent decrease from the Proposed Action. While development of federal fluid mineral leases is assumed to occur on an individual, case-by-case basis, no estimate of the amount of such activity or the disturbance associated with it is discussed in the impact analysis.

Alternative F: Agency Preferred Alternative. The RFO developed the Agency Preferred Alternative in response to comments received during the Draft EIS public comment period that indicated that the alternatives analyzed in the Draft EIS did not individually fully respond to issues identified during scoping. Alternative F is designed to incorporate directional drilling to reduce surface impacts while still allowing for resource recovery. This alternative is an amalgam of elements analyzed in the Draft EIS. The principal elements of the alternative are:

- Water and soil management to reduce fugitive dust and impacts to air and water resources, including salt and sediment contributions to the Muddy Creek and Bitter Creek watersheds. Well pads and related facilities located within ½ mile of Muddy Creek, Red Wash, and/or Bitter Creek, and within a ¼ mile of playas within the Chain Lakes Wildlife Habitat Management Area (WHMA), would be subject to the following surface use COAs:
  - Submission by the Operators to the BLM of a bi-annual BMP monitoring report;
  - Boring of all pipeline crossings of perennial drainages and riparian areas;
  - Soil stabilization of all disturbances within 30 days of well completion;
  - Closed or semi-closed loop drilling (closed loop only within ¼ mile); and
  - Yearly site visits by the CD-C discussion group.
- BLM implementation of a monitoring plan for Muddy Creek and Bitter Creek (**Appendix O**).

- Formation of a CD-C discussion group consisting of the BLM, CD-C cooperators, local landowners, and permittees that would respond to evolving energy issues and concerns related to the project, and would discuss opportunities for off-site mitigation.
- Minimization of surface disturbance to reduce impacts to vegetation, range, wildlife, and wild horse resources.
    - Operators would be limited to no more than eight well pads per square mile on BLM-administered lands with exceptions granted on a case-by-case basis;
    - Transportation planning would be implemented as outlined in **Appendix N, Transportation Plan**;
    - Road and pipeline networks and well pad placement would be carefully sited to avoid critical habitat such as big game winter range and/or migration corridors; and
    - A fugitive dust control plan **(Appendix P)**, would be implemented.

The estimated surface disturbance for Alternative F is 43,808 acres (about 4.1 percent of the project area), a 7.2-percent decrease from the Proposed Action.

Alternatives Considered but Eliminated from Detailed Analysis. The BLM considered three alternatives to the Proposed Action that were not carried forward for detailed analysis in this EIS—a Surface Disturbance Cap with Reclamation Credits and Debits alternative, a Focused Development alternative, and a 100-percent Vertical Drilling alternative.

The Surface Disturbance Cap with Reclamation Credits and Debits would have placed a 30-acre cap on the amount of future surface disturbance at any one time in a section of public land, with credits and debits for successful or failed reclamation of previous disturbance. Because of the complexity and the uncertainty about its effects, and because Alternative C already satisfied all the criteria for a surface disturbance cap, the BLM decided that the Surface Disturbance Cap with Reclamation Credits and Debits would not be carried forward for analysis in the EIS.

Several variations of a Focused Development alternative were considered during discussions between the Operators and the CD-C cooperating agencies between 2007 and 2009. With the large number of leaseholders and the fractured nature of land ownership in the project area, it proved impossible to reach agreement among a sufficient number of parties as to which properties should be developed first. Unitization of the leases over such a large area would not be viable and thus could not provide a framework for focusing development. The BLM also concluded that relaxation of seasonal wildlife stipulations in focus areas—an essential element of such an alternative—would not be feasible.

The third eliminated alternative, which was presented in the Draft CD-C EIS but not in the Final EIS, is Alternative A: 100-percent Vertical Drilling. Alternative A was dropped from further consideration in the Final EIS because comments on the Draft EIS raised considerable concerns regarding the amount of surface disturbance that would result from this alternative. In addition, this alternative did not resolve resource conflicts identified during scoping and the Draft EIS comment period. Therefore, it has been dropped from further consideration.

AFFECTED ENVIRONMENT AND ENVIRONMENTAL IMPACTS: OVERVIEW

Chapter 3 of the EIS describes the affected physical, biological, human, and management environment of the CD-C project area. The identified resources present within the project area provide the basis to address substantive issues of concern brought forward during internal and public scoping. Chapter 3 provides quantitative data and spatial information where appropriate to the resource, which serves as a baseline for comparison of the direct, indirect, and cumulative impacts of each of the alternatives.

Chapter 4 of the EIS describes the environmental effects of implementing the Proposed Action and alternatives on the affected environment described in Chapter 3. The chapter is divided into subsections that address the impacts for the resources affected by the Proposed Action and alternatives. Much of the analysis of impacts for each resource is related to the surface disturbance associated with the Proposed Action and Alternatives B through F, which is over and above the existing disturbance in the project area. **Figure ES-1** summarizes surface disturbance within the project area projected for the Proposed Action and the five alternatives together with historical surface disturbance. **Table ES-1** provides a more detailed description of surface disturbance by alternative.

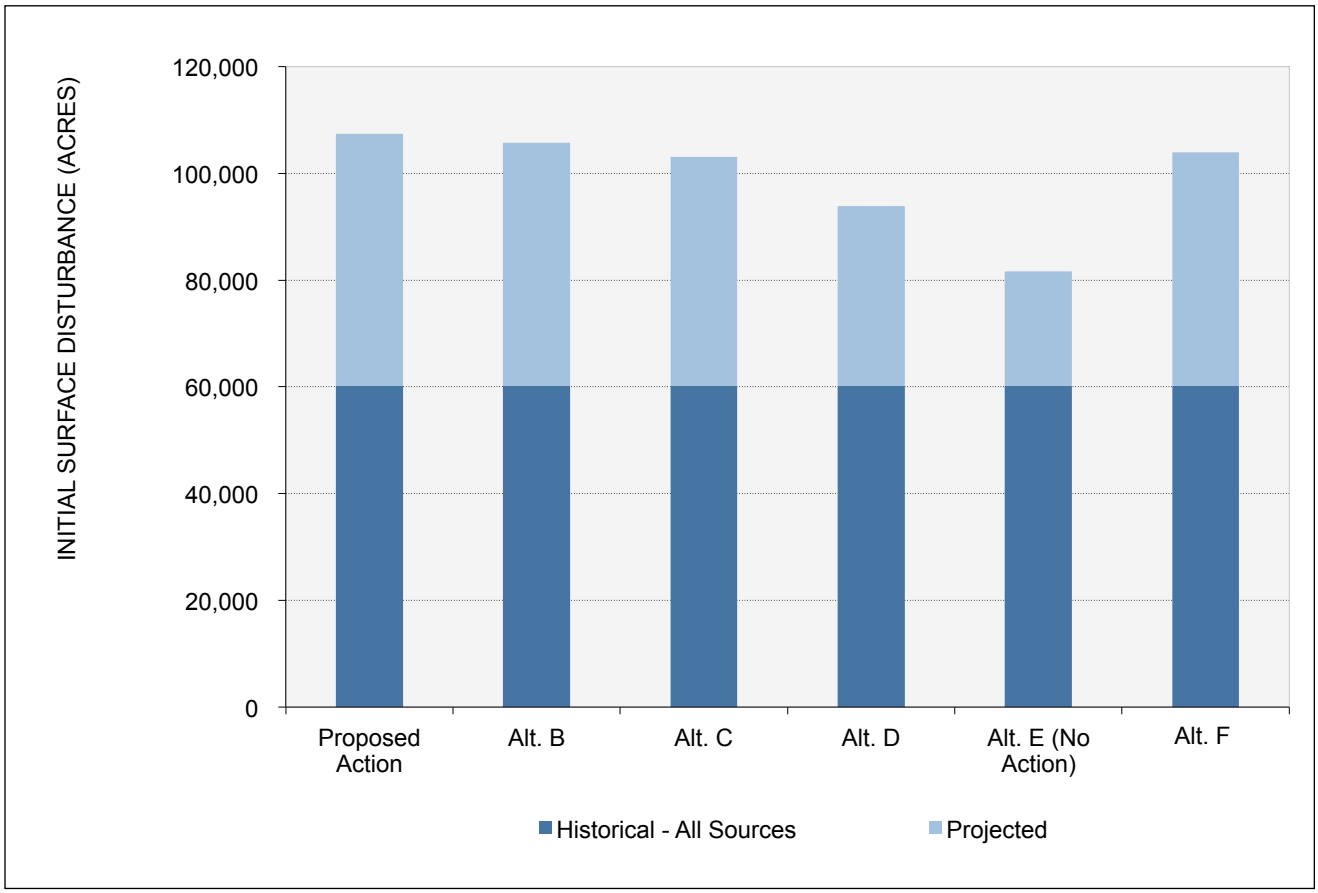


Figure ES-1. Historical and projected initial disturbance, Proposed Action and alternatives

A summary of the Chapter 4 impact analysis by discipline is provided in **Table ES-2**. The impacts of the CD-C alternatives on project resources are described in Table ES-2 as Low, Medium, High, or Significant. Following Table ES-2 is a more detailed summary description of the affected environment and the environmental impacts by discipline. The resource-specific effects of the alternatives are evaluated quantitatively and qualitatively, as appropriate, based on available data and the nature of the resource analyzed.

Table ES-1. CD-C surface disturbance – historical, Proposed Action and Alternatives (acres)

Category	SURFACE DISTURBANCE						
	Oil and Gas			Grand Total[2]	*Percent of Project Area*	Change from Proposed Action	
	Well Pads (incl. roads)	Related Facilities[1]	Total			acres	%
Historical							
Initial	20,524	28,694	49,218	60,176	*5.6%*	—	—
Long-term	6,403	2,069	8,472	17,663	*1.7%*	—	—
Proposed Action							
Initial	41,889	5,311	47,200	47,200	*4.4%*	—	—
Long-term	17,998	863	18,861	18,861	*1.8%*	—	—
Combined IN[3]	62,413	34,005	96,418	107,376	*10.0%*	—	—
Combined LT[3]	24,401	2,932	27,333	36,524	*3.4%*	—	—
Alternative B: Enhanced Resource Protection Alternative							
Initial	40,205	5,311	45,516	45,516	*4.3%*	-1,684	*-3.6%*
Long-term	17,386	863	18,249	18,249	*1.7%*	-611	*-3.2%*
Combined IN[3]	60,729	34,005	94,734	105,692	*9.9%*	-1,684	*-1.6%*
Combined LT[3]	23,789	2,932	26,721	35,912	*3.4%*	-611	*-1.7%*
Alternative C: Cap on Surface Disturbance, 60 Acres and 30 Acres per Section							
Initial	37,644	5,311	42,955	42,955	*4.0%*	-4,245	*-9.0%*
Long-term	16,455	863	17,318	17,318	*1.6%*	-1,543	*-8.2%*
Combined IN[3]	58,168	34,005	92,173	103,131	*9.6%*	-4,245	*-4.0%*
Combined LT[3]	22,858	2,932	25,790	34,981	*3.3%*	-1,543	*-4.2%*
Alternative D: Directional Drilling							
Initial	28,347	5,311	33,658	33,658	*3.1%*	-13,541	*-28.7%*
Long-term	12,748	863	13,611	13,611	*1.3%*	-5,250	*-27.8%*
Combined IN[3]	48,871	34,005	82,876	93,834	*8.8%*	-13,541	*-12.6%*
Combined LT[3]	19,151	2,932	22,083	31,274	*2.9%*	-5,250	*-14.4%*
Alternative E: No Action[4]							
Initial	19,028	2,411	21,440	21,440	*2.0%*	-25,760	*-54.6%*
Long-term	8,175	392	8,567	8,567	*0.8%*	-10,293	*-54.6%*
Combined IN[3]	39,552	31,105	70,658	81,616	*7.6%*	-25,760	*-24.0%*
Combined LT[3]	14,578	2,461	17,039	26,230	*2.5%*	-10,293	*-28.2%*
Alternative F: Agency Preferred Alternative							
Initial	38,497	5,311	43,808	43,808	*4.1%*	-3,391	*-7.2%*
Long-term	16,765	863	17,628	17,628	*1.6%*	-1,232	*-6.5%*
Combined IN[3]	59,021	34,005	93,026	103,984	*9.7%*	-3,391	*-3.2%*
Combined LT[3]	23,168	2,932	26,100	35,291	*3.3%*	-1,232	*-3.4%*

[1] Includes utilities such as gas, condensate, and water collection pipelines; buried power line facilities; water management facilities; and compressor facilities. Unchanged under each alternative, except for No Action, which has 45.4% of the Proposed Action figure.

[2] Includes 10,958 acres of non-oil and gas disturbance for the historical totals and the *Combined IN* and *Combined LT* totals.

[3] *Combined IN* equals the sum of historical initial disturbance and future initial disturbance. *Combined LT* equals the sum of historical long-term disturbance and future long-term disturbance.

[4] *Initial* and *Long-term* acreage disturbance estimates are based on the percentage of the CD-C project area mineral estate that is private and state, 45.4 percent of the total.

The CEQ regulations call for a discussion of the significance of the impacts. Significance requires considerations of both context and intensity. Context refers to the spatial, temporal, social, and regulatory setting in which an impact occurs. The duration of the effect may be a factor in evaluation of significance. Intensity refers to the severity of the impact. Each resource section in Chapter 4 begins with a description of the management objectives and the significance criteria for the resource. The objectives and criteria

were developed and used for the evaluation of impacts in the Rawlins RMP (BLM 2008a). The criteria provide thresholds beyond which impacts to the resource would be considered significant. An impact as a result of project actions would be considered significant if its magnitude were such that normally applied mitigation measures were insufficient and additional mitigation measures were warranted. Each resource section includes a summary statement regarding significant effects.

Table ES-2. Comparison of impacts by alternative

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
PHYSICAL ENVIRONMENT						
Geology	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*
	The intensity of impacts on geologic resources would vary in relation to the surface disturbance by alternative but would be low in all cases, providing that the Operators adhere to the measures in **Appendix C** and the Wyoming DEQ and WOGCC requirements. Impacts would not be significant under any alternative.					
Paleontology	*Medium impact*	*Medium impact*	*Medium impact*	*Medium impact*	*Low impact*	*Medium impact*
	Implementation of the **Proposed Action** or **any of the alternatives** may adversely impact paleontological resources by destroying or damaging them and making them unavailable for scientific inquiry, to the extent that the ground is disturbed by development activities. Disturbance could also be beneficial by resulting in the discovery and preservation of fossils that add to scientific knowledge. Pre-disturbance surveys and disturbance mitigation, described in **Appendix C** and **Appendix D**, would minimize adverse impacts. The impact significance criterion would not be exceeded.					
Soils	*High Impact*	*High Impact*	*Medium Impact*	*Medium Impact*	*Low Impact*	*High Impact*
	The types of impacts would be similar for the **Proposed Action** and **all alternatives.** The risk of adverse impacts would be diminished to the degree that an alternative reduces disturbance. Measures in **Alternative B** (expanded avoidance zone in the Muddy Creek drainage), **Alternative C** (disturbance caps), **Alternative D** (limitation of one well pad per section), and **Alternative F** (limitation of eight well pads per section) would reduce adverse impacts produced by surface disturbance. Impacts under **Alternative E** would be greatly decreased because development on public lands would be much less. Successful implementation of required mitigation measures and BMPs would insure that the significance criteria would not be exceeded.					
Water Resources: Surface Water	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Low Impact*	*Low Impact*
	Under the **Proposed Action** and **all alternatives**, surface water impacts could include contamination of surface water from the authorized or accidental discharge of fluids and produced water and the impacts (including sediment loading) from surface disturbance related to the construction of facilities. The degree of impact is related directly to the amount of initial surface disturbance, which is highest for the **Proposed Action** and less for the **alternatives**. Measures in **Alternative B** (expanded avoidance zone in the Muddy Creek drainage), **Alternative C** (disturbance caps), **Alternative D** (limitation on well pads per section), and **Alternative F** (limitation of eight well pads per section) would reduce adverse impacts produced by surface disturbance. Four of the alternatives would exceed at least one of the 8 significance criteria. **Alternative E** and **Alternative F** would not exceed any significance criteria.					

Table ES-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
PHYSICAL ENVIRONMENT, continued						
Water Resources: Groundwater	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*
	Significant impacts to groundwater are not expected under the **Proposed Action or the alternatives** because the formations targeted for gas development and produced water disposal are stratigraphically isolated from aquifers that host springs and flowing wells used for stock and domestic purposes, because of state-of-the-art construction techniques, and because of implementation of protective measures in **Appendix C** and in the Wyoming DEQ and WOGCC requirements.					
Air Quality[1]	**National Ambient Air Quality Standards (NAAQS), Wyoming Ambient Air Quality Standards (WAAQS), and PSD Increments** — Air pollutant concentrations affected by emissions associated with the **Proposed Action** and all **alternatives** would be in compliance with the standards and would not exceed the increments. Ozone concentrations could exceed the level of the NAAQS during a single year; however, the modeled 2-year average of maximum 8-hour concentrations indicated that ozone concentrations would be in compliance with the NAAQS, which is based on a 3-year average. Maximum 1-hour NO_2 impacts from drilling-related activities could exceed the 1-hour standards during years when drilling occurs; however, given that these impacts are maximum yearly values, they would not result in a violation of the NAAQS or WAAQS since the standards are based on a 3-year average and drilling would not occur at the same location for a 3-year duration. **Air Quality Related Values (AQRVs)** — The visibility analysis indicated a maximum of 5 days (for **action alternatives**) with project emissions resulting in impacts greater than the 0.5 delta deciview (Δdv) threshold at any of the Class I and sensitive Class II areas; using the 98th percentile value as a threshold, there are zero days above the 0.5 Δdv threshold. For the **No Action** Alternative there would be no days that are above the 0.5 Δdv threshold. Maximum nitrogen deposition impacts could exceed the deposition analysis threshold of 0.005 kilograms/hectare/year (kg/ha/yr) at the Mount Zirkel, Rawah, Savage Run, and Flat Tops Class I Wilderness Areas; at Class I Rocky Mountain National Park; and at the Dinosaur National Monument Class II area. There would be no sulfur deposition impacts that exceed the deposition analysis threshold at any Class I or sensitive Class II area. In addition there would be no impacts to sensitive lakes that exceed threshold values. **Compliance/Mitigation** — All BLM-approved energy development projects would comply with applicable air quality regulations and standards, as determined by the WDEQ. Mitigation measures determined to be necessary to demonstrate compliance with the applicable NAAQS and WAAQS and to prevent significant impacts to visibility impairment and nitrogen deposition will be a required condition in the ROD.					

[1] The Air Quality impacts are not characterized by alternative because the impacts cannot be described on a spectrum from low to high and because the analysis is too complex to be characterized in a brief format.

Table ES-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
BIOLOGICAL ENVIRONMENT						
Vegetation and Invasive, Non-Native Plant Species	*Medium to High Impact*	*Medium Impact*	*Medium Impact*	*Low to Medium Impact*	*Low to Medium Impact*	*Medium Impact*
	Historical disturbance equivalent to 5.6% of the project area's surface has already occurred. Additional disturbance would increase both short-term loss of **vegetation** and the area that would remain unvegetated during the production period—45–55 years. It would also increase the spread of **invasive species** throughout the project area. The **Proposed Action** would increase surface disturbance by 4.4%, a *Medium to High* impact depending on the success of reclamation. The alternatives would all decrease the degree of impact by reducing surface disturbance, by reducing the number of disturbance sites, and/or by improving the likelihood of reclamation success. **Alternative B** would reduce disturbance by 3.6%, would reduce the number of disturbance sites by 5.4%, and would improve the likelihood of reclamation success in certain habitats, diminishing the degree of overall impact to *Medium*. **Alternative C** would reduce disturbance by 9.0% and the number of disturbance sites by 13.5%, and would improve the likelihood of reclamation success on public lands, diminishing the degree of overall impact to *Medium*. Although it provides no specific measure to address reclamation success, **Alternative D** would strongly reduce disturbance, by 28.7%, and the number of disturbance sites, by 39.1%, diminishing the degree of overall impact to *Low to Medium*. With little or no new disturbance on public lands, **Alternative E** would reduce both disturbance and the number of disturbance sites by 54.6%, diminishing the degree of overall impact to *Low to Medium*. **Alternative F** would reduce disturbance by 7.2% and the number of disturbance sites by 10.8%. Combined with measures that would improve the likelihood of reclamation success, the reduction would diminish the degree of overall impact to *Medium*					
Terrestrial Wildlife	Impacts would include loss of forage, as well as direct and indirect loss of habitat. Significant impact can be reached by actions that result in disruption or irreplaceable loss of vital and high-value habitats such as CWR and migration corridors, resulting in impacts that exceed the WGFD's *High* or *Extreme* impact definitions. Disturbance of big game CWR would be in addition to historical disturbance of 10.3% of pronghorn CWR and 5.4% of mule deer CWR. Big game species in the area are expected to be significantly affected by the **Proposed Action** and **the alternatives**. Other species (raptors, small mammals, and songbirds) should be protected sufficiently by the COAs, RMP requirements, and BMPs to avoid exceeding the significance level under the **Proposed Action and the action alternatives**. Those terrestrial wildlife species that have potential impacts from the **Proposed Action** or **any of the alternatives** approaching or reaching the level of significance are identified below.					
Pronghorn[2]	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Significant Impact*
Mule Deer[2]	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Significant Impact*	*Significant Impact*

[2] The Significant Impact shown for the Proposed Action and all alternatives for Pronghorn and Mule Deer is equivalent to the WGFD (2010a) definition of *High or Extreme*.

Table ES-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
BIOLOGICAL ENVIRONMENT, continued						
Aquatic Wildlife	*Medium impact*	*Low impact*	*Medium impact*	*Medium impact*	*Low impact*	*Low impact*
	For the **Proposed Action** and **all alternatives**, impacts to aquatic wildlife are primarily associated with increased sediment entering aquatic habitats from ground-disturbing activities and road building adjacent to or crossing aquatic habitat, but significant effects are not expected. **Alternative B** (protections for the Muddy Creek and Bitter Creek watersheds and the Chain Lakes wetlands and playas) and **Alternative F** (surface use Conditions of Approval in ½-mile buffer around Muddy Creek and Bitter Creek and in a ¼-mile buffer around playas in the Chain Lakes WHMA) have measures that would diminish impacts on aquatic wildlife.					
Special Status Wildlife	Only those Special Status wildlife species that have potential impacts from the **Proposed Action** or **any of the alternatives** approaching or reaching the level of significance are identified below.					
Sage-Grouse (Overall)	Athough there may be localized loss of habitat at the site-specific scale, by implementing the requirements of the ARMPA and the SGEO (2015) the BLM would be reducing impacts to Greater Sage-Grouse by covering all lands in the state with a single regulatory framework in the most important habitats in the Wyoming basin population.					
Sage-Grouse (PHMA)	Impacts on Greater Sage-Grouse within the PHMA, about 15 percent of the project area, are expected to be low and to support the goal of net conservation gain under the Proposed Action or any of the alternatives. However, some portions of the PHMA within the project area have existing disturbance that may exceed the distance and disturbance thresholds of the ARMPA and the SGEO. As site-specific projects are proposed within this area, the DDCT analysis tool may demonstrate exceedances. The BLM would work with the project proponents to avoid, reduce, and mitigate adverse impacts to the extent compatible with lessees' rights to drill. In some cases, off-site compensatory mitigation may be required.					
Sage-Grouse (GHMA)	In the GHMA, which makes up 85 percent of the project area, the 0.25-mile surface occupancy buffer and the 2-mile buffer for seasonal limitation on disturbance would provide a base level of habitat and population protection. Local impacts would be Low to Extreme depending on the amount of existing development and the degree of new development in an area. In the high-density portions of the CD-C gas field (44 percent of the project area), there is an average of 5 wells per section. New development would likely meet the WGFD criteria for High or Extreme impact (WGFD 2010a) at the site-specific level. In the low-density portions of the CD-C gas field (56 percent of the area), the average wells per section is 0.7. New development in those areas would likely meet the criteria for Low—or at most Moderate—impact because of the Greater Sage-Grouse distance and timing limitations and the application of the conservation and protection measures found in **Appendix C**. Types of impacts would be similar under the Proposed Action or any of the alternatives but each of the alternatives would reduce overall surface disturbance, especially **Alternatives D and E**.					
Endangered Fish	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*
	Impacts to the four Endangered fish species found downstream of the project area are not expected to occur under any alternative, except for water depletion. The biological opinion of the USFWS (**Appendix Q2**) concludes that the CD-C project "is not likely to jeopardize the continued existence of endangered fish and is not likely to destroy or adversely modify designated critical habitat." The biological opinion requires payment of a depletion fee by the Operators based on an annual project depletion of 650 acre-feet.					

Table ES-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
BIOLOGICAL ENVIRONMENT, continued						
Sensitive Fish	*Significant Impact*	*Medium Impact*	*Significant Impact*	*Medium Impact*	*Low Impact*	*Medium Impact*
	Sensitive fish species are found primarily in the Muddy Creek drainage where **Alternative B** and **Alternative F** have measures that would diminish impacts on aquatic wildlife. **Alternative D** and **Alternative E** would reduce overall surface disturbance and thus the impact on sensitive fish species..					
Special Status Plants	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*
	Potential impacts to Ute ladies'-tresses are not expected because suitable habitat is not known to occur within the CD-C project area and the likelihood of occurrence within the project area is low. Measures aimed at avoiding and protecting BLM sensitive plants that would be implemented under the **Proposed Action** and **all action alternatives** would insure that they would be little affected directly. To the extent that surface disturbance decreases and the number of disturbance sites is reduced, the likelihood of adverse impact is diminished further.					
Wild Horses	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*
	For the Proposed Action and all alternatives, long-term loss of forage is estimated at less than 0.1 percent of the total forage for both the Lost Creek HMA and the Adobe Town HMA. None of the impacts on wild horses would be of a magnitude that would exceed any of the three significance criteria. Available forage, water, and other habitat components would remain sufficient to achieve or maintain the Appropriate Management Level in each HMA; the viability of wild horse populations would be maintained; and the wild, free-roaming character of a wild horse herd in an HMA would not be lost.					
HUMAN ENVIRONMENT						
Lands with Wilderness Characteristics	*No Impact*	*No Impact*	*No Impact*	*No Impact*	*No Impact*	*No Impact*
	There are no Lands With Wilderness Characteristics within the CD-C project area.					
Visual Resources	*Medium Impact*	*Medium Impact*	*Medium Impact*	*Low to Medium Impact*	*Low Impact*	*Medium Impact*
	Under the **Proposed Action** and **all action alternatives**, adequate visual mitigation in the form of BMPs and COAs would allow oil and gas development to be compatible with the management objectives for Visual Resource Management Class III landscapes in the project area by partially retaining the existing character of the landscape. Development would be compatible per se with VRM Class IV objectives because VRM Class IV is meant to allow for major modification of the existing character of the landscape. **Alternative E, No Action**, would decrease the potential for visual impacts.					

Table ES-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
HUMAN ENVIRONMENT, continued						
Recreation	*Medium Impact*	*Medium Impact*	*Medium Impact*	*Low to Medium Impact*	*Low Impact*	*Medium Impact*
	Under the **Proposed Action**, the RFO would be able to meet its management objective for recreation because the project area is within the RFO's Western Extensive Recreation Management Area, where restriction or avoidance of surface-disturbing and disruptive activities to protect recreation is not required by the Rawlins RMP. The intensity of impacts to recreation under the alternatives would correlate to the variation in long-term surface disturbance by alternative with **Alternatives B, C, D, and F** producing less impact, and **Alternative E** much less impact.					
Cultural and Historical Resources	*Low to Medium Impact*	*Low to Medium Impact*	*Low to Medium Impact*	*Low Impact*	*Low Impact*	*Low to Medium Impact*
	Pre-disturbance surveys and avoidance would minimize adverse impacts and remove the potential for significant impacts for the **Proposed Action** and the **alternatives**. The numbers of sites that might be affected (and the number potentially eligible for the National Register of Historic Places) are as follows: **Proposed Action**, 1,416 (312); **Alternative B**,1,365 (300); **Alternative C**,1,289 (284); **Alternative D**, 1,010 (222); **Alternative E**, 643 (142); and **Alternative F**, 1,314 (289).					
Socioeconomics	Medium to High Impact	Medium to High Impact	Medium to High Impact	Medium to High Impact	Low to Medium Impact[3]	Medium to High Impact
	The **Proposed Action** and **Alternatives B, C, and F** would generate similar types of effects but with minor differences in scale. Estimated total project-related employment (direct, indirect, and induced jobs) would climb to a peak of around 4,000 jobs in Year 14, in addition to existing project employment. Following the completion of new well development, employment effects would continue during production, but at a substantially lower level, and decrease over time. As compared to the peak employment during development, regional employment would decrease by over 4,300 jobs, including both new and existing jobs following the completion of production. Population changes would closely follow employment gains and losses, peaking at about 3,700 new residents and almost 1,000 temporary workers during Year 15 of development and falling to about 700 residents by Year 20. Most community infrastructure such as water, wastewater, and solid waste disposal systems presently have adequate capacity to accommodate the added population, although some systems may require expansion during the latter part of the 15-year development cycle. Demand for community facilities would substantially diminish after development is completed. Substantial government revenues would be generated by the natural gas production—about $3.8 billion in federal royalties, an estimated $530 million in state mineral royalties, and $3.1 billion in ad valorem and gross products taxes. With a reduced number of wells drilled on federal minerals, **Alternative D** would generate similar effects but with a substantially lower intensity, perhaps 12 percent less in most categories. Future federal mineral royalties would be reduced by 20 percent. Under **Alternative E, No Action**, drilling rates would be reduced by 55 percent with an equivalent reduction in the effects described for the Proposed Action.					

[3] Impact level dependent on the number of wells on federal minerals approved on a case-by-case basis.

Table ES-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
HUMAN ENVIRONMENT, continued						
Transportation	Low to Medium Impact	Low to Medium Impact	Low to Medium Impact	Low to Medium Impact	Low Impact	Low to Medium Impact
	Each alternative would generate traffic associated with drilling and production activities. Based on the specified development assumptions, traffic patterns would be similar for all alternatives. Traffic increases would be substantially lower for **Alternative E** (**No Action)** compared to all other alternatives. For the **Proposed Action** and **Alternatives B, C, and F**, minor differences in the anticipated magnitude of annual average daily traffic (AADT) increases on affected highways and roads would result from differences in the ratio of the number of directional wells drilled on multi-well pads to the number of wells drilled on single-well pads. **Alternative D** differences would also result from the fewer number of total wells drilled. Estimated long-term production-related AADT is the same for the **Proposed Action and Alternatives B, C and F** (1,360) and would be reduced by 12 percent for **Alternative D** and 55 percent for **Alternative E.**					
Noise	*High Impact*	*High Impact*	*Medium Impact*	*Low Impact*	*Low Impact*	*Medium Impact*
	The **Proposed Action** and **alternatives** would generate similar types of noise from construction and operations, including traffic-related noise. The volume of noise would generally be directly related to the number of well pads for each alternative, as follows: **Proposed Action**, 6,126; **Alternative B**, 5,798; **Alternative C**, 5.299; **Alternative D**, 3,728; **Alternative E**, 2,783; and **Alternative F**, 5,465.					

Table ES-2. Comparison of impacts by alternative, *continued*

Feature/Resource	Proposed Action	Alternative B: Enhanced Resource Protection	Alternative C: Cap (High and Low Density Areas)	Alternative D: Directional Drilling	Alternative E: No Action	Alternative F: Agency Preferred Alternative
MANAGEMENT ENVIRONMENT						
Range Resources	*Medium to High Impact*	*Medium to High Impact*	*Medium to High Impact*	*Low to Medium Impact*	*Low Impact*	*Medium Impact*
	Estimated long-term forage loss (Animal Unit Month [AUM] equivalent) by alternative is as follows: **Proposed Action**, 2,193 AUMs; **Alternative B**, 2,122 AUMs; **Alternative C**, 2,014 AUMs; **Alternative D**,1,583 AUMs; **Alternative E**, 996 AUMs; and **Alternative F**, 2,053 AUMs. The number of allotments at risk of exceeding RMP significance criteria (10% permanent decrease in AUMs) would be highest under the Proposed Action, at 2-9 allotments.					
Oil and Gas and Other Minerals	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*	*Low Impact*
	Under the **Proposed Action** and **Alternatives B, C, and F**, the fluid mineral resources of the CD-C project area would be developed fully—12.0 Tcf of natural gas and 167.3 million bbls of liquids—in the context of known reserves and current extraction technologies. Under **Alternative D**, it is postulated that development of federal minerals would be reduced by 20 percent, causing an 11.8-percent decrease in the production of fluid mineral resources. Under **Alternative E**, very little new natural gas resources would be produced from the federal mineral estate, dropping natural gas production from 12.0 Tcf to 5.5 Tcf and liquids from 167.3 million bbls to 75.9.					
Health and Safety	*High Impact*	*High Impact*	*Medium Impact*	*Low to Medium Impact*	*Low Impact*	*Medium Impact*
	The **Proposed Action** and **all alternatives** would result in similar impacts to the public and site workers, including increased risk of vehicle collisions on interstate highways and local road systems.					
Waste and Hazardous Materials	*High Impact*	*High Impact*	*Medium Impact*	*Low to Medium Impact*	*Low Impact*	*Medium Impact*
	Currently authorized actions are already exerting stress on permitted disposal facilities proximal to the project area. Authorization of the **Proposed Action** and **all alternatives** would result in further stress to the capacity of permitted waste management units, including those used for management of solid waste, produced water, and drilling mud**.** To the extent that alternatives increased directional drilling (**C, D, and F**) and/or reduced the total amount of drilling (**D and E**), that stress would be reduced and could work to extend the life of some existing disposal facilities.					

SUMMARY DESCRIPTIONS: IMPACTS OF THE PROPOSED ACTION AND ALTERNATIVES

Geology. The project area straddles the Continental Divide and lies within the southern and eastern parts of the Great Divide and Washakie sub-basins of the Greater Green River Basin. The project area has surface sedimentary exposures of Quaternary, Tertiary, and Late Cretaceous age, including the Green River, Battle Spring, Wasatch, Fort Union, and Lance Formations. These deposits are underlain by sedimentary rocks of the Late Cretaceous age, including Fox Hills Sandstone, Lewis Shale, Mesaverde Group, Steele Shale, Niobrara, Frontier, and Mowry Shale. Petroleum products are generally targeted within the Almond, Ericson, Rock Springs, and Blair formations of the Mesaverde Group.

Under the Proposed Action and the alternatives, there is a remote possibility that alteration of existing topography for well pad and access road construction could result in initiation of mass movement and landslides. Removal of surface vegetation and soil could accelerate erosion of surface features and result in gullying and siltation. The extent of impacts would be directly proportional to the amount of surface disturbance and would therefore vary by alternative, but would be low in all cases and would not be significant. The Proposed Action has the potential for the most impact, followed in order of impact by Alternatives B, F, C, D, and E (No Action).

Paleontology. The CD-C project area is underlain by geological units that have a moderate to very high potential to produce scientifically important fossils: the Battle Spring and Fort Union formations (moderate) and the Green River, Wasatch, and Lance formations (very high). Paleontological resources have been identified in over 30 localities within the project area. Excavation of pipeline trenches and construction of well pads, access roads, and ancillary facilities associated with the Proposed Action or its alternatives could result in the exposure and destruction of these resources, either directly as a consequence of construction or indirectly as a result of increased erosion rates. If these newly discovered resources are properly recovered and catalogued, the Proposed Action and its alternatives could result in a better understanding and knowledge of this resource. Increased access would be available to professional, permitted paleontologists and geologists but could lead to increased illegal collection. Impacts to paleontological resources would be more likely with alternatives that have the greatest amount of surface disturbance. The Proposed Action has the potential for the most impact, followed in order of impact by Alternatives B, F, C, D, and E (No Action). The impact significance criterion would not be exceeded.

Soils. Soils in the project area were formed from erosion of bedrock exposed at the surface and from lacustrine, alluvium, loess, and eolian deposits. The parent material is dominated by tertiary shales and sandstones and uplifted cretaceous sedimentary rock. Soils on the tertiary bedrock are poorly developed with little clay accumulation. Sandy soils occur on stabilized sand dunes and in areas with active dunes. Saline soils exist in playas, and sodic soils occur on alluvial fans derived from high-sodium parent materials.

The analysis in the EIS focuses on five potential soil limitations: water erosion, wind erosion, road construction, runoff potential, and reclamation potential. For the first three of these limitations, soils in the project area were generally rated as having slight or low to moderate limitation. Nearly 70 percent of the project area soils are rated as having *Slight* potential for water erosion, 80 percent as having *Moderate* potential for wind erosion, and 63.5 percent as having a *Moderate* limitation for road construction. About half the area soils have a *Moderate* to *High* runoff potential. The most severe soil limitation is reclamation potential. Fifty percent of the project area has *Poor* reclamation potential and only 21 percent is rated as *Good*. The principal reasons for the *Poor* reclamation potential are High Soil Salinity (42 percent) and Soils Too Clayey (27 percent). To date, 57 percent of the wells that have been drilled within the CD-C project area are located within soils with *Poor* reclamation potential.

Impacts of the Proposed Action and the alternatives on soils would be directly related to the amount of surface disturbance created. In decreasing order of magnitude, impacts would be greatest for the Proposed Action with an estimated 47,200-acre disturbance, and then sequentially less for Alternative B (45,516 acres), Alternative F (43,808) acres, Alternative C (42,955 acres), Alternative D (33,658 acres), and Alternative E (21,440 acres). Although the Proposed Action, Alternative B, and Alternative F are estimated to each have a High Impact on project area soils, full and successful implementation of required mitigation measures and BMPs would insure that the significance criteria would not be exceeded.

Water Resources. Approximately 70 percent of the project area is within the Great Divide Basin, a closed basin that is bounded by the Continental Divide on all sides and has no surface hydrologic outlet; 29 percent is within the White-Yampa Basin that includes the Muddy Creek sub-basin; and 1 percent is within the Upper Green Basin. Muddy Creek is a high-elevation, cold-desert stream and a major drainage system within the project area. Stream flow varies with location along the drainage. Muddy Creek exhibits perennial flow for the majority of its length, and in some years flows intermittently because of irrigation water removal south of the George Dew/Red Wash wetlands complex. In years with high runoff amounts, Muddy Creek flows perennially throughout its length. Flow in the tributaries to Muddy Creek is predominantly ephemeral, responding to localized snowmelt and rainfall events, but tributaries may also experience some intermittent flow due to contributions from springs and seeps. Tributary channels are generally dry and prone to flashy, periodic flood events from isolated thunderstorm systems from May to October.

The Upper Muddy Creek Watershed/Grizzly WHMA is located primarily east of the CD-C project area but the westernmost portion lies within the CD-C project area. The goal of the WHMA as stated in the Rawlins RMP is to "manage habitat for the Colorado River fish species unique to the Muddy Creek watershed" (BLM 2008b). The WGFD has been working with the BLM, the grazing permittee, and the Little Snake River Conservation District (LSRCD) to implement conservation measures in the Upper Muddy Creek Watershed/Grizzly WHMA.

Few streams in the Great Divide Basin exhibit perennial flow. Numerous ephemeral streams flow toward the center of the basin and terminate in natural or artificially constructed impoundments or disappear because of losses to diversions, evaporation, and/or infiltration. Since a majority of the project area is within this closed basin, a majority of the surface water flow originating in the CD-C project area terminates within the project boundary. The Chain Lakes wetlands are located in the basin, in the north central portion of the CD-C project area. The Chain Lakes WHMA consists of 30,560 acres of public land surface in a checkerboard pattern of alternating federal and state ownership

Groundwater resources in the project area include unconfined aquifers which are generally shallow, blanket-type deposits of Quaternary or Tertiary age found within 400–600 feet of the ground surface, and confined aquifers that are bound by relatively impermeable rocks and in the deeper formations. The project area is located over the Great Divide (northern portion of the project area) and Washakie (southern portion) structural basins, with the Wamsutter Arch separating the two.

Quaternary-age aquifers within the CD-C project area likely do not qualify as Underground Sources of Drinking Water (USDW) since there are no wells designated for such use. The yields from these aquifers are not likely sufficient to sustain a public water system. Tertiary-age aquifers within the CD-C project area qualify as USDW based on the presence of Wamsutter municipal wells and on the suitability of the groundwater quality. Upper Cretaceous, Lower Cretaceous, Jurassic, and Pennsylvanian age and older aquifers may qualify as USDW based on water quality and quantity. However, due to the depth of the aquifers in the CD-C area (2,000 to 18,000 feet) and the low population density of the area, these aquifers are not likely to be the target for domestic or public water system wells.

Impacts to water resources resulting from project construction and operation could include: increased water runoff and downstream sediment loading as a result of surface disturbance; contamination from accidental releases of fluids associated with exploration and production operations, produced water, and

other hazardous liquids to soils and surface-water systems; removal of groundwater; improper drilling and completion operations; and subsurface disposal of produced water.

The degree of impact to surface water resulting from the Proposed Action and the alternatives depends primarily on the amount of overall surface disturbance and the number and locations of drill pads and associated roads and pipelines. Impacts for the Proposed Action would be the most severe and would be reduced sequentially for Alternative B, C, D, E and F. Alternative E, with the least surface disturbance of the alternatives and the fewest disturbance locations, would have the least impact. The Proposed Action and Alternatives B, C, and D would each exceed at least one of the surface water significance criteria. The Proposed Action would exceed criteria related to degradation of water quality, to salt loading, and to alteration of stream channel geometry. Alternatives C and D, despite their reduced surface disturbance, would exceed criteria related to salt loading and to alteration of stream channel geometry. Alternative B would exceed the criterion related to alteration of stream channel geometry. Alternative F, the Agency Preferred Alternative, and Alternative E (No Action) would have no surface water impacts that exceed the significance criteria.

Impacts to groundwater are not expected to be significant because the aquifers targeted for gas development and produced-water disposal are located in formations below and isolated from the aquifers that produce springs and flowing wells utilized for stock and domestic purposes. In addition, existing federal and state laws and regulations provide protections that limit the potential for significant impacts on groundwater.

Air Quality. The CD-C air quality analysis addressed the impacts on ambient air quality and Air Quality Related Values (AQRVs) from potential air emissions due to the Proposed Action and alternatives and from other regional emissions sources within a defined study area. Potential ambient air quality impacts were quantified and compared to applicable state and federal ambient air quality standards and Prevention of Significant Deterioration (PSD) increments, hazardous air pollutant (HAP) thresholds, and AQRV impacts (impacts on visibility, atmospheric deposition, and potential increases in acidification to acid-sensitive lakes).

A near-field ambient air quality impact assessment was performed to evaluate maximum pollutant impacts within and near the CD-C project area using EPA's Guideline (EPA 2005) model, AERMOD, to estimate maximum potential impacts of carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter greater than 10 microns or 2.5 microns in diameter (PM_{10}, and $PM_{2.5}$) from project emissions sources. Near-field HAP (benzene, toluene, ethyl benzene, xylene, n-hexane and formaldehyde) concentrations were calculated for assessing impacts both in the immediate vicinity of project area emission sources for short-term (acute) exposure assessment and for calculation of long-term risk.

A far-field ambient air quality impact assessment was carried out using CAMx (Comprehensive Air Quality Model with Extensions) to quantify potential air quality impacts to both ambient air concentrations of carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10}, $PM_{2.5}$, and ozone, and AQRVs from air pollutant emissions of carbon monoxide, nitrogen oxides, sulfur dioxide, PM_{10}, $PM_{2.5}$, and volatile organic compounds expected to result from the development of the CD-C project as well as the combined effects of the CD-C project and other new sources of emissions in the region.

The modeling relied on an emission inventory developed for the project for each year over the expected life of the project. Emission inventories for all regional emissions sources from human activities and natural sources (e.g. wildfires) were compiled for use in the far-field modeling.

Near-field modeling indicated that air pollutant concentrations resulting from Proposed Action and project alternative production and field-development source emissions would be in compliance with the National Ambient Air Quality Standards (NAAQS) and Wyoming Ambient Air Quality Standards (WAAQS), and would not exceed the PSD increments. Short-term (24-hour) PM_{10} and $PM_{2.5}$ impacts from single-well pad and access road construction activities could exceed the applicable NAAQS and

WAAQS at a 100-meter distance from these activities, but would be below the NAAQS and WAAQS at a 175-meter distance. Maximum 1-year modeled 1-hour nitrogen dioxide impacts from drilling related activities could exceed the level of the NAAQS and WAAQS for each of the project alternatives; however, given that these impacts are maximum yearly values, they would not result in a violation of the NAAQS and WAAQS.

Far-field modeling showed that the Proposed Action and action alternatives would not cause any exceedances of the ambient air quality standards for carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10} and $PM_{2.5}$, and would not exceed the PSD increments at any of the Class I and sensitive Class II areas. Using EPA's approved method for estimating future year ozone concentrations, the Proposed Action and all alternatives would be in compliance with the NAAQS. Maximum future year 8-hour ozone concentrations in the vicinity of the project area could exceed the NAAQS during a single year, however the modeled 2-year average of maximum 8-hour concentrations indicated that ozone concentrations would be in compliance with the NAAQS (which is based on a 3-year average). The maximum project contribution to 2-year average maximum 8-hour ozone concentrations is 1.7 ppb.

The visibility analysis indicated a maximum of five days with project emissions resulting in impacts greater the 0.5 delta deciview (Δdv) threshold at any of the Class I and sensitive Class II areas; using the 98^{th} percentile value as a threshold, there would be zero days above the 0.5 Δdv threshold. For the No Action Alternative there would be no days that exceed the 0.5 Δdv threshold.

Maximum nitrogen deposition impacts from the Proposed Action and alternatives could exceed the deposition analysis threshold of 0.005 kilograms/hectare/year (kg/ha/yr) at the Mount Zirkel, Rawah, Savage Run, and Flat Tops Class I Wilderness Areas; at Class I Rocky Mountain National Park; and at the Dinosaur National Monument Class II area, with a maximum value of 0.0197 kg/ha/yr occurring at the Savage Run Wilderness Area. There would be no sulfur deposition impacts that exceed the deposition analysis threshold at any Class I or sensitive Class II area. In addition there would be no impacts to sensitive lakes that exceed threshold values.

Vegetation. The CD-C project area is located within the Omernik Level III "Wyoming Basin" Ecoregion 18, described generally as a broad intermontane basin dominated by arid grasslands and shrublands and interrupted by high hills and low mountains. Three vegetative cover types make up 78 percent of the project area: Wyoming Big Sagebrush (the most common at 39 percent), greasewood flats and fans (23 percent), and saltbush flats and fans (16 percent).

Within the project area, the ecoregion is further divided into two Level IV ecoregions: Rolling Sagebrush Steppe and Salt Desert Shrub Basins. The Rolling Sagebrush Steppe is a semiarid region of rolling plains, alluvial and outwash fans, hills, cuestas, mesas, and terraces, with average annual precipitation from 10–12 inches. The dominant vegetation in this ecoregion is sagebrush, often associated with various wheatgrasses or fescue. The ecoregion is interspersed with desert shrublands, dunes, and barren area in more arid regions (e.g., Red Desert); and with mixed-grass prairie at the eastern limit. The Salt Desert Shrub ecoregion includes disjunct playas and isolated sand dunes. The plains, terraces, and rolling alluvial fans of this ecoregion have soils that tend to be more alkaline and less permeable than soils in the Rolling Sagebrush Steppe. Vegetation is a sparse cover of xeric-adapted species such as shadscale, greasewood, and Gardner's saltbush. This arid region is sensitive to grazing pressure, which may promote the spread of invasive weeds.

Direct impacts to native shrub/grassland communities within the CD-C project area would be similar under the Proposed Action and all alternatives—an initial reduction of herbaceous vegetation and a long-term loss of shrubs due to soil disturbance and related construction activities. These impacts could be mitigated by successful implementation of reclamation practices, but about 40 percent of the disturbance would remain in an unvegetated state for the life of the project—30 to 40 years at each individual well site—while used for access roads and well pad facilities. The remaining 60 percent would have reduced

productivity while reclamation is in progress and would have an altered species composition and density for the life of the project and beyond, including a long-term loss of shrubs.

Vegetation could be impacted indirectly as a result of soil compaction, mixing of soil horizons, loss of topsoil productivity, and increased soil-surface exposure resulting in soil loss due to wind and water erosion. Other indirect impacts could occur as a result of altered runoff hydrology due to roads, well pads, and other facilities, particularly on moderate to steep slopes. Additional indirect impacts would occur due to deposition of dust on vegetation near roads and construction sites, reducing plant productivity and vitality. The increased surface disturbance produced by project implementation would also provide opportunities for invasive plant species to establish and spread.

As with soils, the principal difference in impacts among alternatives is related to the amount of surface disturbance that would initially occur for each alternative. In decreasing order of magnitude, impacts would be greatest for the Proposed Action with an estimated 47,200-acre disturbance, and sequentially less for Alternative B (45,516 acres), Alternative F (43,808 acres), Alternative C (42,955 acres), Alternative D (36,449 acres), and Alternative E (21,440 acres). Impacts would also be diminished to the degree that alternatives reduced the number of disturbance sites or improved the likelihood of reclamation success. Alternatives D and E would reduce the number of sites the most. Alternatives C and F would do the most to encourage reclamation success.

Non-native, Invasive Plant Species. The principal invasive weeds known to occur on or near, or which have been treated within, the CD-C project area include: Russian knapweed (*Centaurea repens*), houndstongue (*Cynoglossum officinale*), halogeton (*Halogeton glomeratus*), hoary cress (whitetop) (*Cardaria draba* and *Cardaria pubescens*), perennial pepperweed (giant whitetop, *Lepidium latifolium*), spotted knapweed (*Centaurea maculosa*), common burdock (*Arctium minus*), and saltcedar (*Tamarix* spp.). The primary impact of these invasive species to the range resource is their ability to out-compete native species, reducing the quality of available forage for wildlife and livestock and also diminishing the long-term productivity, diversity, and aesthetic values of lands within the project area.

Halogeton was selected as a worst-case example of non-native invasive species known to exist in the CD-C project area and a survey was conducted in 2007. At that time an estimated 13,353 acres (about 1.2 percent of the project area) were infested with halogeton. Halogeton has continued to spread since the survey was completed and the current infestation is likely greater.

Impacts to vegetation and range resources would occur under the Proposed Action and all alternatives, due to an increase in surface disturbance that could provide more suitable habitat for invasive weed infestations. The risk of infestation and spread of invasive, non-native plant species within the CD-C project area would be similar under all alternatives because initial surface disturbance would create opportunities for new infestations and new development activity would increase the degree to which such species spread throughout the project area. The extent of impact from invasive, non-native species is directly related to the amount of surface disturbance that would initially occur for each alternative. The Proposed Action has the potential for the most impact, followed in order of impact by Alternatives B, F, C, D, and E (No Action). In addition to the CD-C project, several other natural gas projects located adjacent to the project area could produce cumulative invasive species impacts. Additionally, three transmission-line projects are proposed to cross the project area and vehicles/equipment associated with the planning and construction of those projects would provide other potential seed sources and seed vectors.

Wildlife. At least 396 wildlife species occur in and around the project area including: 77 mammal, 273 bird, six amphibian, 10 reptile, and 30 fish species. Most are common and have wide distribution in the region. Species considered in the EIS include big game, upland game birds, raptors, neotropical birds, and fish. The big game species in the project area are pronghorn, mule deer, and elk. Crucial winter and crucial winter/yearlong ranges of pronghorn and mule deer collectively comprise approximately 92,842 acres (8.7 percent of the project area). Twenty-six raptor species are known to occur in or around the

project area, including 14 that breed or potentially breed in the project area, two that over-winter, and ten that have been recorded as transients or migrants. Many species of neotropical songbirds utilize the project area for breeding, feeding, migration, and as year-round habitats. About 30 species of fish may occur in the project area or in streams upstream or downstream of the project area, including ten game-fish species and 20 non-game fish species.

The Proposed Action and alternatives would disturb and alter up to 47,200 acres of wildlife habitat during the 15-year development period, in addition to the 60,176 acres previously disturbed within the project area. Reclamation of disturbed habitats should recover grass-dominated habitats in one to several years, depending on precipitation. Shrub habitats would not reach pre-disturbance levels during the life of the project. The shrub-dependent Greater Sage-Grouse, loggerhead shrike, sage sparrow, and sage thrasher would be impacted by the loss of these habitats.

In addition to the physical removal of habitat, disturbance during construction and production can displace or preclude wildlife use during all seasons. Seasonal timing restrictions for the critical times of year have been developed for the most sensitive species and would generally be implemented during the development phase. Although disruptive activities would continue to occur during the production phase, seasonal restrictions would not be in place for all species. Other impacts from natural gas development include habitat fragmentation, reduced availability and palatability of forage due to dust, and mortality from collision between vehicles and wildlife.

Pronghorn and mule deer are the wildlife species most impacted by development, particularly in their crucial winter range where previous development has already reduced the quality of the habitat. Impacts from the Proposed Action and all alternatives would reach the WGFD definition of *High or Extreme*, which is the determinant of significance for pronghorn and mule deer CWR and associated migration routes.

Because the BLM places buffers around active raptor nest sites and restricts other activities around raptor nests and because most raptor prey use habitat that can be reclaimed in a timely fashion, the impact from the Proposed Action or the alternatives is not expected to exceed the significance criteria.

The project could result in some unintentional, direct mortality of small birds and small mammals from vehicle collisions; however, this mortality is expected to be negligible and is not likely to reduce populations within the project area. If standard prescribed environmental protection measures and BMPs are implemented under the Proposed Action or the alternatives, the impacts on songbird and small-mammal populations are not expected to exceed the impact significance criteria.

All of the fish species that are not BLM Sensitive Species have wide distribution within Wyoming. Consequently, the project and other human activities within the Muddy Creek and Great Basin watersheds may have localized population impacts but should not impact their status range-wide.

The cumulative impact of multiple individual projects may result in a large area exposed to increased fragmentation, disturbance of wildlife and their habitats, disruption of migratory corridors, and the loss of refuge areas. Additional effects are expected on wildlife dispersal, the reduction of non-fragmented habitats, competition with livestock, and competition with other wildlife species.

Special Status Species. The USFWS lists six species that may be found in the CD-C project area as Threatened, Endangered, or Candidate pursuant to the ESA. Of these, only the Threatened Ute ladies'-tresses is potentially present within the project area. Four Endangered fish species are found downstream of the project area in the Colorado River system, and the Threatened Canada Lynx is very unlikely to occur.

BLM Sensitive Species present on public lands in Wyoming include species that are not listed as Threatened or Endangered by the USFWS but that may be rare or declining in the state. Twenty-one

terrestrial species, including Greater Sage-Grouse and ferruginous hawk, four fish species, and four plant species designated as BLM Sensitive occur in the RFO and may occur in or near the CD-C project area.

The Proposed Action and the alternatives would disturb and alter up to 47,200 acres of wildlife habitat during the 15-year development period, in addition to the 60,176 acres previously disturbed within the project area. Reclamation of grass-dominated habitats should occur in one to several years, depending on precipitation. Shrub habitats would not reach pre-disturbance levels during the life of the project. The Greater Sage-Grouse, loggerhead shrike, sage sparrow, and sage thrasher, which are shrub-dependent, would be impacted by the loss of these habitats.

In addition to the physical removal of habitat, disturbance during construction and production can displace or preclude wildlife use during all seasons. Seasonal timing restrictions for the critical times of year have been developed for a number of species and would generally be implemented during the development phase. Although disruptive activities would continue to occur during the production phase, seasonal restrictions would not usually be applied. Other impacts from natural gas development include habitat fragmentation, reduced availability and palatability of forage due to dust, and mortality from collision between vehicles and wildlife.

Due to the lack of suitable habitat and the extremely limited possibility of the **Threatened Canada lynx** using the project area as a travel corridor, direct impacts to the species are not anticipated. Nor are the Proposed Action and the alternatives expected to affect the four **Endangered fish** species or their habitat provided that mitigation measures for water resources and soils outlined in this EIS are implemented. Water draining from the project area does affect the downstream habitat for these species. Under the Recovery and Implementation Program for Endangered Fish Species in the Upper Colorado River Basin, "any water depletions from tributary waters within the Colorado River drainage are considered as jeopardizing the continued existence of these fish." The biological opinion of the USFWS concludes that the CD-C project "is not likely to jeopardize the continued existence of endangered fish and is not likely to destroy or adversely modify designated critical habitat." It would require a depletion fee based on an annual project depletion of 650 acre-feet.

Potential direct and indirect impacts to the **Threatened Ute ladies'-tresses** are not expected because suitable habitat is not known to occur within the CD-C project area and the likelihood of occurrence within the project area is low. Much of the project area is arid and there are few perennial streams; the elevation of the project area is near the upper limit for the species and very few moist riparian area meadows are present. The low likelihood of impact is further reduced by protective measures that would insure that activities that might directly impact plants or habitat would not occur within that habitat.

In Wyoming, the **BLM Sensitive Greater Sage-Grouse** and its habitat are to be managed according to regulatory mechanisms described in the State of Wyoming Greater Sage-Grouse Core Area Protection Strategy (SGEO) and in the BLM Approved Resource Management Plan Amendments for Greater Sage-Grouse (ARMPA). The ARMPA and the SGEO provide consistent habitat management across the range of the Greater Sage-Grouse, prioritize development outside of priority habitat, and require mitigation that provides a net conservation gain to the species within Core Areas. The BLM and WGFD will implement actions to achieve the goal of net conservation gain that include compensatory mitigation as a strategy that should be used when avoidance and minimization measures are inadequate.

The ARMPA defines Priority Habitat Management Areas (PHMAs) that are generally synonymous with Core Areas described in the SGEO. The ARMPA also defines General Habitat Management Areas (GHMAs), which are occupied habitat outside of priority habitat.

By implementing the requirements of the ARMPA and the SGEO, the BLM and the State of Wyoming would cover all lands in the state, including the most important habitats in the Wyoming Basin population, with a single regulatory framework. This management regime would minimize impacts to Greater Sage-Grouse within the PHMA under the Proposed Action and all alternatives. Although

localized impacts to Greater Sage-Grouse outside of the PHMA would be rated from Low to Extreme, they would not be considered significant at the landscape level. The CD-C project would be developed in accordance with the ARMPA and the SGEO and those strategies have been found to provide sufficient regulatory mechanisms for the conservation of Greater Sage-Grouse. Significant impacts to the regional population would not occur as a result of the CD-C project.

It has also been determined that the regional cumulative effect of RFFAs on Greater Sage-Grouse would be managed such that the ARMPA "would achieve an overall net conservation gain for the regional population and would help mitigate the effects on small, at-risk populations." The local cumulative effects of the CD-C project and other RFFAs within the project area would be managed in accordance with the ARMPA and the SGEO and those strategies have been found to provide sufficient regulatory mechanisms for the conservation of Greater Sage-Grouse.

BLM Sensitive ferruginous hawk nests located near private or state surface in the checkerboard would not benefit from the entire 1-mile seasonal nest buffer zone that is required on BLM-administered lands. However, it is not expected that significance criteria would be exceeded since other factors such as topography could reduce the size of the necessary buffer around nests. Other sensitive terrestrial wildlife species should be sufficiently protected by the COAs, RMP requirements, and BMPs and the impact significance level should not be exceeded.

The primary source of potential risks to **sensitive fish species** would be increases in suspended sediments and sedimentation associated with the construction of well sites and related access roads and pipelines, which could result in a direct loss of habitat. The intensity of these impacts would be greatest during the development of the Proposed Action but may decrease with the completion of the construction phase and with the onset of reclamation efforts on disturbed areas. Accidental releases of produced waters or other materials could occur. Alteration of habitat suitability from sedimentation would result in exceedance of impact significance criteria for sensitive fish species. Significant impacts would also occur under Alternative C. However, Alternatives B and F contain protective measures in the Muddy Creek drainage that would reduce the impacts on sensitive fish to a point that is not significant. Alternatives D and E have no protective measures for the Muddy Creek drainage but would reduce surface disturbance overall such that impacts would not be significant.

Decreased viability or increased mortality of the **sensitive plants** Cedar Rim thistle, Gibben's beardtongue, Meadow milkvetch, and persistent sepal yellowcress—or adverse alteration of their critical habitats—would not occur on public lands within the CD-C project area with implementation of the Proposed Action or any of the action alternatives. The presence of sensitive plant species on public lands would be determined by soil surveys or rare-plant surveys prior to site development. Avoidance and BMPs identified on a case-by-case basis would then be applied to proposed surface-disturbing activities to protect or enhance sensitive plant species and their habitats, insuring that potential impacts to sensitive plants would be minimized or eliminated.

Wild Horses. The BLM protects, manages, and controls wild horses within Herd Management Areas (HMAs). Portions of two HMAs are located within the CD-C project area: 119,600 acres of the 251,000-acre Lost Creek HMA in the northwest corner, and 5,826 acres of the 472,812-acre Adobe Town HMA along the southwest perimeter west of Baggs. Both HMAs are located within livestock grazing allotments, and each allotment has an allocated number of AUMs. The primary direct impact to wild horses would be loss of available forage as a result of surface disturbance. Indirect impacts could result from increased potential for horse/vehicle collisions and increased dust as a result of increased traffic. The Proposed Action has the potential for the most impact to wild horses, followed in order of decreasing impact by Alternatives B, F, C, D, and E (No Action). For the Proposed Action and all alternatives, long-term loss of forage is estimated at less than 0.1 percent of the total forage for both the Lost Creek HMA and the Adobe Town HMA.

None of the impacts on wild horses would be of a magnitude that would exceed any of the three significance criteria. Available forage, water, and other habitat components would remain sufficient to achieve or maintain the Appropriate Management Level in each HMA; the viability of wild horse populations would be maintained; and the wild, free-roaming character of a wild horse herd in an HMA would not be lost.

Visual Resources. The CD-C project area is part of a semiarid desert dominated by patches and thickets of sagebrush. Colors of gray, brown, and olive characterize the vegetation, with grasses and forbs changing to shades of brown as they cure in the summer and fall. Soils and rock strata are shades of red, gray, and brown. The landscape is generally unbroken, so visual contrast draws attention wherever it occurs. Dune fields, playas, cuestas, occasional escarpments, and eroded streambeds create some visual contrast.

Visually prominent features in the project area are the Red Desert Basin, the Chain Lakes Basin, the extended Delaney Rim-Wamsutter Rim cuesta-and-valley complex, and North Flat Top, the high point in the project area. North Flat Top, Little Robbers Gulch, and The Bluffs are prominent geologic features visible from Wyoming Highway (WY) 789, the major north-south road through the southern part of the project area. Interstate 80 (I-80) bisects the project area from east to west. Because of high traffic volumes, I-80 is the vantage point from which potentially the most viewers see the project area. Because of the extensive road network, all land within the project area is in the foreground or middle ground of major or other roads.

The potentially affected scenic quality in the project area is currently low to moderate overall. Human modification due to oil and gas development has negatively affected scenic quality in seven of 15 identified landscape-rating units that are contained wholly or in part within the project area. This is generally because oil and gas development disturbs existing vegetation and introduces structures with unnatural forms, lines, colors, and textures that would contrast with the natural landscape character.

Sixty percent of the project area is classified by the BLM as Visual Resource Management (VRM) Class III. The objective of Class III is to partially retain the existing character of the landscape. The level of change to the landscape should be moderate; management activities may attract the attention of the casual observer but should not dominate the view of the casual observer. The remainder of the project area is classified as VRM Class IV, where the objective is to provide for management activities that require major modifications to the existing character of the landscape and the level of change to the landscape can be high.

Visual mitigation in the form of BMPs and COAs would allow oil and gas development to be compatible with the management objectives for VRM Class III landscapes in the project area. Development would be compatible *per se* with VRM Class IV objectives because VRM Class IV is meant to allow for major modification of the existing character of the landscape. Less degradation of landscape quality would occur under all alternatives, when compared to the Proposed Action. The combination of CD-C project impacts and the Gateway South, Gateway West, and TransWest transmission line right-of-way systems could create a high cumulative impact in some viewsheds in the VRM Class III parts of the CD-C project area. Visual impacts from CD-C and other planned or reasonably foreseeable development may add up to a high enough level of incompatible contrast with existing settings to be non-compliant with VRM Class III.

Recreation. Big game hunting and associated off-highway vehicle use constitute the primary recreational uses of public lands within the project area. Pleasure driving to view wildlife, especially wild horses, is a secondary use that occurs mainly within the Red Desert area. There is one undeveloped recreation site at Little Robbers Gulch Reservoir near the southern boundary of the project area. The reservoir has been used as a group hunting camp and fishing hole.

Impacts to recreation resulting from the Proposed Action and the alternatives would directly correlate to impacts to wildlife, wild horses, the visual setting, traffic, and noise. In turn, these impacts would be directly related to the amount of surface disturbance and the increase in surface disturbance in relation to existing disturbance. Overall, the Proposed Action has the potential for the greatest amount of impact to recreation, followed by Alternatives B, F, C, D, and E (No Action). The intensity of impacts to recreation would potentially be highest in the northern part of the project area, where natural gas development is less dense to date and where the Chain Lakes WHMA and the large block of public land to the northwest are a resource for big game hunting and other wildlife-based recreation.

Lands with Wilderness Characteristics. The RFO maintains an inventory of Lands With Wilderness Characteristics on a continuing basis and relies on this inventory in the development and revision of land use plans and when making subsequent project level-decisions; none are located within the boundaries of the CD-C project area.

Cultural and Historical Resources. Portions of the Overland and Cherokee Trails, the 1868 Union Pacific Railroad Grade, and the Lincoln Highway (US 30 and I-80 corridor) are located within the CD-C project area and eligible for listing on the National Register of Historic Places (NRHP). The BLM has designated a quarter-mile buffer around these linear resources and associated sites as highly sensitive. Natural gas development within this buffer would not be permitted. A 2-mile analysis area surrounding these trails and associated sites is considered as the setting. Where the setting of historic trails and associated sites contributes to eligibility for listing on the NRHP, actions resulting in the introduction of visual elements that diminish the integrity of the property's significant historic features would be mitigated. BMPs would be implemented to reduce visual impacts to the setting, such as consolidation of facilities, use of low-profile tanks, and paint colors that blend with surrounding terrain. Increased access to and activity within the project area during construction associated with the Proposed Action and alternatives could result in increased indirect impacts to archaeological sites such as changes in erosion patterns, soil compaction, or vegetation removal; fugitive dust; off-road vehicle traffic associated with construction or maintenance activities; and increased vandalism, including illegal artifact collection.

The amount of potential impact to historic and archaeological resources is related to the amount of surface disturbance. Impacts under the Proposed Action would be the greatest, with a potential 1,416 sites that could be affected, of which 312 would potentially be eligible for the NRHP. Impacts would decrease proportionately for Alternative B (1,365 potentially affected sites; 300 potentially eligible for the NRHP), Alternative F (1,314 and 289), Alternative C (1,289 and 284)), Alternative D (1,010 and 222), and Alternative E (643 and 142). Avoidance and mitigation would reduce the potential for significant impacts on public lands for all alternatives.

Socioeconomics. Implementation of the Proposed Action or Alternatives B, C, D, or F would allow substantially more and higher-paced development and production activity in the CD-C project area than implementation of the No Action Alternative (Alternative E). Because Alternative D could produce a reduction in drilling to federal minerals, total development under that alternative would be somewhat less than under the Proposed Action. CD-C project development activity is assumed to extend over 15 years, and production would continue for 30 to 40 years thereafter. This activity would be accompanied by increased employment associated with development and production activities for companies that service gas field development and production activities, and in other sectors of the local economy. The additional employment would result in concurrent increases in temporary and long-term population for communities in Carbon and Sweetwater counties. In turn, the additional population would require temporary and long-term housing, place demands on local public facilities and services, and generate increases in revenues for local business establishments.

The added development and production would generate substantial tax revenues for local and state governments, which could fund higher public-sector operating costs and facility and service expansion in

response to development-related demands. However, the timing of the receipt of those revenues and their distribution would not in all cases coincide with the timing and location of demand.

Continued natural gas development within the CD-C project area would also increase the potential for conflicts between natural resource development and outdoor recreation and grazing activities. Given the existing level of development, the incremental effects of potential conflicts and displacement are likely to be minor to moderate across most of the project area. However, conflicts with important environmental values could arise in several areas.

All alternatives have the potential to both positively and adversely affect local and regional economic diversity. Positive effects would include sustained support for existing businesses and possible expansion of the commercial and service sectors in response to natural gas-related increased demand; such expansion could also serve increases in tourism, outdoor recreation, and interstate travel. Similarly, the development of community and commercial infrastructure to support development-related demand would enhance the capacity to accommodate other economic activities in the long run. Adverse effects that could limit economic diversification would include increased competition for labor, increased housing costs, and potential effects on regional environmental amenities, particularly during the 15-year development period.

The level of development contemplated by the Proposed Action and other alternatives is contingent upon natural gas prices being sufficiently high to support that level of development from an economic perspective. The natural gas reserves in the project area are part of a larger regional resource base. Consequently, periods of faster or slower-paced development would generally occur in the context of regional energy development expansion and decline in southwest Wyoming and indeed across much of the Rocky Mountain west. In other words, extended periods of elevated demand for natural gas and resultant high gas sales prices would generally correlate with periods of accelerated development activity in the project area and in other natural gas fields in Carbon, Sweetwater, and adjacent counties. Conversely, extended periods of lower natural gas demand or relatively higher availability of gas from other sources would result in regional slowdowns in development activity. The effects of such regional potentials are discussed in the 2008 Baseline Socioeconomic Technical Report and in Chapter 5 of this EIS.

The BLM and Operators consider the natural gas production volumes forecast for this assessment technically recoverable given current technology and knowledge. The ultimate level of recovery would depend on natural gas prices, future improvements in technology for developing and producing gas resources, markets for the gas, and delivery capacity to collect, process, and deliver the gas to market. This assessment assumes that the forecast natural gas production volumes would be recovered, while acknowledging the potential for lower gas prices and corresponding lower levels of development and production. This assumption provides a basis for assessing reasonable potential upper bounds of effects on socioeconomic conditions including the fact that natural gas sales prices to support this level of development would also provide tax revenues to aid the state and communities in responding to development-related effects, as well as continued support for existing programs and services locally and throughout the state.

Transportation and Access. The Proposed Action and all alternatives would result in natural gas development and production-related increases in traffic on federal and state highways and county and BLM roads that provide access to and within the CD-C project area. The pattern of traffic increases would be similar for the action alternatives but the level of increase would vary moderately by alternative. Because Alternative D could result in a reduction in drilling to federal minerals, total traffic under that alternative would be somewhat less than under the Proposed Action. Traffic increases for the No Action Alternative would be substantially less than for the other alternatives. Each action alternative would result in temporary increases in annual average daily traffic on federal and state highways resulting from construction of ancillary facilities such as field compression facilities, a central pipeline compression

facility, a central gas-processing/stabilization facility, and a high-pressure gas line. For I-80, the level of increase would be relatively modest compared to existing levels of traffic. A number of other reasonably foreseeable projects could generate cumulative effects on I-80: wind farm construction; other, smaller oil and gas development projects; power transmission lines; and an in-situ uranium project. The effect would be greatest during construction of the projects and the overall effect would depend greatly on the relative timing of the construction of the projects.

The Proposed Action and all alternatives would accelerate highway maintenance requirements on county, BLM, and private roads. The timing and level of improvements and maintenance requirements would be driven by the magnitude and characteristics of traffic increases on specific highways and roads. Some temporary increases in congestion could occur on local streets in some communities in Carbon and Sweetwater counties and there would be potential for increases in motor vehicle accidents, primarily during the 15-year development period. The Proposed Action and alternatives B, C, and F would generate similar amounts of revenue that could be used to fund highway and road-maintenance needs; Alternative D and the No Action Alternative would generate less revenue for those purposes.

Noise. Existing sources of noise in the CD-C project area include gas compression stations, livestock grazing operations, wind, well workover operations, and traffic along area access roads, state highways, and I-80. Additional noise would be generated under the Proposed Action and the alternatives by well site and access road construction, drilling and completion, pipeline construction, and surface-disturbing reclamation operations. Noise levels may at times temporarily exceed EPA guidance in specific locations. The duration of noise-generating activity and dispersal of noise-generating equipment across the project area would be greatest under the Proposed Action.

Noise impacts would be similar among the alternatives but would differ in the intensity at individual well pads and in the number of well pads where most noise sources would be located. Noise sources would be more dispersed across the landscape under the Proposed Action, with 6,126 well pads. The number of well pads, and the number of locales for new noise sources, would be reduced under all the alternatives. Alterative B would have the smallest reduction at 5.4 percent, followed by Alternative F (10.8 percent), Alternative C (13.5 percent), Alternative D (39.1 percent), and then Alternative E (54.6 percent). As the number of well pads decreased, the volume and duration of noise-generating activity at each site would increase but the number of such sites would decrease. However, full and successful implementation of the required mitigation measures as set forth in the Rawlins RMP and CD-C required Conditions of Approval and BMPs (**Appendix C**) would ensure that the significance criterion is not exceeded.

Range Resources. Impacts to livestock and grazing resources would occur under the Proposed Action and all alternatives. Impacts could include those caused by a reduction of total available forage due to road, well pad, and pipeline construction and maintenance; improperly fenced open pits; vehicle traffic; fugitive dust deposited on potential forage; accidental spills of potentially hazardous materials; and creation of suitable habitat for invasive/noxious weed infestations. Livestock may be injured or killed by vehicle collision, become trapped in open pipeline trenches, stray from pastures through gates left open, and ingest poisonous invasive plant species. Additionally, existing range improvements can be damaged by equipment and vehicles. The level of impact resulting from the Proposed Action and the alternatives would be related to the amount of surface disturbance that would initially occur for each alternative.

Loss of forage in a grazing allotment due to oil and gas development could result in a long-term reduction of the stocking rate for the allotment if the total long-term surface disturbance exceeds 10 percent of the allotment area (one of the significance criteria). Of the 44 allotments within or overlapping the CD-C project area, two already have had disturbance in excess of 9 percent, and nine more have had disturbance in excess of 5 percent. The Proposed Action and alternatives have the potential to result in a long-term reduction in the stocking rate for these allotments until past and new disturbance is successfully reclaimed. For the Proposed Action, it is estimated that a long-term forage loss equivalent to 2,193 of the total 123,910 Animal Unit Months (AUMs) within the CD-C project area could occur. Estimated long-

term forage equivalent lost would be 2,122 AUMs for Alternative B; 2,014 AUMs for Alternative C; 1,583 AUMs for Alternative D; 996 AUMs for Alternative E (No Action); and 2,053 AUMs for Alternative F (Agency Preferred Alternative).

Oil and Gas and Other Minerals. Under the Proposed Action and Alternatives B, C, and F, the fluid mineral resources of the CD-C project area would be developed fully—12.0 trillion cubic feet (Tcf) of natural gas and 167.3 million barrels (bbls) of liquids—in the context of known reserves and current extraction technologies. Under Alternative D, it is postulated under a worst-case analysis that development of federal minerals would be reduced by 20 percent, causing an overall 11.8-percent decrease in the production of natural gas and condensate resources. Under Alternative E (No Action), a reduced amount of fluid mineral resources would be produced from the federal mineral estate, dropping natural gas production from 12.0 Tcf to 5.5 Tcf and liquids from 167.3 million bbls to 75.9.

Deposits of coal and uranium are not expected to be affected by the Proposed Action and the alternatives. Development of surface mineral material deposits mined in support of CD-C development activities would occur under any of the alternatives.

Health and Safety. Implementation of the Proposed Action and all alternatives would likely result in an increased risk to the workforce due to the increased number of personnel in the field, the increase in heavy equipment use and drilling operations, and the resultant increase in vehicle traffic. Compliance with the State of Wyoming Department of Employment Workers Occupational Health and Safety program rules and regulations for construction and oil and gas well drilling, well servicing, and well special servicing operations would aid in reducing project-related occupational hazards. Risks to the project workforce would decline substantially once construction, drilling, and completion are concluded and the project enters the production phase. The Proposed Action and all alternatives would result in similar impacts to the public and site workers with regard to increased risk of vehicle collisions on interstate highways and local road systems during the development and production phases. Impacts under Alternative E (No Action) would be less than half those of the other alternatives because of the greatly reduced activity.

Waste and Hazardous Materials. With the exception of produced water, most waste materials that would be generated at project locations are considered to be solid and classified as non-hazardous, and are disposed of at approved facilities offsite. Some operators recycle drilling mud between wells for re-use, reducing the volume to be disposed of. Completion fluids are also recycled to the extent possible to minimize waste disposal but are generally produced to an open pit onsite for disposal. Produced water within the project area would continue to be managed through the use of private and commercially permitted evaporation ponds and injection/disposal wells. Hazardous wastes and disposal sites are permitted and managed in compliance with Wyoming Department of Environmental Quality regulations.

Currently authorized and approved actions are already exerting stress on authorized disposal facilities near the project area. Authorization of the Proposed Action or Alternatives B, C, or F would result in further stress to the capacity of permitted waste management units, including those used for management of solid waste, produced water, and drilling mud. Alternative D may serve to extend the life of some existing disposal facilities if it results in higher levels of recycling and reuse of drilling materials. Similarly, Alternative E (No Action) may serve to extend the life of some existing disposal facilities because its activity level would be less than half that of the other alternatives.

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