ENVIRONMENTAL ASSESSMENT

For

Jim Bridger Coal Mine Complex Mining Plan Modification for Federal Coal Lease WYW-02727

August 2017

Environmental Assessment
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United States Department of the Interior
Office of Surface Mining Reclamation and Enforcement

August 2017

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ACRONYMS

μg/g – micrograms per gram

μg/m^3 – micrograms per cubic meter

ACEC – Area of Critical Environmental Concern

AIRFA – American Indian Religious Freedom Act of 1978

APLIC – Avian Power Line Interaction Committee

AQRV – air quality related value

ASCM – alternate sediment control measures

ASLM – Assistant Secretary for Land and Minerals Management

BACT – best available current technology

BART – Best Available Retrofit Technology

BCC – Bridger Coal Company

BKS – BKS Environmental Associates, Inc.

BLM – Bureau of Land Management

B.P. – before present

BTU – British thermal unit

CAA – Clean Air Act, as amended

CCW – coal combustion residues or wastes

CEQ – Council on Environmental Quality

CFR – Code of Federal Regulations

CHIA – Cumulative Hydrologic Impact Assessment

CIAA – cumulative impact analysis area

CO – carbon monoxide

CO_2 – carbon dioxide

CO_2e – carbon dioxide equivalent

DOI – Department of the Interior

EA – environmental assessment

EIS – environmental impact statement

EPA – U.S. Environmental Protection Agency

ESA – Endangered Species Act of 1973

FCLAA – Federal Coal Leasing Act Amendment of 1976

FGD – flue gas desulphurization

FLPMA – Federal Land Policy and Management Act of 1976

GAP – National Gap Analysis Program

GHG – greenhouse gas

GIS – geographic information system

gpm – gallons per minute

HAPs – hazardous air pollutants

HUC – Hydrologic Unit Code

kV – kilovolt(s)

lbs – pounds

MACT – Maximum Achievable Control Technology

MBTA – Migratory Bird Treaty Act of 1918, as amended

mg/L = milligrams per liter

MLA – Mineral Leasing Act of 1920

MMPA – Mining and Mineral Policy Act of 1970

MOA – Memorandum of Agreement

MPDD – Mining Plan Decision Document

MSHA – Mine Safety and Health Administration

NAAQS – National Ambient Air Quality Standards

NEPA – National Environmental Policy Act

NESHAPs – National Emissions Standards for Hazardous Air Pollutants

NHPA – National Historic Preservation Act, as amended

N_2O – nitrous oxide

NO_2 – nitrogen dioxide

NO_X – nitrogen oxides

NRCS – Natural Resources Conservation Service

NRHP – National Register of Historic Places

NSPS – New Source Performance Standards

NWI – National Wetlands Inventory

O_3 – ozone

OSMRE – Office of Surface Mining Reclamation and Enforcement

PM – particulate matter

PSD – Prevention of Significant Deterioration

R2P2 – Resource Recovery and Protection Plan

RFFAs – reasonably foreseeable future actions

SCC – social cost of carbon

SDWA – Safe Drinking Water Act, as amended

SEDCO – sediment control monitoring network

SMCRA – Surface Mining Control and Reclamation Act of 1977

SO_2 – sulfur dioxide

SPCC – spill prevention, control, and countermeasure

TDS – total dissolved solids

TSS – total suspended solids

USFWS – U.S. Fish and Wildlife Service

USGS – U.S. Geological Survey

VOC – volatile organic compound

WAAQS – Wyoming Ambient Air Quality Standards

WAS – Western Archaeological Services

WDEQ – Wyoming Department of Environmental Quality

WDEQ-AQD – Wyoming Department of Environmental Quality, Air Quality Division

WDEQ-LQD – Wyoming Department of Environmental Quality, Land Quality Division

WDEQ-WQD – Wyoming Department of Environmental Quality, Water Quality Division

WDWS – Wyoming Department of Workforce Services

WGFD – Wyoming Game and Fish Department

WWPC – Wyoming Weed and Pest Council

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1. PURPOSE AND NEED

1.1. Introduction

The *Environmental Assessment for Jim Bridger Coal Mine Complex Mining Plan Modification for Federal Coal Lease WYW-02727* has been prepared by the Office of Surface Mining Reclamation and Enforcement (OSMRE), Western Region. Since 1974, in accordance with the Mineral Leasing Act of 1920 (MLA) and the federal mining plan approved by the Assistant Secretary for Land and Minerals Management (ASLM), the operator of the Bridger Mine Complex (currently Bridger Coal Company [BCC]) has mined portions of federal coal lease WYW-02727, in accordance with the approved surface coal mining permit issued by the state regulatory authority, the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ-LQD). On November 28, 2014, in accordance with its responsibilities under the Federal Surface Mining and Reclamation Control Act of 1977 (SMCRA), the WDEQ-LQD approved the Amendment and Mine and Reclamation Plan Revision for surface coal mining Permit No. 338-T7, including the mining of portions of federal coal lease WYW-02727 not previously approved by the ASLM. In accordance with the MLA, the ASLM must approve the mining plan modification for federal coal lease WYW-02727 before mining of the federal coal can occur.

OSMRE prepared this environmental assessment (EA) to evaluate and disclose the potential for direct, indirect, and cumulative impacts to the environment from current and future mining operations at the Bridger Mine Complex from 2016 through the life of the mine within the portions of federal coal lease WYW-02727 that lie within the approved SMCRA permit area; mining operations in this area are hereafter referred to as the project (Figure 1-1).

The EA review has been conducted in accordance with the National Environmental Policy Act (NEPA) and with the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508); the Department of the Interior's (DOI's) regulations for implementation of NEPA (43 CFR 46); the DOI's Departmental Manual Part 516; and OSMRE's Directive REG-1, *Handbook on Procedures for Implementing the National Environmental Policy Act* (OSMRE 1989). Information gathered from federal, state, and local agencies; BCC; publicly available literature; and in-house OSMRE sources, such as the Bridger Mine Complex Permit Application Package, were used in the preparation of this EA.

NEPA requires federal agencies to disclose to the public the potential environmental impacts of projects they authorize and to make a determination as to whether the analyzed actions would "significantly" affect the environment. The term "significantly" is defined in 40 CFR 1508.27. If OSMRE determines, based on the analysis in the EA, that the proposed mining plan modification would have significant impacts, OSMRE would prepare an environmental impact statement (EIS) for the proposed mining plan modification. If OSMRE determines that the potential impacts would not be significant, OSMRE would prepare a finding of no significant impact to document this finding, and, accordingly, would not prepare an EIS.

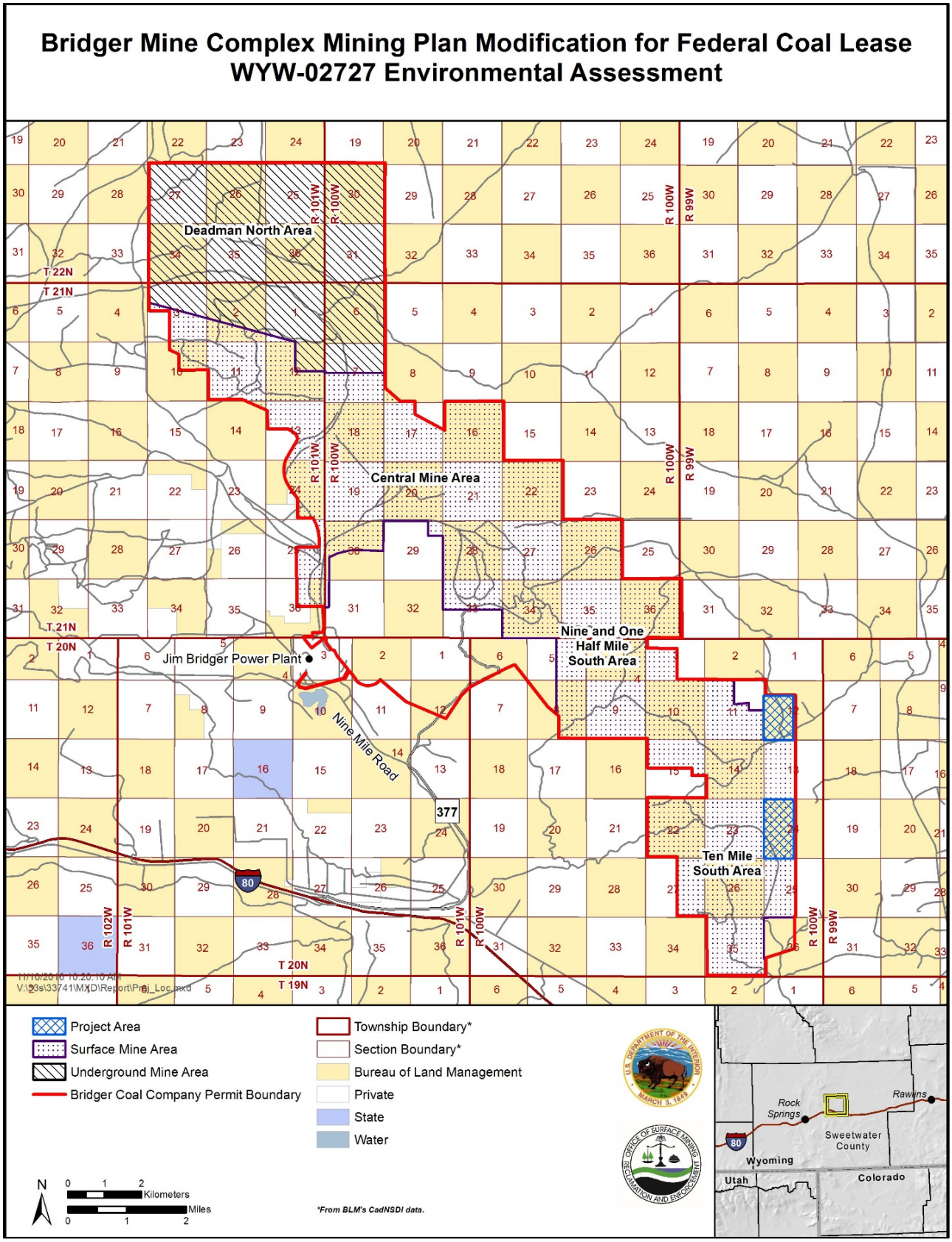

Figure 1-1. Project location and surface and underground mining areas.

The Bureau of Land Management (BLM) completed an EA in 2010 that analyzed the modification of BCC's coal lease WYW-02727 (referred to hereafter as the "2010 Bridger Lease Modification EA") (BLM 2010). OSMRE was a cooperating agency on the 2010 Bridger Lease Modification EA. The proposed action analyzed in the 2010 Bridger Lease Modification EA was the modification of coal lease WYW-02727 to include parcels of unleased coal lands situated within Sections 12 and 24, Township 20 North, Range 100 West, and to obtain a right-of-way to conduct surface operations in Section 36, Township 20 North, Range 100 West. The 2010 Bridger Lease Modification EA analyzed potential impacts to air quality and climate change, cultural resources, grazing, riparian wetlands, water depletion, and wildlife.

The mining plan modification area is 560 acres in total and would result in approximately 104 acres of surface disturbance from surface mining activities. This EA only addresses the mining plan modification associated with the modification of lease WYW-02727 and does not address rights-of-way that may be required. The indirect effects of overall coal combustion at the Jim Bridger Power Plant are analyzed in this EA, but the Jim Bridger Power Plant is not considered a connected action in the EA because the power plant would operate whether or not the Proposed Action is approved and because the Proposed Action would not automatically trigger any action at the Jim Bridger Power Plant that would require an EIS, permit modification, or other changes. There are no federal decisions currently being analyzed regarding the power plant.

1.2. Background

The Bridger Mine Complex is operated by BCC and is located approximately 31 miles northeast of Rock Springs, in Sweetwater County, Wyoming (see Figure 1-1). The Bridger Mine Complex consists of a multi-faceted mining operation inclusive of surface, underground, and highwall mining methods, together with ongoing reclamation operations. As shown in Figure 1-1, the Bridger Mine Complex includes different mining operations (i.e., surface operations and underground operations) occurring in different areas within the mining permit boundary. The mining operations at the Bridger Mine Complex produce coal from federal, private, and state lands situated within the area known as the Union Pacific Railroad checkerboard land grant. Union Pacific lands are now owned and controlled by Anadarko Petroleum Corporation. BCC is a joint venture by two owners: Idaho Energy Resource Company, a wholly owned subsidiary of Idaho Power Company, and Pacific Minerals, Inc., a wholly owned subsidiary of PacifiCorp. The mining operations at the Bridger Mine Complex produce upward of 6 million tons of coal per year, supported by 4.0 to 4.5 million tons of coal from the underground operation and 1.0 to 1.5 million tons from the surface operation. The mining operations at the Bridger Mine Complex currently provide most of the coal requirements for the adjacent Jim Bridger Power Plant.

With the potential expansion for surface strip-mine development in the southern Bridger coal field, it becomes necessary to secure 560 acres of federal coal lands to accommodate the expanded mine recovery area. The 560 acres of federal coal lands contain an estimated 4.5 million tons of recoverable coal (199,979 tons in Section 12 and 4.3 million tons in Section 24). When added to previously permitted coal from areas immediately adjacent to the Section 12 and Section 24, this mining plan modification would allow approximately 700,000 tons of federal coal per year to be surface-mined on average. The proposed mining plan modification would not extend the life of the mine. If the mining plan modification is not approved, mining would continue until 2037, but with a lower annual production after 2025 or sooner. The average annual production of coal mined directly from the 560 acres of federal coal lands would be 214,286 tons. If the proposed mining plan modification is not approved, the average annual production of coal mined at the Bridger Mine Complex would be reduced from between approximately 3.7 and 6.5 million tons to between approximately 3.5 and 6.3 million tons of coal per year from 2025 through 2037. This would represent an approximate 3% to 5% reduction in annual production. The estimate for recoverable reserves was predicated on several factors, including inherent geologic and mining conditions, coal quality, mine economics, marketability, environmental concerns, and safety. The

inclusion of these lease modification parcels into the existing Bridger Mine Complex surface coal mine operation is the only economical and technologically feasible means of recovering these portions of coal reserves, which otherwise would be subjected to bypass. The coal reserves contained within the lease tract would be mined, delivered, and utilized for the generation of electricity. The surface mine expansion in the mining plan modification area forms a logical contiguous reserve.

Four federal leases are included in the Bridger Mine Complex. The BLM issued lease WYW-0313558 to BCC in January 1968. The BLM issued leases WYW-02728 and WYW-02727 to BCC in October 1969. The BLM issued lease WYW-154595 to BCC for the underground mine in March 2005. The BLM modified lease WYW-02727 to add 560 acres in July 2010, following completion of the 2010 Bridger Lease Modification EA. The BLM modified lease WYW-154595 to add approximately 320 acres to the underground mine in May 2013, following completion of the 2013 Bridger Lease Modification EA. BCC now seeks federal mine plan approval to account for the 560 new acres added to lease WYW-02727.

Four State of Wyoming leases are included in the project area. The State of Wyoming issued lease 0-40779 (1,280 acres) to BCC in April 2001, issued lease 0-26745 (1,280 acres) to BCC in January 1995, issued lease 0-40333 to BCC in June 2001, and issued lease 0-42077 (640 acres) to BCC in February 2007.

BCC acquired the Union Pacific Railroad coal lease in January 1969, for private coal adjacent to the federal coal leases. Union Pacific coal leases were later converted to Anadarko coal leases. The Anadarko coal lease for the underground mine was obtained in December 2003. The Anadarko coal leases applicable to the current federal mining plan modification area were obtained in June 2012 and April 2014.

The total acreage covered by BCC's existing mine permit is 28,513.71 acres. The total acreage of completed mining and reclamation in the permit area is 4,491.8 acres. The total acreage of existing surface mining operations in the permit area is 6,151.4 acres. Upon completion of mining, approximately 11,368 acres will have been disturbed and reclaimed. The proposed mining plan modification area would add 104 acres of mining and reclamation to the permit area.

1.2.1. *Statutory and Regulatory Background*

For existing approved federal mining plans that are proposed to be modified, OSMRE prepares a recommendation to the Assistant Secretary of Land and Minerals Management (ASLM) regarding a Mining Plan Decision Document (MPDD) for a federal mining plan modification. The ASLM reviews the MPDD and decides whether to approve the federal mining plan modification and, if the modification is approved, what, if any, conditions may be needed. OSMRE's recommendation regarding the evaluation of the federal mining plan modification will be based, at a minimum, on the following (*see* 30 C.F.R. Part 746):

1. The permit application package
2. The Resource Recovery and Protection Plan (R2P2)
3. Information prepared in compliance with NEPA, including this EA
4. Documentation demonstrating compliance with the applicable requirements of federal laws, regulations, and executive orders other than NEPA
5. Comments and recommendations or concurrence of other federal agencies and the public
6. Findings, recommendations, and contractual commitments and requirements of the BLM with respect to lease WYW-02727, the R2P2, and the MLA
7. Findings and recommendations of the WDEQ-LQD with respect to the mine permit revision application
8. The findings and recommendations of OSMRE with respect to the additional requirements of 30 CFR Chapter VII, Subchapter D (30 CFR 740–746)

1.3. Purpose and Need

The purpose of the Proposed Action is established by the MLA and SMCRA, which requires evaluation of BCC's proposed mining plan modification for the Bridger Mine Complex before conducting surface mining and reclamation operations to develop federal coal under lands within the lease WYW-02727 area. OSMRE is the agency responsible for making a recommendation to the ASLM to approve, disapprove, or approve with conditions the proposed mining plan modification. The ASLM will decide whether the mining plan modification is approved, disapproved, or approved with conditions.

The need for the action is to provide BCC the opportunity to exercise its valid existing rights granted by the BLM under federal coal lease WYW-02727 to access and mine undeveloped resources located adjacent to the existing mining operations at the Bridger Mine Complex. The need for the action is also established by the ASLM responsibility under the MLA of 1920 and the SMCRA of 1977, as amended. The MLA and SMCRA are described in further detail in section 1.4.1. Statutes and Regulations. Part of OSMRE's responsibility, as stated in the SMCRA Public Law 95-87, Title I, Section 102, is to "assure that the coal supply essential to the Nation's energy requirements, and to its economic and social well-being is provided and strike a balance between protection of the environment and agricultural productivity and the Nation's need for coal as an essential source of energy."

1.4. Relationship to Statutes, Regulations, and Other Agency Plans

1.4.1. *Statutes and Regulations*

The following key laws, as amended, establish the primary authorities, responsibilities, and requirements for developing federal coal resources:

1. MLA
2. NEPA
3. SMCRA
4. Federal Coal Leasing Act Amendment of 1976 (FCLAA)
5. Federal Land Policy and Management Act of 1976 (FLPMA)
6. Multiple-Use Sustained Yield Act of 1960
7. Endangered Species Act of 1973 (ESA)
8. Clean Air Act, as amended (CAA)
9. Safe Drinking Water Act, as amended (SDWA)
10. National Historic Preservation Act, as amended (NHPA)
11. American Indian Religious Freedom Act of 1978 (AIRFA)
12. Migratory Bird Treaty Act of 1918, as amended (MBTA)
13. Mining and Mineral Policy Act of 1970 (MMPA)

The MLA and FCLAA provide the legal foundation for the leasing and development of federal coal resources. The BLM is the federal agency that has been delegated the authority to offer federal coal resources for leasing and to issue leases. The MMPA declares that it is the continuing policy of the

federal government to foster and encourage the orderly and economic development of domestic mineral resources. In that context, the BLM complies with FLPMA to plan for multiple uses of public lands and to determine those lands suitable and available for coal leasing and development. Through preparation of land use plans and/or in response to coal industry proposals to lease federal coal, the BLM complies with NEPA to disclose to the public the potential impacts from coal leasing and development, and also complies with the NHPA, CAA, CWA, ESA, and other environmental laws to ensure appropriate protection of other resources. The BLM then makes the lands that are determined suitable for coal development available for leasing. The BLM is also responsible for ensuring that the public receives fair market value for the leasing of federal coal. Once a lease is issued, the BLM ensures that the maximum economic recovery of coal is achieved during the mining of those federal leases and ensures that waste of federal coal resources is minimized through review and approval of a mine's R2P2 as required under the MLA. The BLM implements its responsibilities for leasing and oversight of coal exploration and development under its regulations at CFR, Title 43, Public Lands, Subtitle B, Chapter II, BLM, Department of the Interior, Subchapter C – Minerals Management, Parts 3400–3480 (43 CFR 3400–3480).

SMCRA provides the legal framework for the federal government to regulate coal mining by balancing the need for continued domestic coal production with protection of the environment and ensuring the mined land is returned to pre-mine conditions or better when mining is finished. OSMRE was created in 1977 under SMCRA to carry out and oversee those federal responsibilities. OSMRE implements its MLA and SMCRA responsibilities under regulations at Mineral Resources, Chapter VII – OSMRE, DOI (30 CFR 700–end).

As provided for under SMCRA, OSMRE works with coal-producing states and tribes to develop their own regulatory programs to permit coal mining. Once a regulatory program is approved for a state or tribe, OSMRE steps into an oversight role. OSMRE approved the State of Wyoming's coal regulatory program on November 26, 1980 (30 CFR 950.10). As a result, Wyoming manages its own program under the WDEQ-LQD's Coal Rules and Regulations. WDEQ-LQD has the authority and responsibility over surface coal mining permits and regulates coal mining in Wyoming under its Coal Rules and Regulations with oversight from OSMRE. The cooperative agreement between OSMRE and WDEQ-LQD allows the WDEQ-LQD to regulate surface coal mining on federal lands or leases while OSMRE continues to carry out its obligations under the MLA, NEPA, and other public laws (30 CFR 950.20), which includes the recommendations related to mining plans and mining plan modifications. Mining plan decisions cannot be delegated to the states.

1.4.2. *Other Agency Plans*

The BLM's *Record of Decision and Green River Resource Management Plan* (BLM 1997), effective as of 1997, allows for coal leasing and development and provides land use guidance for coal leasing within the proposed project area. Decisions pertaining to this proposal include the following:

- Solid Leasables (Coal)
  - The objective for management of the federal coal resources in the Green River planning area is to provide for both short- and long-range development of federal coal, in an orderly and timely manner, consistent with the policies of the federal coal management program, environmental integrity, national energy needs, and related demands.
  - With appropriate limitations and mitigation requirements for the protection of other resource values, all BLM-administered public lands and Federal coal lands in the Green River planning area, except for those lands identified as closed, are open to coal resource inventory and exploration to help identify coal resources and their development potential. (BLM 1997:13)

- Land and Realty Management
  - Manage public lands to support the goals and objectives of other resource programs;
  - Respond to public demand for land use authorizations; and
  - Acquire administrative and public access where necessary. (BLM 1997:9)

1.5. Authorizing Actions

Two separate approvals are needed for a coal mine operator to conduct mining operations on lands containing leased federal coal: 1) a SMCRA permit approved by the regulatory authority, in this case WDEQ-LQD, and 2) a mining plan or mining plan modification approved by the ASLM in accordance with the MLA.

1.6. Scoping, Outreach, and Issues Identification

In advance of preparing this EA, public comments were solicited through several methods. OSMRE published a legal notice in *The Rocket-Miner* on June 1, 2016. The legal notice summarized the proposed mining plan modification and informed the public that comments would be accepted until July 1, 2016. An outreach letter describing the proposed mining plan modification and soliciting comments was mailed on June 1, 2016, to a total of 126 recipients, including city governments, adjacent landowners, and other interested parties. Also on June 1, 2016, letters were sent to four American Indian tribes.

In all, nine letters were received during the public scoping comment period. These comment letters were evaluated for relevance in preparing this EA. Letters expressing concerns or suggestions regarding the Proposed Action were received from state and local government entities, such as chambers of commerce, the Rock Springs City Council, Sweetwater County, and the Wyoming Game and Fish Department (WGFD). Letters were also received from the Sierra Club and Wild Earth Guardians. One individual submitted a letter in support of the Proposed Action. Local government entities were generally in support of the Proposed Action because of its potential economic benefits. The WGFD noted that the project area lies within a greater sage-grouse core area and that any surface disturbance is potentially subject to a density/disturbance calculation tool process. The WGFD also suggested reclamation practices for the sage-grouse core area. The Sierra Club and Wild Earth Guardians both requested analysis of specific potential impacts of the Proposed Action, such as the continued combustion of coal at the Jim Bridger Power Plant, climate change impacts, cumulative impacts of surface and underground mining, subsidence impacts, fugitive dust impacts, air quality impacts, wildlife impacts, and water resources impacts. The Sierra Club and Wild Earth Guardians also requested that an EIS be prepared rather than an EA. Wild Earth Guardians requested that a larger range of alternatives be analyzed, and they suggested five new alternatives that would limit the mining levels, reduce emissions, use renewable sources of energy, and require off-site mitigation. A summary of the issues raised in the public scoping comments is on file with OSMRE, and all issues brought forth were considered and addressed as needed by OSMRE during the preparation of this EA.

2. PROPOSED ACTION AND ALTERNATIVES

2.1. Introduction

Under NEPA requirements, the agency must evaluate the environmental impacts of a reasonable range of alternatives. The DOI's NEPA implementing regulations define reasonable alternatives as those that are "technically and economically practicable or feasible and meet the purpose and need of the proposed

action" (43 CFR 46.420). This chapter describes Alternative A (No Action Alternative) and Alternative B (Proposed Action), which are considered and analyzed in detail in this EA, and provides information on the existing operations at the Bridger Mine Complex and how those operations may change under the Proposed Action. In addition, it identifies alternatives considered but eliminated from detailed analysis.

2.1.1. *Existing Operations at Bridger Mine Complex*

Since 1974, BCC has mined portions of federal coal lease WYW-02727 in accordance with the approved surface coal mining permit issued by the state regulatory authority, the WDEQ-LQD. On November 28, 2014, in accordance with its responsibilities under the SMCRA and specific State of Wyoming administrative rules related to coal mining (Wyoming Administrative Rules 2014), the WDEQ-LQD approved the Amendment and Mine and Reclamation Plan Revision for surface coal mining Permit No. 338-T7, including the mining of portions of federal coal lease WYW-02727 not previously approved by the ASLM. In accordance with the MLA, the ASLM must approve the mining plan modification for federal coal lease WYW-02727 before mining of the federal coal can occur.

BCC currently has approximately 28,500 permitted acres in Sweetwater County, Wyoming. Upon completion of mining, approximately 11,368 acres will have been disturbed and reclaimed. The total disturbance from mining activities at the Bridger Mine Complex from 1986 to 2016 is estimated to be 10,690 acres. The existing mine facilities total approximately 10,580 acres of surface disturbance, which includes structures, roads, ponds, pits, and all other mine-related disturbance. Table 2-1 lists the total acres of disturbance from mining and mine facilities for each year beginning in 1986.

Table 2-1. Acres of Disturbance at the Bridger Mine Complex

Year	Estimated Disturbed Area (acres)	Cumulative Disturbed Area (acres)
Inception: 1986	4,285	4,285
1987	177	4,462
1988	313	4,775
1989	400	5,175
1990	126	5,301
1991	149	5,450
1992	194	5,644
1993	415	6,059
1994	537	6,596
1995	357	6,953
1996	175	7,128
1997	313	7,441
1998	351	7,792
1999	481	8,273
2000	575	8,848
2001	64	8,912
2002	212	9,124
2003	236	9,360
2004	152	9,512
2005	186	9,698

Year	Estimated Disturbed Area (acres)	Cumulative Disturbed Area (acres)
2006	−47*	9,651
2007	102	9,753
2008	91	9,844
2009	95	9,939
2010	115	10,054
2011	350	10,404
2012	90	10,494
2013	52	10,546
2014	71	10,617
2015	44	10,661
2016	29	10,690

Note: Data from 2013–2016 are projections.

*A reassessment of the total acres of disturbed areas resulted in an adjustment between the acres disturbed to date as of December 2005 and December 2006.

2.1.1.1. MINING METHODS

Within the surface mining portion of the Bridger Mine Complex, stripping is presently being done from the Central Mine Area to the Tenmile South Area. The final highwall has been reached in Deadman North Area; highwall mining has been completed there, and underground mining is in progress. The Tenmile South Area was linearly extended to its southernmost limit by the end of 2000. Dragline stripping is currently supported by truck-loader pre-stripping in areas of thick overburden.

The underground mining layout and sequence at the Bridger Mine Complex is an arrangement of longwall panels and development sections interconnected by systems of main and sub-main entries. The underground mine is developed by continuous miners with mains and gate road entries that support a series of longwall mining panels. Mining takes place within the D41 seam, which is found to dip 2 to 5 degrees to the northeast and which is covered with overburden ranging from 200 feet to 1,000 feet over the mining area. Access to the underground mine is through a series of three portals located at the base of the highwall. Main entries are driven into the deposit to develop the mine for longwall mining type of coal extraction.

Overburden, interburden, and coal are blasted as necessary before removal. BCC's blasting program applies to surface mining, highwall mining, and underground mining. BCC complies with all applicable state, federal, and local laws regarding the handling, preparation, and use of explosives, and BCC's mining plan contains a detailed blasting plan. BCC provides a pre-blasting survey to any residents or owners of buildings located within 0.5 mile of the permit area upon request. The blasting schedule for the Bridger Mine Complex is published annually in the local newspaper in Rock Springs, Wyoming, and distributed to applicable government entities and utilities providers. A notice is published between 30 and 60 days before a blasting program begins.

2.1.1.2. TOPSOIL

Soil removal occurs prior to mining disturbance and prevents contamination of soil resources by potentially unsuitable material. Salvage depths are based on soil survey and site evaluation. Removal is accomplished with scrapers or with a dozer-loader-truck combination. Qualified reclamation personnel using baseline soil maps supervise the fleet. All suitable soils are salvaged. When feasible, the top 6 inches of soil is handled separately.

Whenever practical, soil is salvaged and applied directly to regraded soil. However, when field conditions preclude this opportunity or when the amount of soil being salvaged is greater than the amount needed for application, soil is stored in stockpiles located within the permit area per the WDEQ requirements described in Permit No. 338-T7.

Soil stockpiles are protected from wind and water erosion and clearly marked with signs. Stockpiles are located so they are out of operational pathways, are oriented to minimize erosion, and are out of natural drainages.

2.1.1.3. TEMPORARY OVERBURDEN STOCKPILE

Temporary out-of-pit overburden stockpiles may be constructed on the highwall or lowwall sides of the pit, as necessary. Approved out-of-pit spoils have occurred as a result of boxcut pits south of Nine and One-Half Mile Draw and Tenmile Draw. Boxcut spoils or spoil piles will not be placed on slopes greater than 20 degrees or in drainages. The permanent out-of-pit spoil material is designed and constructed to blend into the native topography to achieve approximate original contour in conformance with WDEQ-LQD Coal Rules and Regulations, Chapter 4, Section 2(c)(xi).

2.1.1.4. ACCESS AND HAUL ROADS

Roads currently provide the primary means of transport for personnel and materials within the Bridger Mine Complex. Roads are also the means of transport of coal from the pit to the conveyor truck dump hoppers and as a contingency for coal haulage to the power plant in the event of conveyor system failure. The roads are separated into two main categories: primary roads and ancillary roads.

Primary roads are defined in the Wyoming coal rules as:

> "surface corridor(s) of affected land associated with travel by land vehicles used in surface coal mining and reclamation operations or coal exploration. A road consists of the roadbed, shoulders, parking and side areas, approaches, structures, ditches, and surface. The term includes access and haul roads constructed, reconstructed, improved, or maintained for use in surface coal mining and reclamation operations or coal exploration, including use by coal hauling vehicles to and from the transfer, processing, or storage areas. The term does not include ramps and routes of travel within the immediate mining area or within spoil or coal mine waste disposal areas. The term *immediate mining area* refers to areas subjected to frequent surface changes. This includes areas where topsoil and overburden are being moved." (WDEQ-LQD, Coal Rules and Regulations, Chapter 1, Section 2(ds))

All of BCC's primary roads have designed surfaces, grades, shoulders, and drainage control structures. Additional primary roads may be constructed throughout the mine life to facilitate coal haulage.

An ancillary road is any road not classified as a primary road. Most of the ancillary roads in the Bridger Mine Complex are roads in the pit. These roads are reclaimed simultaneously with the pit. Other roads in the Bridger Mine Complex that are classified as ancillary include roads to several air quality sites and soil

stockpiles and roads along power lines. Although these types of roads are unchanging in some cases for the life of the mine, they are lightly used roads typically built on the land surface following the removal of topsoil. These roads follow the land surface profile and do not have any road surfacing.

There are approximately 19 miles of haul roads and 1.5 miles of county roads in the existing Bridger Mine Complex.

2.1.1.5. POWER LINES

Electrical power is provided to the Bridger Mine Complex from the Jim Bridger Power Plant located adjacent to the mine site. There are approximately 54 miles of power lines in the existing Bridger Mine Complex. Design of all existing electrical distribution lines conforms to the Avian Power Line Interaction Committee's (APLIC's) *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC et al. 1996). If new information on best available current technology (BACT) for improved electrocution protection becomes available, it would be used to update power line designs as necessary to prevent raptor electrocution. Minor modifications to power lines may be required during the life of the surface mine.

2.1.1.6. MINE FACILITIES

Buildings are located in three areas: the general office area, the erection lot, and the underground mine facility area. The first area includes the main office, the shop and warehouse building, and the gasoline shop. The erection lot includes a field maintenance shop, tire shop, electrical shop, cable rebuild shop, and several small storage trailers and sheds. The underground mine facility area includes an office and bathhouse, warehouse and shop building, parking, material storage, and other associated structures.

Facilities for storing explosives used for blasting are located away from offices and warehouse facilities. Explosive storage facilities comply with applicable requirements of the Bureau of Alcohol, Tobacco and Firearms as administered by the Mine Safety and Health Administration (MSHA) and other applicable MSHA requirements. Other storage facilities include aboveground storage tanks, soil stockpiles, overburden stockpiles, coal stockpiles, ponds, and one active solid waste disposal site. There are approximately 3.8 acres of buildings and storage tanks in the existing Bridger Mine Complex mine permit boundary.

2.1.1.7. PONDS, IMPOUNDMENTS, DIVERSIONS

Ponds are used for two separate functions at the Bridger Mine Complex. First, holding ponds treat pit water before it is discharged into adjacent ephemeral streams. Treatment refers primarily to the settling of sediment particles, although other treatments may also be necessary. Second, sediment ponds are used to collect surface runoff from facilities and coal storage areas. Most of the sediment ponds that treat runoff from mine disturbance have been replaced by alternate sediment control practices. However, sediment ponds still exist at facilities areas where point source discharges occur. There are approximately 2.5 acres of ponds in the existing Bridger Mine Complex mine permit boundary.

2.1.1.8. WATER SOURCE

BCC's domestic water is supplied from four sources: a well registered to Pacific Power & Light Company, the Bridger No. 1 well, the Green River pipeline system, and bottled water. Potable water is used at the Bridger Mine Complex for drinking and showers (1.75 million gallons per year). Non-potable water is obtained from the Jim Bridger Power Plant and used for haul-road watering (approximately 34 million gallons per year), washing equipment (approximately 1 million gallons per year), fire prevention,

and other related uses. There are approximately 11 miles of water lines in the existing Bridger Mine Complex mine permit boundary.

BCC has secured an agreement with Pacific Power & Light Company for the domestic and non-potable water used by the BCC surface mine office and shop facilities. The appropriation for the water is held by Pacific Power & Light Company. BCC has been designated as a user.

BCC's underground facilities are supplied by the Bridger No. 1 well, which is 3,100 feet deep and completed in the Ericson Formation. This well pumps to a storage tank that provides the pressure for the uses of the water. Underground facilities, including the mine operations, are estimated to require 200 gallons per minute (gpm), or 105 million gallons per year, on the average. The peak usage of water is estimated to be 400 gpm. The usage of potable water for drinking, showers, and washing equipment is a small portion of the total usage and is estimated at approximately 2 million gallons per year.

2.1.1.9. OPEN PITS

The initial cut or boxcut in a panel starts along the strike of a coal seam and is irregular in shape and width. At low overburden depths, the draglines normally work in a side-casting mode to strip the overburden. The overburden is excavated and placed in a previously excavated pit. When the overburden depth becomes great enough, the simple side-casting mode becomes impractical because the previous pit will no longer allow sufficient room for the spoil material at the effective spoil radius of the dragline.

As stripping depths increase, other procedures are employed, such as two-pass or pull-back methods. In the two-pass method, a pad is formed in the previous pit for positioning the dragline for the next lift in the pit. Placing the dragline on the pad allows the machine to dig to a greater depth while still maintaining spoil room. When overburden to be stripped is beyond the capacity of the dragline to spoil off the coal by any other methods, the pull-back method can be used. In this method, a secondary dragline can be placed on the spoil bank to pull back sufficient spoil to make room for complete removal of overburden.

At varying times during the life of the mine, it has been necessary to place spoil material outside of the active mining area. Because of the operating constraints of the dragline, it is necessary for spoil material to be permanently placed outside of the pit when new pit areas are being developed. The spoil material that is permanently placed outside of the pit would be blended to meet post-mining requirements.

BCC currently operates a backhoe and front-end loaders as primary coal loading units. Changes to the equipment type and use may occur as BCC constantly evaluates and updates the equipment requirements for the Bridger Mine Complex.

2.1.1.10. HAZARDOUS MATERIALS

Mine equipment operating at the Bridger Mine Complex uses diesel fuel, unleaded gasoline, engine oils, gearbox oils, open gear greases, and glycols. Solvents are used for parts cleaning during major equipment maintenance outages. All used lubricants, glycols, and solvents are collected in drums or small storage tanks with appropriate waste category labels and stored at a waste and used lubricant storage area. The Bridger Mine Complex has a waste minimization program and is a conditionally exempt small quantity generator. Most waste chemical or lubricant is solid, non-hazardous waste that is recycled. Unleaded gasoline and diesel fuels are stored and dispensed at designated fuel islands with secondary containment to meet spill prevention, control, and countermeasure (SPCC) requirements.

2.1.1.11. MINE PERSONNEL

The mining operations at the Bridger Mine Complex operate 24 hours per day, 7 days a week, and employ approximately 510 people.

2.1.1.12. TRANSPORTATION

No rail transport is currently used at the Bridger Mine Complex. All transport of coal is accomplished using haul trucks and an overland conveyor. The overland conveyor transports coal from the mining operations at the Bridger Mine Complex to the Jim Bridger Power Plant. No public roads are used to transport coal from the mining operations to the Jim Bridger Power Plant. Additional facilities associated with the conveyor include power lines, wildlife crossings, hydrologic control structures, and dust control equipment.

2.1.1.13. RECLAMATION

Reclamation is an ongoing process at the Bridger Mine Complex. The reclamation schedule is dependent on the mining plan and the mining sequence. The surface mine has multiple seams at various thickness and quality scheduled to be mined. Mine sequencing is dependent on the depth of overburden, length of pit, and coal blending requirements. BCC will normally leave four spoil peaks between the regraded area and the pit, which generally requires that 2 or 3 years lead time precede final grading. This helps to protect reclaimed areas from blasting, spoiling, and other mining operations (BCC 2009).

Following regrading of the spoil materials, topsoil is applied. Topsoil is usually removed from a stockpile and applied on regraded spoil. When possible, topsoil will be direct hauled from new soil stripping areas and immediately applied on regraded spoil. Newly applied topsoil will normally be revegetated ahead of the next growing season. Revegetation is done with a mixture of mostly native grasses, forbs, and shrubs. Seed mixes contain high species diversity. Revegetation techniques are designed to minimize erosion (BCC 2009). In general, topsoil replacement will occur in the spring through fall, and final seeding will occur in the fall.

The objective for reclaiming disturbed land in the mine area is to restore the land to its pre-mine use of wildlife and domestic livestock habitat and forage, respectively. No portions of the reclaimed site would be managed exclusively for either domestic livestock or wildlife species. Rather, the entire area would be returned to an undeveloped rangeland status, equal to or better than its pre-mining condition, capable of supporting both domestic livestock and wildlife species. A vegetation monitoring program is conducted over the life of the mine to aid in determining when the post-mining land use of undeveloped rangeland is met.

An objective of reclamation at the Bridger Mine Complex is to recreate wildlife habitats on post-reclamation acreages. Because of their pre-mining prevalence and specific winter browse requirements, pronghorn and sage grouse are considered in reclamation planning.

The objectives of the surface recontouring effort are as follows:

1. Leave most slopes that are less than or equal to 4 horizontal to 1 vertical, with the exception of the mine area that was disturbed prior to May 3, 1978, and areas where bluffs are to be constructed.
2. Provide drainage to all areas.
3. Ensure that the reclaimed surface will support the post-mining land use.

2.1.1.13.1. Backfilling and Grading

Contemporaneous reclamation is normally done to within 1,000 feet from the active pit centerline wherever practical. The backfill volume is large because drainages are reconstructed perpendicular to the highwall. The 1,000-foot distance accounts for the volume of spoil that is required to backfill the final pit. Otherwise, excess material would have to be taken from additional back-sloping of the highwall, which may increase disturbed area. Spoils adjacent to the ramps will remain unreclaimed until that area reaches its final pit limits and the spoil will be utilized for ramp closure.

As mining is concluded in each area, a determination would be made on the feasibility of highwall mining, and rough grading would occur as quickly as equipment capacity and practicality allow. Final grading is defined as grading the surface to the approved post-reclamation contour or post-mining topography. Once this topography has been achieved, and approval has been received from the State for application of topsoil, ripping of the surface occurs in preparation for soil application. When doing contemporaneous reclamation, this process occurs between 1,000 and 1,500 feet from the pit centerline, except along ramp access points and other areas required for supplying material to the final pit.

Highwall mining could potentially occur along most of the final highwall of the mine. As mining reaches each of these final highwalls, an evaluation would be conducted to determine whether it would be feasible to recover additional coal from the areas beyond this mining highwall limit. After this determination is made, the coal would either be recovered or remain in the ground, and the final pit would be graded as soon as equipment capacity and practicality allow. At times, this requires extended grading time because of the large volumes of material required to fill the final pit to approved contours. Material required to backfill the final pit is obtained by lowering the slope of the final highwall and by widening the drainage basin on the lowwall site of the final pit.

Final grading and soil application for all areas except those reserved for filling the final pits and ramps follows rough grading as soon as practicable. Constraints in this activity include availability of material for direct application. Time between rough grading, final grading, and soil application operations is necessary to allow time to sample soils, provide 4 feet of suitable cover if necessary, and complete soil replacement operations. Seeding begins in the fall or in early spring following the application of soil.

BCC would minimize disturbed areas consistent with good mining practices and coal production requirements. Additionally, the reclamation bond would continue to be maintained in an amount adequate to reclaim the disturbance existing or projected during the term of the bond. BCC anticipates that all areas would be ready for bond release approximately 15 years following final mining.

2.1.1.13.2. Revegetation

The post-reclamation vegetation objective throughout the Bridger Mine Complex is to reestablish the land use as undeveloped rangeland. A vegetation monitoring program would be conducted over the life of the mine to aid in determining when that objective is met.

A diverse, effective, and permanent vegetation cover would be established on lands disturbed by mining operations. Species selected for revegetation would be adapted to climatic and edaphic conditions. In accordance with the post-reclamation land use, which includes both domestic livestock grazing and wildlife habitat, BCC would reestablish major species of graminoids, forbs, and shrubs.

Loamy/Shallow Loamy and Saline Upland range sites are dominant in the permit area, with soils in Sections 12 and 24 that are generally sandy loam, loamy sand, loam, or silty loam in texture. Thus, Loamy/Shallow Loamy, Saline Upland, Saline Lowland and Sands seed mixtures would be selected from the grasses, forbs, and shrubs used for revegetation. Examples of species that would be used for revegetation are as follows:

Grasses

- Thickspike wheatgrass (*Elymus lanceolatus* spp. *lanceolatus*)
- Stream bank wheat grass (*Elymus lanceolatus* spp. *psammophilus*)
- Western wheatgrass (*Pascopyrum smithii*)
- Bluebunch wheatgrass (*Pseudoroegneria spicata* spp. *spicata*)
- Beardless wheatgrass (*Agropyron inerme*)
- Slender wheatgrass (*Elymus trachycaulus* spp. *trachycaulus*)
- Basin wildrye (*Elymus cinereus*)
- Sheep fescue (*Festuca ovina*)
- Indian ricegrass (*Achnatherum hymenoides*)
- Canada bluegrass (*Poa compressa*)
- Canby bluegrass (*Poa canbyi*)
- Sandberg bluegrass (*Poa sandbergii*)
- Bottlebrush squirreltail (*Elymus elymoides*)
- Needle-and-thread grass (*Stipa comata*)
- Green needlegrass (*Stipa viridula*)

Shrubs

- Silver sage (*Artemisia cana*)
- Fringed sagebrush (*Artemisia frigida*)
- Wyoming big sagebrush (*Artemisia tridentata*)
- Fourwing saltbush (*Atriplex canescens*)
- Gardner's saltbush (*Atriplex gardneri*)
- Winterfat (*Ceratoides lanata*)
- Rubber rabbitbrush (*Chrysothamnus nauseosus*)
- Low rabbitbrush (*Chrysothamnus viscidiflorus*)
- Spiny hopsage (*Grayia spinosa*)
- Greasewood (*Sarcobatus vermiculatus*)
- Gray horsebush (*Tetradymia canescens*)
- Spiny horsebush (*Tetradymia spinosa*)

Forbs

- Buckwheat (*Eriogonum* sp.)
- Penstemon (*Penstemon* sp.)
- Lupine (*Lupinus* sp.)
- Paintbrush (*Castilleja* sp.)
- Globemallow (*Sphaeralcea* sp.)
- Flax (*Linum* sp.)

2.1.1.14. LIFE OF OPERATION

Under the current mining plan, the Bridger Mine Complex is expected to operate until 2037.

2.1.1.15. PROJECT DESIGN FEATURES

The following design elements are discussed in BCC's existing mine permit and in the 2010 Bridger Lease Modification EA (BLM 2010), are currently in effect at the mine, and would also apply to the proposed mining plan modification:

- A water truck is operated, as needed, to control fugitive dust within BCC's control.
- Identified paleontological, archaeological, and cultural resources are preserved or mitigated in conformance with BCC's existing memorandum of agreement that is part of the existing mining operations. Class 3 Cultural Inventory has been completed and cultural clearance has been obtained. Any previously undiscovered cultural resources would be investigated if discovered upon entering the project area.
- Appropriate fencing is placed around the lease area to ensure livestock are not affected by the surface mining activities.
- Application of the Raptor Mitigation Plan, with nesting survey information submitted yearly to WDEQ-LQD, WGFD, and U.S. Fish and Wildlife Service (USFWS).
- Requirement to conduct a breeding bird survey twice each spring to record migratory birds of high federal interest, as well as conduct annual nest surveys in areas of raptor concentration near the permit area. Information gathered during raptor surveys is submitted yearly to WDEQ-LQD, WGFD, and USFWS. Information gathered during surveys and wildlife monitoring is presented in BCC's WDEQ-LQD annual reports.
- Application of wildlife monitoring and protection program that was designed to allow assessment of the wildlife response to development of mining activities and reclamation efforts. Through the wildlife monitoring program, BCC identifies any substantial wildlife/mining conflicts and potential conflicts within its permit boundary. Information gathered during surveys and wildlife monitoring is presented in BCC's WDEQ-LQD annual reports.
- Application of soil monitoring program, which tests soil prior to application, to identify physical and chemical soil characteristics that are inhibitory to plant development. This program helps to ensure revegetation success.
- Application of vegetation monitoring program to aid in determining when the post-mining land use of undeveloped rangeland is met.
- Application of alternate sediment control system, which implements erosion control measures including the following:
    - Hay or straw mulch to stabilize soils (and add a source of organic material), with alternative options of cover crops or soil pitting
    - Proper slope design (the shaping of reclaimed slopes to slopes with upper convexities, middle straight reaches, and lower concave reaches wherever possible)
    - Interceptor ditches to slow runoff, reduce erosion, and enhance sediment deposition
    - Temporary sediment traps when runoff flow cannot be controlled adequately with a check dam

- Containment berms to direct flow into structures such as check dams or temporary sediment traps
- Revegetation of all reclaimed areas
- Vegetative buffer strips to prevent erosion in critical areas
- Drainage of disturbed areas into the pit where the water evaporates or is pumped into holding ponds (outside the project area) for treatment prior to discharge
- Design techniques using computer modeling to evaluate disturbed area runoff prior to disturbance and simulation of the various sediment control measures
- An alternative sediment control monitoring network (SEDCO) to monitor the effectiveness of sediment control
- Check dams, water bars, and hay or straw bales when the SEDCO monitoring indicates a need to stabilize the effects of rills and gullies in reclaimed areas or in other erosion-prone areas such as disturbed areas

2.2. Description of Alternatives

2.2.1. *Proposed Action*

Under the Proposed Action, the ASLM would approve the application for a mining plan modification for federal coal lease WYW-02727, which would result in adding 560 acres of federal surface (the project area), which includes an estimated 4.5 million tons of federal coal, to the approved mining plan. The Proposed Action would result in approximately 104 acres of disturbance from surface mining activities and would be a continuation of current surface mining. Federal coal lease WYW-02727 was originally issued to BCC on October 1, 1969, and was readjusted effective October 1, 1999. The project area is adjacent to current surface mining operations at the larger Bridger Mine Complex (Figure 2-1).

The 560 acres of federal surface would be added to the existing federal (14,279 acres) and private acreages (13,674 acres) being mined. The Proposed Action would add 4.5 million tons of federal coal to the approved federal mine plan. This proposed mine plan modification would result in an annual production increase of between 3% and 5%, allowing the mine to maintain existing annual production levels from 2025 until 2037, when combined with future mining on adjacent lands. After 2025, the average annual production of coal mined at the Bridger Mine Complex would increase from between approximately 3.5 and 6.3 million tons to between approximately 3.7 and 6.5 million tons of coal per year. This mining plan modification would allow approximately 215,000 tons of federal coal per year to be mined on average. When combined with previously permitted coal from adjacent sections, this mining plan modification would allow approximately 700,000 tons of federal coal per year to be surface-mined on average. The proposed mining plan modification would not extend the life of the mine.

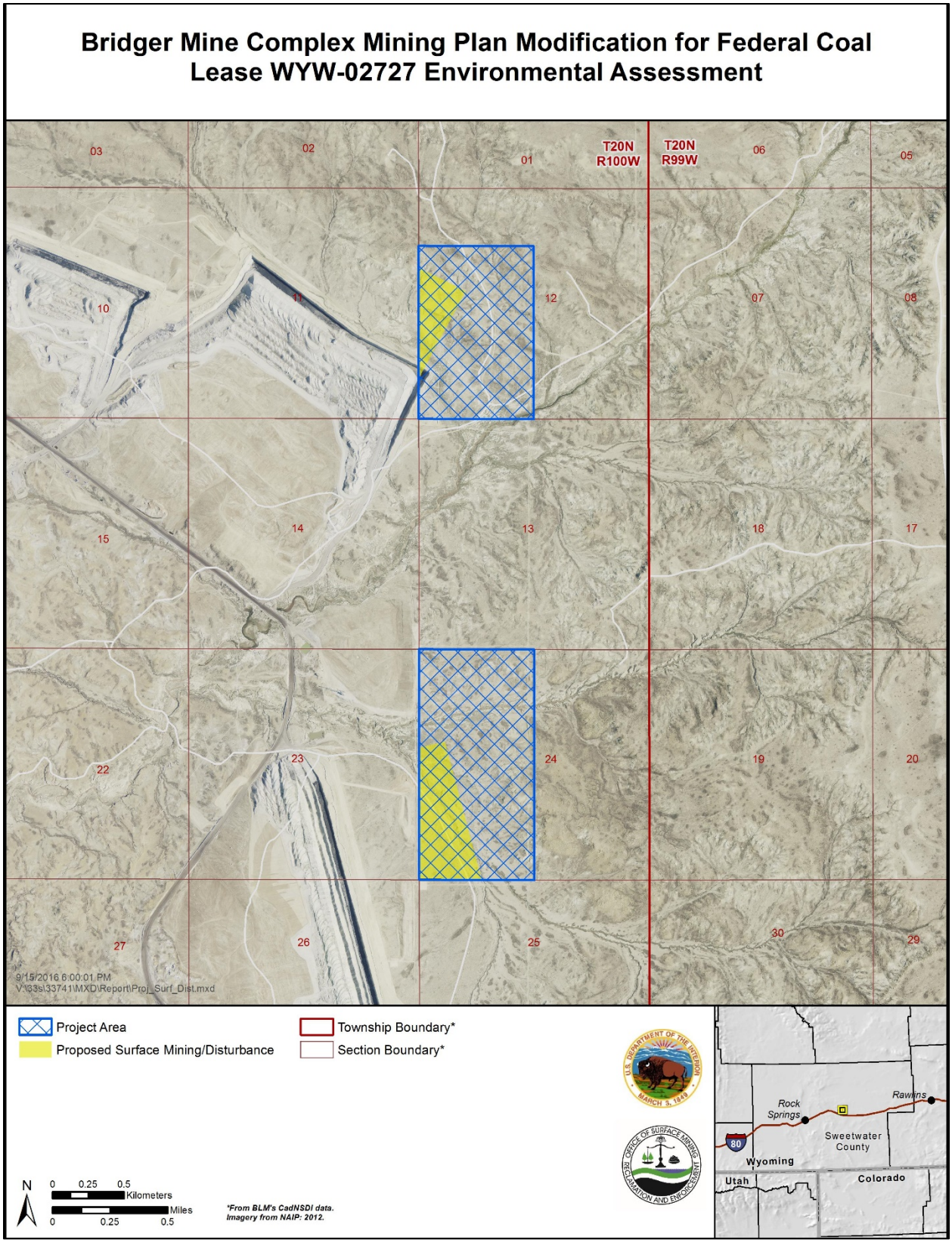

Figure 2-1. Location of proposed mining in project area.

If BCC is successful in obtaining the mining plan modification, they would provide the access, equipment, and technology to mine the coal from this lease area, with no resulting change in overall annual coal production. BCC's life of mine would not change under the Proposed Action, with mining of the estimated 4.5 million tons of economically recoverable coal, along with future mining on adjacent lands, being projected to conclude in 2037. If the mining plan modification is not approved, mining would continue until 2037, but with a reduced annual production rate (relative to the Proposed Action) after 2025 or sooner. If the coal mine plan modification is not approved, this coal would likely be bypassed by BCC.

The proposed mining plan modification would not displace other competitive commercial interests in the lands or deposits, and would not include coal deposits that could be developed by a non-BCC potential or existing mining operation.

2.2.1.1. LOCATION AND OVERVIEW

The Bridger Mine Complex is approximately 31 miles northeast of Rock Springs in Sweetwater County, Wyoming. The project area for the Proposed Action encompasses 560 acres bordering the existing surface mine on the southeast and comprises federal surface and subsurface estate owned and managed by the BLM. The Public Land Survey System description for the project area is as follows: 240 acres are in the SW ¼, S ½, NW ¼ of Section 12, Township 20 North, Range 100 West Sixth Principal Meridian, and 320 acres are in the W ½ of Section 24, Township 20 North, Range 100 West Sixth Principal Meridian, as shown on the Black Rock South (1986), Wyoming, U.S. Geological Survey (USGS) 7.5-minute quadrangle (see Figure 1-1).

The Bridger Mine Complex is divided into four distinct areas by drainages that cross the permit area; these areas cover both the surface and underground portions of the complex and include the following, from north to south:

- Deadman North Area: The area of the mine north of Deadman Wash
- Central Mine Area: The area from Deadman Wash to Nine and One-Half Mile Draw
- Nine and One-Half Mile South Area: The area south of Nine and One-Half Mile Draw
- Tenmile South Area: The area south of Tenmile Draw to the southernmost permit boundary

The coalfield is located on the northeastern flank of the Rock Springs uplift, a 34-mile-wide by 60-mile-long anticlinal structure that generally separates the Green River Basin on the west and the Great Divide and Washakie Basins on the east. The surface remaining mineable coal reserve is about 9 miles long and 1 mile wide. The underground mine encompasses an additional mineable coal reserve area of approximately 4,500 acres.

2.2.1.2. PROPOSED MINING METHODS IN MINING PLAN MODIFICATION AREA

There are four seams of coal in Sections 12 and 24, designated D5, D4, D3, and D2 from top to bottom. The seams generally dip 2 to 5 degrees to the northeast. Coal seam thickness and quality vary in Sections 12 and 24, ranging from 2 to 15 feet thick (BCC 2009). The information about existing mining operations provided in this section comes from the 2010 Bridger Lease Modification EA (BLM 2010).

Mining in Section 12 is projected to be a combination of dragline excavation of the overburden with scraper and front-end loader excavation of the interburden material between the coal seams. Figure 2-1 depicts the area of Section 12 that would be mined. The individual coal seams would be removed by a

front-end loader as they are uncovered and readied for delivery to the power plant. In this sequence, topsoil would first be removed and stockpiled for reclamation using scrapers. The overburden would then be drilled for pre-splitting, and then blasted to loosen the material for removal. A combination of dozers and draglines would remove the remaining overburden down to the top of the D5 seam. After the D5 seam has been uncovered, it would be drilled and blasted for removal by the front-end loader and haulage to the power plant. Once the D5 seam has been recovered, the scrapers and the front-end loader would remove the interburden material over the D4 seam so the coal can be subsequently removed and hauled to the power plant. Surface mining in Section 12 is projected to recover only the D5 and D4 seams because of the increased depths and the high stripping ratios involved. After the economically recoverable surface-mined portions of the D5 and D4 seams have been removed, BCC proposes to recover additional coal reserves from the D5 seam using highwall mining techniques (BCC 2009). The duration of mining in Section 12 is expected to occur through 2037.

Mining in Section 24 is projected to be a combination of truck-shovel pre-stripping and dragline excavation of the overburden. Figure 2-1 depicts the area of Section 24 that would be mined. A front-end loader would remove each coal seam as it is uncovered and readied for delivery to the power plant. In the same manner as described above, topsoil would be removed and stockpiled for reclamation using scrapers. The overburden would then be drilled for pre-splitting, and then blasted to loosen the material for removal. The truck-shovel operation would remove a portion of the overburden material down to a level where a combination of dozers and draglines can remove the remaining overburden to uncover the D5 seam. After the D5 seam has been uncovered, it would be drilled and blasted for removal by the front-end loader and haulage to the power plant. Once the D5 seam has been recovered, the dragline would remove the interburden material over the D4 seam so that this coal can be recovered as previously described. After the D4 seam has been uncovered and removed, the dragline would again return to take out the interburden and uncover the underlying D3 seam. Core drilling has indicated that the quality of the D3 seam is of a lower British thermal unit (BTU) and of higher sulfur content than can be used at the power plant. In areas where this seam is of exceedingly poor quality, it may be bypassed and the coal would be spoiled along with the overlying D3 interburden and the underlying D1 interburden material. Whether the D3 seam is recovered or not, the dragline would continue the excavation of the interburden material until the D1 seam is uncovered. The D1 seam would subsequently be removed and hauled to the power plant as previously described. The D1 seam is the deepest coal in the sequence and would continue to be mined until the economic stripping limit is reached. There are currently no plans to recover additional coal reserves in this section using highwall mining techniques (BCC 2009). The duration of mining in Section 24 is expected to occur through 2037.

The following sections provide more detail regarding the mining methods and facilities. The methods would generally be the same as those that occur at the current surface-mining operation under the existing permit. A diagram of the general flow of coal during the proposed mining activities is depicted in Figure 2-2.

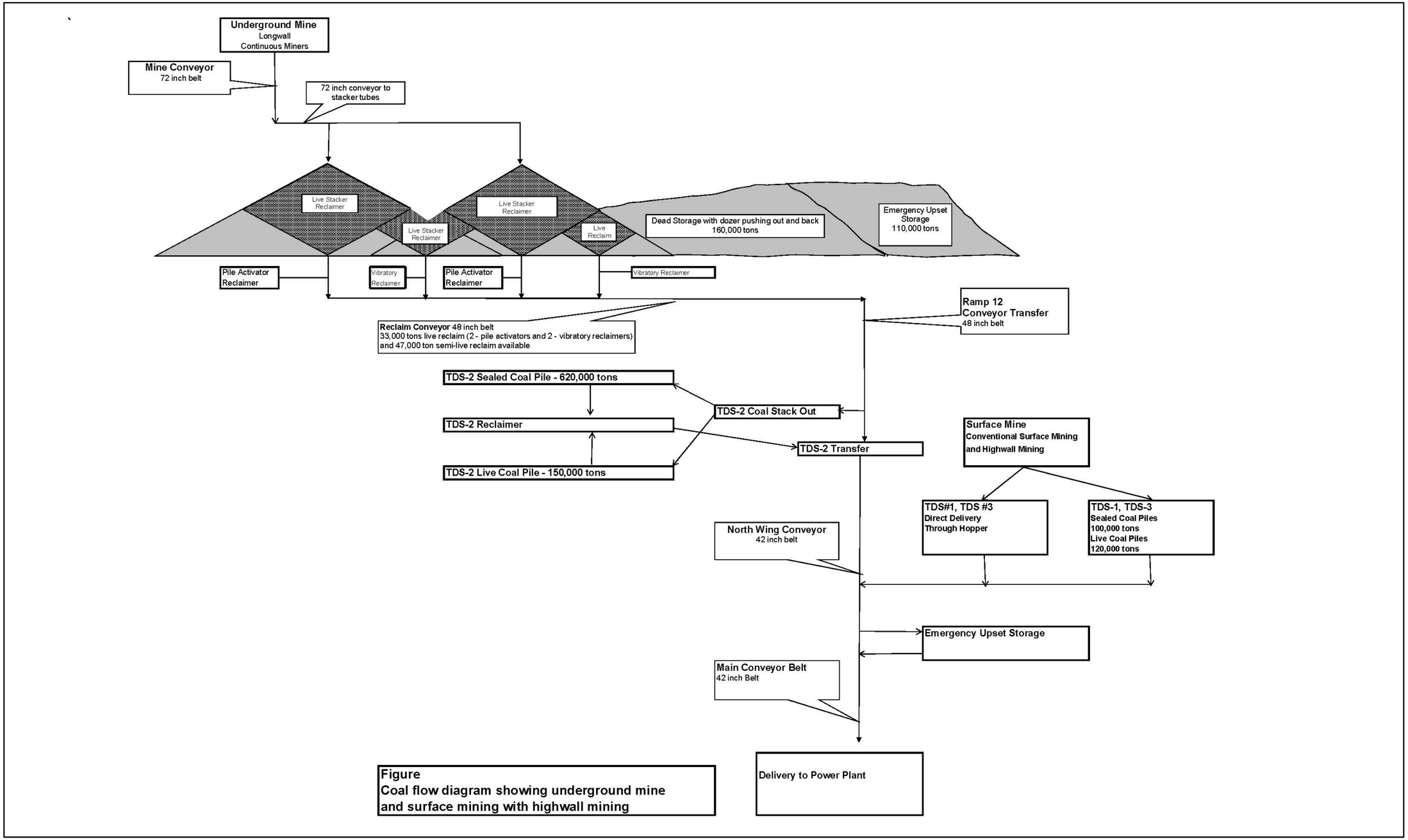

Figure 2-2. Coal flow diagram.

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2.2.1.2.1. Topsoil

Soil removal and storage would be carried out as described in Section 2.1.1.2.

2.2.1.2.2. Temporary Overburden Stockpile

Temporary overburden stockpiles would occur as described in Section 2.1.1.3.

2.2.1.2.3. Access and Haul Roads

No new primary roads would be constructed into the mining plan modification areas. Existing haul roads and ramps into the existing pit would be used for access. Existing ramps into the pit would be extended as the pit progresses cut by cut into the modification areas. Highwall access for drill benches would be on a dragline deadhead road on the area where topsoil has been removed on the highwall in an area classified as an active mining and pit area.

2.2.1.2.4. Power Lines

No new power lines are anticipated for the mining plan modification areas. The power line loop that would serve the modification areas has already been constructed on permitted rights-of-way around the perimeter of the modification areas. This power line loop already serves the existing mine operation. Design of all proposed electrical distribution lines conforms to the *Suggested Practices for Raptor Protection on Power Lines: The State of the Art in 1996* (APLIC et al. 1996). If new information on BACT for improved electrocution protection becomes available, it would be used to update power line designs as necessary to prevent raptor electrocution. Minor modifications to power lines may be required during the life of the surface mine.

2.2.1.2.5. Mine Facilities

The proposed mine permit expansion area would use the same mine facilities that are described in Section 2.1.1.6.

2.2.1.2.6. Ponds, Impoundments, Diversions

Ponds, impoundments, and diversions would be used in the same manner as described in Section 2.1.1.7. No new ponds would be needed under the Proposed Action.

2.2.1.2.7. Water Source

The water sources used for mining operations in Sections 12 and 24 would be the same as those described in Section 2.1.1.8. The mining operations in Sections 12 and 24 would not affect the existing annual water usage at the Bridger Mine Complex. Water usage would consist of pumping water out of pits into holding ponds on an as-needed basis, and pumped from the holding ponds into water trucks to be used for dust suppression on haul roads and work areas. Water would also be pumped from overburden dewatering wells on the existing permit area. This water would also be pumped to holding ponds and used for dust suppression. Annual water usage for dust suppression at the Bridger Mine Complex ranges between 70 million and 170 million gallons.

2.2.1.2.8. Open Pits

Development of the pits would occur the same way as described in Section 2.1.1.9.

2.2.1.2.9. Hazardous Materials

Use of hazardous materials during the mining operations in Sections 12 and 24 would be the same as currently exists in the adjacent operating pit areas (see Section 2.1.1.10). No hazardous materials would be produced by the proposed mining activities, and no hazardous materials would be stored in the mining plan modification areas.

2.2.1.2.10. Mine Personnel

The mining operations in Sections 12 and 24 would not affect existing hours of operation or number of mine personnel for the mining operations at the Bridger Mine Complex (see Section 2.1.1.11), because existing employees would conduct mining in Sections 12 and 24 as mining is completed in other areas of the Bridger Mine Complex.

2.2.1.2.11. Transportation

No rail transport would be needed for the proposed mining plan modification area. As described in Section 2.1.1.12, all coal transport would be accomplished using haul trucks and an overland conveyor. The overland conveyor would be used in the same way for the mining plan modification areas as it is for the existing permit area. There is a truck dump station at the southernmost point on the overland conveyor, which is northwest of the mining plan modification area. Coal would be transported from the pits in the modification areas to this truck dump station by an existing fleet of haul trucks. No public roads would be used in the transportation of coal from the mine to the Jim Bridger Power Plant.

2.2.1.2.12. Reclamation

The reclamation measures described in Section 2.1.1.13 would be applied to the mining operations in Sections 12 and 24.

2.2.1.2.13. Life of Operation

The proposed mining plan modification would allow for coal to be mined at the current annual production level through 2037.

2.2.2. No Action Alternative

The No Action Alternative would reject the application for a mining plan modification for federal coal lease WYW-02727, which would result in an estimated 4.5 million tons of federal coal not being mined at this time and the 560 acres of federal surface would not be added to the approved mining plan. BCC would continue to mine coal under the currently-approved mine plan within the existing permit boundary of the Bridger Mine Complex. Under the No Action Alternative, mining would continue until 2037, and the annual production rate would be between approximately 3.5 and 6.3 million tons of coal per year from 2025 through 2037. This would represent an approximately 3% to 5% reduction in annual production after 2025 when compared to the Proposed Action.

Under this alternative, BLM would continue to manage the federal surface lands in the project area for multiple use, including livestock and wild horse grazing, recreation, and oil and gas exploration and development.

2.2.3. *Alternatives Considered but Eliminated from Detailed Analysis*

This section discusses alternatives that were considered but eliminated from detailed analysis. Reasons that an alternative might not be considered in detail, in accordance with the CEQ's NEPA implementing regulations (40 CFR 1502.14), are as follows:

- The alternative is ineffective (does not respond to the purpose and need).
- The alternative is technically or economically infeasible, considering whether implementation of the alternative is likely given past and current practice and technology).
- The alternative is inconsistent with the basic policy objectives for the management of the area (e.g., it is not in conformance with land use plans).
- The alternative is remote or speculative.
- The alternative is substantially similar in design to an alternative that is analyzed.
- The alternative is substantially similar in impacts to an alternative that is analyzed.

No other alternatives were identified that meet the purpose and need for this action. No unresolved conflicts concerning alternative uses of available resources were identified. There is no logical competitive interest based on the use of the lands or mining of the deposits because

- BCC is the lessee of record, holding the private, state, and federal leases adjacent to the proposed lease modification;
- the lease modification would allow a continuum of an existing mining block and could not be economically developed on a stand-alone basis;
- there is no other nearby operation that could economically mine the proposed lease modification; and
- the only logical access is from the Bridger Mine Complex.

During the public scoping period, five alternatives were suggested for detailed analysis. These alternatives are described below, along with rationales for why they were dismissed from detailed analysis.

2.2.3.1. ALTERNATIVE MINING LEVELS

This alternative would limit the amount of coal tonnage and/or acreage to be mined to lower levels than are proposed under the Proposed Action. This alternative was aimed at limiting the direct and indirect impacts of mining, hauling, and coal combustion. This alternative was not considered in detail because it would not meet the purpose and need (see Section 1.3) and would be inconsistent with the MLA requirement to maximize recovery by achieving maximum economic recovery of this energy resource (43 CFR 3480.0-5 (21)). OSMRE's purpose and need is to evaluate BCC's proposed mining plan modification submitted in accordance with the federal coal lease granted to BCC. BCC already holds the lease, but OSMRE must decide whether to approve, approve with conditions, or disapprove the mining plan modification.

2.2.3.2. LOW OR NO POLLUTANT EMITTING EQUIPMENT

This alternative would require the use of equipment that produces less or no emissions, such as natural gas-powered vehicles and machinery or electric machinery powered by solar panels or other renewable energy sources. The Bridger Mine Complex surface mine operation uses Marion model 8200 walking draglines as the primary earthmoving equipment. Draglines are powered by electricity. Most mobile equipment is diesel powered. All diesel-powered equipment meets U.S. Environmental Protection Agency (EPA) emissions standards. New purchases of diesel-powered mobile equipment would include Tier 4 engines. The mining operations at the Bridger Mine Complex are a relatively small contributor of the emissions related to engine combustion (primarily carbon dioxide [CO_2] and oxides of nitrogen [NO_X]) in the region. The cost to make the switch to equipment powered by a different fuel (such as natural gas– or solar-powered equipment) for 104 acres of federal coal would be prohibitive for the minimal benefit to the regional air quality. In addition, the use of natural gas–powered engines in mining equipment is relatively new and some types of equipment would not be available for replacement with natural gas–powered engines. The use of solar power to run large equipment has not been tested and is not considered technologically feasible at this time. Similarly, retrofitting existing equipment with additional emissions control devices would be expensive with limited effect on regional air emissions. OSMRE has not brought forward this alternative for full analysis because requiring natural gas– and solar-powered engine technology and retrofitting existing equipment is not economically or technically feasible for all equipment at the Bridger Mine Complex; and would likely have substantially similar effects as the Proposed Action.

2.2.3.3. AIR QUALITY MITIGATION

This alternative would apply air quality mitigation measures to the proposed mining activities. The mitigation measures under this alternative would include such measures as stronger emissions limits for power plants fueled by the mine, efforts to eliminate nitrogen dioxide (NO_2)[1] emissions during blasting operations, and compensatory reductions in emissions that would result from the proposed mining activities. This alternative was eliminated from detailed analysis because OSMRE does not have the regulatory authority to require electricity-generating plants to reduce emissions because the emissions are regulated by the States or Counties where the plants are located. Any mitigation measure proposed by OSMRE imposing more stringent emission limits at generating stations and upon oil and gas operators is beyond OSMRE's authority. Furthermore, the Bridger Mine Complex must comply with the requirements of the Clean Air Act and operate under the conditions of BCC's existing air quality permit from the WDEQ Air Quality Division. The air permit incorporates measures that address the issues this alternative seeks to address. OSMRE can consider potential mitigation measures to limit emissions from the proposed mining activities, such as dust from coal and overburden stockpiles or emissions from mine equipment. Prior to issuance of BCC's 2010 air quality permit (Air Quality Permit MD-9156), NO_2 emissions, including NO_2 emissions from blasting, were analyzed. No limitations to NO_2 were added to the air permit based on the modeled concentrations of NO_2.

2.2.3.4. LIMIT OR REDUCE GREENHOUSE GAS EMISSIONS

This alternative would limit or reduce greenhouse gas (GHG) emissions associated with the proposed mining activities by requiring BCC to secure an increase in the efficiency of the power plant it fuels to reduce the total CO_2 rate, requiring the use of low-carbon fuels for the operation of heavy machinery, and/or requiring BCC to use renewable energy to power the mine. This alternative was eliminated from detailed analysis because OSMRE does not have the regulatory authority to require electricity-generating

[1] The EPA uses NO_2 as the indicator for the larger group of nitrogen oxides (oxides of nitrogen) or NO_x. However, emissions are usually reported as NO_x.

plants to reduce emissions because the emissions are regulated by the States or Counties where the plants are located. Any mitigation measure proposed by OSMRE imposing more stringent emission limits at generating stations and upon oil and gas operators is beyond OSMRE's authority. Furthermore, the Bridger Mine Complex must comply with the requirements of the Clean Air Act and operate under the conditions of BCC's existing air quality permit from the WDEQ Air Quality Division. The air permit incorporates measures that address the issues this alternative seeks to address.

2.2.3.5. REQUIRED OFF-SITE MITIGATION OR COMPENSATION FOR IMPACTS

This alternative would require off-site mitigation or compensation for impacts caused by the proposed mining activities. This mitigation or compensation would offset the carbon dioxide emissions from the proposed mining activities and the Jim Bridger Power Plant. The Proposed Action has the potential to emit CO_2 at levels identified in Section 4.2.1. CO_2 emissions from the Proposed Action would be well below the EPA's Final Mandatory Reporting of Greenhouse Gases Rule threshold of 25,000 metric tons per year of carbon dioxide equivalent (CO_2e) (40 CFR Part 98). Because no significant impacts are predicted from CO_2 emissions attributed to the Proposed Action, an alternative that requires compensatory mitigation is eliminated from detailed analysis.

3. AFFECTED ENVIRONMENT

3.1. Introduction

This chapter describes the existing environment of the area that would be affected by the Proposed Action or No Action Alternative. The affected environment was considered and analyzed by an interdisciplinary team, as documented in Table 3-1. The table indicates which resources are either not present in the project area or would not be affected to a degree that requires detailed analysis. Guidance at 40 CFR 1500.1(b) states that NEPA documents "must concentrate on the issues that are truly significant to the action in question." The elimination of non-relevant resources is consistent with the guidance in 40 CFR 1500.4, especially using the scoping process to identify significant environmental issues, deemphasize insignificant issues, and emphasize areas that are useful to decision-makers and the public. Resources or issues that could be affected by the Proposed Action or the No Action Alternative are analyzed in the remainder of this chapter.

Table 3-1. Resources Analyzed in Detail and Resources Eliminated from Detailed Analysis

Resource	Rationale for Analysis or Elimination from Analysis
Air quality and GHG emissions	See discussion in Affected Environment and Environmental Consequences sections.
Alluvial valley floors	Dismissed from analysis. No alluvial valley floors are present in the project area. The subirrigated alluvial deposits are limited in area, have poor soil and water quality, and are of no value for agricultural development beyond grazing (BCC 2016a).
Cultural resources and Native American religious concerns	See discussion in Affected Environment and Environmental Consequences sections.
Environmental justice	The closest town to the project area is Superior, Wyoming, approximately 17 miles to the northwest. The Proposed Action would have no impacts to environmental justice populations because no such populations are located near the Bridger Mine Complex.
Farmlands (prime or unique)	Dismissed from analysis. No prime or unique farmland is present in or near the project area.

Resource	Rationale for Analysis or Elimination from Analysis
Fish and wildlife	See discussion in Affected Environment and Environmental Consequences sections.
Floodplains	Dismissed from analysis. There are no floodplains in the project area.
Geology and minerals	See discussion in Affected Environment and Environmental Consequences sections.
Hazardous or solid waste	Dismissed from analysis. The Proposed Action is a continuation of mining within the existing mine permit boundary and would not change the mine's current hazardous or solid waste practices.
Livestock grazing	Dismissed from analysis. The Proposed Action is a continuation of mining within the existing mine permit boundary and livestock grazing is excluded from the boundary by fencing.
Noise	Dismissed from analysis. The Proposed Action is a continuation of mining within the existing mine permit boundary and would follow the current blasting plan that is already in place.
Ownership and land use	Dismissed from analysis. The Proposed Action is a continuation of mining within the existing mine permit boundary and would not change current ownership or land use.
Paleontology	Dismissed from analysis. No significant paleontological finds have been made in the course of 42 years of both surface and underground mining at the Bridger Mine Complex. BCC's lease modification (WYW-02727) requires that if paleontological resources, either large and conspicuous, and/or of significant scientific value are discovered during mining operations, the find will be reported to the Authorized Officer immediately and mining operations will be suspended within 250 feet of said find.
Public Health and Safety	Dismissed from analysis. There would be no direct or indirect impacts to public health and safety because the Proposed Action would be a continuation of mining operations within the existing permit boundary.
Recreation	Dismissed from analysis. The Proposed Action is a continuation of mining within the existing mine permit boundary (where no recreation currently occurs).
Socioeconomics	See discussion in Affected Environment and Environmental Consequences sections.
Soils	See discussion in Affected Environment and Environmental Consequences sections.
Threatened, endangered, candidate, and special-status animal species	Dismissed from analysis. There would be no direct or indirect impacts to threatened, endangered, candidate, or special-status animal species from mining or coal combustion resulting from the Proposed Action because of a lack of habitat within the direct and indirect impacts analysis area.
Threatened, endangered, candidate, and special-status plant species	Dismissed from analysis. Site-specific data from BCC's existing mine permit indicate no potential for any threatened, endangered, candidate, or special-status plant species to occur in the project area.
Topography and physiography	See discussion in Affected Environment and Environmental Consequences sections.
Transportation and access	Dismissed from analysis. The Proposed Action is a continuation of mining within the existing mine permit boundary.
Vegetation (including invasive species and noxious weeds)	See discussion in Affected Environment and Environmental Consequences sections.
Visual resources	Dismissed from analysis. The Proposed Action is a continuation of mining within the existing mine permit boundary.
Water resources and water quality (groundwater, surface water, and hydrologic conditions)	See discussion in Affected Environment and Environmental Consequences sections.
Wetlands and riparian zones	See discussion in Affected Environment and Environmental Consequences sections.

For each element or resource brought forward for analysis in this EA, an analysis area is identified in which to examine potential project-related impacts. The analysis area is defined as the outer boundary of an area that encompasses potential direct and indirect impacts that may affect the resource. Issues identified during interdisciplinary team analysis of the area and public scoping have guided the development of the affected environment and environmental consequences sections.

3.2. General Setting

The project area is 560 acres in size and is located approximately 31 miles northeast of Rock Springs, Wyoming. The general topography of this portion of Wyoming consists of numerous bluffs and peaks rising from an area-wide base elevation of 6,000 feet above mean sea level (BCC 2016a). The project area is situated on the southwest side of the Continental Divide, with elevations ranging from 6,700 to 6,900 feet above mean sea level.

3.3. Air Quality and Climate Change

The analysis area for impacts to air quality is Sweetwater County, Wyoming. This area was chosen because it is a typical spatial boundary used to determine compliance with the National Ambient Air Quality Standards (NAAQS) established in the Clean Air Act. A county is often selected to be the geographic area evaluated or designated as meeting or not meeting NAAQS. In addition, Sweetwater County includes the area analyzed as part of BCC's 2009 air quality permit modification application. The analysis area is approximately 6,672,640 acres (Gardner 2016).

The analysis area for impacts to climate change is the Great Plains region (comprising the states of Montana, Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas), as defined in *Climate Change Impacts in the United States: The Third National Climate Assessment* (Assessment), a comprehensive report on climate change and its impacts in the United States (Shafer et al., 2014). This area includes Sweetwater County and was chosen because climate change and global warming are regional and global phenomena.

3.3.1. Local Climate and Meteorology

The climate of the area is characteristic of the Northern Great Plains Continental Steppe. Winters are typically very cold, summers are warm, and precipitation is light. There is considerable variation in annual and seasonal temperature and precipitation (BCC 2016a). Summer is usually influenced by Pacific Maritime air masses (dried by the Cascade and Rocky Mountain ranges). Winter is dominated by high-pressure, cold Canadian-Arctic air masses that move southward along the eastern front of the Rocky Mountains. Most precipitation occurs during the spring and early summer.

Meteorological data from the Bridger Mine Complex indicate that wind speed from January to December 2015 averaged 4.5 meters per second. The predominant wind direction was from the west-southwest sector, accounting for 18.4% of the possible winds (Figure 3-1). Total precipitation during this period was 6.33 inches, and the average temperature was 44.2 degrees Fahrenheit (IML Air Science 2015).

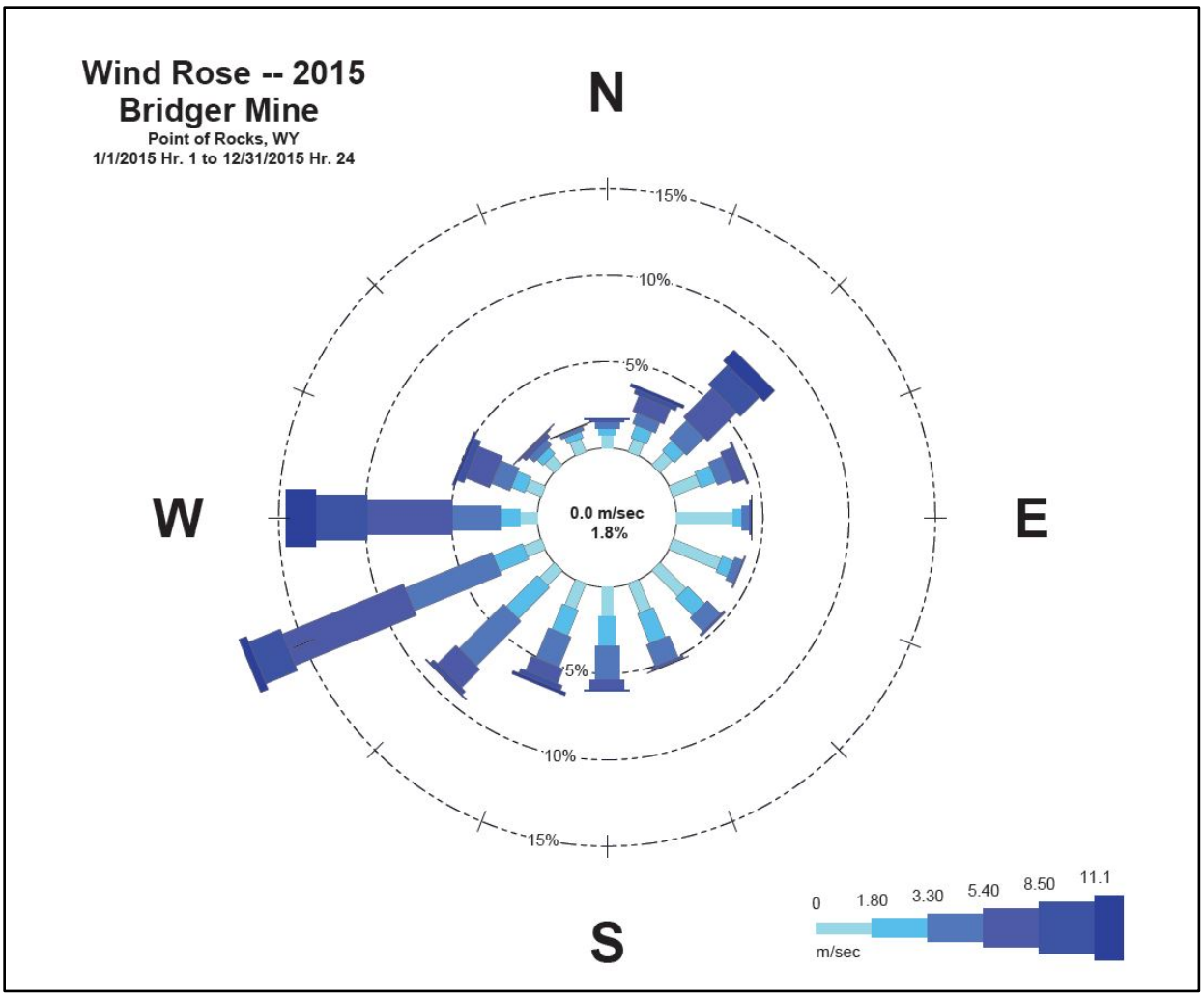

Figure 3-1. Bridger Mine Complex wind rose (January–December 2015). Source: IML Air Science (2015).

3.3.2. Air Quality

3.3.2.1. REGULATORY COMPLIANCE

3.3.2.1.1. NAAQS and WAAQS

The EPA established NAAQS to limit the amount of air pollutants considered harmful to public health and the environment. Primary and secondary standards have been set for six criteria pollutants: carbon monoxide (CO), lead, nitrogen dioxide (NO_2), (also known as nitrogen oxides, oxides of nitrogen, or NO_x), ozone (O_3), sulfur dioxide (SO_2), and particulate matter (PM). Ground-level ozone is not directly emitted into the air but is created by chemical reactions between NO_x and volatile organic compounds (VOCs) in the presence of sunlight. The primary standards provide public health protection and include protection for sensitive populations such as children and the elderly. Secondary standards provide public welfare protection, which includes protection against decreased visibility and damage to animals, crops, vegetation, and buildings (EPA 2016a). Areas that do not comply with NAAQS requirements for criteria pollutants are considered nonattainment areas. A particular geographic region may be designated an attainment area for some pollutants and a nonattainment area for others. A portion of Sweetwater County (the Upper Green River Basin area) is currently a nonattainment area for O_3 (8-hour) (EPA 2016b). The

Bridger Mine Complex is not in the Upper Green River Basin and is in an area currently considered in attainment with NAAQS (WDEQ-AQD 2012). As a result, the General Conformity Rule does not apply to the Proposed Action (the General Conformity Rule ensures that actions taken by federal agencies in nonattainment and maintenance areas are consistent with a State's plans to meet NAAQS [CAA Section 176(c)]).

The WDEQ Air Quality Division (WDEQ-AQD) has also established its own ambient air quality standards—the Wyoming Ambient Air Quality Standards (WAAQS). The NAAQS and WAAQS are summarized in Table 3-2.

Table 3-2. NAAQS and WAAQS

Pollutant		Primary/ Secondary	Form	Averaging Time	NAAQS	WAAQS
CO		Primary	Not to be exceeded more than once per year	8 hours	9 ppm	9 ppm
				1 hour	35 ppm	35 ppm
Lead		Primary and secondary	Not to be exceeded	Rolling 3-month average	0.15 $\mu g/m^3$	0.15 $\mu g/m^3$
NO2		Primary	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years	1 hour	100 ppb	100 ppb
		Primary and secondary	Annual mean	1 year	53 ppb	53 ppb
Ozone		Primary and secondary	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	8 hours	0.070 ppm	75 ppb
Particulate Matter	$PM_{2.5}$	Primary	Annual mean, averaged over 3 years	1 year	12 $\mu g/m^3$	12 $\mu g/m^3$
		Secondary	Annual mean, averaged over 3 years	1 year	15 $\mu g/m^3$	15 $\mu g/m^3$
		Primary and secondary	98th percentile, averaged over 3 years	24 hours	35 $\mu g/m^3$	35 $\mu g/m^3$
	PM_{10}	Primary and secondary	Not to be exceeded more than once per year on average over 3 years	24 hours	150 $\mu g/m^3$	150 $\mu g/m^3$
		N/A	Annual mean, averaged over 3 years	24 hours	N/A	50 $\mu g/m^3$
SO_2		Primary	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years	1 hour	75 ppb	75 ppb
		Secondary	Not to be exceeded more than once per year	3 hours	0.5 ppm	0.5 ppm

Source: EPA (2016a); WDEQ (2015)

Note: N/A = not applicable; ppb = parts per billion; ppm = parts per million; $PM_{2.5}$ = PM less than 2.5 micrometers in diameter; PM_{10} = PM between 2.5 and 10 micrometers in diameter; $\mu g/m^3$ = micrograms per cubic meter

3.3.2.1.2. Ambient Air Quality in the Analysis Area

Compliance with NAAQS is demonstrated by monitoring for ground-level atmospheric air pollutant concentrations. WDEQ-AQD operates and maintains a network of air quality monitoring stations across the state to collect ambient air quality data and to evaluate compliance with the NAAQS. Particular stations monitor for certain pollutants; not all stations monitor all pollutants. Table 3-3 summarizes ambient air quality recorded at air quality monitors in Sweetwater County (outside the Upper Green River Basin) from 2013 to 2015. CO was not monitored in Sweetwater County and most of Wyoming during this time because past monitoring indicated that CO levels were relatively low and that the benefit of monitoring was not justified for a long-term period (WDEQ-AQD 2016a). All data shown in Table 3-3 are in compliance with NAAQS and WAAQS, indicating that the air quality in the analysis area is meeting federal and state standards.

Table 3-3. Ambient Air Quality Data in the Analysis Area from 2013 through 2015

Criteria Pollutant and Averaging Time (Form)		Primary NAAQS	Monitoring Station Data			
			Hiawatha Station (43 miles southeast of Rock Springs)	Moxa Arch Station (25 miles northwest of Green River)	Rock Springs (in Rock Springs)	Wamsutter (2 miles west of Wamsutter)
NO_x						
1 hour (annual 98% of daily maximum 1-hour average)		100 ppb	–	19 ppb (2013) 18 ppb (2014) 22 ppb (2015)	–	38 ppb (2013) 32 ppb (2014) 35 ppb (2015)
1 year (annual arithmetic mean)		53 ppb	–	2 ppb (2013) 2 ppb (2014) 2 ppb (2015)	–	4 ppb (2013) 3 ppb (2014) 3 ppb (2015)
Ozone						
8 hours (4th highest 8-hour average)		0.070 ppm	0.064 ppm (2013) 0.062 ppm (2014) 0.062 ppm (2015)	0.067 ppm (2013) 0.063 ppm (2014) 0.071 ppm (2015)*	–	0.064 ppm (2013) 0.060 ppm (2014) 0.060 ppm (2015)
Particulate Matter						
$PM_{2.5}$	1 year (annual arithmetic mean)	12 μg/m^3	–	–	5.1 μg/m^3 (2013) 4.5 μg/m^3 (2014) 4.8 μg/m^3 (2015)	–
	24 hours (98% 24-hour average)	35 μg/m^3	–	–	12 μg/m^3 (2013) 10 μg/m^3 (2014) 19 μg/m^3 (2015)	–
PM_{10}	24 hours (highest 24-hour average)	150 μg/m^3	–	79 μg/m^3 (2013) 67 μg/m^3 (2014) 52 μg/m^3 (2015)	43 μg/m^3 (2013) 39 μg/m^3 (2014) 54 μg/m^3 (2015)	193 μg/m3 (2013)† 41 μg/m3 (2014) 47 μg/m3 (2015)
SO_2						
1 hour (annual 99% 1-hour average)		75 ppb	–	20 ppb (2013) 16 ppb (2014) 18 ppb (2015)	–	–

Source: WDEQ-AQD (2016a).

Note: ppb = parts per billion; ppm = parts per million; $PM_{2.5}$ = PM less than 2.5 micrometers in diameter; PM_{10} = PM between 2.5 and 10 micrometers in diameter; μg/m^3 = micrograms per cubic meter

* To comply with the 8-hour ozone NAAQS, the daily maximum 8-hour ozone averages are ranked over a year. The 3-year average of the fourth-highest annual value must not exceed 0.070 ppm. At the Moxa Arch station, the 3-year average of the fourth-highest annual value is 0.067 ppm, which indicates compliance with the NAAQS.

† To comply with the 24-hour PM_{10} NAAQS, a monitor may only have one exceedance (a 24-hour average concentration greater than 150 μg/m^3) per year over a 3-year period. The design value is the average number of exceedances per year from 2013–2015. At the Wamsutter station, the design value for 24-hour PM_{10} from 2013–2015 is 0.3, which indicates compliance with the NAAQS.

3.3.2.1.3. Prevention of Significant Deterioration

The Prevention of Significant Deterioration (PSD) is a CAA New Source Review permitting program for new and modified major sources of air pollution that are located in attainment areas. It is designed to prevent NAAQS violations, to preserve and protect air quality in sensitive areas, and to protect public health and welfare (EPA 2016c). Under PSD regulations, the EPA classifies airsheds as Class I, Class II, or Class III. Congress designated certain existing areas as mandatory Class I areas, which preclude redesignation to a less restrictive class. Class I areas are those areas allowing for very little deterioration of air quality. They are areas of special national or regional natural, scenic, recreational, or historic value for which PSD regulations provide extra protection. Class II areas allow moderate deterioration and Class III areas allow more deterioration, but in all cases, pollutant concentrations cannot violate any of the NAAQS (National Park Service 1981).

A PSD increment prevents the air quality in clean areas from deteriorating and is the maximum allowable increase in ambient pollutant concentrations. Significant deterioration is said to occur when the amount of new pollution would exceed the applicable PSD increment (EPA 2016c). The allowable PSD increments of new pollution are very small in Class I areas.

Wyoming has seven Class I areas (national parks and wilderness areas); the closest is the Bridger Wilderness, approximately 63 miles north of the project area (EPA 2012). Because of its distance from the project area, it would not be affected by the Proposed Action. All portions of Wyoming outside of Class I areas are designated as Class II areas. The project area is located in a Class II area.

PSD requirements are applicable to a source if it has the potential to exceed the major source thresholds of either 100 or 250 tons per year of a regulated pollutant, depending on the type of pollutant. For stationary source categories listed in the regulation, the threshold is 100 tons per year. For unlisted source categories, such as surface mining operations, the threshold is 250 tons per year. PSD regulations would not apply to the Proposed Action because it does not have the potential to emit 250 tons per year of any air pollutant (it is not a major source) and because there would be no change to current annual emissions at the Bridger Mine Complex (no air permit modification would be required).

Air Quality Related Values

An air quality related value (AQRV) is defined as a resource "for one or more Federal areas that may be adversely affected by a change in air quality. The resource may include visibility or a specific scenic, cultural, physical, biological, ecological, or recreational resource" identified by a federal land manager for a particular area" (National Park Service, U.S. Forest Service, and U.S. Fish and Wildlife Service 2010:4). The requirement to assess impacts to AQRVs is established in the PSD rules. The federal land manager for each Class I area has the responsibility to define and protect the AQRVs at such areas, and to consider whether new emissions from proposed major facilities (or modifications to major facilities) would have an adverse impact on those values. Since the Proposed Action does not meet the applicability requirements of the PSD rule, no assessment of AQRV impacts is needed.

3.3.2.1.4. Other Air Quality Regulations

Emissions sources generally fall into two broad categories: stationary and mobile. Stationary sources are non-moving, fixed sources of air pollution that emit pollutants through process vents/stacks or through fugitive releases. Stationary sources are classified as major or minor. A major source emits or has the potential to emit a regulated air pollutant in quantities above defined CAA thresholds. Stationary sources that are not major are considered minor or area sources. The Bridger Mine Complex is a minor source.

Section 111 of the CAA requires the EPA to establish federal emission standards for source categories which cause or contribute significantly to air pollution (New Source Performance Standards, or NSPS). NSPS regulations limit emissions from source categories to minimize the deterioration of air quality.

Stationary sources are required to meet these limits by installing new equipment or adding pollution controls to older equipment. The mining operations at the Bridger Mine Complex use existing equipment that is subject to NSPS regulations (e.g., passive enclosure control systems, open coal storage piles, and coal truck dumps); however, the Proposed Action would not require the purchase or use of new equipment or source categories potentially subject to NSPS regulations.

Section 112 of the CAA requires the EPA to promulgate regulations establishing emission standards for each category or subcategory of major sources and area sources of hazardous air pollutants (National Emissions Standards for Hazardous Air Pollutants, or NESHAPs). Hazardous air pollutants, or HAPs (e.g., benzene, perchloroethylene, and mercury) are known or suspected to cause cancer or other serious health effects. The EPA regulates 187 HAPs through Maximum Achievable Control Technology (MACT) standards, which are individual emission standards developed for a particular stationary source category. Each MACT standard applies to major sources in the industrial source category; major sources are those that emit more than 10 tons per year of a single HAP or 25 tons per year of any combination of HAPs (EPA 2016d). The EPA also regulates HAPs from mobile sources such as highway vehicles and non-road equipment; at least six rules or control programs have been promulgated to reduce these emissions. The Proposed Action would not increase annual emissions at the Bridger Mine Complex and would not require any changes that are subject to NESHAPs.

Section 169A of the CAA established a national visibility goal to prevent future visibility impairment and remedy any existing impairment in national parks and wilderness areas (Class I areas). *Visibility* refers to the clarity with which scenic vistas and landscape features are perceived at great distances. *Impairment* refers to human-caused air pollution. In 1999, the EPA promulgated the Regional Haze Rule to address regional haze, which refers to haze that impairs visibility in all directions over a large area. Haze forms when sunlight encounters particle pollution in the air. The Regional Haze Rule calls for state and federal agencies to work together to establish goals and emission reduction strategies to improve visibility in Class I areas (EPA 2001). States are required to address visibility in their State Implementation Plans. Because the Proposed Action would not increase annual emissions at the Bridger Mine Complex nor require changes to its air permit, it is not subject to the Regional Haze Rule.

3.3.2.2. BRIDGER MINE COMPLEX EMISSIONS

The project area is part of the larger Bridger Mine Complex (described in Section 1.2). The most recent Bridger Mine Complex emissions inventory data are summarized in Table 3-4. An emissions inventory is a summary of emissions for a particular source during a given time period. The Bridger Mine Complex emissions data include both the underground and surface portions of the mine. Surface mining emissions would be difficult to separate from underground mining emissions because of interrelated components such as shared equipment and vehicle traffic.

Table 3-4. Bridger Mine Complex 2014 and 2015 Emissions Inventories

Pollutant	Emissions (tons per year)	
	2014	2015
CO	169.0	327.0
NO_x	193.6	245.3
PM_{10}	923.2	888.8
$PM_{2.5}$	196.0	194.5
Sulfur oxides	19.0	22.0

Note: $PM_{2.5}$ values are calculated using EPA emission factors. The increase in CO and NO_x emissions between 2014 and 2015 is primarily because of an increase in blasting.

Source: BCC (2014, 2015).

As evident in Table 3-4, PM is the primary pollutant of concern at the Bridger Mine Complex. The main sources of PM consist of the following:

- fugitive emissions from exposed areas and stockpiles
- emissions from coal and overburden haulage
- emissions from topsoil stripping, haulage, and placement
- blasting emissions
- emissions from loading and dumping coal and overburden
- emissions from engine tailpipes

NO_x emissions at the Bridger Mine Complex come from gases produced from blasting, gases related to air heating equipment, and from diesel-powered equipment. CO and SO_2 also come from blasting and tailpipe emissions.

Emissions of air pollutants at the Bridger Mine Complex are currently controlled and limited by air quality permits issued by WDEQ-AQD (Air Quality Permits MD-9156 and MD-12225). Annual PM tonnage limits for three baghouses are established in MD-9156. Neither air permit sets limits for emissions of criteria pollutants other than PM, but an annual maximum coal production rate of 9.0 million metric tons is established in MD-9156. Other limits and requirements outlined in the air permits include the following:

- Opacity limitations and daily inspections for the three baghouses
- Daily inspections of passive enclosure systems for visible emissions
- Opacity limitations, weekly inspections, and control effectiveness demonstrations for truck dump control systems
- Limitation of multiple coal storage stockpiles to certain sizes and throughputs
- Treatment of sealed coal stockpiles and associated active work areas with a sealant, water, or chemical dust suppressants
- Treatment of all permanent haul roads with a chemical dust suppressant to control fugitive dust emissions (fugitive dust is PM released to the air by wind or similar forces)
- Treatment of temporary haul routes with water and/or chemical dust suppressants
- Effective stabilization of topsoiled areas (of a certain size) that are not revegetated within 60 days topsoil laydown completion
- Operation of an ambient particulate monitoring program and meteorological station
- Implementation of contingency action plan for high particulate levels
- Implementation of a fugitive coal dust emissions control plan

As part of the application for Air Quality Permit MD-9156 and under the guidance of WDEQ-AQD, modeling of PM_{10} and NO_X emissions from the Bridger Mine Complex was performed using the Industrial Source Complex 3 Long-Term model (IML Air Science 2009). Annual average impacts to ambient air were modeled using 10,000 sources and receptors. PM_{10} annual concentrations from all modeled emission sources (Bridger Coal, Leucite Hills, and the Black Butte Mine) were determined for each receptor location. All PM_{10} modeled values were below the NAAQS. A NO_x significance analysis was conducted to determine the extent of significant NO_x impact from the mining operations at the Bridger Mine Complex. Significance was defined as impacts greater than or equal to 1 microgram per

cubic meter (μg/m^3). Model receptors from the PM_{10} analysis were used to model NO_x impacts. Results demonstrated that the 1-μg/m^3 isopleths fall well inside the maximum extent of these receptors. Maximum Bridger Mine Complex contribution to boundary receptor concentrations for NO_x were shown to be 4.0 μg/m^3 in 2010 and 4.9 μg/m^3 in 2011 (the years 2010 and 2011 were selected as worst-case scenarios to model) (IML Air Science 2009).

As required in the air permits, the Bridger Mine Complex operates a particulate and meteorological monitoring network that includes two PM_{10} continuous particulate monitors (JB4 and JB5). Recent monitoring data from 2013–2015 are summarized in Table 3-5 below.

Table 3-5. Bridger Mine Complex 2013–2015 Particulate Concentration Summaries

PM_{10} Measurement	PM_{10} Concentration (μg/m3)					
	2013		2014		2015	
	JB4	JB5	JB4	JB5	JB4	JB5
Annual mean concentration	13.4	17.3	11.3	20.0	12.3	15.9
24-hour high concentration	81.7	90.0	68.5	134.1	134.5	116.1
24-hour 2nd highest concentration	67.4	89.1	63.4	134.0	101.9	78.0

Source: IML Air Science (2013, 2014, 2015)

These concentrations are in compliance with the PM_{10} NAAQS (150 μg/m^3 highest 24-hour average) and PM_{10} WAAQS (150 μg/m^3 highest 24-hour average and 50 μg/m^3 annual mean). If elevated PM_{10} readings are detected at JB4 and JB5, BCC would implement the contingency action plan for high particulate levels.

HAP emissions are not required to be tracked at the Bridger Mine Complex, likely because its status as a minor source and the low levels of HAPs that would potentially be emitted from mining activities.

The Proposed Action would be covered under the Bridger Mine Complex's existing air permits and would be subject to the same limitations and requirements. No permit modification would be required.

3.3.2.3. JIM BRIDGER POWER PLANT

The Jim Bridger Power Plant, a coal-fired power station, is located in the analysis area and is classified as a major source. Coal is transported from the Bridger Mine Complex by overland conveyor to the Jim Bridger Power Plant. Along with the coal from the Bridger Mine Complex, the Jim Bridger Power Plant also receives coal from other mines, such as the Black Butte Mine. The analysis of air quality in this EA presumes that the power plant would continue to operate at current levels, regardless of the input from the Bridger Mine Complex, using coal from other sources. Coal-fired power plants emit criteria pollutants, HAPs, and other toxic air pollutants. Two notable problems associated with such air pollutant emissions are acid and mercury deposition. Coal-fired power plants can contribute to acid deposition through SO_2 and NO_x emissions. When acid chemicals are incorporated into rain, snow, fog, mist, dust, or smoke, some of the pollution falls to the ground as acid deposition. Atmospheric deposition of air pollutants can increase the acidity of soil and water resources. Coal-fired power plants are the largest source of mercury emissions in the United States; however, most mercury deposited in the western U.S. originates in Asia (Strode et al. 2008). Because of the potential for emitted mercury to undergo chemical conversion to methyl mercury and bio-accumulate in aquatic organisms and fish, the EPA has promulgated standards for emission technologies to remove mercury from power plant emissions, thereby reducing the deposition of mercury in the environment (40 CFR 60 and 63). Coal combustion is also a potential source

of trace element emissions, including arsenic, barium, boron, cadmium, chromium, lead, molybdenum, and selenium. Increasing concern about the effects of trace pollutants on the environment has led to the introduction of emission standards for some of these elements.

The Jim Bridger Power Plant operates under a 2005 Title V Operating Permit No. 3-1-120-2 (WDEQ-AQD 2005). A number of amendments or waivers to the operating permit have been issued for equipment modifications and updates, process changes, and for pollution control projects. The Jim Bridger Power Plant is considered a stationary source with most emissions being emitted through the plant's four stacks and a lower fraction occurring as fugitive dust and other emissions. The plant also operates under WDEQ-AQD air permit MD-12186, dated 2011, which contains emission limitations and other requirements for the plant's coal-burning boilers. The Jim Bridger Power Plant has a startup and shutdown emission minimization plan, as well as a water spray operations plan for dust emissions.

In 2011, the EPA finalized national standards (the Mercury and Air Toxics Standards (MATS) to reduce air pollution from coal- and oil-fired power plants (40 CFR 60 and 63). These rules set emission limitation standards for mercury and other toxic air pollutants such as arsenic, chromium, nickel, and acid gases (e.g., hydrochloric acid and hydrofluoric acid). The final rule sets standards for all HAPs emitted by coal- and oil-fired electric generating units with a capacity of 25 megawatts or greater. The Jim Bridger Power Plant is subject to these standards. The MATS rule requires the Jim Bridger Power Plant to implement mercury emission control measures. Activated carbon injection, calcium halide coal conditioning, and soluble mercury re-emission control systems have been installed and the plant has been in compliance with the MATS rule since April 16, 2015 (BLM 2017).

On September 2015, the EPA's SO_2 data requirements rule for the 2010 1-hour SO_2 primary NAAQS became effective. This rule directs state agencies to characterize current air quality in areas with large sources of SO_2 emissions to identify maximum concentrations in ambient air. The Jim Bridger Power Plant is subject to this rule and will operate an SO_2 monitoring station to meet the rule requirements. The WDEQ-AQD is currently evaluating locations for the SO_2 monitor. The Jim Bridger Power Plant is equipped with electrostatic precipitators to control particulate emissions and wet scrubbers to control SO_2 emissions. Ninety-nine percent of SO_2 emissions from the Jim Bridger Power Plant have been eliminated with the installation of wet scrubbers (BLM 2017).

Section 169A of the CAA directs states to evaluate the use of retrofit controls at specific larger, older stationary sources to address visibility impacts. Certain categories of sources must install and operate Best Available Retrofit Technology (BART) as determined by the State. Wyoming's State Implementation Plan establishes BART requirements for NO_x emission controls for power plant units in the state, including the Jim Bridger Power Plant. Under Wyoming's long-term strategy, low NO_x burners with separated overfire air are required on all four boilers at the plant. In addition, a 2010 BART appeal settlement agreement between WDEQ-AQD and PacifiCorp requires the installation of additional NO_x controls at the Jim Bridger Power Plant. The plant operates under BART permit MD-6040A2, dated 2010, which sets NO_x emission limits. The Jim Bridger Power Plant operator has begun work to install selective catalytic reduction systems to remove NO_X from the plant's emissions. With the implementation of the catalytic reduction system, an overall reduction of 67% in NO_X emissions will have occurred since 2004 (BLM 2017).

The Jim Bridger Power Plant would also be subject to the new Clean Power Plan Final Rule (Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units) announced on August 3, 2015, and plans to address all requirements under the rule (Childs et al., 2015). Implementation of the rule was stayed by the Supreme Court on February 9, 2016. An executive order issued on March 28, 2017 instructed the EPA Administrator to review the Clean Power Plan Final Rule and suspend, revise, or rescind it as soon as practicable (White House 2017).The primary emission sources at the Jim Bridger Power Plant are four tangentially fired coal-burning boilers. The four boilers

were initially equipped with early low-NO_x burners to control emissions of NO_x. The early low-NO_x burners have been updated with new, modern low-NO_x burners, each with overfire air. Each boiler is also equipped with a dry electrostatic precipitator to control PM emissions; SO_2 emissions from each unit are controlled using a wet sodium flue gas desulfurization system. Selective catalytic reduction (SCR) was installed on the Unit 3 boiler in December 2015, and was scheduled to be installed on the Unit 4 boiler by December 2016. The plant must also install SCR or other NO_X emission controls on the Unit 2 boiler by the end of the year 2021 and the Unit 1 boiler by the end of 2022.

The Jim Bridger Power Plant submitted an air operating permit application to the WDEQ-AQD on March 21, 2016, to revise their operating permit to include the new emission control technology. The new control technology will also help reduce mercury emissions.

The permit application for revision of the operating permit quantified the Jim Bridger Power Plant's potential to emit the following HAPs and toxic air pollutants:

- Mercury: 0.03 ton per year from each of the four boilers (0.12 ton per year total)
- Sulfuric acid: 105.1 tons per year from each of the four boilers (420.4 tons per year total)
- Hydrofluoric acid: 9.0 tons per year from each of the four boilers (36.0 tons per year total)
- Ammonia: 133.2 tons per year from each of two of the four boilers (266.4 tons per year total)

A summary of other emissions from the Jim Bridger Power Plant is included here to provide context and to assist with analysis of the combustion of coal mined from the project area. Table 3-6 summarizes the Jim Bridger Power Plant's 2015 annual emission inventory data.

Table 3-6. Jim Bridger Power Plant 2015 Emissions Inventory

Pollutant	Emissions (tons per year)
CO	5,007
NO_x	13,704
PM_{10}	705
$PM_{2.5}$	221
PM	1,400
SO_2	10,265
VOCs	228
HAPs	145
Ammonia	2.5

Note: The HAPs total includes emissions for 73 individual HAPs.
Source: PacifiCorp (2015a).

Some of the individual HAP totals quantified by the 2015 emission inventory include:

- Mercury: 187.6 pounds (lbs) per year
- Sulfuric acid: 88.3 tons per year
- Hydrofluoric acid: 28.7 tons per year
- Acetaldehyde: 441.9 lbs per year
- Acrolein: 262.2 lbs per year
- Arsenic: 94.2 lbs per year

- Benzene: 538.8 lbs per year
- Cadmium: 25.4 lbs per year
- Chromium: 292.2 lbs per year
- Formaldehyde: 363.0 lbs per year
- Selenium: 340.2 lbs per year
- Xylene: 174.0 lbs per year

Annual coal throughput at the Jim Bridger Power Plant in 2015 was 7,613,893 tons (the annual permitted throughput is 9,500,000 tons) (PacifiCorp 2015b). In 2015, coal for the power plant was supplied by Black Thunder Mine, Black Butte Mine, and the Bridger Mine Complex.

Coal-fired power plants such as the Jim Bridger Power Plant create coal combustion residues or wastes (CCW), which consist of inorganic residues that remain after pulverized coal is burned. The different types of CCW are bottom ash (inert slag formed during combustion), fly ash (fine PM removed from the gas stream prior to venting), flue gas desulphurization products (precipitate formed during chemical removal of SO_2 prior to venting), and boiler slag (ash collected from the base of certain furnaces quenched with water) (Luther 2010). CCW are typically contained either in surface impoundments or landfills. Landfills are used where the power plant adopts a dry disposal of its CCW. When a power plant adopts a wet disposal, the CCW are slurried and piped to a surface impoundment (Solmax International 2012). Some CCW are put to beneficial use in other ways, such as a component in concrete, structural fill, or road-base materials (Luther 2010). At the Jim Bridger Power Plant, CCW are disposed of in the Jim Bridger Industrial Landfill and the Jim Bridger Flue Gas Desulphurization (FGD) Ponds 1 and 2. FGD Pond 1 is no longer in operation and is undergoing closure.

CCW typically contain a range of heavy metals such as arsenic, lead, selenium, mercury, and chromium, which can be hazardous to human health and the environment. The primary concern regarding the management of CCW is the potential for hazardous constituents to leach into surface or groundwater through unlined CCW surface impoundments or landfills and contaminate drinking water, surface water, or living organisms. The EPA has determined that arsenic, lead, and other carcinogens have leached into groundwater and exceeded safe limits when CCW is disposed of in unlined disposal units, presenting substantial risks to human health and the environment (Luther 2010; Tan et al. 2012). There are complex physical and biogeochemical factors that influence the degree to which heavy metals can dissolve and migrate off-site, including the mass of toxins in the waste and the degree to which water can flow through the waste (Luther 2010). Additional concerns regarding the management of CCW are the blowing of contaminants into the air as dust and the catastrophic failure of surface impoundments.

The EPA published a final rule in April 2015 on the disposal of coal combustion residuals from electric utilities. Prior to this rule, CCW were only subject to state requirements. The rule provides a comprehensive set of requirements for the safe disposal of CCW and establishes technical specifications for CCW landfills and surface impoundments under subtitle D of the Resource Conservation and Recovery Act. The rule also sets out recordkeeping and reporting requirements and supports the responsible recycling of CCWs by distinguishing safe, beneficial use from disposal. State solid waste management plans, approved by the EPA, serve as mechanisms for States to detail how they intend to regulate CCW landfills and surface impoundments as part of their overall solid waste program.

As part of a national program to assess the management of CCW, the EPA conducted a specific site assessment of the dam safety of FGD Ponds 1 and 2 embankment dams at the Jim Bridger Power Plant in June 2009. FGD Pond 1 first went into service in 1979, and FGD Pond 2 first went into service in 1990. The assessment indicated that there were no known spills or unpermitted releases for either pond in the

last 10 years. Typically, 90% of the generated fly ash at the Jim Bridger Power Plant is sold commercially for use in concrete. Waste bottom ash is dewatered and disposed of in the industrial landfill. Water-borne combustion waste that consists primarily of FGD solids is pumped from the plant via two aboveground pipes around FGD Pond 1 (which is undergoing closure) to an inlet structure for FGD Pond 2. Both pond embankments were generally found to be in satisfactory condition by the assessment, with acceptable maintenance and surveillance programs. Minor corrective measures for the structures were recommended (GEI Consultants, Inc. 2009).

3.3.3. Climate Change

Global warming refers to the ongoing rise in global average temperature near the Earth's surface. It is caused mostly by increasing concentrations of GHGs (primarily CO_2, methane, nitrous oxide (N_2O), and fluorinated gases) in the atmosphere, and it is changing climate patterns. *Climate change* refers to any significant change in the measures of climate (e.g., temperature, precipitation, and wind patterns) lasting for an extended period of time (EPA 2016e). In 2010, the National Research Council concluded that "climate change is occurring, is caused largely by human activities, and poses significant risks for a broad range of human and natural systems" (National Research Council 2010:1).

Carbon dioxide is the primary GHG emitted through human activities that contributes to climate change (81% of total United States GHG emissions in 2014); it is followed by methane (11% of total 2014 emissions), N_2O (6% of total 2014 emissions), and fluorinated gases (3% of total 2014 emissions) (EPA 2016f). The main human activity emitting CO_2 is the combustion of fossil fuels (including the combustion of coal) for energy and transportation (EPA 2016g).

In May 2014, the U.S. Global Change Research Program released *Climate Change Impacts in the United States: The Third National Climate Assessment* (Assessment), a comprehensive report on climate change and its impacts in the United States (Melillo et al. 2014). In the Assessment, the Great Plains region comprises the states of Montana, Wyoming, North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas. According to the Assessment, projections suggest more frequent and more intense droughts, severe rainfall events, and heat waves in this region. High temperatures are projected to occur much more frequently. Key climate change highlights for the Great Plains region include the following, excerpted directly from the Assessment:

- Rising temperatures are leading to increased demand for water and energy. In parts of the region, this will constrain development, stress natural resources, and increase competition for water among communities, agriculture, energy production, and ecological needs.
- Landscape fragmentation is increasing, for example, in the context of energy development activities in the northern Great Plains. A highly fragmented landscape will hinder adaptation of species when climate change alters habitat composition and timing of plant development cycles.
- Communities that are already the most vulnerable to weather and climate extremes will be stressed even further by more frequent extreme events occurring within an already highly variable climate system.
- The magnitude of expected changes will exceed those experienced in the last century. Existing adaptation and planning efforts are inadequate to respond to these projected impacts. (Melillo et al. 2014)

Specifically in Wyoming, most of the state has warmed by 1 to 3 degrees Fahrenheit over the past century (EPA 2016h). Heat waves are becoming more common and snow is melting earlier in the spring. The snowpack has been decreasing since the 1950s. The changing climate will likely decrease the availability of water in Wyoming, affect agricultural yields, and increase the risk of wildfires. By 2050, Wyoming is likely to have twice as many days above 100 degrees Fahrenheit as it does today (EPA 2016h).

Coal combustion for electric power and industry produces CO_2 emissions, in addition to non-GHG pollutants such as SO_2, NO_X, PM, mercury, and other heavy metals. Coal mining, particularly underground mining, produces methane, which is created during coal formation and is released from the coal seam and the surrounding rock strata. The term carbon dioxide equivalent (CO_2e) is used to describe different GHGs in a common unit. For any quantity and type of GHG, CO_2e represents the amount of CO_2 that would have the equivalent global warming impact (Brander 2012). In 2014, U.S. fossil fuel combustion resulted in emissions of 5,208.2 million metric tons of CO_2e and coal mining resulted in emissions of 67.6 million metric tons of CO_2e (compared to total emissions of 6,870.5 million metric tons of CO_2e) (EPA 2016i). In Wyoming, energy-related CO_2 emissions from coal were 49.2 million metric tons in 2013 (out of a total of 68.4 million metric tons of energy-related total CO_2 emissions in the state) (EPA 2015a).

The EPA regulates GHG emissions under several initiatives, including the Mandatory Greenhouse Gas Reporting rule, the Final Greenhouse Gas Tailoring Rule, geologic sequestration requirements, and EPA and National Highway Traffic Safety Administration standards for new motor vehicles. Under the Mandatory Greenhouse Gas Reporting rule (40 CFR 98), coal mines subject to the rule are required to report emissions in accordance with the requirements of Subpart FF. Subpart FF is applicable only to underground coal mines and would not apply to the Proposed Action. Because no change to emissions would occur under the Proposed Action, no other GHG reporting or permitting requirements would apply.

3.4. Cultural Resources

Cultural resources are evidence of past human activity. They can be either prehistoric or historic in age (i.e., dating to either before or after the time of Euro-American settlement), and they include artifacts (portable objects of human manufacture such as tools); features such as fire pits, houses, earthworks, and other types of structures; human burial sites; art; trails; and archaeological sites where any of the above may be found. Cultural resources can also include other types of places that are important to the heritage of contemporary peoples (e.g., sacred and traditional cultural properties).

Cultural resources are managed under a variety of laws and regulations, including Section 106 of the National Historic Preservation Act of 1966 (NHPA) (36 CFR 800). This section requires that federal agencies take into account the effect that a federal undertaking may have on historic properties—that is, any district, site, building, structure, or object that is included in or eligible for the National Register of Historic Places (NRHP).

The analysis area for impacts to cultural resources is the 560-acre project area. This is the area of potential effects for purposes of review under Section 106 of the NHPA.

3.4.1. Cultural Context

The project area lies in an expanse of Wyoming that is an elevated structural plain (the Wyoming Basin) located between the Great Plains to the east, the Great Basin to the west and southwest, and the Columbia Plateau to the northwest. This area served as a natural travel corridor between surrounding cultural areas, with outside groups passing through the region and interacting with the indigenous population. In addition, the local indigenous population adapted to local environmental conditions. Consequently, a variety of unique cultural manifestations over time are present in the Wyoming Basin (BCC 2016a).

A chronology for the Wyoming Basin has been developed based on the frequency of radiocarbon dates from southwest Wyoming (BCC 2016a). The chronology defines six phases, as follows:

- Pre-Paleoindian Period (pre-12,000 B.P.): Recent evidence suggests that South America has been inhabited for more than 13,000 years. There are also claims suggesting that some form of pre-

Clovis or generic pre-Paleoindian populations occupied the New World prior to the well-known Paleoindian groups. However, there is currently no firm evidence for the early occupation of the western Wyoming Basin.

- Paleoindian Period (12,000–8200 B.P.): Archaeological evidence for this period suggests a specialized hunting subsistence strategy based on megafauna such as bison. The lithic technology of this period is distinctive for its meticulous workmanship, especially on projectile points which are usually lanceolate.
- Archaic Period (8200–1800 B.P.): Aboriginal subsistence methods became more diverse in response to climatic change, resulting in a proliferation of technological traditions. The lanceolate projectiles of the Paleoindian Period were replaced with smaller side-and corner-notched atlatl dart points. Other evidence suggests increased use of vegetable resources and increased procurement of small animals.
- Late Prehistoric Period (begins 2000 B.P.): This period begins with the introduction of the bow and arrow and pottery, and ends when European culture begins to influence the area approximately 300 years ago. Pottery first appears approximately A.D. 650. Evidence suggests that a wide variety of plant foods were utilized, as well as larger animals such as antelope and bison.
- Protohistoric Period (begins A.D. 1700–1750): The Protohistoric Period begins when the first European trade goods arrive, and ends in the early 1800s with the appearance of Euro-Americans associated with the Rocky Mountain fur trade. The most profound influence on Native cultures during this time was the introduction of the horse in the early 1700s, which improved mobility, increased the efficiency of hunting, and allowed for better transportation of material culture.
- Historic Period (begins in the early A.D. 1800s): This period begins with the Lewis and Clark expedition of the Missouri River in 1805–1806. The Rocky Mountain fur trade developed rapidly, with dramatic changes in traditional Indian lifeways. Traditional aboriginal subsistence strategies became increasing difficult with the intensified competition over game and land. The Union Pacific Railroad reached the Wyoming Basin in 1868, and the effective end of aboriginal occupation of the Wyoming Basin occurred the same year, with the removal of the resident Shoshone to the Wind River Reservation. Stage roads and other expansion-era roads were constructed after the railroad reached southwest Wyoming. After 1868, cow and sheep camps were established with the development of the livestock industry (BCC 2016a).

3.4.2. Known Cultural Resources

The Bridger Mine Complex has been the focus of multiple archaeological investigations, beginning with initial Class III surveys by the Office of the Wyoming State Archaeologist in 1976. Most of the studies have been conducted for BCC and the Jim Bridger Power Plant and have included block inventories and studies connected to roads, power lines, core holes, and other projects associated with mining activities. Small inventories for well pads, natural gas pipelines, and roads have also been conducted on the periphery of the Bridger Mine Complex permit area (Western Archaeological Services [WAS] 2009).

3.4.2.1. SECTION 12 OF THE PROJECT AREA

A Class III cultural resource inventory was conducted by WAS in 2009 on a larger study area that included the portion of Section 12 in the project area (WAS 2009). The objectives of the inventory were to provide a complete record of cultural properties identifiable from surface and natural exposures in the study area and to determine the relationship of the cultural resources to the proposed mine disturbance area. An intensive pedestrian survey was conducted. Portions of Section 12, as well as the larger WAS

study area, had previously been inventoried for cultural resources. The WAS 2009 cultural resource inventory resulted in the discovery of five new sites, nine previously recorded sites, and four isolated artifacts. All of the new and previously recorded sites are located in Section 12; two of the isolated artifacts are located in Section 12. None of these sites are eligible for nomination to the NRHP. The cultural resource inventory indicated that there is a low potential for encountering intact buried cultural remains within the residual soils and shallow sands in the study area. No further action was recommended (WAS 2009).

Following submission of the 2009 Class III cultural resource inventory report, the BLM Rock Springs Field Office identified a segment of 48SW3860, Cherokee Trail, Evans Variant, in the study area (Segment 1). In 2010, WAS evaluated the trail segment in the study area to determine whether it retained sufficient integrity to contribute to the NRHP eligibility of the Cherokee Trail (WAS 2010). The physical and visual integrity of the trail segment was assessed. The Evans Variant of the Cherokee Trail is one of two variants of the trail that led west from the Indian Territory of modern-day Oklahoma to the gold fields of California (WAS 2010). The route was first used in 1849 and crosses the south half of Section 12 and runs northeast to southwest. In Section 12, it consists of an upgraded, flat, bladed, or crown-and-ditch road. Modern culverts are present in the larger tributary drainage crossings and modern construction was noted at the western end of the segment. The road was upgraded sometime in the past but has not been recently maintained. The setting has been extensively affected by ongoing mining activities (WAS 2010).

The Cherokee Trail has been previously determined eligible for the NRHP by the North Dakota State Historic Preservation Officer. Segment 1 of the portion recorded by the BLM Rock Springs Field Office is evaluated as non-contributing to the overall NRHP eligibility of the Cherokee Trail (WAS 2010). The trail segment has been completely destroyed by modern road construction activities and consists entirely of an upgraded road. No intact trail remains were observed. The trail segment does not retain physical integrity and the setting does not contribute to its NRHP eligibility. No significant trail remains would be affected by proposed mining activities and no further work is recommended (WAS 2010).

3.4.2.2. SECTION 24 OF THE PROJECT AREA

A Class III cultural resource inventory was conducted in 2008 on a larger study area that included the portion of Section 24 in the project area (WAS 2008). The objectives of the inventory were to provide a complete record of cultural properties identifiable from surface and natural exposures in the study area and to determine the relationship of the cultural resources to the proposed mine disturbance area. An intensive pedestrian survey was conducted. The file search indicated that three previous projects have been conducted in Section 24, covering 109 acres. Of this total, 80 acres overlapped the WAS study area. One previously recorded site (48SW13859) was identified in the portion of Section 24 that is in the project area. A second previously recorded site (48SW6061) was identified in the portion of Section 24 in the project area; however, WAS found this site to be 200 feet east of the project area boundary (WAS 2008). No newly identified cultural resource sites were in the project area.

Site 48SW13859 (Bitter Creek NW 153) is located on a tributary of Tenmile Draw and was originally recorded in August 2001. At that time, it consisted of a scatter of historical debris, including wire nails, wood scraps, small pieces of coal, six food cans, a flat tobacco tin, a condensed milk can, three seam cans, and a probable wagon part. The site was revisited during the WAS cultural resource inventory and the same scatter of debris was noted. The artifacts date to the mid-twentieth century and likely reflect a sheep camp. The cultural resource inventory indicated that buried material remains are highly unlikely given the age and use of the site. The site is recommended not eligible for the NRHP (sheep camps contribute little to our understanding of sheep raising or the early economic development of Wyoming's livestock industry) (WAS 2008).

Site 48SW6061 is an open camp that has been determined eligible for the NRHP. Because of its location 200 feet east of the inventory area, it would not be affected by surface disturbance and no further work was recommended (WAS 2008).

Also present nearby are the Overland Trail (48SW1226) and the Point of Rocks to South Pass State Road (48SW386), both of which are NRHP-eligible historic properties. The Overland Trail is located 6.5 miles southwest and the Point of Rocks stage road is located 5 miles west of the WAS study area. Both properties and the WAS study area are covered by a Memorandum of Agreement (MOA) between the BLM and the Wyoming State Historic Preservation Office (WAS 2008). The MOA states that those segments of the Overland Trail and State Road that are covered by the MOA do not contribute to the visual integrity of the historic properties because of modern developments such as roads, power lines, and the Bridger Mine Complex. No visual impacts to the Overland Trail or the Point of Rocks to South Pass State Road would result from the proposed mine disturbance (WAS 2008).

3.4.3. Native American Religious Concerns

A scoping letter was sent on June 1, 2016, to the following Native American tribes to identify any Native American religious concerns or other issues with the Proposed Action:

- Shoshone-Bannock Tribes (Fort Hall Reservation, Idaho)
- Eastern Shoshone Tribe (Wind River Reservation, Wyoming)
- Northern Arapahoe Tribe (Wind River Reservation Wyoming)
- Northern Ute Tribe (Uintah and Ouray Reservation, Utah)

The scoping letter requested comments on the Proposed Action and continued consultation with the tribes for the stages of proposal development and implementation of the final federal action. No cultural or religious concerns or Traditional Cultural Properties have been identified through consultation with the tribes.

3.5. Fish and Wildlife

The impact analysis area for fish and wildlife is the project area with a 0.5-mile buffer. This area was chosen because it provides a reasonable boundary for analysis of the potential direct and indirect impacts to wildlife and wildlife habitat from the proposed surface mining activities.

3.5.1. Common Wildlife

The landscape in the wildlife impact analysis area supports Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*) and/or big sagebrush (*Artemisia tridentata* var. *tridentata*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), rubber rabbitbrush (*Ericameria nauseosa*), Gardner's saltbush (*Atriplex gardneri*) and/or mat saltbush (*Atriplex corrugata*), and bud sagebrush (*Picrothamnus desertorum*). Most of the analysis area is covered by either the Inter-Mountain Basins Big Sagebrush Shrubland or Inter-Mountain Basins Mixed Salt Desert Scrub land cover types. Wildlife species that are commonly associated with these vegetation and land cover types include species such as coyotes, red fox, prairie dogs, ground squirrels, white-tailed jackrabbits, desert cottontails, various game and non-game birds, reptiles, amphibians, etc.

3.5.2. Big Game

As discussed in the 2010 Bridger Lease Modification EA, the wildlife impact analysis area offers year-round habitat for many big game species, such as pronghorn antelope, elk, and mule deer. Table 3-7 lists the acres of mule deer, elk, and pronghorn antelope habitat in the wildlife impact analysis area. Figures 3-2, 3-3, and 3-4 show the locations mule deer, elk, and pronghorn antelope habitat in the wildlife impact analysis area.

Table 3-7. Acres of Big Game Habitat in the Fish and Wildlife Impact Analysis Area

Habitat Type	Acres
Mule deer winter/year-long	3,323.2
Elk year-long	3,323.2
Pronghorn antelope crucial, winter/year-long	2,477.3
Pronghorn antelope winter/year-long	845.9

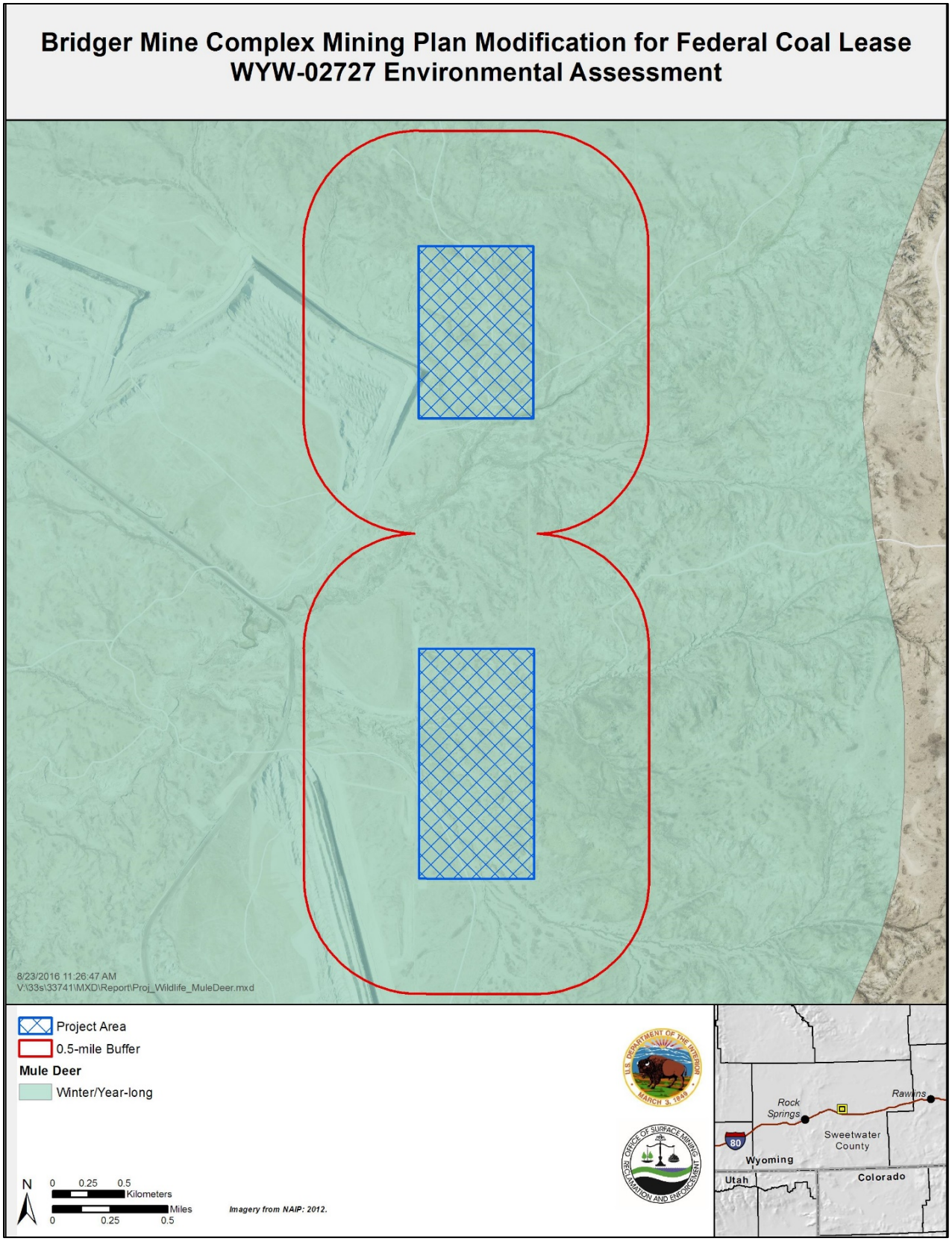

Figure 3-2. Mule deer habitat in the fish and wildlife impact analysis area.

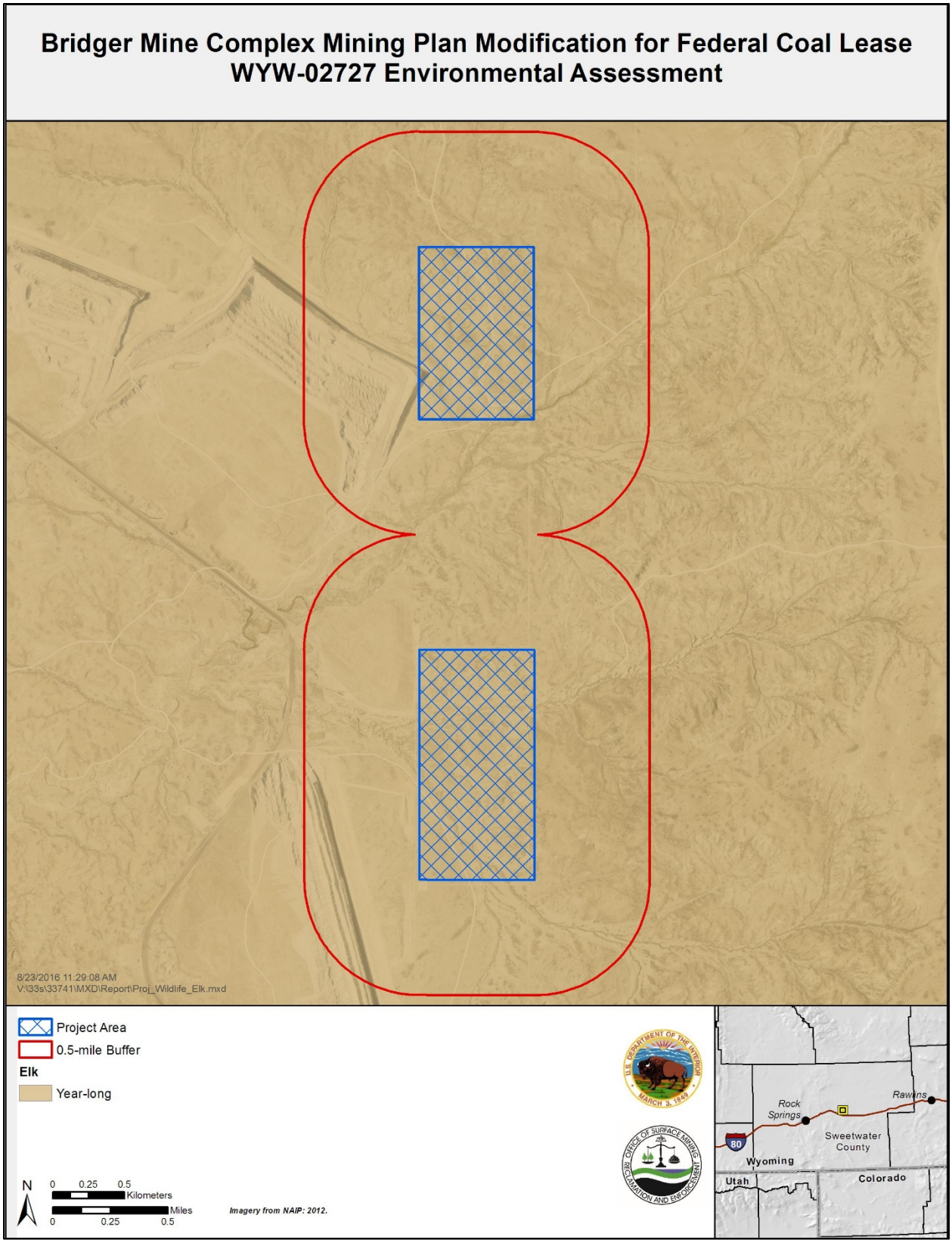

Figure 3-3. Elk habitat in the fish and wildlife impact analysis area.

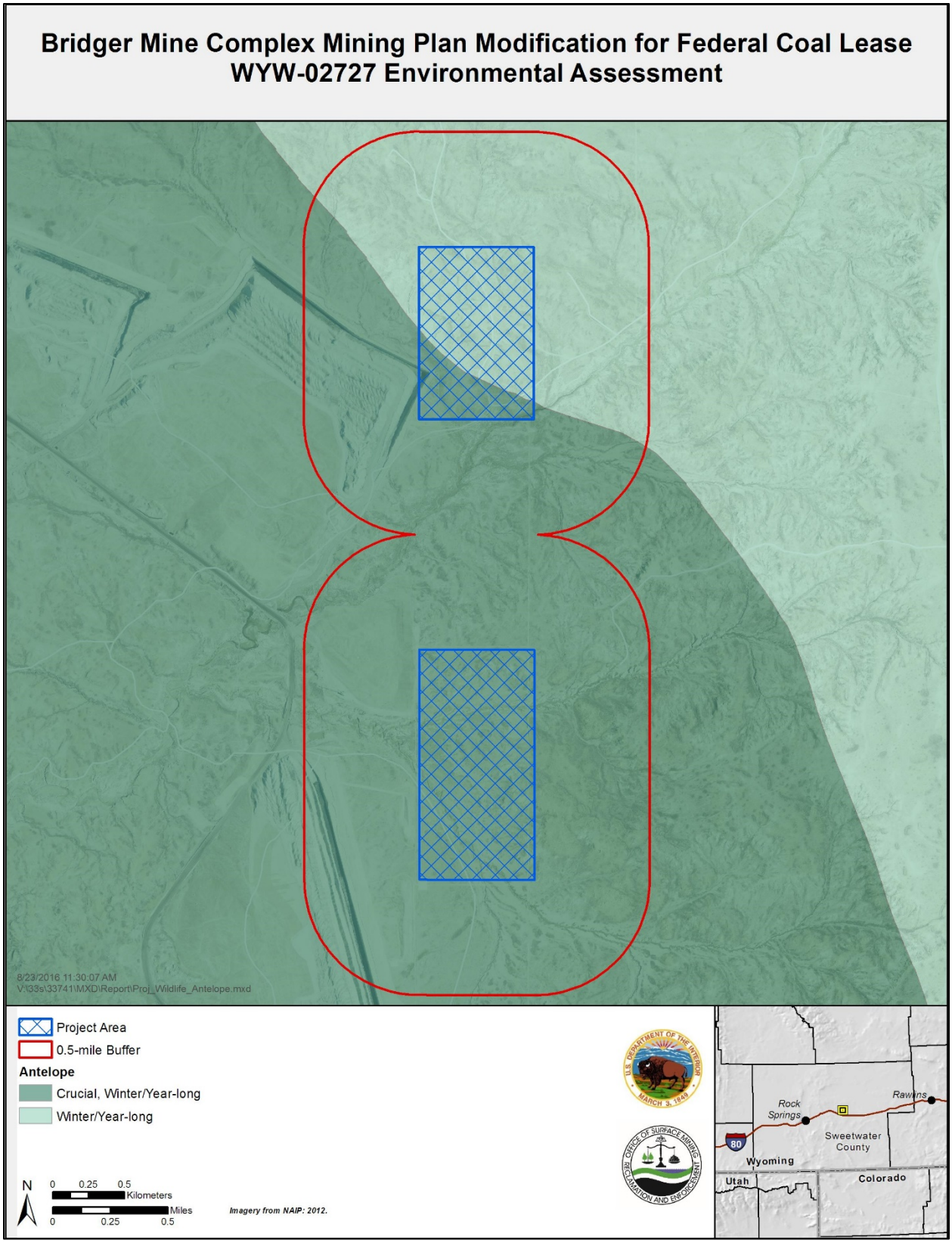

Figure 3-4. Pronghorn antelope habitat in the fish and wildlife impact analysis area.

3.5.3. Migratory Birds, including Raptors

The fish and wildlife impact analysis area contains suitable ferruginous hawk (*Buteo regalis*) nesting and foraging habitat, such as basin-prairie shrub, grassland, and rock outcrops (BLM 2010). Ferruginous hawks are a BLM sensitive species and are managed to ensure that BLM actions do not result in the listing of the species under the Endangered Species Act. Table 3-8 lists migratory birds that occur in Sweetwater County, Wyoming. Other migratory birds that are associated with the vegetation types found in the fish and wildlife impact analysis area include Gambel's quail *(Callipepla gambelii),* Brewer's sparrow *(Spizella breweri),* sage sparrow *(Amphispiza belli)*, mountain bluebird (Sialia currucoides), green-tailed towhee *(Pipilo chlorurus)*, and sage thrasher *(Oreoscoptes montanus).*

Annual raptor nest surveys are currently conducted by BCC within the permit area and in areas of raptor concentration near the permit area. All previously located nests are monitored each spring, with searches of new nest sites conducted throughout the study area. Methodologies for raptor monitoring follow those described in WDEQ-LQD Coal Rules and Regulations, Appendix B. Nest status and production success is reported in an annual report. According to BCC's 2016 Annual Report (BCC 2016b), nine species of raptors potentially nest within the permit area and in areas of raptor concentration near the permit area. All nine of these species nested or were observed on territories in the annual report study area in 2015: golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), ferruginous hawk, northern harrier (*Circus cyaneus*), prairie falcon (*Falco mexicanus*), American kestrel (*Falco sparverius*), burrowing owl (*Athene cunicularia*), long-eared owl (*Asio otus*), and great horned owl (*Bubo virginianus*). The predominant substrates for nesting raptors were cliffs, rock pedestals, rocky outcrops, spoil piles, and highwalls. Five species used mine-created habitat, such as highwall, truck dump station hoppers, the interior of the dragline, and platforms. Overall raptor success dipped slightly in 2016. Red-tailed hawks, ferruginous hawks, golden eagles, prairie falcons, American kestrels, and northern harriers experienced an increase in productivity or remained the same in occupied territories. Productivity for all other raptors remained the same or showed a slight increase in occupied territories. Overall reproductive nests were up, but fledgling counts were down, and less territories were occupied with less active nests (BCC 2016b).

BCC currently monitors Migratory Birds of High Federal Interest opportunistically and on the northern road route during the nesting season. Any observations of Migratory Birds of High Federal Interest are recorded and reported as required in WDEQ-LQD Coal Rules and Regulations, Appendix B.

Table 3-8. Migratory Birds with Potential to Occur in or near the Fish and Wildlife Impact Analysis Area

Common Name	Scientific Name	Season	Potential to Occur in the Wildlife Impact Analysis Area
American bittern	*Botaurus lentiginosus*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Bald eagle	*Haliaeetus leucocephalus*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area. However, there are no bald eagle roosts on or within 1 mile of BCC's existing permit boundary.
Black rosy-finch	*Leucosticte atrata*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Brewer's sparrow	*Spizella breweri*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Burrowing owl	*Athene cunicularia*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Cassin's finch	*Carpodacus cassinii*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Ferruginous hawk	*Buteo regalis*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.

Common Name	Scientific Name	Season	Potential to Occur in the Wildlife Impact Analysis Area
Fox sparrow	*Passerella iliaca*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Golden eagle	*Aquila chrysaetos*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Greater sage-grouse	*Centrocercus urophasianus*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Loggerhead shrike	*Lanius ludovicianus*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Long-billed curlew	*Numenius americanus*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Mountain plover	*Charadrius montanus*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area. However, surveys in the summer and fall of 2000 found very little, if any, suitable mountain plover nesting habitat in BCC's mine permit boundary. Negative habitat indicators predominate. No sightings of mountain plovers have been documented within the permit boundary during 24 years of monitoring. Therefore, no further discussion of this species is included in this EA.
Olive-sided flycatcher	*Contopus cooperi*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Pinyon jay	*Gymnorhinus cyanocephalus*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Sage thrasher	*Oreoscoptes montanus*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Short-eared owl	*Asio flammeus*	Year-round	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Snowy plover	*Charadrius nivosus*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Swainson's hawk	*Buteo swainsoni*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Western grebe	*Aechmophorus occidentalis*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.
Willow flycatcher	*Empidonax traillii*	Breeding	USFWS habitat data indicate that there is potential for this species to occur in the analysis area.

Source: USFWS (2016).

The northern portions of the existing mining operations at the Bridger Mine Complex, Section 12, and a small portion of the northeast corner of Section 24 are within the identified State of Wyoming's Core Population Areas for greater sage-grouse. However, the Wyoming Governor's Sage-Grouse Implementation Team refined the boundaries to remove the existing mine and the adjacent parcels (including Sections 12 and 24) from the Core Population Areas because of the lack of healthy sagebrush habitat within the mining areas that are suitable for sage-grouse (WGFD 2016).

BCC currently conducts intensive sage-grouse strutting surveys each spring to ensure documentation of any future sage-grouse strutting conflicts associated with the mining operations at the Bridger Mine Complex. Lek searches and lek attendance surveys follow methodologies described in WDEQ-LQD Coal Rules and Regulations, Appendix B. Male peak counts and linear distance from each lek to the closest known mine disturbance are reported in an annual report. According to BCC's 2016 Annual Report (BCC 2016b), there are seven active leks within 5 miles of existing mining disturbance. The closest of these leks is the Black Rock Satellite A lek, which is approximately 1.6 miles away from existing mining disturbance. In addition to strutting surveys, BCC works with the WGFD and other state agencies to voluntarily implement stipulations and mitigation practices on a case-by-case basis.

3.5.4. Fish

All of the streams in the fish and wildlife impact analysis area are ephemeral or intermittent streams that are unlikely to support fish populations and no fish populations are present within the fish and wildlife analysis area.

3.6. Geology and Minerals

The impact analysis area for geology and minerals is the 560-acre mining plan modification area. This area was chosen because potential impacts to geology and minerals from the Proposed Action would not extend beyond the surface disturbance related to the proposed mining activities.

3.6.1. Geology

The Jim Bridger coalfield is located on the northeastern flank of the Rock Springs Uplift, a 34-mile-wide by 60-mile-long asymmetrical anticlinal structure that separates the Green River Basin on the west and the Great Divide/Washakie Basins on the east. The coalfield is approximately 15 miles long and 2 miles wide. The coal seams in the Jim Bridger area occur in the lowermost Paleocene Fort Union Formation, in the "Black Rock Coal Groups." The beds generally dip 2 to 5 degrees to the northeast. The entire project area overlies the Fort Union Formation. A stratigraphic column for the mine permit area is shown in Figure 3-5. The *Cumulative Hydrologic Impact Assessment of Coal Mining in the Greater Green River Basin, Southwestern Wyoming* (CHIA; WDEQ-LQD 2014) provides several maps and figures depicting the surface and subsurface geology of the region (see Figures 2, 3, 4, and 5 of the CHIA).

The Rock Springs Uplift has a north-trending major axis. The dip of strata on its flanks is generally between 3 and 15 degrees toward the adjacent structural lows. Precambrian rocks on the apex of the uplift are estimated to be 17,000 feet above the Precambrian rocks in the Green River and Washakie Basins. Normal faults with generally less than 100 feet vertical displacement cut through the Rock Springs Uplift.

The Deadman Coal Zone of the Fort Union Formation is approximately 60 to 80 feet above the contact with the underlying Lance Formation. The Fort Union Formation is approximately 1,500 feet thick in the Jim Bridger area, and the Lance Formation is approximately 900 feet thick.

The surface geology in the project area includes approximately 247 acres of residuum mixed with eolian deposits, 159 acres of residuum mixed with slope wash and eolian deposits, and 153 acres of eolian deposits and residuum with minor bedrock outcrops. The surface geology in the project area is shown on Figure 3-6.

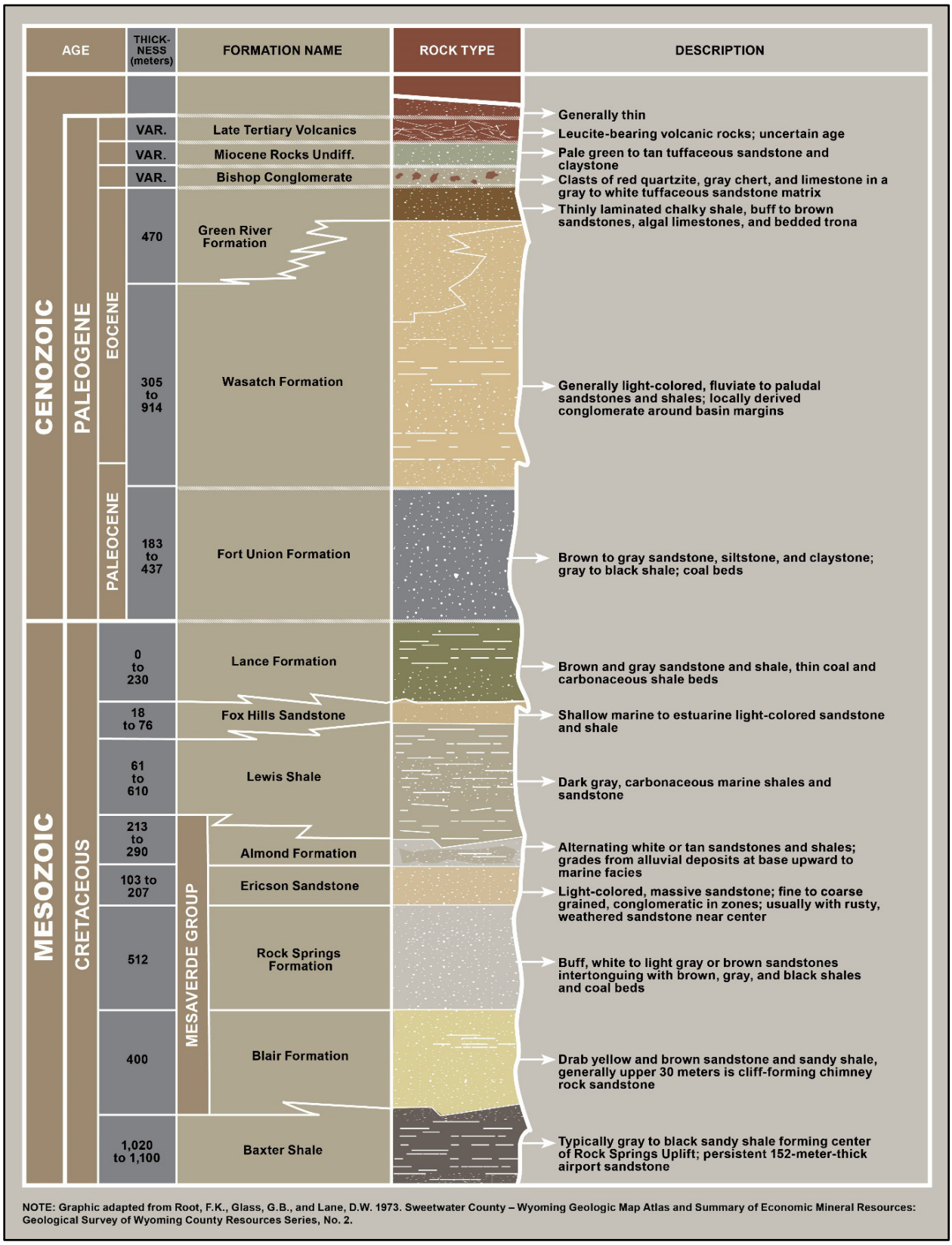

Figure 3-5. Stratigraphic column for the mine permit area.

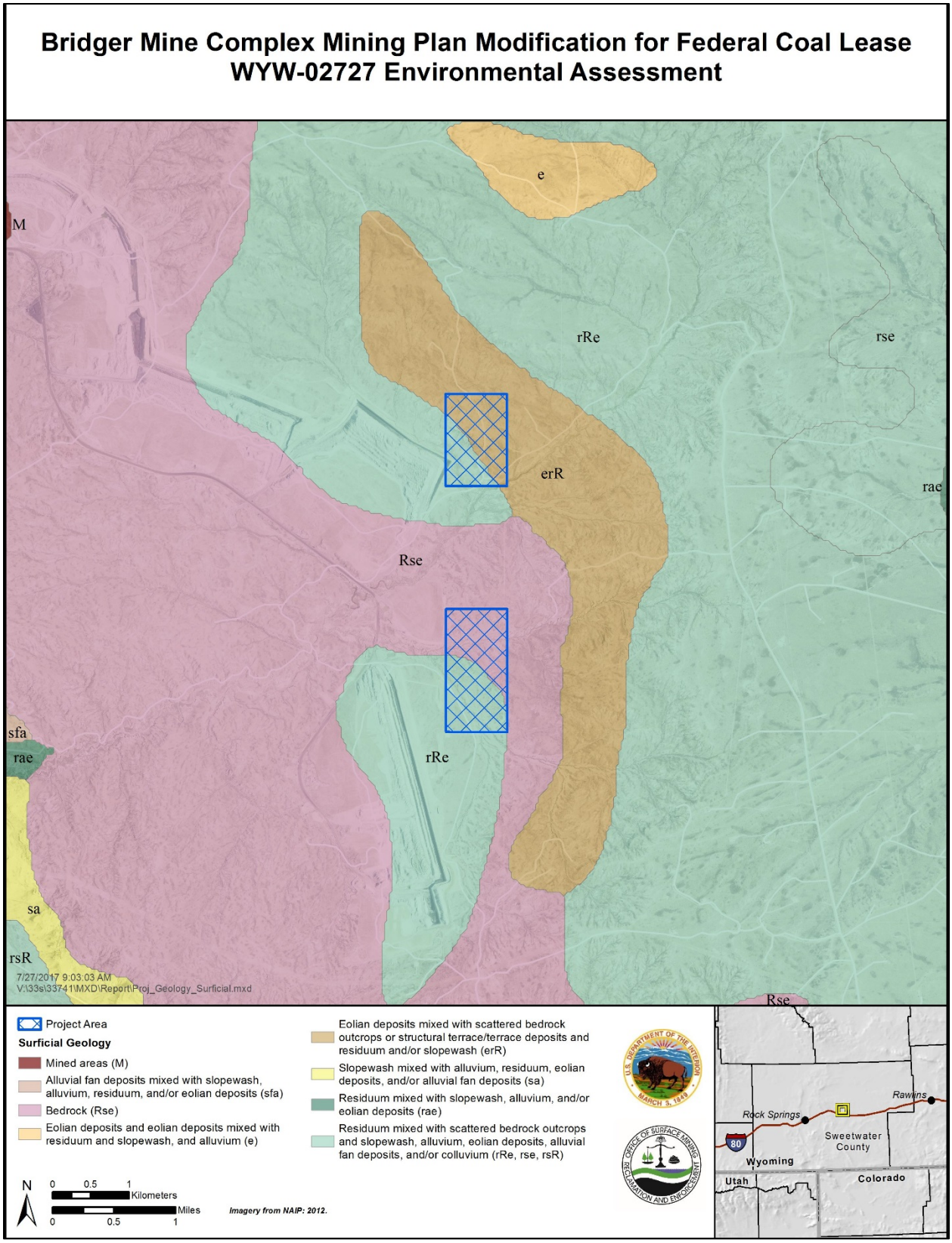

Figure 3-6. Surface geology in the project area.

3.6.1.1. GEOLOGIC HAZARDS

The Jim Bridger coalfield is located in Seismic Zone 1 (Uniform Building Code), an area of low seismic risk and minimal potential for earthquake activity. Faults that are apparently younger than those within the coalfield are located about 40 miles to the north. These high-angle normal faults, named the Continental and Flattop faults, are approximately 25 to 45 miles in length, and were apparently last active in the late Cenozoic period.

3.6.2. Minerals

There are five seams of coal in the Jim Bridger Coal Field within the Deadman Coal Zone. The seams are designated D-5 through D-1, from top to bottom. Coal seam thicknesses vary throughout the field. Average coal thicknesses for the various seams are listed in Table 3-9. In the north-central portion of the mine area, the five seams join together to form a single seam with a maximum thickness of 32 feet. The seams divide into two coal seams (D-5 and D-4 through D-1) toward the northwest and northeast. The single seam divides into two seams (D-5/D-4 and D-3 through D-1) toward the southeast. Further to the southeast, both of these coal seams divide once again, forming a total of four seams (D-5, D-4, D-3, and D-2/D-1) from 2 to 15 feet thick. Coal in the Jim Bridger coalfield is typically ranked in a range from subbituminous A to subbituminous B.

Table 3-9. Average Thickness of Coal Seams in the Jim Bridger Coal Field

Seam	Average Thickness (feet)
D-5	5
D-4	8
D-3	4
D-2	3
D-1	4

The major sedimentary units of the Fort Union Formation in the Bridger Mine Complex permit area are sandstone, siltstone, claystone, and coal. These units interbed and interfinger, forming a complex stratigraphic section that is characteristic of coal-bearing sequences in the western United States. The lithology of stratigraphic sections and the lateral continuity of sedimentary units are quite variable. The proportions and stratigraphic position of sandstone, siltstone, and claystone that form the overburden also differ considerably from one area of the Bridger Mine Complex to another. Often these differences are quite substantial and occur over a distance of only a few feet to several hundred feet.

3.7. Socioeconomics

The analysis area for impacts to socioeconomics is Sweetwater County, Wyoming. This area was chosen because the economic and demographic effects of the Proposed Action would likely be experienced by the surrounding communities in the county. This area is where most of the employees of proposed mining operations on the project area would likely reside or take temporary accommodations. The analysis area is approximately 6,672,640 acres in size (Gardner 2016).

3.7.1. Population

The population of Sweetwater County in 2010 was 43,806 (U.S. Census Bureau 2010a). This is equivalent to a density of 4.2 persons per square mile of land area. Demographic data for 2010 indicates that 47.8% of the population was female and the median age of the total population was 32.8 years (U.S. Census Bureau 2010a). The county's population was estimated to be 44,626 people in 2015, which is an increase of approximately 1.9% (U.S. Census Bureau 2016).

The town of Superior, approximately 17 miles northwest of the project area, had a total population of 336 in 2010 (U.S. Census Bureau 2010b). Superior's population was estimated to be 323 in 2015, which is a decrease of 3.9% (U.S. Census Bureau 2016). The town of Rock Springs, approximately 31 miles southwest of the project area, had a total population of 23,036 in 2010 (U.S. Census Bureau 2010c). Rock Springs' population was estimated to be 23,962 people in 2015, which is an increase of approximately 4.0% (U.S. Census Bureau 2016).

3.7.2. Employment and Income

In 2014, mining, quarrying, and oil and gas extraction was the largest employment sector of the county (6,165 jobs), followed by local government (4,312 jobs), retail trade (2,842 jobs), accommodation and food services (2,420 jobs), construction (2,123 jobs), transportation and warehousing (1,742 jobs), manufacturing (1,497 jobs), health care and social assistance (1,479 jobs), and real estate, rental, and leasing (1,203 jobs) (Bureau of Economic Analysis 2015). According to preliminary data, Sweetwater County had a labor force of 21,549 in July 2016 (Wyoming Department of Workforce Services [WDWS] 2016a). The preliminary unemployment rate for the same month and year in the county was 6.3% (WDWS 2016a). Unemployment rates rose in most counties across the state from July 2015 to July 2016, including Sweetwater County (WDWS 2016a).

The mean household income in Sweetwater County in 2014 was estimated to be $79,437 (U.S. Census Bureau 2014). In 2014, the average annual wage in the mining industry in Wyoming was $68,244 (WDWS 2015a). The average annual wage in Sweetwater County in 2014 was $45,808 (WDWS 2015a).

There are two coal mines in Sweetwater County that provide employment: Black Butte and Leucite Hills (189 employees) and the Bridger Mining Complex (230 employees for surface operations and 236 employees for underground operations) (Wyoming Mining Association 2016).

3.7.3. Housing

During the 2010 census, the 18,735 total housing units in Sweetwater County were 87.9% occupied (U.S. Census Bureau 2010a). The number of housing units was estimated to be 18,938 in 2014, which is an increase of 1.1% (U.S. Census Bureau 2016). The average household size in the 2010 census was 2.62, with 12.1% of the housing units vacant (U.S. Census Bureau 2010a). Of the vacant units, 934 were for rent and 337 were for sale.

In 2010, there were 10,070 housing units in the town of Rock Springs: 8,762 occupied units and 1,308 vacant units. Of the 1,308 vacant units, 667 were for rent and 199 were for sale (U.S. Census Bureau 2010c). In Superior, there were 181 housing units in 2010; 131 occupied units and 50 vacant units. Of the vacant units, six were for rent and six were for sale (U.S. Census Bureau 2010b).

3.7.4. Economy

The mining sector (particularly coal, oil, and natural gas) is a major economic engine of the Wyoming economy, both in direct employment and indirect industries such as transportation, food service, and accommodations. In the first quarter of 2015, mining accounted for 19% of the total payroll in Wyoming (WDWS 2016b). Coal is Wyoming's second-largest source of tax revenue for state and local governments (Wyoming Mining Association 2016).

Wyoming experienced a period of rapid economic growth from the third quarter of 2005 to the fourth quarter of 2008, with wage and employment levels increasing from prior year levels during every quarter. The state entered a downturn in the first quarter of 2009 that ended in the first quarter of 2010, followed by a period of moderate growth from the second quarter of 2010 to the first quarter of 2015. A recent downturn began in 2015, when Wyoming experienced a substantial decline in the price of oil, an extended period of low natural gas prices, and an erosion in the price of coal. As a result, the mining support industry experienced substantially reduced employment and wages (WDWS 2016b).

The average price for Wyoming coal from the Powder River Basin in 2017 fiscal year to date is $10.25 per ton (Wyoming Department of Administration & Information 2017). Production at Sweetwater County coal mines in 2015 consisted of the following (WDWS 2015b):

- Black Butte and Leucite Hills: 2,735,308 tons
- Bridger Mine Complex (surface operation): 2,073,197 tons
- Bridger Mine Complex (underground operation): 3,090,175 tons

Wyoming mineral production taxes are generally categorized as state severance taxes and ad valorem property taxes. Surface coal has a severance tax rate of 7.0% in Wyoming; underground coal has a severance tax rate of 3.75%. For Sweetwater County in 2015, the state assessed value for surface coal was $133,813,693 and the state assessed value for underground coal was $97,291,138 (an assessed value total of $231,104,831 for coal) (Wyoming Department of Revenue 2016). Total ad valorem production tax assessed for all mineral production in Sweetwater County was $1,366,372,044 (Wyoming Department of Revenue 2016).

Coal production on federal lands is subject to royalty payments and disbursements under the MLA. The BLM receives revenues on coal leasing at three points: 1) a bonus paid at the time BLM issues the lease, 2) an annual rental payment of $3.00 per acre or fraction thereof, and 3) royalties paid on the value of the coal after it has been mined. Production royalties have been established by law at 12.5% of the gross value of coal produced. Underground mining has a reduced royalty rate of 8%. Royalties are paid to the U.S. Treasury, and roughly half (49%) are returned to the states where production activity takes place. In Wyoming, money has been used to fund schools, highways, and community colleges. Table 3-10 shows the bonuses, rents, and revenues for coal in Wyoming in 2005, 2010, and 2015.

Table 3-10. Reported Coal Revenues in Wyoming

Revenue Type	Revenue		
	Fiscal Year 2005	Fiscal Year 2010	Fiscal Year 2015
Bonuses	$488,575,149	$96,758,009	$448,080,676
Rents	$544,331	$521,005	$602,482
Royalties	$349,912,519	$598,146,416	$539,904,453

Source: U.S. Department of the Interior, Office of Natural Resources Revenue (2005, 2010, 2015).

3.8. Soils

The analysis area for impacts to soils consists of the project area. This area covers 560 acres and was chosen because it comprises the potential area of surface and subsurface impacts for the Proposed Action.

3.8.1. Soil Mapping Observations

Soil complexes in the analysis area were identified through the Digital General Soil Map of the United States, or STATSGO. There is one soil complex in the analysis area consisting of seven soil series: Wint-Westvaco-Teagulf-Tasselman-Rogrube-Huguston-Haterton. Of the seven soil series, four have official soil series descriptions from the Natural Resources Conservation Service (NRCS) (NRCS 2016a).These four soil series are described below.

- Teagulf series: Moderately deep, well-drained soils formed in modified residuum and slope wash alluvium from calcareous sedimentary rocks. Found on erosional upland plains and alluvial fans. Slopes range from 0% to 8%.
- Rogrube series: Very deep, well-drained soils that formed in loess and residuum derived from gypsiferous shales. Found on plateaus. Slopes range from 1% to 12%.
- Huguston series: Well-drained soils that are shallow and very shallow to soft, calcareous sandstone. Formed in residuum and colluvial slope wash weathered from the underlying sedimentary beds. Found on upland hillslope positions and rock-controlled pediments. Slopes range from 0% to 30%.
- Haterton series: Well-drained soils that are shallow and very shallow to soft, calcareous shale. Formed in residuum and colluvial slope wash weathered from the underlying bedrock. Found on hill and ridge backslopes, shoulders, and summits. Slopes are 0% to 60%.

Soil health is the continued capacity of soil to function as a vital living ecosystem that sustains plants, animals, and humans. Sensitive soils have soil properties that make them more susceptible to degradation with a disturbance. These properties include water erosion hazard, wind erosion hazard, soil drought susceptibility, excess salt, excess sodium, and rooting depth.

Water erodibility indicates soil detachment by runoff and raindrop impact. Some of the most important soil properties that influence rainfall erosion are texture, organic matter content, structure size class, and the saturated hydraulic conductivity of the subsoil (NRCS 2016b). Wind erodibility indicates the susceptibility of soil to blowing or wind erosion. Soil properties that are most important with respect to soil blowing are soil texture class, organic matter content, carbonates in the fine-earth fraction, rock and pararock fragment content, and mineralogy. Soil moisture and the presence of frozen soil also influence soil blowing (NRCS 2016b). Droughty soils are determined through available water capacity measurements. Available water capacity is influenced by soil properties such as particle size; pore size, shape, and distribution; organic matter; type of clay mineral; and structure. Soils with excess salt may interfere with the absorption of water by plants and may also interfere with the exchange capacity of nutrient ions, resulting in nutritional deficiencies in plants. Soils with excess sodium may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure. Rooting depth is the depth to a restrictive layer such as bedrock; shallow soils often provide an unfavorable rooting environment and are prone to erosion (NRCS 2016b).

The inherent risk of soil degradation from disturbance for the single soil complex in the project area is shown in Table 3-11.

Table 3-11. Inherent Risk of Soil Degradation of the Project Area's Wint-Westvaco-Teagulf-Tasselman-Rogrube-Huguston-Haterton Soil Complex

Soil Property	Level of Degradation Risk
Water erosion hazard	Moderate
Wind erosion hazard	Moderate
Drought susceptibility	Moderate
Excess salt	No data available
Excess sodium	Low
Rooting depth	Moderate

In summary, the Wint-Westvaco-Teagulf-Tasselman-Rogrube-Huguston-Haterton soil complex that covers the project area has four properties that moderately increase the risk of soil degradation and erosion—water erosion hazard, wind erosion hazard, droughtiness, and rooting depth.

3.8.2. Baseline Soil Assessment

A baseline soil assessment (soil assessment) was conducted in 2012 on the project area as part of a larger survey of 1,266 acres (plus a 0.5-mile buffer) in the Bridger Mine Complex (BKS Environmental Associates, Inc. [BKS] 2012a). Soils in the 1,266-acre (plus a 0.5-mile buffer) study area are typical of sandy rangeland sites in southwestern Wyoming. Study area soils were classified taxonomically as Typic Torriorthents, Typic Torripsamments, Typic Haplocambids, Typic Torrifluvents, and Ustic Torriorthents (BKS 2012a).

Because of prevailing climate conditions and vegetation, organic matter is accumulated slowly and is confined primarily to the surface horizons, resulting in a light coloration throughout the soil profile. Although some soils in the study area derived in alluvium and residuum from sandstone and shale, others are of eolian origin. Soils are generally sandy loam, loamy sand, loam, or silty loam in texture (BKS 2012a). The soil assessment evaluated the soil's suitability as a plant growth medium and found it to be limited by the physical factor of high sand texture and the chemical factors of pH, electrical conductivity (excess salt), sodium adsorption ratio (excess sodium), selenium, and calcium carbonate. Marginal material was found in six of the 17 sampled profiled and unsuitable material was found in three of the 17 sampled profiles. The recommended weighted average topsoil salvage depth over the entire study area was determined to be 0.90 feet. The soil assessment also noted that the wind and water erosion hazard across the study area varied from negligible to severe. Based on the generally sandy loam to loamy sand texture of the surface horizons throughout most of the study area, soils are somewhat more susceptible to erosion from wind than water (BKS 2012a). Soils vary in depth to paralithic material, from 10 to 12 inches (represented by shallow soil series such as Horsley and Huguston), to as deep as 36 to 60 inches (represented by soil series such as Thayer and Sagecreek) (BKS 2012a).

The soil assessment confirmed the presence of the Haterton, Huguston, Tasselman, and Wint soil series in or near the project area, as described in Section 3.8.1. The Westvaco, Teagulf, and Rogrube series were not identified (BKS 2012a). Soil map units identified by the soil assessment in Section 12 are Boltus clay and clay loam; Boltus-Horsley Rock Outcrop complex; Corlett fine sand; Disturbed Land; Haterton sandy loam; Horsley-Boltus-Rock Outcrop complex; Horsley loam and sandy clay loam; Horsley-Rock Outcrop complex; Huguston sandy loam; Kandaly loamy sand and fine sand; Laney loam; Laney loam, saline phase; Leckman sandy loam; Slickspots Type; Terada-Huguston-Rock Outcrop complex; Terada sandy loam; Thayer sandy loam; Wint channery sandy loam; and Wint-Horsley-Rock Outcrop complex (BKS 2012a).

Soil map units identified by the soil assessment in Section 24 are Boltus-Horsley Rock Outcrop complex; Dines-Laney loam association, Overflow phase; Haterton sandy loam; Horsley-Boltus Rock Outcrop complex; Horsley loam and sandy clay loam; Huguston sandy loam; Kandaly loamy sand and fine sand; Laney loam; Laney loam, saline phase; Leckman sandy loam; Rock Outcrop; Slickspots Type; Terada-Huguston-Rock Outcrop complex; Sagecreek loam; Terada sandy loam; Thayer sandy loam; Wint channery sandy loam; and Wint-Horlsey-Rock Outcrop complex (BKS 2012a). Approximate salvage depths of each map unit series range from 0 to 5 feet (BKS 2012a). Individual soil unit descriptions and soil laboratory analyses can be found in the soil assessment. Quantities (acreages) of soil map units in the project area were not provided in the soil assessment. No prime farmland is present in the project area (BKS 2012a). No alluvial valley floors are present in the project area; the subirrigated alluvial deposits are limited in area, have poor soil and water quality, and are of no value for agricultural development beyond grazing (BCC 2016a).

3.9. Topography and Physiography

The impact analysis area for topography and physiography is the 560-acre mining plan modification area. This area was chosen because the potential effects to topography and physiography would not extend beyond the footprint of proposed surface disturbance. The terrain at the Bridger Mine Complex varies from a series of gently sloping, flat-topped bluffs and moderate to steep-sided ridges to broad, gently sloped valleys. The latter terrain occurs over a length of 2 to 3 miles at each end of the permit area, which covers the mining plan modification area. Bluffs and ridges are capped by erosion-resistant, moderately to strongly indurated sandstone. The slopes between successive bluffs consist of less resistant shale and weakly indurated sandstone and siltstone. Elevations range from approximately 6,800 to 7,100 feet.

3.10. Vegetation

The impact analysis area for vegetation resources is the project area. This area covers 560 acres and was chosen because it comprises the potential area of surface and subsurface impacts for the Proposed Action.

3.10.1. Land Cover Mapping Observations

Vegetation communities in the project area were identified and described using data from the USGS National Gap Analysis Program (GAP). Land cover types or ecological systems are defined as recurring groups of biological communities found in similar physical environments and influenced by similar ecological process (USGS 2011). Ecological systems descriptions and acres are derived from the GAP descriptions (NatureServe 2015) and GAP geographic information system (GIS) data (USGS 2011), respectively. Seven ecological systems were identified in the impact analysis area. Table 3-12 lists the ecological systems in the vegetation impact analysis area.

Table 3-12. Ecological Systems in the Vegetation Analysis Area

Ecological System	Acres in Analysis Area
Inter-Mountain Basins Active and Stabilized Dune	11.0
Inter-Mountain Basins Big Sagebrush Shrubland	374.0
Inter-Mountain Basins Greasewood Flat	0.3
Inter-Mountain Basins Mat Saltbush Shrubland	1.8
Inter-Mountain Basins Mixed Salt Desert Scrub	128.3
Inter-Mountain Basins Shale Badland	0.3
Western Great Plains Riparian Woodland and Shrubland	43.7
Total	**559.4**

3.10.1.1. INTER-MOUNTAIN BASINS ACTIVE AND STABILIZED DUNE

The Inter-Mountain Basins Active and Stabilized Dune ecological system covers approximately 2% of the analysis area. This ecological system occurs on plains, valleys, and basins in the Intermountain western United States. It is often composed of a mosaic of migrating dunes, anchored dunes, stabilized dunes, and bare dunes with sparse to moderately dense vegetation. Vegetation may be composed of Indian ricegrass (*Achnatherum hymenoides*), needle and thread grass (*Hesperostipa comata*), yellow wildrye (*Leymus flavescens*), alkali sacaton (*Sporobolus airoides*), sandhill muhly (*Muhlenbergia pungens*), blowout grass (*Redfieldia flexuosa*), lemon scurfpea (*Psoralidium lanceolatum*), joint-fir species (*Ephedra* spp.), sand sagebrush (*Artemisia filifolia*), big sagebrush (*Artemisia tridentata* var. *tridentata*), fourwing saltbush (*Atriplex canescens*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), blackbrush (*Coleogyne ramosissima*), rubber rabbitbrush (*Ericameria nauseosa*), antelope bitterbrush (*Purshia tridentata*), greasewood (*Sarcobatus vermiculatus*), and fourpart horsebrush (*Tetradymia tetrameres*).

3.10.1.2. INTER-MOUNTAIN BASINS BIG SAGEBRUSH SHRUBLAND

The Inter-Mountain Basins Big Sagebrush Shrubland ecological system covers approximately 66.9% of the analysis area. This ecological system typically occurs in broad basins between foothills, plains, and mountain ranges between 2,600 and 8,200 feet in elevation. This ecological system is dominated by Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*) and/or big sagebrush (*Artemisia tridentata* var. *tridentata*). Disturbed stands may be co-dominated by yellow rabbitbrush (*Chrysothamnus viscidiflorus*), rubber rabbitbrush (*Ericameria nauseosa*), antelope bitterbrush (*Purshia tridentata*), or mountain snowberry (*Symphoricarpos oreophilus*). Common grass species may include Indian ricegrass (*Achnatherum hymenoides*), needle and thread grass (*Hesperostipa comata*), blue grama (*Bouteloua gracilis*), thickspike wheatgrass (*Elymus lanceolatus*), basin wildrye (*Leymus cinereus*), James' galleta (*Pleuraphis jamesii*), western wheatgrass (*Pascopyrum smithii*), or Sandberg bluegrass (*Poa secunda*).

3.10.1.3. INTER-MOUNTAIN BASINS GREASEWOOD FLAT

The Inter-Mountain Basins Greasewood Flat ecological system covers approximately 0.05% of the analysis area. This ecological system typically occurs near drainages on stream terraces. Soils are typically saline and sites usually have a shallow water table and flood intermittently. This ecological system typically occurs as a mosaic of multiple communities with open to moderately dense shrublands dominated or co-dominated by greasewood (*Sarcobatus vermiculatus*). Common shrubs present include fourwing saltbush (*Atriplex canescens*), shadscale saltbush (*A. confertifolia*), Gardner's saltbush (*A. gardneri*), Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*), big sagebrush (*Artemisia tridentata* var. *tridentata*), silver sagebrush (*Artemisia cana* var. *cana*), or winterfat (*Krascheninnikovia lanata*).

3.10.1.4. INTER-MOUNTAIN BASIN MAT SALTBUSH SHRUBLAND

The Inter-Mountain Basins Mat Saltbush Shrubland ecological system covers approximately 0.3% of the analysis area. This ecological system on rolling plains, wind-swept basins, and gentle slopes, and supports dwarf shrublands. These shrublands are dominated by saltbush species, typically Gardner's saltbush (*Atriplex gardneri*) and/or mat saltbush (*Atriplex corrugata*). Other dominant or co-dominant dwarf shrubs may include longleaf wormwood (*Artemisia longifolia*), birdfoot sagebrush (*Artemisia pedatifida*), or bud sagebrush (*Picrothamnus desertorum*). The herbaceous layer is typically sparse and consists of perennial forbs and perennial grasses.

3.10.1.5. INTER-MOUNTAIN BASINS MIXED SALT DESERT SCRUB

The Inter-Mountain Basins Mixed Salt Desert Scrub ecological system covers approximately 22.9% of the analysis area. This ecological system includes open-canopied shrublands found in saline basins, plains, and alluvial slopes. Vegetation is typically open to moderately dense and composed of one or more saltbush species, such as fourwing saltbush (*Atriplex canescens*), shadscale saltbush (*A. confertifolia*), cattle saltbush (*A. polycarpa*), or spinescale saltbush (*A. spinifera*). Other dominant or co-dominant shrubs include Wyoming big sagebrush (*Artemisia tridentata* var. *wyomingensis*), yellow rabbitbrush (*Chrysothamnus viscidiflorus*), rubber rabbitbrush (*Ericameria nauseosa*), winterfat (*Krascheninnikovia lanata*), bud sagebrush (*Picrothamnus desertorum*), Nevada jointfir (*Ephedra nevadensis*), spiny hopsage (*Grayia spinosa*), or horsebrush species (*Tetradymia* spp.). The herbaceous layer varies from sparse to moderately dense and is dominated by perennial grass species.

3.10.1.6. INTER-MOUNTAIN BASINS SHALE BADLAND

The Inter-Mountain Basins Shale Badland ecological system covers approximately 0.05% of the analysis area. This ecological system is composed of barren and sparsely vegetated substrates typically derived from shales, marine shales, mudstones, and siltstones. Vegetation is sparse and is dominated by dwarf shrubs and herbaceous vegetation.

3.10.1.7. WESTERN GREAT PLAINS RIPARIAN WOODLAND AND SHRUBLAND

The Western Great Plains Riparian Woodland and Shrubland ecological system covers approximately 7.8% of the analysis area. This ecological system is found in the riparian areas of small and medium-sized rivers and streams on alluvial soils in highly variable landscape settings throughout the western Great Plains. Vegetation communities in this ecological system are dominated by willow species (*Salix* spp.), eastern cottonwood (*Populus deltoides*), silver sagebrush (*Artemisia cana* var. *cana*), western wheatgrass (*Pascopyrum smithii*), and sand dropseed (*Sporobolus cryptandrus*). This ecological system can be heavily degraded through livestock grazing and agriculture. Invasive species such as saltcedar (*Tamarix* spp.) and weedy grasses and forbs typically occur if this system becomes degraded.

3.10.2. Baseline Vegetation Assessment

A baseline vegetation assessment (vegetation assessment) was conducted in 2012 on the project area as part of a larger survey of 1,266 acres in the Bridger Mine Complex (BKS 2012b). The baseline vegetation inventories were used to delineate range sites and vegetation resources within the mining plan modification area.

Vegetation mapping was conducted within both the mining plan modification area and a 0.5-mile buffer, whereas vegetation sampling for vegetative cover and shrub density was only conducted within the mining plan modification area and not within the 0.5-mile buffer. Range site mapping performed in 2012 included areas that had not previously been mapped and modified range sites that had changed since the original mapping in 1979. Mapping was performed using an aerial photograph with the original mapping as the base map. Range sites were mapped using soil texture, soil depth, and dominant vegetation. The range sites outlined on the base maps were verified in the field during field sampling. Sampling procedures were designed according to the WDEQ Land Quality Division S-1 Rules Package. Vegetation cover data were collected using point intercept transects and the Daubenmire quadrate method, and percent absolute cover and total vegetation cover were calculated. Surveys were conducted for threatened and endangered plant species as well as for BLM Rock Springs Field Office Sensitive Plant Species. Noxious weeds and Sweetwater County–declared weeds were noted if observed within the mining plan modification area (BKS 2012b).

Quantitative analyses were performed for six range sites located within the mining plan modification area: Saline Upland, Saline Lowland, Sands, Shallow Loamy, Loamy, and Saline Sub-irrigated. Shallow Loamy and Loamy were sampled together but mapped separately. Range sites identified by the vegetation assessment in Section 12 are Sands, Shallow Loamy, Saline Upland, Saline Lowland, and Saline Sub-irrigated (BKS 2012b). Range sites identified by the vegetation assessment in Section 24 are Shallow Loamy, Saline Upland, Saline Lowland, and Loamy (BKS 2012b). Quantitative analyses of vegetation cover and species inventory data specifically for the project area were not provided in the vegetation assessment. Tables 3-13 through 3-15 summarize the results of the vegetation assessment analyses.

Table 3-13. Mining Plan Modification Area Absolute Vegetation by Lifeform for Each Range Site

	Annual Grasses	Cool Season Perennial Grasses*	Annual Forbs	Perennial Forbs	Sub-Shrubs	Shrubs
Saline Upland	0	13.1	0	0.5	5.3	10.2
Shallow Loamy-Loamy	1.0	7.9	0.5	4.2	0.85	11.8
Saline Lowland	0	12.4	0	0.1	1.0	15.6
Sands	0.05	8.3	0.15	0.9	2.6	15.1
Saline Sub-irrigated	0	63*	0.3	2.7	0	0

Source: BKS (2012b).

* In the Saline Sub-irrigated range site there was only 3% Cool Season Perennial Grass cover and the remainder was grass-like species.

Table 3-14. Mining Plan Modification Area Relative Cover by Lifeform

	Annual Grasses	Cool Season Perennial Grasses	Annual Forbs	Perennial Forbs	Sub-Shrubs	Shrubs
Saline Upland	0%	45.0%	0%	1.7%	18.2%	35.05%
Shallow Loamy-Loamy	3.8%	30.1%	1.9%	16.0%	3.2%	44.95%
Saline Lowland	0%	42.6%	0%	0.3%	3.4%	53.6%
Sands	0.18%	30.6%	0.55%	3.3%	9.6%	55.7%
Saline Sub-irrigated	0%	95.45%	0.5%	4.05%	0%	0%

Source: BKS (2012b).

* In the Saline Sub-irrigated range site there was only 3% Cool Season Perennial Grass cover and the remainder was grass-like species.

Table 3-15. Mining Plan Modification Area Shrub Density by Range Site

	Shrub (number per m^2)	Shrub (number per acre)	Sub-shrub (number per m^2)	Sub-shrub (number per acre)	Total Density (number per m^2)	Total Density (number per acre)
Saline Upland	0.6	2,274.4	3.3	13,452.2	3.9	15,726.6
Shallow Loamy-Loamy	1.6	6,523.8	0.7	2,751.9	2.3	9,275.7
Saline Lowland	1.9	7,794.5	0.6	2,622.5	2.6	10,417.0
Sands	1.4	5,722.5	0.4	1,756.4	1.8	7,478.9

Source: BKS (2012b)

Note: No shrubs were surveyed in the Saline Sub-irrigated community

Plant species diversity varied among range sites. The Sands range site had the greatest species diversity at 40 species for the combined qualitative and quantitative data and a species richness of 5.1 species per plot. Saline Sub-irrigated had the lowest species diversity at eight species. Saline Upland, Shallow Loamy-Loamy, and Saline Lowland had similar species richness calculations to Sands, ranging between 4.2 and 4.3 (BKS 2012b).

Habitat and species surveys were conducted for two federally listed plant species with potential to occur within the mining plan modification area: Ute ladies'-tresses (*Spiranthes diluvialis*) and blowout penstemon (*Penstemon haydenii*). No plants or suitable habitats were observed in the mining plan modification area for either species. Suitable habitats for BLM Rock Springs Field Office Sensitive Plant Species were not identified during field surveys (BKS 2012b).

3.10.3. Invasive Species and Noxious Weeds

A weed is any undesirable plant species, but weed species may be classified as non-native or introduced, or they may be formally designated by federal, state, or other entities as invasive or noxious. Federal and state agencies maintain lists of noxious weed species that must be controlled, as required by federal and state laws and regulations. Generally, federal weed laws and regulations target unwanted plant introductions, whereas state laws and regulations are aimed at the control and removal of noxious weeds.

The Wyoming Weed and Pest Council (WWPC) defines *noxious weeds* as "the weeds, seeds or other plant parts that are considered detrimental, destructive, injurious or poisonous, either by virtue of their direct effect or as carriers of diseases or parasites that exist within this state" (WWPC 2013). If a plant is listed as a Wyoming designated noxious weed, that listing provides statewide legal authority to regulate and manage it. Wyoming Statute 11-5-102 (a)(xi) designated noxious weeds are listed in Table 3-16.

Table 3-16. Wyoming Designated Noxious Weeds

Scientific Name	Common Name
Agropyron repens	Quackgrass
Arctium minus	Common burdock
Cardaria draba, C. pubescens	Hoary cress
Carduus acanthoides	Plumeless thistle
Carduus nutans	Musk thistle
Centaurea diffusa	Diffuse knapweed
Centaurea maculosa	Spotted knapweed
Centaurea repens	Russian knapweed

Scientific Name	Common Name
Chrysanthemum leucanthemum	Ox-eye daisy
Cirsium arvense	Canada thistle
Convolvulus arvensis	Field bindweed
Cynoglossum officinale	Houndstongue
Elaeagnus angustifolia	Russian olive
Euphorbia esula	Leafy spurge
Franseria discolor	Skeletonleaf bursage
Hyoscyamus niger	Black henbane
Hypericum perforatum	Common St. Johnswort
Isatis tinctoria	Dyers woad
Lepidium latifolium	Perennial pepperweed
Linaria dalmatica	Dalmatian toadflax
Linaria vulgaris	Yellow toadflax
Lythrum salicaria	Purple loosestrife
Onopordum acanthium	Scotch thistle
Sonchus arvensis	Perennial sowthistle
Tamarix species	Saltcedar
Tanacetum vulgare	Common tansy

Source: WWPC (2016).

In addition to noxious weed status, Wyoming Statute 11-5-102(a)(viii) recognizes county-level *declared weeds*, defined as "any plant which the board and the Wyoming weed and pest council have found, either by virtue of its direct effect, or as a carrier of disease or parasites, to be detrimental to the general welfare of persons residing within a district" (WWPC 2015). The current list of declared weed species for Sweetwater County, Wyoming, is provided as Table 3-17.

Table 3-17. Sweetwater County Declared Weed Species

Scientific Name	Common Name
Asclepias speciose Torr.	Showy milkweed
Cirsium vlulgare (Savi) Ten.	Bull thistle
Galium verum	Lady's bedstraw
Glycyrrhiza lepidota	Wild licorice
Grindelia squarrosa (Pursh) Dunal	Curlycup gumweed
Hordeum jubatum	Foxtail barley
Phragmites australis	Common reed
Rumex crispus L.	Curly dock
Thermopsis montana	Mountain thermopsis

Source: WWPC (2017)

BKS conducted a baseline vegetation assessment of a 1,266-acre study area in 2012. No noxious weed species designated by the State of Wyoming were noted during the surveys; however, one Sweetwater County declared weed, foxtail barley (*Hordeum jubatum*), was observed in the mining plan modification area. The vegetation baseline assessment states that the foxtail barley had a low occurrence frequency with a limited contribution to vegetative cover (BKS 2012b).

3.11. Water Resources

3.11.1. Surface Water Resources

The impact analysis area for surface water resources (Figure 3-7) is the boundary of the Lower Deadman Wash Hydrologic Unit Code (HUC) 12 watershed (33,990 acres). This area was chosen because it provides a logical topographical boundary for the surface water resources that could be potentially affected by the proposed mining activities in the mining plan modification area. The Deadman Wash watershed drains most of the Bridger Mine Complex. Deadman Wash is the major tributary to Bitter Creek, which is a major tributary of the Green River. All of the watersheds and associated channels traversing the mine permit area are ephemeral and typically exhibit flow only as a result of rainfall or snowmelt.

Unnamed ephemeral tributaries to Black Rock Creek and the Continental Divide Basin Drainage in the Great Divide Basin occur in the northern portion of the Bridger Mine Complex permit area, as well as a portion of the mining plan modification area. There are approximately 1 acre of intermittent lake/pond, 0.5 acre of perennial lake/pond, and 0.4 acre of reservoir in the surface water impact analysis area.

3.11.1.1. SURFACE WATER QUANTITY

All native stream channels within both the surface and underground mine areas of the Bridger Mine Complex permit area are ephemeral in nature and flow only in response to precipitation or snowmelt. Major native channels include Deadman Wash and its tributaries, which are Tenmile Draw, Nine-Mile Draw, and Nine and One-Half Mile Draw. Collectively, these channels provide drainage for over 83 square miles of lands surrounding the Bridger Mine Complex on the west side of the Continental Divide. Flow data from water monitoring stations show that runoff varies dramatically from year to year and is highly dependent on the occurrence of summer storm events. Without summer rainfall, there are long periods of no flow recorded at each station, sometimes over the course of the entire monitoring season (typically May through September). The disturbed Ninemile Wash watershed has the most frequent flows, with flow occurring roughly 3% of the time. The Deadman Wash Tributary, the smallest watershed monitored, has the most infrequent flows, as flow occurs less than 1% of the time. On the mainstem of Deadman Wash, flow is more frequent across a range of flow values at the downstream station, compared to the station that drains an undisturbed area above the mining pits.

On Tenmile Draw, flow has occurred 2.5% of the time at the water monitoring station downstream of mining disturbance and 1.4% of the time at the water monitoring station at the upstream permit boundary. However, flow at the upstream permit boundary was more frequent across a range of flows.

Surface water rights in the Deadman Wash watershed are entirely held by the Jim Bridger Power Plant, the Leucite Hills Mine, and the Bridger Mine Complex. Surface water rights are mostly held for industrial purposes such as sediment control, flood control, and facilities.

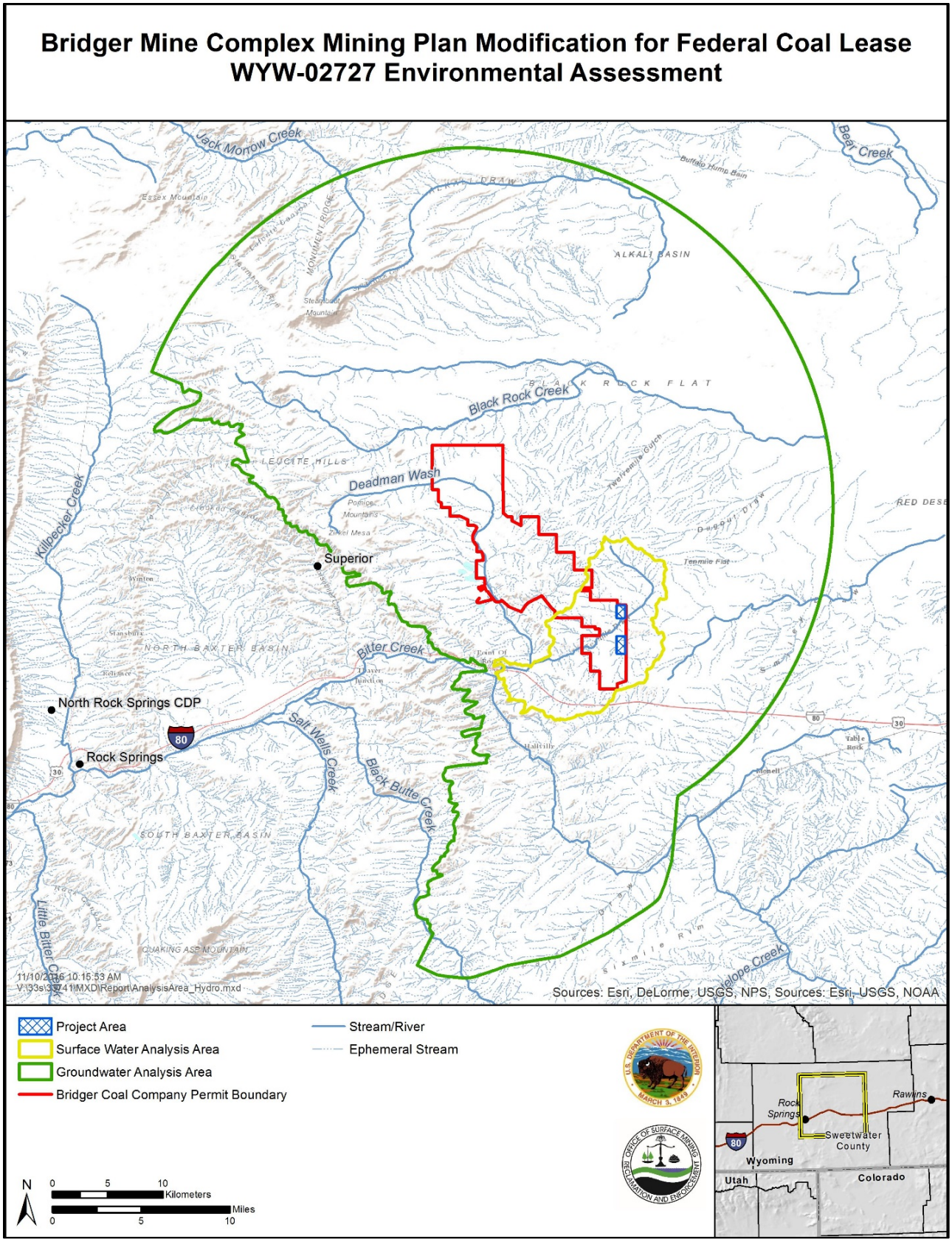

Figure 3-7. Surface water and groundwater impact analysis areas.

3.11.1.2. SURFACE WATER QUALITY

Prior to the Bridger Mine Complex's original mine permit, collected surface water quality data showed that total suspended solids (TSS) was the only water quality monitoring parameter (WDEQ-LQD 2014). The TSS was consistently high, and was, therefore, of concern to instream water quality. In addition to analyzing for TSS in every sampled flow event at the monitoring stations, BCC also analyzes collected surface-water chemical quality biannually at monitoring stations for the following parameters: pH, electrical conductivity, total dissolved solids (TDS), boron, fluoride, ammonia-nitrogen, sodium adsorption ratio, total alkalinity, total hardness, silica, turbidity, bicarbonate, carbonate, hydroxide, chloride, nitrate and nitrite, sulfate, calcium, magnesium, potassium, sodium, aluminum, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, zinc, and cation-anion balance (WDEQ-LQD 2014).

The Wyoming Department of Environmental Quality Water Quality Division (WDEQ-WQD) has two different surface water classifications for Deadman Wash. Upstream of the Jim Bridger Power Plant, Deadman Wash is classified as Class 3B water. Class 3B waters are intermittent or ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life, including invertebrates, amphibians, or other flora and fauna which inhabit water of the state at some stage of their life cycles. Supported uses include aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value. Class 3B waters need to meet acute and chronic water quality standards for aquatic life other than fish. The WDEQ-WQD numeric standards for selected constituents for Class 3B surface waters are in Table 3-18.

Downstream of the Jim Bridger Power Plant, Deadman Wash is classified as Class 2AB (ww) water. The change in classification is presumably because of the flow contributed from the surge pond at the power plant that the WDEQ-WQD deems sufficient to support drinking water and fish. Class 2AB waters support game-fish populations or spawning and nursery areas at least seasonally. Class 2AB waters are also presumed to have sufficient water quality and quantity to support drinking water supplies. Supported uses include drinking water, game fish, nongame fish, fish consumption, other aquatic life, recreation, wildlife, agriculture, industry, and scenic value. The "ww" notation indicates a predominance of warm-water species present. The WDEQ-WQD numeric standards for selected constituents for Class 2AB surface waters are in Table 3-18.

The WDEQ-WQD has classified Ninemile Wash, Nine and One-Half Mile Wash, and Tenmile Draw as Class 3B water. All other unnamed ephemeral tributaries to Deadman Wash would also be classified as Class 3B under the unlisted waters guidance of Chapter 1 of the WDEQ-WQD Rules and Regulations (WDEQ-WQD 2013).

Table 3-18. Wyoming Department of Environmental Quality Water Quality Division Numeric Standards for Class 2AB(ww), Class 2C, and Class 3B Surface Waters

Constituent	Units	Class 2AB(ww)	Class 2C	Class 3B	Class 3B	Class 3B
		Deadman Wash Below Jim Bridger Power Plant	Bitter Creek	Deadman Wash Above Jim Bridger Power Plant	Tenmile Draw	Ninemile Wash and Other Class 3B Streams in Impact Analysis Area
Aluminum (dissolved)	mg/L	0.75	0.75	0.75	0.75	0.75
Ammonia (NH_3 as N) (total)	mg/L	0.92	0.95	N/A	N/A	N/A
Arsenic	mg/L	0.01	0.01	0.15	0.15	0.15

Constituent	Units	Class 2AB(ww)	Class 2C	Class 3B	Class 3B	Class 3B
		Deadman Wash Below Jim Bridger Power Plant	Bitter Creek	Deadman Wash Above Jim Bridger Power Plant	Tenmile Draw	Ninemile Wash and Other Class 3B Streams in Impact Analysis Area
Barium (total)	mg/L	2	N/A	N/A	N/A	N/A
Cadmium (dissolved)	mg/L	0.0006	0.0004	0.0004	0.0003	0.0006
Chloride (total)	mg/L	230	230	N/A	N/A	N/A
Chromium (III)	mg/L	0.1	0.136	0.136	0.087	0.231
Copper (dissolved)	mg/L	0.029	0.017	0.017	0.011	0.029
Dissolved oxygen	mg/L	>3	>3	N/A	N/A	N/A
Iron (dissolved)	mg/L	0.3	1	1	1	1
Lead (dissolved)	mg/L	0.011	0.005	0.005	0.002	0.011
Manganese (dissolved)	mg/L	0.050	2.188	2.188	1.621	3.105
Mercury	µg/L	0.05	0.051	0.77	0.77	0.77
Nickel	mg/L	0.169	0.098	0.098	0.061	0.169
Nitrate + Nitrite as N (total)	mg/L	10	N/A	N/A	N/A	N/A
pH	SU	6.5–9.0	6.5–9.0	6.5–9.0	6.5–9.0	6.5–9.0
Selenium (dissolved)	mg/L	0.0046	0.0046	0.0046	0.0046	0.0046
Temperature	°C	<30	<30	N/A	N/A	N/A
Turbidity	NTU	<15	<15	N/A	N/A	N/A
Zinc (dissolved)	mg/L	0.388	0.225	0.225	0.141	0.388

Note: µg/L = micrograms per liter; mg/L = milligrams per liter; NTU = nephelometric turbidity unit; SU = standard unit; °C = degrees Celsius; N/A = not applicable.

Between 1996 and 2011, on Tenmile Draw, approximately 22 samples were collected upstream of mining and approximately 18 samples were collected downstream of mining (WDEQ-LQD 2014). Sodium chloride was the dominant water type at both upstream and downstream monitoring stations, occurring in 41% and 61% of the samples, respectively. TDS ranged from 118 to 5,040 milligrams per liter (mg/L) at the upstream station between 1996 and 2011, with a median of 1,450 mg/L. TDS was lower at the downstream station, ranging from 168 to 2,260 mg/L, with a median of 960 mg/L. TSS concentrations in the Deadman Wash drainage were highly variable, ranging from <5 to 121,000 mg/L at the upstream station, with a median of 2,900 mg/L. TSS concentrations at the downstream station ranged from 20 to 308,000 mg/L, with a median of 12,600 mg/L. Only one pH sample was reported at either station, and the value (9.09) at the upstream station slightly exceeded WDEQ-WQD Class 3B standards.

Dissolved metal concentrations at both stations on Tenmile Draw were mostly low over the 1997–2011 period, with numerous values below detection limits (WDEQ-LQD 2014). The maximum concentrations of aluminum (4.7 mg/L), copper (0.2 mg/L), iron (2.63 mg/L), and selenium (0.007 mg/L) at the upstream station exceeded WDEQ-WQD Class 3B water quality standards. Between 1996 and 2011, the maximum concentrations of aluminum (3.5 mg/L), copper (0.04 mg/L), iron (1.38 mg/L), and selenium (0.025

mg/L) at the downstream station also exceeded Class 3B standards. Between 2001 and 2012, periodic selenium exceedances were seen at both the upstream and downstream stations. Because exceedances occasionally occur at the upstream station, natural sources of selenium appear to exist in the Tenmile Draw watershed.

Between 1996 and 2012, approximately 30 samples were collected on Ninemile Wash. Magnesium chloride was the dominant water type, occurring in 38% of the samples (WDEQ-LQD 2014). TDS ranged from 118 to 5,040 mg/L between 1996 and 2012, with a median of 1,450 mg/L. TSS concentrations were highly variable between 1996 and 2012. The TSS from 472 samples ranged from 34 to 112,000 mg/L, with a median of 7,200 mg/L. The maximum concentrations of aluminum (11.9 mg/L), cadmium (0.002 mg/L), copper (0.06 mg/L), iron (7.33 mg/L), lead (0.04 mg/L), and selenium (0.072 mg/L) exceeded WDEQ-WQD Class 3B standards. These constituents have also shown periodic exceedances at other stations in the Deadman Wash drainage. However, the dissolved metal data indicate that Ninemile Wash may have the poorest water quality among the Deadman Wash tributaries near the Bridger Mine Complex, as metal concentrations are often the highest.

Between 1996 and 2012, approximately 22 samples were collected upstream of mining on Deadman Wash, and approximately 24 samples were collected downstream of mining (WDEQ-LQD 2014). Calcium bicarbonate was the dominant water type at the upstream station, occurring in 63% of the samples. The water type was more variable at the downstream station. Magnesium chloride occurred in 24% of the samples, whereas calcium bicarbonate and calcium sulfate each occurred in 21% of the samples. TDS ranged from 60 to 868 mg/L at the upstream station from 1996 to 2012, with a median of 295 mg/L. The TDS at the downstream station was much higher during this period, ranging from 118 to 4,730 mg/L, with a median of 1,470 mg/L. TSS concentrations at the upstream station ranged from 50 to 25,600 mg/L (from 80 samples), with a median of 5,410 mg/L. TSS concentrations at the downstream station ranged from 40 to 125,000 mg/L (from 418 samples), with a median of 10,600 mg/L.

Dissolved metal concentrations at both the upstream and downstream stations on Deadman Wash were mostly low between 1996 and 2012, with numerous values below detection limits (WDEQ-LQD 2014). The maximum concentrations of aluminum (6.0 mg/L), copper (0.02 mg/L), iron (2.96 mg/L), and selenium (0.006 mg/L) at the upstream station exceeded Class 3B water quality standards. The maximum concentrations of aluminum (30.7 mg/L), iron (9.44 mg/L), and selenium (0.075 mg/L) at the downstream station also exceeded Class 3B standards.

WDEQ classifies this section of Bitter Creek as 2C, which requires that the aquatic life standards of less than 1.4 ppb and a chronic value of less than 0.77 ppb of mercury are met. Periodic monitoring of mercury concentrations in surface water at monitoring sites SBC1-75 and SBC2-75 has occurred since 1976. As of May 2015, a total of 38 and 35 water samples have been analyzed respectively. With the exception of three detections in the single digit ppb range, no other detections of mercury have occurred (BBCC 2015). Monitoring site SBC1-75 read 7 ppb in December 1978 and 1 ppb in September 1982. Between these two isolated detections, nine water samples from SCR1-75 were taken and tested. None of these samples showed detectable levels of mercury. Monitoring site SBC2-75 read 1 ppb in June 1982. Previous and subsequent samples at this location did not show results above the levels of detection.

All water sample tests from these monitoring sites since 1982 have registered no mercury above the level of detection. Water from SBC1-75 has been analyzed 23 times since 1982, and SBC2-75 has been sampled 20 times since 1982, the last of which for both sites was May 5, 2015 (BBCC 2015). The three mercury reading exceptions occurred prior March 2014, which was when Jim Bridger Power Plant was issued the permits to install mercury controls.

3.11.2. Groundwater Resources

The impact analysis area for groundwater resources is the boundary of assessment that the CHIA used for mine permitting (673,297 acres) (see Figure 3-7) (WDEQ-LQD 2014). This area was chosen because it covers the groundwater resources that could be potentially affected by the proposed mining activities in the mining plan modification area.

The western extent of the Ericson Sandstone outcrop represents the western extent of the groundwater impact analysis area. The horizontal extent of the groundwater impact analysis area encompasses approximately 1,040 square miles, extending as far as 16 miles north, 10 miles east, and 13 miles west of the Bridger Mine Complex; and 2 miles south, 2 miles west, and 3 miles east of the Black Butte Mine. The vertical extent of the groundwater impact analysis area includes six aquifer units of concern that are within the horizontal extent of the groundwater impact analysis area: alluvial, Fort Union Formation, Lance Formation, Almond Formation, Ericson Sandstone, and backfill. A brief discussion of each of these units is presented below.

When in hydrologic connection, materials classified as alluvium and colluvium are categorized together as alluvial deposits. The alluvium along Bitter Creek, Deadman Wash, and segments of their tributaries store and transmit water in sufficient quantities to be considered aquifers in some parts of the groundwater impact analysis area. Alluvial aquifers are generally discontinuous and are present only along major drainages.

The coal mine pits are in the Fort Union, Lance, and Almond Formations. Within the Fort Union Formation lie economic coal deposits and vertebrate fossils of scientific significance (BLM 2003). The Deadman Coal Zone of the Fort Union Formation is about 10 to 30 feet thick. All of the mining at the Bridger Mine Complex occurs in the Fort Union Formation. Seven of the 11 pits at the Black Butte Mine are in the Fort Union Formation. The Black Butte Mine has two pits in reclamation that mined coal from the Lance Formation. All four pits at the Leucite Hills Mine mined coal from the Almond Formation. Two out of 11 mine pits at the Black Butte Mine are in the Almond Formation.

The Ericson Sandstone outcrops to the eastern edge of the Leucite Hills Mine and the Bridger Mine Complex. It consists of massive beds of sandstone and conglomerate with a thickness of up to 700 feet. Because of yield and water quality as compared to other aquifers in the area, the Ericson Sandstone is generally used as a water supply for municipal and industrial use. The Ericson Sandstone is tapped as a potable water source for the town of Superior, Wyoming. Coal mine facility wells are also completed in the Ericson Sandstone.

The outcrops of Wasatch Formation and Fox Hills Sandstone and Lewis shale are also in the vicinity of the coal mines. The Wasatch Formation outcrops to the west of the mine permit boundaries. The Wasatch Formation is discontinuous and of limited extent within the mine permit boundaries. Some of the Bridger Mine Complex's Fort Union Formation wells are completed in both the Fort Union Formation and the Wasatch Formation. Fox Hills Sandstone and Lewis shale has very low hydraulic conductivity and therefore the hydrologic impacts caused by mining are expected to be mostly limited to very short distances within the formation.

The backfill aquifer is a new aquifer created by saturation of overburden materials placed into the mined pit after the coal is removed. The backfilled materials consist primarily of overburden materials removed to expose the coal seam for mining. The water quality of the backfill aquifer is intended to support livestock use, which is the approved post-mining land use for the area.

The groundwater in the vicinity of the Bridger Mine Complex is contained in several aquifers. Alluvial aquifers are found in some of the drainage channels and overburden, coal and interburden, and underburden aquifers are found in the Fort Union and Lance Formations. Transmitting properties of each of these formations vary with typical sustained yields of only a few gpm, but each of these aquifers can yield several tens of gpm in a few locations.

3.11.2.1. GROUNDWATER QUANTITY

Water levels from 27 monitor wells were used to characterize the groundwater levels in the alluvial aquifer during 2010–2012 (WDEQ-LQD 2014). The specific locations of the monitor wells, and the aquifers they are associated with, are shown on Figures 14 through 19 in the CHIA (WDEQ-LQD 2014). The highest median 2010–2012 water-level elevation of 6,814 feet was observed at the Randor Springs well on Black Rock Creek. The lowest median 2010–2012 water-level elevation of 6,539 feet was observed at Black Butte Mine well 567794 on Bitter Creek.

Water levels from 26 monitor wells were used to characterize the groundwater levels in the overburden aquifer during 2010–2012 (WDEQ-LQD 2014). The highest median 2010–2012 overburden water-level elevation of 6,997 feet was observed at Black Butte Mine well SW3-OB in the Almond Formation. The lowest median 2010–2012 water-level elevation of 6,625 feet was observed at the Bridger Mine Complex well 81-03-OB in the Fort Union Formation.

Water levels from 21 monitor wells were used to characterize the groundwater levels in the coal seams of the Fort Union Formation, Almond Formation, and Lance Formation during 2010–2012 (WDEQ-LQD 2014). The highest median 2010–2012 coal water-level elevation of 6,971 feet was observed at Black Butte Mine well SW1-CZ in the Almond Formation. The lowest median 2010–2012 water-level elevation of 6,537 feet was observed at well 534990 at the Black Butte Mine.

Water levels from 21 monitor wells were used to characterize the groundwater levels in the underburden aquifer during 2010–2012 (WDEQ-LQD 2014). The highest median 2010–2012 underburden water-level elevation of 7,008 feet was observed at Black Butte Mine Almond Formation well SW3-UB. The lowest median 2010–2012 water-level elevation of 6,635 feet was observed at Lance Formation well 81-03-LA to the west of the proposed mining plan modification area.

Three wells had groundwater level data available in the WDEQ-WQD Hydrology Database for the Ericson Sandstone aquifer (WDEQ-LQD 2014). All three wells were located in the Leucite Hills Mine area. The highest median 2010–2012 Ericson Sandstone aquifer water-level elevation of approximately 6,657 feet was observed at the Leucite Hills Mine well LE05. The lowest median 2010–2012 water-level elevation of approximately 6,612 feet was observed at the Leucite Hills Mine well LE10.

Water levels from 16 monitor wells were used to characterize the groundwater levels in the backfill aquifer during 2010–2012 (WDEQ-LQD 2014). The highest median 2010–2012 backfill water-level elevation of 6,889 feet was observed at the Bridger Complex Mine well 82-01-SP. The lowest median 2010–2012 water-level elevation of 6,556 feet was observed at Black Butte Mine well 568298.

3.11.2.2. GROUNDWATER QUALITY

Groundwater quality is more heterogeneous than groundwater quantity and varies both between and within the aquifers. There are fewer wells with water-quality data compared to the number of wells with water-level data, and the spatial distribution of the well monitor network is too sparse to conduct a robust analysis of the impacts of mining on groundwater quality.

Eighteen alluvial aquifer wells were evaluated during 1992–2012 and 2010–2012 (WDEQ-LQD 2014). Groundwater quality data were also collected from the WDEQ-LQD Hydrology Database for the period from 1992–2012. For the 1992–2012 period, Class III exceedances were noted for aluminum (one well), boron (one well), chloride (10 wells), chromium (one well), copper (two wells), nitrite + nitrate as N (one well), selenium (seven wells), sulfate (nine wells), TDS (13 wells), and pH (two wells). For the 2010–2012 period, exceedances were observed for chloride (10 wells), nitrite + nitrate as N (one well), selenium (two wells), sulfate (eight wells), and TDS (13 wells). TDS over the 2010–2012 period ranged from 610 to 30,000 mg/L, with a median of 7,280 mg/L. The minimum TDS was observed at the Randor Springs well north of the Bridger Mine Complex and the maximum TDS was observed at well 455485 along Bitter Creek at the Black Butte Mine. The overall results indicate that several wells in the alluvial aquifer exceed WDEQ-WQD Class III livestock standards for several constituents, particularly along Bitter Creek. The alluvial aquifer has poorest water quality among the aquifers of concern in the groundwater impact analysis area.

Groundwater quality data were collected from 18 overburden wells during 2010–2012 (WDEQ-LQD 2014). Groundwater quality data were also collected from the WDEQ-LQD Hydrology Database for the period from 2005–2012. For the entire during-mining period (2001–2012) in the Fort Union Formation overburden, Class III exceedances were noted for pH (10 wells). For the 2010–2012 period, pH showed exceedances at two wells. TDS over 2010–2012 ranged from 510 to 1,990 mg/L, with a median of 1,120 mg/L. For the entire during-mining period (2005–2012) in the Almond Formation overburden, Class III exceedances were noted for pH (one well) and selenium (one well). For the 2010–2012 period, selenium showed one exceedance at one well. TDS over 2010–2012 ranged from 740 to 2,200 mg/L, with a median of 1,500 mg/L. The overall results from the overburden monitoring wells in both the Fort Union Formation and Almond Formation indicate good water quality that generally meets WDEQ-WQD Class III livestock standards. Periodic exceedances of pH occur in both formations, and for selenium in the Almond Formation overburden. Water quality in the overburden formations is better than quality in the alluvial and backfill monitoring wells.

Groundwater quality data were collected from 12 coal aquifer wells during 2010–2012 (WDEQ-LQD 2014). Groundwater quality data were also collected from the WDEQ-LQD Hydrology Database for the period from 1992–2012. For the entire during-mining period (1992–2012) in the Fort Union Formation coal, Class III exceedances were noted for sulfate (one well), TDS (one well), and pH (two wells). For the 2010–2012 period, pH showed one exceedance at one well. TDS over 2010–2012 ranged from 280 to 1,600 mg/L, with a median of 1,395 mg/L. For the entire during-mining period in the Almond Formation coal (1986–2012), Class III exceedances were noted for chromium (one well), selenium (one well), and pH (three wells). For the 2010–2012 period, pH showed two exceedances at one well. TDS over 2010–2012 ranged from 442 to 1,530 mg/L, with a median of 974 mg/L. For the entire during-mining period in the Lance Formation coal (1992–2012), Class III exceedances were noted for chloride (one well), selenium (three wells), sulfate (one well), TDS (two wells), and pH (three wells). For the 2010–2012 period, exceedances were noted for chloride (one well), selenium (three wells), TDS (one well), and pH (two wells). TDS over 2010–2012 ranged from 1,450 to 11,300 mg/L, with a median of 4,120 mg/L. The overall results from the coal monitoring wells indicate water quality is slightly poorer in the Lance Formation coal, although much of this is driven by high dissolved ions at one well at the Black Butte Mine (well 305381). The Lance Formation coal wells also contain higher concentrations of selenium compared to the Fort Union Formation and Almond Formation coal wells.

Groundwater quality data were collected from 14 underburden wells during 2010–2012 (WDEQ-LQD 2014). Groundwater quality data were also collected from the WDEQ-LQD Hydrology Database for the period from 2001–2012. For the entire during-mining period (2001–2012) in the Fort Union Formation underburden, Class III exceedances were noted for mercury (one well) and pH (one well). For the 2010–2012 period, there were no exceedances of Class III standards. TDS over 2010–2012 ranged from 1,880

to 2,020 mg/L, with a median of 1,990 mg/L. For the entire during-mining period in the Almond Formation underburden (2005–2012), Class III exceedances were noted for selenium (one well) and pH (two wells). For the 2010–2012 period, pH showed four exceedances at one well. TDS over 2010–2012 ranged from 1,490 to 3,140 mg/L, with a median of 1,790 mg/L. For the entire during-mining period in the LF underburden (2001–2012), Class III exceedances were noted for aluminum (one well) and pH (10 wells). For the 2010–2012 period, 21 exceedances were noted for pH at eight wells. TDS over 2010–2012 ranged from 960 to 1,960 mg/L, with a median of 1,485 mg/L. The overall results from the underburden monitoring wells indicate water quality is high and generally meets WDEQ-WQD Class III livestock standards. Some wells in each underburden formation show slight exceedances of pH, and one Almond Formation well at the Black Butte Mine (SW4-UB) has shown recent exceedances of the Class III selenium criterion.

Groundwater quality data were collected from three Ericson wells during 2010–2012 (WDEQ-LQD 2014). For the entire during-mining period, Class III exceedances were noted for pH (four wells). For the 2010–2012 period, exceedances were observed for pH at two wells. TDS over 2010–2012 ranged from 410 to 1,270 mg/L, with a median of 1,010 mg/L. The overall results indicate water quality in the Ericson Sandstone is high and meets WDEQ-WQD Class III livestock standards, with the exception of periodic exceedances of pH.

Groundwater quality data were collected from seven backfill aquifer wells during 2010–2012 (WDEQ-LQD 2014). For the entire during-mining period, Class III exceedances were noted for boron (two wells), chloride (five wells), chromium (two wells), lead (one well), nitrite + nitrate as nitrogen (one well), selenium (four wells), sulfate (eight wells), TDS (10 wells), and pH (three wells). For the 2010–2012 period, exceedances were observed for boron (one well), chloride (one well), selenium (one well), sulfate (three wells), TDS (four wells), and pH (two wells). TDS over 2010–2012 ranged from 2,080 to 13 800 mg/L, with a median of 6,170 mg/L. The minimum TDS was observed at Bridger Mine Complex well SP-09-01 and the maximum TDS was observed at Black Butte Mine well 566394. The backfill aquifer currently has poorer water quality compared to the overburden-Fort Union Formation, overburden-Almond Formation, coal-Fort Union Formation, coal-Almond Formation, coal-Lance Formation, underburden-Fort Union Formation, underburden-Almond Formation, underburden-Lance Formation, and Ericson Sandstone aquifers, but better quality than the alluvial aquifer.

3.12. Wetlands and Riparian Zones

The impact analysis area for wetlands and riparian zones is the 560-acre project area. This area was chosen because the potential impacts to wetlands and riparian zones would generally be limited to the footprint of the proposed surface mining activities and would not extend beyond the mining plan modification area boundary.

3.12.1. Wetlands

The surface water in the wetlands and riparian zones impact analysis area occurs as ephemeral streams, which flow only as a result of precipitation. However, the drainage known as Tenmile Draw located in Section 12 has an established riparian area. There are unnamed tributaries and other draws in the analysis area that are dominated by upland species of big sagebrush, sticky-leaved rabbitbrush, and western wheatgrass and do not support wetland characteristics (BKS 2012c). There are no National Wetlands Inventory (NWI) wetlands identified in the wetlands and riparian zones impact analysis area.

3.12.2. Riparian Zones

There are approximately 11,808 feet of ephemeral streams, no perennial streams, and 43.7 acres of Western Great Plains Riparian Woodland and Shrubland land cover type in the wetlands and riparian zones impact analysis area. Approximately 90% of the wetlands and riparian zones impact analysis area is covered by the Inter-Mountain Basins Big Sagebrush Shrubland (374.0 acres) and Inter-Mountain Basins Mixed Salt Desert Scrub (128.3 acres) land cover types.

4. ENVIRONMENTAL CONSEQUENCES

4.1. Introduction

In accordance with 40 CFR 1502.16, this chapter presents the anticipated environmental consequences of the Proposed Action and No Action Alternative on the affected environment.

For the purposes of this document, an environmental impact is defined as a change in the quality and/or quantity of a given resource due to a modification in the existing environment from the Proposed Action. Impacts may be beneficial or adverse, direct or indirect, and of short-term or long-term duration. Unless otherwise specified, short term is defined as the time period required to mine the project area, estimated to be approximately 21 years. Long-term impacts are those that would occur or remain after this time. Direct impacts are caused by the action and occur at the same time and place, and indirect impacts from an action occur later in time and/or are removed in space.

Impacts may vary in degree from a slightly discernible change in the environment to a total change in the environment. The significance of these impacts is determined using the criteria set forth by CEQ (40 CFR 1508.27) and the professional judgment of the specialists doing the analyses; it is assessed using the two key elements of context and intensity. The context where impacts occur can be local, regional, and national. Intensity refers to the severity of the effect. Impacts can be beneficial (positive) or adverse (negative). Impacts are described by their level of significance (i.e., major, moderate, minor, negligible, or no impact). For purposes of discussion and to enable use of a common scale for all resources, resource specialists considered the following impact levels in qualitative terms.

- Major Impact: Impacts that potentially could cause irretrievable loss of a resource; significant depletion, change, or stress to resources; or stress within the social, cultural, and economic realm.
- Moderate Impact: Impacts that potentially could cause some change or stress to an environmental resource but the impact levels are not considered significant.
- Minor Impact: Impacts that potentially could be detectable but slight.
- Negligible Impact: Impacts in the lower limit of detection of an effect that potentially could cause a minimal change or stress to an environmental resource or use.
- No Impact: No discernible or measurable impacts.

This EA uses generally available environmental data and data collected in the project area to predict environmental effects that could result from the Proposed Action and No Action Alternative. A level of uncertainty is associated with any set of data in terms of predicting outcomes, especially when natural systems are involved. The predictions described in this analysis are intended to allow comparison of the No Action Alternative to the Proposed Action, as well as to provide a method to determine whether activities proposed by the applicant would be expected to comply with applicable federal, state, and local regulations.

4.2. Air Quality and Climate Change

4.2.1. Proposed Action

4.2.1.1. DIRECT AND INDIRECT IMPACTS

4.2.1.1.1. Air Quality

Emissions of air pollutants at the Bridger Mine Complex are currently regulated and limited by air quality permits issued by WDEQ-AQD (Air Quality Permits MD-9156 and MD-12225). Any federal coal produced by anticipated surface mining methods in the proposed modification would replace coal previously produced in other portions of the Bridger Mine Complex, with no resulting change in overall annual coal production. Because the Proposed Action is a continuation of existing surface mining and not an increase in the mining rate or an increase in production levels at the mine, no permit modifications would be required. Mining of the project area would occur under the existing air quality permits. The Proposed Action would not require a change in already permitted actions or in production levels and there would be no direct incremental increase in annual emissions from implementation of the Proposed Action.

Under the Proposed Action, direct emission sources are divided into three categories: fugitive emissions (particulate matter from excavation, hauling, and reclamation activities; NO_x, CO, and SO_2 from blasting), tailpipe emissions (criteria pollutant and HAP emissions from vehicles), and process emissions (particulate matter from coal processing). Major fugitive emission sources include the following:

- Pit surface mining of an area approximately 104 acres in size through truck-shovel pre-stripping, dragline excavation, scraper and front-end loader excavation, overburden drilling and blasting, dozer excavation, and grading for reclamation
- Any topsoil, overburden, and coal stockpiles located in the project area
- Travel on unpaved access and haul roads in the project area

The primary tailpipe emission sources include the following:

- Vehicles used by employees and occasional delivery trucks coming to and from the project area
- Water trucks, scrapers, front-end loaders, dozers, and graders used in the project area

Once the coal has been excavated, it would be hauled to other parts of the Bridger Mine Complex for processing. Process emissions include the following:

- Coal truck dumps
- Coal transfer points
- Primary crushers
- Coal hauling in trucks
- Coal hauling with the overland conveyor

The Proposed Action would result in an annual production increase of 3% to 5%, allowing the mine to maintain existing annual production levels after 2025 until 2037, when combined with future mining on adjacent lands. Activity levels and equipment use at the surface mine would remain the same but would transition into the project area from mined-out areas. Employee levels would remain essentially

unchanged. Fugitive, process, and tailpipe emissions from the sources described above would remain at or near current levels. Emissions under the Proposed Action would continue at the levels quantified in Table 3-4. No NAAQS or WAAQS exceedances are expected to occur. Because the Proposed Action would be a continuation of mining and would occur under BCC's existing air permits and because of the particulate monitoring system and contingency action plan, direct emission impacts from mining activities are expected to be short-term and minor.

Indirect effects from the burning of the coal removed from the project area are estimated by using emissions from the Jim Bridger Power Plant. The annual coal throughput at the Jim Bridger Power Plant in 2015 was 7,613,893 tons. The project area has approximately 4.5 million tons of economically recoverable federal coal; the total time needed to remove the coal from the project area is anticipated to be 21 years (2017–2037). The coal mined annually from the proposed mining plan modification area would contribute to BCC's customer's needs through 2037. Assuming the coal is excavated at a steady rate over the 21-year time period, approximately 214,286 tons of coal[2] from the project area would be available for purchase by the Jim Bridger Power Plant, representing approximately 2.8% of the annual coal throughput at the plant.

Using the Jim Bridger Power Plant's 2015 emission inventory (see Table 3-6), and assuming that the coal from the project area is equal to 2.8% of the power plant's annual coal throughput, emissions from burning of the coal from the project area are presented in Table 4-1. The 214,286 tons of coal mined annually from the proposed mining plan modification area would assist BCC with maintaining existing production levels to support its fuel commitments to the plant. The Proposed Action would have a negligible indirect effect on the plant's compliance with its operating permit and the NAAQs. As previously stated, the Jim Bridger Power Plant is currently in compliance with its operating permit and the NAAQS, and the Jim Bridger Power Plant is required by law to maintain compliance with its operating permit and the NAAQS.

Table 4-1. Estimated Emissions Associated with the Burning of Federal Coal from the Project Area at the Jim Bridger Power Plant

Pollutant	Annual Emissions* (tons per year)	Total Emissions† (tons)
CO	140	2,944
NO_x	384	8,058
PM_{10}	20	415
$PM_{2.5}$	6	130
PM	39	823
SO_2	287	6,036
VOCs	6	134
HAPs	4	85
Ammonia	0.1	2

Note: Data for this table was calculated without rounding; however, the annual and total emissions columns have been rounded.

*Annual emissions are calculated by multiplying the Jim Bridger Power Plant 2015 emissions in Table 3-6 by 2.8%, to reflect the percentage of coal burned that would be attributable to the Proposed Action.

† Annual emissions are multiplied by 21 (the total number of years needed to remove the coal) to calculate total emissions attributable to the Proposed Action

[2] The 214,286 tons of coal do not include coal from mining on adjacent private lands (the 700,000 tons of coal described in Sections 1.2 and 2.2.1 include previously permitted coal from mining on adjacent private lands).

When burned, the coal mined from the project area would indirectly contribute to criteria pollutant emissions, HAP and other toxic air pollutant emissions, acid or mercury deposition impacts, and CCW caused by the Jim Bridger Power Plant. No known data are available for acid or mercury deposition impacts caused by emissions from the Jim Bridger Power Plant. No data were identified that quantify pollution impacts on soil and vegetation from the power plant. Based on its operating permit and associated amendments and waivers, Jim Bridger Power Plant has implemented appropriate pollutant control technology which is intended to reduce potential emission impacts to the surrounding environment. Inspection data for Jim Bridger's management of CCW indicate that the ponds are generally in satisfactory condition, with acceptable maintenance and surveillance programs. The Proposed Action would have a negligible indirect effect on the plant's compliance with its operating permit and the NAAQs. As previously stated, the Jim Bridger Power Plant is currently in compliance with its operating permit and the NAAQS, and the Jim Bridger Power Plant is required by law to maintain compliance with its operating permit and the NAAQS. Based on the information above, indirect impacts to air quality occurring as a result of the Proposed Action would be short-term and minor.

4.2.1.1.2. Climate Change

Impacts of the Proposed Action on Climate Change

The Proposed Action would result in a continuation of existing mining levels at the Bridger Mine Complex through 2037; therefore, direct effects on greenhouse gases (GHG) would also continue at current levels and would have a negligible impact because they would not exceed the limits of BCC's air quality permit, The following analysis estimates GHG emissions from the off-site burning of the coal from the project area to account for indirect emissions.

BCC estimates that the project area has approximately 4.5 million tons of economically recoverable coal. Table 4-2 shows the estimated greenhouse gas emissions associated with the burning of this quantity of coal, based on EPA's Equation 2 (EPA 2016j):

Emissions (mass of GHG emitted) = Fuel (mass of fuel combusted) × Fuel Heat Content (units of energy per mass of fuel) × Emission Factor (GHG emission factor per energy unit)

Table 4-2. Estimated GHG Emissions Associated with Burning of Federal Coal from the Project Area

GHG	Mass of Fuel Combusted (million tons)	Fuel Heat Content at Bridger Mine Complex (MMBTU/ton)	Emission Factor for Sub-bituminous Coal*	Total Emissions (kg)	Total Emissions (metric tons)	Total CO_2e Emissions† (metric tons)
CO_2	4.5	18.4	97.17 kilograms CO_2/mmBtu	8,045,676,000	8,045,676	8,045,676
CH_4	4.5	18.4	11 grams CH_4/mmBtu	910,800	911	32,796
N_2O	4.5	18.4	1.6 grams N_2O/mmBtu	132,480	132	39,336
Total	-	-	-	-	-	8,117,808

As shown in Table 4-2, total GHG emissions from burning the coal excavated from the project area would be 8,117,808 metric tons CO_2e. Note that the 8,117,808 metric tons CO_2e would be emitted through 2037 over a 21-year period. Assuming the coal is excavated at a steady rate over this time period, this comprises 386,562 metric tons of CO_2e emissions per year. This indirect impact is expected to be long-term and moderate, when compared to the Jim Bridger Power Plant's total 2015 CO_2e emissions of 13,229, 723 metric tons (the Proposed Action's annual CO_2e emissions are 2.9% of the Jim Bridger Power Plant's annual 2015 CO_2e emissions) (EPA 2015a). For additional context, the Naughton Power Plant in adjacent Lincoln County emitted 5,112,600 metric tons of CO_2e in 2015 (the Proposed Action's annual CO_2e emissions are 7.6% of the Naughton Power Plant's annual 2015 CO_2e emissions) (EPA 2015a).

Impacts of Climate Change on the Proposed Action

The USGS Climate Change Viewer provides information on climate change impacts at local to regional scales and enhances understanding of possible future climate patterns and climate impacts at a local scale. The Climate Change Viewer is used in this analysis to predict the indirect impacts of climate change on the Proposed Action. Final reclamation at the Bridger Mine Complex is expected to be completed by 2046; therefore, the time period selected for the Climate Change Viewer projections was 2025–2049. Climate and water balance projections for Sweetwater County are shown in Table 4-3.

Table 4-3. USGS Climate Change Viewer Projections for Sweetwater County

Variable	Sweetwater County Climate and Water Balance Projections*		
	1950–2005 (Historical Period)	2025–2049 (Future Period)	Change
Climate Changes			
Annual Mean Maximum Temperature	55.0°F	59.2°F	4.1°F
Annual Mean Minimum Temperature	27.3°F	31.6°F	4.3°F
Annual Mean Precipitation	0.024 inch/day	0.024 inch/day	0.0 inch/day
Water Balance Changes			
Annual Mean Snow†	0.3 inch	0.2 inch	−0.1 inch
Annual Mean Soil Storage‡	0.5 inch	0.4 inch	−0.1 inch
Annual Mean Evaporative Deficit§	1.0 inch/month	1.2 inches/month	0.2 inch/month

Source: USGS (2015)

Note: °F = degrees Fahrenheit. No annual changes to runoff would occur.

* Projections are based on the mean model and Representative Concentration Pathway 8.5 (the most aggressive emissions scenario).

† Snow water equivalent: the liquid water stored in the snowpack

‡ Soil water storage: the water stored in the soil column

§ Evaporative deficit: the difference between potential evapo-transpiration if unlimited water were available and actual evapo-transpiration

The Proposed Action would be completed in 2037 and would not necessarily be subject to the full extent of the potential impacts shown in Table 4-3. Overall Bridger Mine Complex reclamation activities, which would include reclamation of areas mined in the Proposed Action, would be completed in 2046. The exact period of reclamation for mining conducted under the Proposed Action is not known because it is dependent on the mine plan and mining sequence. This analysis assumes that the projections shown in Table 4-3 would affect the Proposed Action and associated reclamation.

During the 21-year time period it would take to remove the coal from the project area, natural weather variations could result in dryer or wetter years. However, as shown in Table 4-3, the overall trend in Sweetwater County would be warmer and drier. The potential changes to climate and the water balance could impact water resources, soil erosion, vegetation, and reclamation in the analysis area.

Surface water impacts from climate change could be offset by the potential for Proposed Action mining activities to increase surface water runoff. However, it is also possible that mining activities would decrease surface water runoff (see Section 4.10.1). In this case, climate change would amplify any decrease caused by the Proposed Action. Overall, water monitoring stations in the analysis area indicate that mining impacts to surface water have been minimal (and short term). Based on this information, the impact of climate change on the Proposed Action with regard to surface water is expected to be negligible.

In general, coal mining at the mine and other nearby coal mines (e.g., Black Butte) is expected to lower the groundwater level to some extent (WDEQ-LQD 2014). The Proposed Action is expected to have local

impacts on groundwater in the alluvial aquifer but minimal impacts on the overburden, coal seam, and underburden aquifers (see Section 4.10.1.1.2). A warmer and drier climate could contribute to reduced groundwater recharge and amplify any Proposed Action impacts to the alluvial aquifer. Impacts are expected to be minor based on the overall low intensity of mining impacts to groundwater.

Under the Proposed Action, 104 acres of soils (18.6% of the project area) would be directly disturbed by surface mining. Surface-mining activities would disturb soil productivity, texture, structure, and porosity through the large-scale removal, stockpiling, and replacement of soils during surface mining. Because of the soil's degradation characteristics (water and wind erosion hazard, drought susceptibility, rooting depth, excess salt, excess sodium) (see Section 3.8), there is an increased risk of erosion impacts from Proposed Action surface mining. A warmer and drier climate could amplify soil susceptibility to erosion. However, this risk would be negligible because of by BCC's sediment control system (see Section 4.7.1.1).

Approximately 104 acres of vegetation (18.6% of the project area) would be directly disturbed by surface mining under the Proposed Action. Following the completion of mining, mined areas would be backfilled and regraded, then topped with the stockpiled soils and revegetated. Newly applied topsoil would typically be revegetated the following spring and/or fall with a mixture of mostly native grasses, forbs, and shrubs. Seed mixes would be selected based on pre-mining vegetation communities, post-mining land use, seed availability, timing, topography, soil characteristics, and other site-specific considerations. Seed mix species selected for reclamation have significant browse, livestock and/or wildlife forage, or cover value and are adapted to the region (see Section 4.9.1.1). A vegetation monitoring program would also be conducted over the life of the mine to aid in determining when the post-mining land use of undeveloped rangeland is met (BCC 2016a). Climate change impacts as shown in Table 4-3 could reduce reclamation success. These changes could result in the need to consider different plant species during reclamation to account for higher temperatures. The vegetation monitoring program would provide real-time data to respond to any climate change-caused impacts; based on this program, the indirect impact of climate change on reclamation would be negligible.

Social Cost of Carbon

The social cost of carbon (SCC) is an estimate of the monetized damages associated with a small increase in CO_2 emissions (typically 1 metric ton) in a particular year. This dollar figure also represents the value of damages avoided for a small emission reduction. SCC is meant to be a comprehensive estimate of climate change damages and includes changes in net agricultural productivity, human health, property damages from increased flood risk, and changes in energy system costs. Federal agencies have used the SCC to incorporate the social benefits of reducing CO_2 emissions into the cost-benefit analyses of certain regulatory actions (EPA 2015b).

Although the SCC can be a helpful tool to assess the benefits of CO_2 reductions, it does not include all damages given current modeling and data limitations. The models used to develop the SCC estimates do not include all of the important physical, ecological, and economic impacts of climate change because of a lack of precise data on the nature of potential damages and because the science used in the models lags behind the most recent research (EPA 2015b). The NEPA process does not require a cost-benefit analysis or a quantitative presentation of SCC cost estimates. Without the completion of a thorough cost-benefit analysis incorporating the social benefits of energy production, the inclusion of an SCC analysis in this EA would present only part of the necessary data. The SCC was designed for rulemakings and not project-level analyses; therefore, the SCC protocol was not used in this NEPA analysis. In addition, SCC analyses are no longer governmental policy (The White House 2017). GHG coal combustion emissions are quantified in Impacts of the Proposed Action on Climate Change, above.

4.2.2. No Action Alternative

4.2.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. Therefore, there would be no direct or indirect impacts to air quality and climate change from surface mining activities in the mining plan modification area. Under the No Action Alternative, mining would continue until 2037, and the annual production rate would be between approximately 3.5 and 6.3 million tons of coal per year through 2037 representing a 3% to 5% reduction in annual production after 2025 when compared to the Proposed Action. However, existing mining activities in the adjacent Bridger Mine Complex would continue to emit pollutants that affect air quality and climate change through approximately 2037, as would other current emission sources in the analysis area such as the Jim Bridger Power Plant. Current ambient air quality conditions in the analysis area are shown in Table 3-3; they are in compliance with the NAAQS and WAAQS. Current emissions from the Jim Bridger Power Plant, which would continue to occur under the No Action Alternative, are shown in Table 3-6.

4.3. Cultural Resources

4.3.1. Proposed Action

4.3.1.1. DIRECT AND INDIRECT IMPACTS

4.3.1.1.1. Known Cultural Resources

Surface disturbance would occur on 104 acres of the project area. Actions that cause surface and subsurface physical disturbance could result in the direct damage, destruction, or inadvertent discovery of cultural resources. Any direct or indirect impacts that result in the damage or destruction of cultural resources would be permanent. Impacts would include the loss of research potential and interpretation possibilities.

A cultural resources inventory performed in Section 12 resulted in the discovery of five newly identified sites, nine previously recorded sites, and four isolated artifacts. None of these sites are eligible for nomination to the NRHP and no further action was recommended (WAS 2009). A segment of the Cherokee Trail, Evans Variant, that crosses the south half of Section 12 was also evaluated and found to be non-contributing to the NRHP eligibility of the Cherokee Trail. No significant trail remains would be affected by the Proposed Action and no further work was recommended (WAS 2010).

A cultural resources inventory was also performed in Section 24, identifying one previously recorded site (48S13859). No newly identified cultural resource properties were in this section of the project area. Site 48S13859 was recommended not eligible for the NRHP and no further work was recommended (WAS 2008). Although the Evans Variant segment of the Cherokee Trail that crosses the south half of Section 12 may be impacted by the Proposed Action, it is a non-contributing element to the NRHP eligibility of the Cherokee Trail and there would be no adverse effect.

Based on the results of the cultural resource inventories, the Proposed Action would have no adverse effect (no impact) on any cultural resources eligible for the NRHP.

According to the mine plan for the mine, if unrecorded cultural resources are encountered during mining operations, activity that has the potential to impact those resources would cease, and the BLM archaeologist would be notified (the mine plan decision document for this EA, if the Proposed Action is approved, would also include the condition that OSMRE and WDEQ-LQD be notified). The cultural remains would then be recorded and evaluated. If significant cultural remains are inadvertently affected during mining operations, salvage or data recovery excavations may be required to mitigate the adverse effects to the resources. The mine plan also outlines procedures to follow if human remains are discovered (BCC 2016a).

4.3.1.1.2. Native American Religious Concerns

No comments were received on the Proposed Action from any Native American tribe. No Native American religious concerns have been identified; therefore, the Proposed Action would have no impact on Native American religious concerns.

4.3.2. No Action Alternative

4.3.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As such, no new surface coal mining activity would be conducted under this alternative, and no cultural resources in the mining plan modification area would be directly or indirectly affected.

4.4. Fish and Wildlife

4.4.1. Proposed Action

4.4.1.1. DIRECT AND INDIRECT IMPACTS

4.4.1.1.1. Common Wildlife

Under the Proposed Action, there would be 104 acres of surface disturbance from mining activities. This surface disturbance would affect vegetation types (grasses, forbs, sagebrush, etc.) and ephemeral streams that are associated with common wildlife such as birds, small rodents, jackrabbits, coyotes, reptiles, and amphibians. The proposed surface mining activities would result in direct impacts to wildlife that include a loss of habitat and an increased potential of mortality for less-mobile species, from being struck by mining equipment or vehicles.

The proposed surface mining activities would also have direct impacts on wildlife species through increased noise and human activity. Increased human activity could cause some localized avoidance of areas adjacent to mining activities, which could affect foraging and other wildlife behaviors. Noise can impact wildlife in several ways, as follows (Lynch et al. 2011):

- Noise can interfere with acoustical awareness by temporarily deafening animals, especially those close to the source, with very loud sounds or by distracting animals with less dramatic noises. Distraction can be especially detrimental if the typical predation or foraging pattern of the animal is altered, such as the coyote being unable to catch a prey item. Repeated distractions can lead to a reduction in individual health and ultimately in the health and success of the population.

- Noise can add to existing sound levels and reduce the range at which signals can be detected, identified, and localized (masking). Masking can increase predation rates for colonial species, such as prairie dogs and ground squirrels, if warnings indicating the presence of a predator are not heard by other individuals.

- Prolonged exposure to noise has been shown to cause some wildlife, such as mule deer and songbirds, to avoid certain areas, reducing already limited suitable habitat. Displacement due to noise has also been shown to impact songbirds by reducing pairing success, bird density, and biodiversity of birds in the area.

Indirect impacts on wildlife resulting from the proposed surface mining activities include long-term alterations in the mining plan modification area's topography and vegetation cover and diversity after the area is mined and reclaimed. For example, there would be a reduction in sagebrush density that would cause a decrease in carrying capacity for some wildlife species until the sagebrush gradually becomes reestablished on the reclaimed land.

BCC's existing mine permit includes a wildlife monitoring and protection program that was designed to allow assessment of the wildlife response to development of mining activities and reclamation efforts. Through the wildlife monitoring program, BCC identifies any substantial wildlife/mining conflicts and potential conflicts within its permit boundary. If conflicts develop or are anticipated, mitigation programs are designed and implemented to relieve or offset the expected impacts. This wildlife monitoring and protection program would be applied to the mining plan modification area as well. The methodologies of the wildlife monitoring and protection program follow those found in WDEQ-LQD Coal Rules and Regulations, Appendix B. Information gathered from the wildlife monitoring and protection program is included in BCC's WDEQ-LQD Annual Report. Given the availability of habitat in the fish and wildlife impact analysis area, as well as the wildlife monitoring program that would be part of the mine permit, impacts to common wildlife under the Proposed Action are expected to be short-term and minor.

4.4.1.1.2. Big Game

Under the Proposed Action, the proposed surface mining activities would cause approximately 104.1 acres of surface disturbance in winter/year-long mule deer habitat and year-long elk habitat. The proposed surface mining activities would also cause approximately 77.6 acres of surface disturbance in crucial, winter/year-long pronghorn antelope habitat, as well as 26.5 acres of surface disturbance in winter/year-long pronghorn antelope habitat. The acres of impact in each type of big game habitat represents 3.1% of the total acres of these types of habitat available in the fish and wildlife analysis area. These acres would be generally unavailable as habitat until the completion of reclamation activities.

The impacts to big game from increased noise and human activity that result from the proposed surface mining activities would be the same in nature as those described for common wildlife in Section 4.4.1.1.1. Given the availability of habitat in the fish and wildlife impact analysis area, as well as the wildlife monitoring program that would be part of the mine permit, impacts to big game under the Proposed Action are expected to be short-term and minor.

4.4.1.1.3. Migratory Birds, including Raptors

Under the Proposed Action, the proposed surface mining activities would cause approximately 104 acres of surface disturbance in vegetation types commonly used by migratory birds. BCC's existing mine permit requires a breeding bird survey that is conducted twice each spring to record migratory birds of high federal interest. The existing permit also requires annual nest surveys in areas of raptor concentration near the permit area. These surveys would also be required for the mining plan modification area. BCC's

existing permit also contains a Raptor Mitigation Plan, which would be applied to the mining plan modification area. Given the availability of habitat in the fish and wildlife impact analysis area, as well as the surveys and mitigation plan that would be part of the mine permit, the impacts to migratory birds and raptors under the Proposed Action are expected to be short-term and minor.

4.4.1.1.4. Fish

Under the Proposed Action, the proposed surface mining activities are expected to have minimal impacts on surface water quantity and quality, and thus, minimal impacts on any fish in the ephemeral and intermittent streams in the fish and wildlife impact analysis area. However, as stated in Section 3.5.4, all of the streams in the fish and wildlife impact analysis area are ephemeral or intermittent streams that do not support fish populations.

Coal mined as a result of the Proposed Action would be burned at the Jim Bridger Power Plant (see discussion in Section 4.2.1.1.1). The emissions resulting from the combustion of the coal could have potential indirect effects on fish at a local and regional level due to the deposition of hazardous air pollutants, such as mercury, on soil and surface waters. After deposition in water, the mercury can undergo chemical conversion to methyl mercury and bio-accumulate in aquatic organisms and fish. Methyl mercury can act as a neurotoxin, endocrine disruptor, and cause an inability to grow new brain cells (Lusk 2010). Because of the regulation and monitoring of the power plant's emissions under the existing air quality permit, MATS-required controls currently in place at the power plant, and the lack of fish habitat within the analysis area, indirect impacts to fish as a result of coal combustion would be short-term and minor.

4.4.2. No Action Alternative

4.4.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As such, no new surface coal mining activity would be conducted under this alternative, and there would be no direct or indirect impacts to fish and wildlife in the mining plan modification area. However, existing mining activities at the Bridger Mine Complex would continue to affect fish and wildlife species within the fish and wildlife impact analysis area. The existing mining activities would affect wildlife and wildlife habitat through surface disturbance, increased noise and human activity, and through indirect impacts resulting from continued coal combustion at the Jim Bridger Power Plant.

4.5. Geology and Minerals

4.5.1. Proposed Action

4.5.1.1. DIRECT AND INDIRECT IMPACTS

4.5.1.1.1. Geology

The proposed surface mining operation would remove coal and return noncoal material back into the mine pit on an estimated 104 acres under the Proposed Action. The geology of the mining plan modification area would be permanently altered. The replaced overburden material would be similar to pre-mining lithologies; however, the physical characteristics of the material, including permeability and stratigraphy, would be altered through the placement of a mixture of sizes and rock types back into the

mined-out pit. The removal and relocation of the overburden would create a blend of the original geologic units. The stratigraphy of the area would also be permanently altered by the removal of the coal layer itself, which is currently a component of the stratigraphic arrangement of rock layers in the tract. Because the proposed mining plan modification area represents a small portion of the Jim Bridger coalfield, the Proposed Action is expected to cause a long-term, minor, direct impact to geological resources.

4.5.1.1.2. Minerals

The Proposed Action would result in the production of up to 4.5 million tons of recoverable coal over the life of the mine. When combined with previously permitted coal from adjacent sections, this mining plan modification would allow approximately 700,000 tons of federal coal per year to be surface-mined on average. The proposed mining plan modification would not extend the life of the mine. Impact to coal reserves would be permanent and adverse because coal resources extracted from the mining plan modification area cannot be replaced, and extraction would result in a permanent depletion from the total coal reserve of the Jim Bridger coalfield. However, because the recoverable coal in the proposed mining plan modification area represents a small portion of the coal in the Jim Bridger coalfield, the Proposed Action is expected to cause a long-term, minor, direct impact to mineral resources.

4.5.2. No Action Alternative

4.5.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the proposed mine plan modification area. As such, no new surface coal mining activity would be conducted under this alternative, and there would be no direct or indirect impacts to geology and minerals in the mining plan modification area. Mining would continue until 2037 within the Bridger Mine Complex, but with a lower annual production after 2025 or sooner.

4.6. Socioeconomics

4.6.1. Proposed Action

4.6.1.1. DIRECT AND INDIRECT IMPACTS

4.6.1.1.1. Population

Implementation of the Proposed Action would not affect population levels in the analysis area (estimated to be 44,626 in 2015; see Section 3.7.1) because no new employees would be hired. However, surface mining in the project area would continue current annual production levels at the mine until 2037, which could prolong the duration of employment for some current employees.

4.6.1.1.2. Employment and Income

Under the Proposed Action, coal production and employment levels at the Bridger Mine Complex would not increase, but would continue until 2037. Surface mining at the Bridger Mine Complex currently employs 230 workers (see Section 3.7.2), who would continue to be employed and paid through 2037.

Using the 1.78 coal mining employment multiplier for Wyoming's southwest coal industry (Godby et al. 2015), surface mining at the Bridger Mine Complex generates 409 additional jobs in the local economy (the industry multiplier accounts for other jobs that are created by the labor, services, and goods needed to operate a coal mine). The Proposed Action would continue to support these secondary jobs through 2037. Other indirect effects to the local economy would continue through the purchase and use of goods and services needed for mine operations, vehicles, and employees.

The mining, quarrying, and oil and gas extraction sector employed the largest number of Sweetwater County residents (6,165 jobs) in 2014. Under the Proposed Action, this industry sector's share of the workforce in Sweetwater County would not change. However, geographies with economies that focus narrowly on resource extraction, particularly on fossil-fuel development (such as Sweetwater County), can be subject to boom-and-bust cycles as well as other economic challenges, such as slower long-term economic growth. Because of changes in external market pressures, natural resource economies are often vulnerable to unpredictable cycles of economic growth and recession. This can present challenges to communities in the form of fluctuating tax bases, demands for public infrastructure and social services, employment numbers, housing prices, and migration of workers into and out of a particular area.

4.6.1.1.3. Housing

Existing infrastructure in Sweetwater County is sufficient to sustain the current Bridger Mine Complex workforce for the additional time period. The 18,735 total housing units in Sweetwater County are not fully occupied (87.9% occupied; see Section 3.7.3) and there are both rental and sale units on the market. There is available housing in Rock Springs and Superior. In addition, the population growth in Sweetwater County over the last 5 years has been relatively slow at approximately 1.9% (see Section 3.7.1).

4.6.1.1.4. Economy

As discussed in Section 3.7.4, Wyoming's economy has experienced a recent downturn. Approval of the Proposed Action would continue current annual production levels at the Bridger Mine Complex through 2037, which would contribute positively to the economy through continued employment, income, and taxes and royalty payments.

Taxes and royalty payments from the mining of coal in the project area would provide direct revenue to the state and federal government at approximately the same rate that currently occurs because the Proposed Action is a continuation of mining. However, the Proposed Action would add approximately 13 additional years to the life of the mine, which would extend the amount of time revenue is provided to the state and federal government.

The average price for Wyoming coal from the Powder River Basin in 2017 fiscal year to date is $10.25 per ton (see Section 3.7.4) (Wyoming Department of Administration & Information 2017). Assuming the coal mined from the project area would be priced similarly, the 4.5 million tons of total coal produced would be worth approximately $46.13 million in total revenue.

Table 4-4 shows 2015 coal production levels and percentages for Sweetwater County.

Table 4-4. Sweetwater County Coal Production

Sweetwater County Coal Mines	2015 Coal Production Levels (tons)	Percent of Coal Production in Sweetwater County
Black Butte/Leucite Hills (surface operation)	2,735,308	35.6
Bridger Mine Complex (surface operation)	2,073,197	26.2
Bridger Mine Complex (underground operation)	3,090,175	38.2
Total	**7,898,680**	**100**

Source: WDWS (2015b)

Based on the data shown in Table 4-4, the Bridger Mine Complex surface operation comprises approximately 26.2% of the coal production in Sweetwater County, which would generate approximately 26.2% or $35,059,188 of the state assessed value for surface coal in 2015 ($133,813,693; see Section 3.7.4). This annual severance tax value would not increase under the Proposed Action because coal production would not increase; however, it would continue to be paid through 2037. No data were found on the total ad valorem tax for coal production in Sweetwater County.

The federal revenues shown in Table 3-10 would not change with the implementation of the Proposed Action; however, the portion of the revenues that comes from the project area would be paid for an additional 13 years because the life of the mine would be extended for that time period.

Overall, the Proposed Action would have no impact on population levels and housing in the county. Employment, income, and the economy would be positively impacted in the short-term by the extension of the mine life.

4.6.2. No Action Alternative

4.6.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. Therefore, there would be no direct or indirect impacts to the social and economic conditions of nearby communities from surface mining activities in the mining plan modification area. The local population, employment, housing conditions, and revenue would remain similar to current conditions, because mining would continue in other areas of the Bridger Mine Complex. However, changes in other local industries could impact the socioeconomics of the communities in Sweetwater County. Annual production at the Bridger Mine Complex would be reduced by approximately 3% to 5% following 2025 or sooner when compared to the Proposed Action, and associated employment and economic benefits would be reduced proportionally under the No Action Alternative.

4.7. Soils

4.7.1. Proposed Action

4.7.1.1. DIRECT AND INDIRECT IMPACTS

Under the Proposed Action, 104 acres of soils (18.6% of the project area) would be directly disturbed by surface mining. This impact would be short term and moderate because reclamation is an ongoing process at the Bridger Mine Complex. The disturbance would occur in the Wint-Westvaco-Teagulf-Tasselman-Rogrube-Huguston-Haterton soil complex that covers 100% of the project area and analysis area. This soil complex has a moderate risk of soil degradation through water erosion hazard, wind erosion hazard, drought susceptibility, and rooting depth. More specifically, the surface mining disturbance would occur in the soil map units discussed in Section 3.8.2. As discussed in Section 3.8.2, the soil's suitability as a plant growth medium is limited by high sand texture, pH, electrical conductivity (excess salt), sodium adsorption ratio (excess sodium), selenium, and calcium carbonate (BKS 2012b). Wind and water erosion hazard varies from negligible to severe (across the soil assessment study area) and soils are somewhat more susceptible to erosion from wind than water (BKS 2012b). Surface-mining activities would disturb soil productivity, texture, structure, and porosity through the large-scale removal, stockpiling, and replacement of soils during surface mining. This would be a long-term, moderate impact because of the physical changes to the soil and the time needed for full reclamation. Because of the soil degradation characteristics (water and wind erosion hazard, drought susceptibility, rooting depth, excess salt, excess sodium), there is an increased risk of indirect erosion impacts from surface mining. However, this risk would be limited by BCC's sediment control system (discussed later in this section) and the Mine Permit Reclamation Plan (BCC 2009).

Soils would be removed to their full depth where surface mining takes place and all suitable soils would be salvaged (topsoil suitability and soil salvage depths were determined by the soil assessment using WDEQ-LQD guidelines for topsoil [WDEQ-LQD 1994]). When feasible and to limit impacts, the top 6 inches of soil would be handled separately to protect topsoil. In addition, salvaged soil would be applied directly to regraded soils where practical. However, when field conditions preclude this opportunity or the amount of soil being salvaged is greater than the amount needed for application, soil would be stored in stockpiles located within the permit area. Soil stockpiles would be protected from wind and water erosion and clearly marked with signs. Stockpiles would be located so they are out of operational pathways, oriented to minimize erosion, and outside of natural drainages. They would generally have slopes constructed at a ratio of 3 to 1 or less.

Direct haul/application of topsoil to regraded soils and storage of topsoil in stockpiles may have different impacts on soil components. Stockpiling has been shown to negatively impact favorable soil properties including microbial biomass, bulk density, water holding capacity, and viable seed populations, mainly at depth (Wick et al. 2008). With topsoil stripping and storage, losses of soil aggregation are thought to contribute to declines in soil organic matter in reclaimed systems (Ingram et al. 2005). Generally, soil aggregation is slow to recover and whole soil carbon is greatly reduced in all soil depths with stockpiling (Wick et al. 2008). Soil organic matter has been found to increase with reclamation, but there is not always a corresponding increase in soil macroaggregation (Wick et al. 2008). However, the results of one study showed that stockpiling increased stockpile surface aggregation and aggregate associated organic carbon concentrations after 3 years of storage (Wick et al. 2008). Another Wyoming study found that there were no differences in soil organic carbon or microbial biomass carbon between sites reclaimed with directly hauled or stockpiled topsoil at two mines where the comparison was made. However, this study noted that use of directly hauled topsoil may avoid or minimize some of the problems (e.g., decline in fungal and bacterial populations or significant losses of total whole carbon) associated with long-term topsoil storage (Anderson et al. 2006). Thus, chemical and biological impacts to soils would likely be long-term and moderate.

As part of the mine plan, overburden materials would be sampled and characterized to ensure that any material that is unsuitable (toxic, acid-forming, or inhibits vegetation growth) is properly handled and disposed of (BCC 2009). Sampling and analysis is conducted in accordance with WDEQ-LQD guidelines for overburden (WDEQ-LQD 1994). Materials identified as being unsuitable would be handled by three procedures: 1) mixing through the mining process, 2) supplemental stripping extraction and placement, or 3) modification of the dragline operation to place unsuitable material in the lower portions of the spoil where operationally feasible. Details for the three procedures can be found in the Mine Permit Reclamation Plan (BCC 2009). In addition, regraded spoils would be sampled before the soil is distributed to identify any areas of unsuitable materials within 4 feet of the surface. Any unsuitable materials would be covered with at least 4 feet of suitable material or relocated to the bottom of the pit where they would be covered by spoil from the next adjacent pit mined.

Following the completion of mining, mined areas would be backfilled and regraded, then topped with the stockpiled soils. This would result in reclaimed soils with different long-term physical, structural, biological, and chemical properties than those present prior to surface mining. Post-mining soils would likely be more uniform in thickness, structure, type, texture, nutrient availability, and chemistry. The existing soil structure would largely be eliminated by the removal and replacement of soils in areas that are surface mined. In addition, changes in bulk density would occur because of mixing, aeration, and compaction. These impacts would be long-term and moderate. Revegetation and natural weathering would eventually reform new soil structures with the reclaimed soils, although this would be a long-term process.

Contemporaneous reclamation would normally be done to within 1,000 feet from the active pit centerline wherever practical. Newly applied topsoil would typically be revegetated ahead of the next growing season with a mixture of mostly native grasses, forbs, and shrubs. Seed mixes contain high species diversity. Revegetation techniques are designed to minimize erosion. In general, topsoil replacement would occur in the spring through fall and final seeding would occur in the fall. BCC conducts a soil monitoring program, which tests stockpiled soil prior to application, to identify physical and chemical soil characteristics that are inhibitory to plant development and evaluate the suitability of soils for distribution. Samples are taken from stockpiles prior to distribution and analyzed for multiple constituents, including pH, electrical conductivity, saturation percentage, texture, nitrate nitrogen, phosphorus, potassium, and boron. The data are interpreted using agronomic, soil science, and reclamation information, in conjunction with WDEQ-LQD guidelines. Stockpiled soils will be amended as necessary. This program helps to ensure revegetation success. A vegetation monitoring program would also be conducted over the life of the mine to aid in determining when the post-mining land use of undeveloped rangeland is met. Additional information on mine reclamation practices can be found in Section 2.1.1.13 and in the Mine Permit Reclamation Plan (BCC 2009).

Temporary out-of-pit overburden stockpiles may be constructed on the highwall or lowwall sides of the pit as necessary; these stockpiles, as well as salvaged soil piles, could also directly disturb soils in the project area, primarily through compaction. There would be no disturbance to soils from roads because existing haul roads and ramps into the current pit would be used for access. Existing ramps into the pit would be extended as the pit progresses cut-by-cut into the project area.

Soil compaction during disturbance and/or reclamation can temporarily reduce infiltration capacity and result in a greater potential for runoff and erosion. In addition to the stockpile erosion control measures discussed above, BCC would extend its sediment control system to the surface mining activities in the project area. The sediment control system implements erosion control measures including the following:

- Hay or straw mulch to stabilize soils (and add a source of organic material), with alternative options of cover crops or soil pitting
- Proper slope design (the shaping of reclaimed slopes to slopes with upper convexities, middle straight reaches, and lower concave reaches wherever possible)

- Interceptor ditches to slow runoff, reduce erosion, and enhance sediment deposition
- Temporary sediment traps when runoff flow cannot be controlled adequately with a check dam
- Containment berms to direct flow into structures such as check dams or temporary sediment traps
- Revegetation of all reclaimed areas
- Vegetative buffer strips to prevent erosion in critical areas
- Drainage of disturbed areas into the pit where the water evaporates or is pumped into holding ponds (outside the project area) for treatment prior to discharge
- Design techniques using computer modeling to evaluate disturbed area runoff prior to disturbance and simulation of the various sediment control measures
- An alternative sediment control monitoring network (SEDCO) to monitor the effectiveness of sediment control
- Check dams, water bars, and hay or straw bales when the SEDCO indicates a need to stabilize the effects of rills and gullies in reclaimed areas or in other erosion-prone areas such as disturbed areas

4.7.2. No Action Alternative

4.7.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As such, no new surface coal mining activity would be conducted under this alternative, and soils in the mining plan modification area would not be affected.

4.8. Topography and Physiography

4.8.1. Proposed Action

4.8.1.1. DIRECT AND INDIRECT IMPACTS

The topographical expression of the land surface in the analysis area would be permanently altered by the 104 acres of surface disturbance. In general, the post-mining topography would be returned to its approximate original contour, unless a variance or exemption is granted by the WDEQ-LQD. The removal of the coal seam would not substantially alter the original elevation of the area following reclamation. This is because the topsoil and overburden that is used to backfill the pits would have swelled in volume after it was removed from the ground. Topsoil and overburden swells in volume after being removed from the ground, losing some of the compaction that has occurred over the thousands of years that it laid undisturbed. The increased volume of the topsoil and overburden would help compensate for the coal seam's removal. Although the replaced overburden and topsoil would settle slightly over time, the final ground surface elevation would not be substantially different from the analysis area's original elevation. Because reclamation requirements would return the proposed mining plan modification area to its approximate original contour, including replacement of drainages and other surface structure nuances, the Proposed Action is expected to have a short-term, minor, direct impact on topography and physiography.

4.8.2. No Action Alternative

4.8.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As such, no new surface coal mining activity would be conducted under this alternative, and there would be no direct or indirect impacts to topography and physiography in the mining plan modification area. Existing mining activities at the adjacent Bridger Mining Complex would continue to affect topography and physiography in the existing mine permit area.

4.9. Vegetation

4.9.1. Proposed Action

4.9.1.1. DIRECT AND INDIRECT IMPACTS

Under the Proposed Action, approximately 104 acres of soil and associated vegetation (18.6% of the analysis area) would be directly disturbed by surface mining. The disturbance would occur in the Inter-Mountain Basins Active and Stabilized Dune, Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Mat Saltbush Shrubland, Inter-Mountain Basins Mixed Salt Desert Scrub, and Western Great Plains Riparian Woodland and Shrubland ecological systems. Table 4-5 presents the anticipated magnitude of direct impact to the ecological systems and the relative proportion of this impact compared to the total amount of each ecological system in the analysis area.

Table 4-5. Anticipated Impacts on Ecological Systems in the Analysis Area

Ecological System	Acres of Ecological System in the Analysis Area	Acres of Ecological System Disturbed by Proposed Action	Percent of Ecological System Disturbed
Inter-Mountain Basins Active and Stabilized Dune	11.0	2.5	22.7%
Inter-Mountain Basins Big Sagebrush Shrubland	374.0	61.1	16.3%
Inter-Mountain Basins Greasewood Flat	0.3	0	0%
Inter-Mountain Basins Mat Saltbush Shrubland	1.8	1.1	61.1%
Inter-Mountain Basins Mixed Salt Desert Scrub	128.3	18.3	14.3%
Inter-Mountain Basins Shale Badland	0.3	0	0%
Western Great Plains Riparian Woodland and Shrubland	43.7	21.1	48.3%
Total	**559.4**	**104.1**	**18.6%**

The ecological systems that would experience the largest acreage of disturbance would be Inter-Mountain Basins Big Sagebrush Shrubland, Inter-Mountain Basins Mixed Salt Desert Scrub, and Western Great Plains Riparian Woodland and Shrubland because most of the proposed disturbance is located within these ecological systems.

Because quantitative analyses of vegetation cover and species inventory data specifically for the project area were not provided in the 2012 baseline vegetation assessment, it is uncertain which of the six range sites (Saline Upland, Saline Lowland, Sands, Shallow Loamy, Loamy, and Saline Sub-Irrigated) mapped in 2012 would be affected and how many acres of each range site would be affected in the project area.

The surface disturbance and removal of vegetation increases the potential for the indirect introduction, establishment, and spread of noxious and/or invasive, introduced weed species, which would be an indirect effect of the Proposed Action. However, weed control measures outlined in the Mine Permit Reclamation Plan (BCC 2009) would be implemented for any noticeable weed infestation of species listed in the Wyoming designated noxious weeds and prohibited noxious weeds list (WWPC 2015).

Following the completion of mining, mined areas would be backfilled and regraded, then topped with the stockpiled soils and revegetated. Contemporaneous reclamation would normally be done to within 1,000 feet from the active pit centerline wherever practical. Newly applied topsoil would typically be revegetated the following spring and/or fall with a mixture of mostly native grasses, forbs, and shrubs. Seed mixes would be selected based on pre-mining vegetation communities, post-mining land use, seed availability, timing, topography, soil characteristics, and other site-specific considerations. Seed mix species selected for reclamation have substantial browse, livestock and/or wildlife forage, or cover value and are adapted to the region. Per the Mine Permit Reclamation Plan found in the approved mine plan/PAP/Permit, a vegetation monitoring program would also be conducted over the life of the mine to aid in determining when the post-mining land use of undeveloped rangeland is met (BCC 2009). Additional information on reclamation practices can be found in Section 2.1.1.13. Because of the relatively small area of surface disturbance, the acres of existing vegetation in the project area and surrounding area, and the reclamation and revegetation requirements that would be included in the mine permit, the Proposed Action is expected to have a short-term, minor impact on vegetation resources.

4.9.2. No Action Alternative

4.9.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As such, no new surface coal mining activity would be conducted under this alternative, and there would be no impact to vegetation resources in the mining plan modification area.

4.10. Water Resources

4.10.1. Proposed Action

4.10.1.1. DIRECT AND INDIRECT IMPACTS

4.10.1.1.1. Surface Water

Surface Water Quantity

Mining activities have the potential to both increase surface water runoff and decrease surface water runoff. Increased runoff can result if mines are dewatering aquifers and discharging water into ponds or stream channels. Decreased runoff can result when runoff from areas upstream of a mine is captured by flood control reservoirs or the mine pit or routed around the active mining and reclaimed areas. Increased or decreased runoff would be a direct effect of the Proposed Action.

Reclamation can also increase surface water runoff. This is because topsoil is often stockpiled for long periods of time and lacks structure when it is applied during reclamation. Soils with diminished structure have lower infiltration rates in comparison to native soils, which may increase runoff until root and soil structure develops. The backfilling of pits during reclamation may also result in a decrease in runoff due to runoff being captured in areas of the backfilled pit where the use of uncompacted material has resulted in differential settling.

Data from the water monitoring stations in the analysis area indicate that mining impacts to surface water quantity have been minimal (WDEQ-LQD 2014). However, it is reasonable to expect some amount of short-term reduction in water yield in the drainage due to retention in mining pits, sediment ponds, and alternate sediment control measures (ASCMs) in the mining plan modification area. ASCMs are used extensively for sediment control at the Bridger Mine Complex, and consist mostly of rock check dams. Because of the relatively small size of the mining plan modification area and the minimal impact on water quantity that previous and existing mining operations in the surface water impact analysis area have had, the Proposed Action is expected to have a short-term, minor impact on surface water quantity.

Surface Water Quality

Removal of vegetation and topsoil during mining activities exposes overburden and can result in increased erosion potential, causing an indirect effect to water quality. Runoff from areas of surface disturbance during mining activities may contain increased concentrations of sediments or other constituents which may degrade surface water quality in the analysis area. An increase in impervious surfaces during mining activities can also decrease infiltration and increase erosion. However, all surface water runoff from disturbed areas would be required to pass through a sediment pond or ASCM and meet specific water quality criteria prior to discharge.

Data from water monitoring stations at the Bridger Mine Complex indicate that there is not a substantial difference between the sediment yields carried between undisturbed and disturbed drainages, implying that ASCMs are effective in reducing sediment loads from drainages disturbed by surface mining activities (WDEQ-LQD 2014). Data from water monitoring stations at the Bridger Mine Complex also indicate that TSS concentrations are highly variable and can become very high during runoff events, exceeding 100,000 mg/L. Water quality standards for WDEQ-WQD Class 3B waters have occasionally been exceeded for dissolved metals at the Bridger Mine Complex, particularly aluminum, copper, iron, and selenium. However, mining does not appear to be a controlling factor in the cause of the exceedances,

because many of the exceedances were also noted upstream of the mining disturbance and during a baseline sampling period (WDEQ-LQD 2014). Thus, the Proposed Action is expected to have a minor impact on surface water quality in the short term. Following reclamation, long-term water resource impacts are typically increased TDS and possibly other water quality constituents. Long-term TSS are usually limited because of the requirements of SMCRA and stringent revegetation and BACT requirements after sediment ponds are removed. Given that the streamflow in the direct impacts analysis area is primarily ephemeral, impacts to surface water quality would likely be short-term, minor, and limited in geographical extent if they were to occur. Mercury could be entrained in surface water through deposition from the burning of coal at the Jim Bridger Power Plant and other power plants upwind of the region. Once in the surface water system and under the anoxic conditions, the mercury could be transformed into a biologically available form and be accumulated in aquatic organisms. Based on the currently available analytical data (See section 3.11.1.2), potential indirect impacts to surface waters within the indirect impacts analysis area would be short-term and minor.

4.10.1.1.2. Groundwater

Groundwater Quantity

During mining, sections of the alluvial aquifer in the vicinity of the mine would be affected by removal and replacement of alluvial sediments, drawdown due to the influences of pit de-watering, temporary diversion of streams, or increased water levels due to the infiltration of pit and pond discharges. In general, these direct effects would be local and would not extend large distances beyond the permit area. Cumulative effects to the alluvial aquifer would be mitigated by the distribution of the alluvial sediments only along drainages and the spatial distribution of the mines over small segments of the alluvial aquifer. Therefore, although there may be some direct impact to the alluvial aquifer caused by the Proposed Action, few to none of the impacts to the alluvial aquifer would be cumulative in nature as the individual mines tend to impact different sections of discrete alluvial sediments.

Predicted drawdowns by the individual mines in the overburden aquifer do not overlap with each other. In addition, cumulative effects of mining on the overburden would likely be limited as the sandstone units are discontinuous, and interbedded with claystone and siltstone. The CHIA concluded that based on current available data, the model predictions by the mines, and the area geology, it is expected that the impacts caused by mining on the overburden aquifer would likely be short-term and minor (WDEQ-LQD 2014). Although mining would have impacts within the permit boundary, based on available data, information presented in the mine permit, and analysis in the CHIA, the potential for material damage outside the permit boundaries to groundwater quantity is limited (WDEQ-LQD 2014). In locations where the mined coal seams are in the Almond Formation, the Ericson Sandstone aquifer is separated from the coal seams by a thick, low permeable interbedded sandstone, claystone, and siltstone Almond Formation underburden unit (WDEQ-LQD 2014). Therefore, the groundwater quantity impacts on the Ericson Sandstone aquifer would be minimal with no discernible effects that can be attributed to mining (WDEQ-LQD 2014).

Predicted drawdowns by the individual mines in the coal seams do not overlap with each other. Therefore, the cumulative effects of mining on the coals seams would likely be limited as these seams are generally less than 20 to 30 feet thick. The CHIA concluded that based on current available data, the model predictions by the mines, and the area geology, it is expected that the impacts caused by mining on the overburden aquifer would likely be short-term and minor (WDEQ-LQD 2014).

Predicted drawdowns by the individual mines in the underburden aquifer do not overlap with each other. The relatively lower hydraulic conductivity and the discontinuous nature of the underburden supports that the Proposed Action would have limited cumulative effects on the underburden groundwater system.

Given that the Ericson Formation is up to 700 feet thick, the Proposed Action is expected to have a short-term, minor impact on groundwater quantity as a result of drawdown, and would not affect the ability of the existing Ericson wells outside the mine permit boundaries to supply their intended use.

Groundwater Quality

Groundwater flowing through the backfill aquifer may have higher concentrations of dissolved constituents because more fresh mineral surfaces are exposed for chemical reaction in the backfill than in the undisturbed sediments. Initial conditions in the backfill include a more oxidized environment when compared to the undisturbed conditions. This increase in exposed mineral surfaces and difference in oxidation state may cause an increase in TDS and other constituents in groundwater. There is a potential for groundwater migrating from the backfill aquifer to affect the undisturbed native aquifers outside mine permit boundaries.

The Bridger Mine Complex mining permit provides a detailed description of how overburden materials are sampled, characterized, handled, and identified as suitable or unsuitable. The permit also documents how unsuitable materials would be mitigated in the backfilling process, such as blending unsuitable overburden with suitable material, using suitable material from adjacent spoil areas, and selective placement of material in between the predicted post-mine potentiometric surface and 4 feet below the graded backfill surface.

As part of the mine's annual reports, which are evaluated by WDEQ-LQD, backfill material sampling data are reviewed to ensure that the operator has properly handled and disposed of all overburden and spoil material that may be toxic or acid-forming. This review provides some assurance that the water quality of the backfill aquifer would be able to support the post-mining land use. Given the detailed process for handing and sampling overburden materials, the Proposed Action is expected to have a short-term, minor, direct impact on groundwater quality. Although mining would have impacts within the permit boundary, based on available data, information presented in the mine permit, and analysis in the CHIA, the potential for material damage outside the permit boundaries to groundwater quality is limited (WDEQ-LQD 2014). In locations where the mined coal seams are in the Almond Formation, the Ericson Sandstone aquifer is separated from the coal seams by a thick, low permeable interbedded sandstone, claystone, and siltstone Almond Formation underburden unit (WDEQ-LQD 2014). Therefore, the groundwater quality impacts on the Ericson Sandstone aquifer would be minimal with no discernible effects that can be attributed to mining (WDEQ-LQD 2014). The proposed mining activities are not expected to change the potential for material damage to groundwater quality in any of the aquifers of concern.

4.10.2. No Action Alternative

4.10.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As such, no new surface coal mining activity would be conducted in the mining plan modification area under this alternative, and there would be no direct or indirect impacts to surface water and groundwater resources in the mining plan modification area. Existing mining activities at the adjacent Bridger Mining Complex would continue to affect surface water and groundwater resources in the surface water and groundwater impact analysis areas.

4.11. Wetlands and Riparian Zones

4.11.1. Proposed Action

4.11.1.1. DIRECT AND INDIRECT IMPACTS

4.11.1.1.1. Wetlands

Under the Proposed Action, there would be no direct or indirect impacts to wetlands from the proposed surface mining activities because there are no NWI wetlands identified in the wetlands and riparian zones impact analysis area.

4.11.1.1.2. Riparian Zones

Under the Proposed Action, mining activities would cause 21.1 acres of surface disturbance in Western Great Plains Riparian Woodland and Shrubland land cover type. This represents approximately 48% of the total amount of this land cover type in the wetlands and riparian zone impact analysis area. Areas disturbed by mining activities would be returned to their approximate original contour during reclamation. These acres of disturbance would be revegetated with seed mixes selected based on pre-mining vegetation communities, post-mining land use, seed availability, timing, topography, soil characteristics, and other site-specific considerations. Seed mix species selected for reclamation have substantial browse, livestock and/or wildlife forage, or cover value and are adapted to the region. The direct impact to riparian zones would be short-term and minor. The proposed mining activities would disturb almost half of the Western Great Plains Riparian Woodland and Shrubland land cover type in the analysis area, but the required reclamation and revegetation activities would return the disturbed areas to their approximate original contour and pre-mining vegetation types.

4.11.2. No Action Alternative

4.11.2.1. DIRECT AND INDIRECT IMPACTS

Under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As such, no new surface coal mining activity would be conducted under this alternative, and there would be no direct or indirect impacts to wetlands and riparian zones in the mining plan modification area.

5. CUMULATIVE IMPACTS ANALYSIS

As defined in 40 CFR 1508.7 (CEQ regulations for implementing NEPA), a cumulative impact is an impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (RFFAs), regardless of which agency (federal or non-federal) or person undertakes such actions. Cumulative impacts may result from individually minor but collectively significant actions occurring over a period of time.

5.1. Analysis Areas

The geographic extent of cumulative impacts may vary by the type of resource and resource issues and by the type of potential impact. The time frames, or temporal boundaries, for those impacts may also vary by resource and resource issue. Spatial and temporal cumulative impact analysis areas (CIAAs) have been developed for each resource and are listed in Table 5-1. The temporal boundary for each resource was chosen because it is a reasonable time frame within which to predict RFFAs.

Table 5-1. Cumulative Impacts Analysis Areas by Resource

Resource	CIAA	Rationale	Total CIAA Acreage	Temporal Boundary
Air Quality	Sweetwater County	This CIAA was chosen because it is a typical spatial boundary used to determine compliance with NAAQS.	6,672,640	Life of the mine
Cultural and Historic Resources	Lower Deadman Wash HUC 12 watershed	Much of human cultural and behavioral variation is conditioned by the natural environment. Accordingly, archaeological, historical, and cultural sites within a defined natural habitat are often the product of a singular settlement system. This CIAA was chosen because it is a defined natural habitat, and impacts to cultural resources in one part of that habitat can affect a broader understanding of the interrelationships between sites in the habitat area as a whole.	33,990	Effects on cultural resources could be permanent.
Fish and Wildlife	Lower Deadman Wash HUC 12 watershed	The watershed provides a rational topographical boundary to analyze the cumulative impacts to fish and wildlife.	33,990	Life of the mine and reclamation
Geology and Minerals	Bridger Mine Complex Cumulative Hydrological Assessment Area for groundwater analysis	The Cumulative Hydrological Assessment Area was used to analyze the cumulative impacts during the permitting process. Thus, using this boundary makes this analysis consistent with the permitting analysis.	673,297	Effects on geology and minerals would be permanent.
Socioeconomics	Sweetwater County	This CIAA was chosen because the economic and demographic effects of the mine and surrounding mines would likely be experienced by communities in the county.	6,672,640	Life of the mine
Soils	Bridger Mine Complex Cumulative Hydrological Assessment Area for groundwater analysis	The Cumulative Hydrological Assessment Area was used to analyze cumulative impacts during the permitting process. Use of this boundary provides consistency with the permitting analysis.	673,297	Life of the mine and reclamation
Topography and Physiography	Bridger Mine Complex	The Bridger Mine Complex boundary is a rational boundary for analysis of impacts to topography and physiography as a result of mining activities because impacts would be limited to the surface disturbance caused by mining.	32,841	Effects on topography and physiography would be permanent.
Vegetation	Bridger Mine Complex Cumulative Hydrological Assessment Area for groundwater analysis	The Cumulative Hydrological Assessment Area was used to analyze cumulative impacts during the permitting process. Use of this boundary provides consistency with the permitting analysis.	673,297	Life of the mine and reclamation
Water Resources	Bridger Mine Complex Cumulative Hydrological Assessment Areas for surface water and groundwater analysis	The Cumulative Hydrological Assessment Area was used to analyze the cumulative impacts on water resources during the permitting process. Thus, using this boundary makes this analysis consistent with the permitting analysis.	Surface water: 33,990 Groundwater: 673,297	Life of the mine and reclamation
Wetlands and Riparian Zones	Lower Deadman Wash HUC 12 watershed	The watershed provides a rational topographical boundary to analyze the cumulative impacts to wetlands and riparian zones.	33,990	Life of the mine and reclamation

Note: Because the direct and indirect effects analysis for climate change in Chapters 3 and 4 addresses cumulative impacts from the Proposed Action, a separate cumulative effects analysis for climate change is not needed.

5.2. Past, Present, and Reasonably Foreseeable Future Actions

5.2.1. Past and Present Actions Summary

Past and present actions in the CIAAs that would affect the resources analyzed in this EA include cattle and sheep grazing; exploratory drilling for coal in support of the Bridger Mine Complex and other coal mining in the area; coal mining at the Bridger Mine Complex, Black Butte Mine, and Leucite Hills Mine (currently undergoing reclamation); roads; operation of the Jim Bridger Power Plant; and oil and gas exploration and development activity. The permit areas for the Bridger Mine Complex, Black Butte Mine, and Leucite Hills Mine cover approximately 50,405 acres in Sweetwater County and the hydrological assessment area for groundwater analysis. The permit areas for the Bridger Mine Complex and the Leucite Hills Mine cover approximately 1,134 acres of the Lower Deadman Wash HUC 12 watershed. Surface disturbance approved at the three mines through 2014 totals 32,462 acres (WDEQ-LQD 2014). Past and present long-term disturbance from oil and gas development is estimated to be 5,069 acres on all lands within the BLM Rock Springs Field Office Planning Area (BLM 2013a).

5.2.2. Reasonably Foreseeable Future Actions Summary

RFFAs are decisions, funding, or formal proposals that are either existing or are highly probable, based on known opportunities or trends. The following RFFAs have been identified: continuing mining operations at the Bridger Mine Complex, expansion of the Black Butte Mine, oil and gas development, and the Gateway West transmission line project.

Mining operations at the Bridger Mine Complex are expected to continue through at least 2037.

The Black Butte Mine is currently applying for a 449-acre lease modification to its existing federal coal lease for its surface coal mine. Black Butte Mine would also need to initiate modifications to its current mine permit area to allow for future mining.

Future long-term oil and gas surface disturbance is projected to be 12,571 acres on all lands within the BLM Rock Springs Field Office Planning Area (BLM 2013a).

The Gateway West transmission line project would build and operate approximately 1,000 miles of new high-voltage transmission lines between Glenrock, Wyoming, and Melba, Idaho, including approximately 150 miles of 230-kilovolt (kV) lines in Wyoming and approximately 850 miles of 500-kV lines in Wyoming and Idaho. The BLM-authorized route from the Wamsutter area to Anticline/Jim Bridger (Segment 3) would run east to west in a transmission corridor generally following Interstate 80 and an existing utility corridor. The route includes Segment 3A, a new 345-kV line between the Anticline substation and the Jim Bridger Power Plant (Idaho Power and Rocky Mountain Power 2016). Construction within Segment 3A is anticipated to begin in 2019.

The BLM Rock Springs Field Office Planning Area's Reasonable Foreseeable Development Scenario estimates up to 6,018 oil and gas wells to be developed in the planning area (BLM 2016). BLM estimates each well to represent approximately 7.1 acres of surface disturbance. Thus, these wells would result in approximately 42,727 acres of surface disturbance within the 3.6 million-acre planning area, or 1.2% of the planning area. Because the exact location of these wells is not known, the cumulative effects analysis assumes that the disturbance will be evenly distributed across the planning area and that approximately 1.2% of each CIAA would be affected by reasonably foreseeable oil and gas well disturbance.

5.2.3. Cumulative Impacts by Resource Issue Category

Cumulative impacts organized by resource issue category are described below. A choice of No Action would not contribute incrementally to the impacts of past, present, and reasonably foreseeable future actions, because under the No Action Alternative, OSMRE would recommend that the ASLM disapprove the proposed mining plan modification and there would be no extraction of recoverable coal in the project area. As a result, a No Action Alternative cumulative impacts analysis is not included below.

5.2.3.1. AIR QUALITY

Past and present actions in the air quality CIAA are described in Section 5.2.1. Most past and present action emissions (that are still occurring) likely consist of fugitive dust and emissions associated with mining activities, the Jim Bridger Power Plant, and oil and gas wells. Emissions from the Jim Bridger Power Plant are summarized in Table 3-6. Present emissions in the air quality CIAA are reflected in the ambient air quality data shown in Table 3-3, which is in compliance with the NAAQS and WAAQS. RFFAs in the air quality CIAAs are described in Section 5.2.2. In addition, the WDEQ-AQD lists the following new source review permit applications (WDEQ-AQD 2016b):

- Jim Bridger Power Plant has requested a renewal of plantwide applicability limitations for NO_x and SO_2 at their current levels. WDEQ-AQD has indicated it will consider retaining the existing limitations as appropriate for the facility. This will not result in an emission change.
- Wexpro Company submitted an application to modify an existing gas pad through the addition of a compressor engine. The engine would add the following emissions to the CIAA: 5.1 tons per year of NO_X, 14.7 tons per year of CO, 5.1 tons per year of VOC, and 0.37 tons per year of formaldehyde.
- QEPM Gathering I, LLC submitted an application to modify a compressor station through the replacement of an old compressor engine with a new compressor engine. The new engine would reduce emissions of NO_x, CO, VOC, and formaldehyde. WDEQ-AQD indicated in the application analysis that the change would have a negligible impact on existing ambient air quality by reducing emissions.
- Mountain Gas Resources LLC submitted an application to modify a compressor station through the replacement of an old compressor engine with a new compressor engine. The new engine would increase existing CO emissions by 4.0 tons per year and existing formaldehyde emissions by 0.11 tons per year; it would decrease NO_x and VOC emissions. WDEQ-AQD indicated in the application analysis that ambient air quality standards would be maintained with the approval of this application (through the use of control measures).

Of the four RFFAs listed above, changes requested by Wexpro Company and Mountain Gas Resources LLC have the possibility to increase emissions in the air quality CIAA, but in low quantities that are unlikely to impact NAAQS attainment. Expansion of the Black Butte Mine would result in a continuation of its current emission levels for two to three years and is unlikely to impact NAAQS attainment (BLM 2017).

Regarding oil and gas development, gas, oil, and coalbed natural production are expected to increase through 2031, with an increase in associated emissions and cumulative impacts. From 2012–2031, cumulative production of conventional gas in the BLM Rock Springs Field Office Planning Area is expected to be between 1,631,711,137 thousand cubic feet and 4,096,453,750 thousand cubic feet; cumulative production of conventional oil is expected to be between 39,662,119 barrels and 99,572,794 barrels; and cumulative production of coalbed natural gas is expected to range from 5,529,685 thousand cubic feet to 8,385,492 thousand cubic feet (BLM 2013b). The range in values is based on different

alternatives being analyzed for the revised resource management plan. No data were identified for expected emissions associated with these production increases. The Proposed Action would not increase annual emissions currently occurring from the Bridger Mine Complex because it is a continuation of existing mining operations (there would be no change in annual production); rather, it would continue operations at current production and emission levels through 2037. Because the Proposed Action would allow the mine to operate and emit air pollutants at current emissions levels for a longer period of time, it would add cumulatively to air emissions in the CIAA during these years. Although the indirect emissions resulting from combustion of the coal mined from the proposed mining modification area can be calculated (Table 4-1), it is not possible to calculate the direct emissions that would result from the mining of Sections 12 and 24. In addition, the incremental impact of these emissions when added to past, present, and reasonably foreseeable future actions emissions cannot be calculated because of the lack of data. Direct emissions of air pollutants from mining in the project area would be limited by current WDEQ-AQD air quality permits for the Bridger Mine Complex (Air Quality Permits MD-9156 and MD-12225); indirect emissions from the burning of coal mined from the project area would be limited by the Jim Bridger Power Plant's operating permit and air quality permit with WDEQ-AQD. Because emissions would occur from regulated facilities with enforced air quality permits, the cumulative impacts are considered short-term and moderate.

5.2.3.2. CULTURAL RESOURCES

Cultural resources tend to degrade over time from natural forces; however, many survive for hundreds or thousands of years. Any land-disturbing activity can disturb or damage cultural resources. Impacts to cultural resources in the CIAA would primarily result from past, present, and reasonably foreseeable future actions associated with surface and subsurface disturbance. Impacts would depend on the amount, placement, and type of disturbance, and could be beneficial (if the identification of cultural resources newly identified during surface disturbance contributes cumulatively to an increase in the knowledge of cultural properties in the area) or adverse (if widespread disturbance activities cover a large portion of the landscape when viewed as a whole and lead to an increase in the potential for destruction or damage of cultural resources).

Based on site-specific cultural resource inventories (see Section 3.4.2), the Proposed Action would not impact any cultural resources eligible for the NRHP. Therefore, the Proposed Action would not contribute to cumulative impacts in the cultural resources CIAA.

5.2.3.3. FISH AND WILDLIFE

The CIAA for fish and wildlife is the Lower Deadman Wash HUC 12 watershed. There are 481 acres of land in the fish and wildlife CIAA that are identified as developed land. The permit areas for the Bridger Mine Complex and Leucite Hills Mine cover approximately 1,134 acres of land in the fish and wildlife CIAA. The reasonably foreseeable surface disturbance from oil and gas development in the fish and wildlife CIAA is approximately 408 acres. The Proposed Action would add 104 acres of surface disturbance to the approximately 2,023 acres of surface disturbance caused by past, present, and reasonably foreseeable future actions in the fish and wildlife CIAA. The Proposed Action would represent an approximate 5.1% increase in disturbance to suitable wildlife habitat in the fish and wildlife CIAA. All mining and oil and gas operations are required to reclaim the land to its approximate original contour and pre-development uses, which would include revegetating the land with appropriate seed mixes. Revegetation activities would help restore disturbed areas so that it could be used as wildlife habitat, if the areas were used as wildlife habitat prior to mining activities.

The Table 5-2 lists the acres of big game habitat affected by the Proposed Action and the percentage of available habitat in the CIAA that the affected acres represents. The big game habitat that is affected by the Proposed Action would be reclaimed following disturbance.

Table 5-2. Big Game Habitat Acres Affected by the Proposed Action and Percentage of Available Acres in the CIAA

Habitat Type	Acres Affected by Proposed Action (% of available acres in CIAA)
Pronghorn antelope crucial, winter/year-long	77.6 (0.4%)
Pronghorn antelope winter/year-long	26.5 (0.2%)
Elk year-long	104.1 (0.5%)
Mule deer winter/year-long	104.1 (0.3%)

The hazardous air pollutants, such as mercury, released into the atmosphere by the combustion of coal from the project area at the Jim Bridger Power Plant could be deposited and accumulate in the surface waters in the CIAA for fish and wildlife. This would add cumulatively to other sources of HAPs in the CIAA's surface waters. Cumulative impacts to fish and wildlife are expected to be short-term and negligible. The nature of these impacts is described in Section 4.4.1.1.4.

5.2.3.4. GEOLOGY AND MINERALS

Under the Proposed Action, the proposed mining activities would add 104 acres of disturbance to the surface geology in the geology and minerals CIAA. Impacts to geology and minerals from past, present, and reasonably foreseeable future actions are similar in nature to the impacts from the Proposed Action, as many of these actions involve surface disturbance from mining activities, as well as oil and gas development activities. The permit areas for the Bridger Mine Complex, Black Butte Mine, and Leucite Hills Mine cover approximately 50,405 acres of the geology and minerals CIAA. There are also approximately 2,621 acres of land in the geology and minerals CIAA that are identified as developed land. The reasonably foreseeable surface disturbance from oil and gas development in the geology and minerals CIAA is approximately 8,080 acres. The total acres of past, present, and reasonably foreseeable future actions causing surface disturbance in the geology and minerals CIAA is approximately 61,106 acres. The Proposed Action would represent a less than 0.2% cumulative increase in the total geological disturbance from past, present, and reasonably foreseeable future actions in the CIAA (61,106 acres).

5.2.3.5. SOCIOECONOMICS

Cumulative impacts to socioeconomics may be beneficial or adverse. Potential cumulative impacts from past, present, and reasonably foreseeable future actions in the socioeconomics CIAA include changes in population and employment, housing demands, effects on the local economy through the purchase and use of goods and services, and demands on government services, school districts, and local infrastructure.

Past and present actions in the socioeconomics CIAA are described in Section 5.2.1. RFFAs within the CIAA, including proposed mining, oil and gas development, and the Gateway West transmission line project, would add cumulatively to the economic output of the county.

The Proposed Action would add cumulatively to the coal mining jobs created by past, present, and reasonably foreseeable future actions. Approval of the Proposed Action would allow the Bridger Mine Complex to continue employment at the surface mine for approximately 230 workers through 2037, and

would continue generating related secondary employment in the local economy (409 additional jobs; see Section 4.6.1.1.2). In addition, revenue generation and economic contributions from taxes and royalties on the mined coal would continue through 2037.

5.2.3.6. SOILS

Land-disturbing activities that remove native vegetation and topsoil from the CIAA may cumulatively and incrementally affect soil resources. Cumulative impacts from the disturbances would depend on the amount, placement, and type of surface disturbance; the type (complex) of soil; and soil characteristics. Specific impacts to soils include removal of vegetation, exposure of soil, mixing of soil horizons (layers), soil compaction, loss of productivity, and increased susceptibility to erosion. The permit areas for the Bridger Mine Complex, Black Butte Mine, and Leucite Hills Mine cover approximately 50,405 acres of the soils CIAA. The reasonably foreseeable surface disturbance from oil and gas development in the soils CIAA is approximately 8,080 acres.

Land cover types indicate impacts to soils through erosion, compaction, and topsoil degradation. In the soils CIAA, there are 483 acres of Pasture/Hay land cover type, 17 acres of Developed, High Intensity land cover type, 260 acres of Developed, Medium Intensity, 646 acres of Developed, Low Intensity land cover type, and 1,215 acres of Developed, Open Space. These agriculture and developed land cover types in the soils CIAA total 2,621 acres. When added to the known and reasonably foreseeable mine surface disturbance of approximately 50,405 acres, as well as the approximately 8,080 acres of reasonably foreseeable oil and gas development, there are approximately 61,106 acres of past, present, and reasonably foreseeable future actions causing surface disturbance in the soils CIAA. Surface disturbance to soils under the Proposed Action would comprise 104 acres or 0.02% of the soils CIAA. This constitutes a less than 0.2% addition to the past, present, and reasonably foreseeable future total surface disturbance (61,106 acres). Reclamation of disturbed areas would limit cumulative impacts to soils.

5.2.3.7. TOPOGRAPHY AND PHYSIOGRAPHY

Under the Proposed Action, the proposed mining activities would add 104 acres of disturbance in the 32,841-acre topography and physiography CIAA. Approximately 11,726 acres of land are expected to be disturbed and reclaimed over the life of the Bridger Mine Complex. Impacts to topography and physiography from the Proposed Action would be similar in nature to the impacts from past, present, and future mining activities at the Bridger Mine Complex. All mining operations are required to reclaim the mined land to its approximate original contour, but there are still some permanent changes to topography as a result of the mining and reclamation activities. The Proposed Action would add cumulatively to the impacts from past, present, and future mining activities at the Bridger Mine Complex, representing an approximate 0.9% increase to the total disturbance in the CIAA.

5.2.3.8. VEGETATION

The removal of native vegetation and topsoil through surface disturbance may cumulatively and incrementally affect vegetation communities by fragmentation and increased competition with noxious and invasive weeds. In addition, surface disturbance may cause soil compaction, increased erosion, and fugitive dust that can cumulatively impact vegetation through decreases in plant productivity and species composition.

As with the soils CIAA, there are approximately 2,621 acres of agriculture and developed land cover types in the vegetation CIAA. The permit areas for the Bridger Mine Complex, Black Butte Mine, and Leucite Hills Mine cover approximately 50,405 acres of the vegetation CIAA. The reasonably foreseeable surface disturbance from oil and gas development in the vegetation CIAA is approximately 8,080 acres.

There are approximately 61,106 acres of past, present, and reasonably foreseeable future disturbance in the vegetation CIAA. Surface disturbance to vegetation under the Proposed Action would comprise approximately 104 acres or 0.02% of the vegetation CIAA. This constitutes a less than 0.2% addition to the past, present, and reasonably foreseeable future total surface disturbance (61,106 acres). Reclamation and revegetation of disturbed areas with native seed or other appropriate species would limit the cumulative impacts to vegetation.

5.2.3.9. WATER RESOURCES

5.2.3.9.1. Surface Water

The CIAA for surface water is the Lower Deadman Wash HUC 12 watershed. There are 481 acres of land in the surface water CIAA that are identified as developed land. The permit areas for the Bridger Mine Complex and Leucite Hills Mine cover approximately 1,134 acres of land in the surface water CIAA. The reasonably foreseeable surface disturbance from oil and gas development in the fish and wildlife CIAA is approximately 408 acres. The Proposed Action would add cumulatively to the approximately 2,023 acres of surface disturbance resulting from past, present, and reasonably foreseeable future actions in the surface water CIAA. The 104 acres of surface disturbance under the Proposed Action would represent a 5.1% increase in total surface disturbance in the surface water CIAA. As discussed in Section 4.10.1.1.1, the Proposed Action is expected to have minimal impacts on surface water quantity and quality. According to the CHIA, impacts to surface water quantity and quality from past and present mining activities in the surface water CIAA have been minimal (WDEQ-LQD 2014). The Proposed Action's cumulative impacts on surface water quantity and quality, when added to the impacts from past, present, and reasonably foreseeable future actions, are also expected to be minor.

5.2.3.9.2. Groundwater

There are approximately 2,621 acres of land in the groundwater CIAA that are identified as developed land. The permit areas for the Bridger Mine Complex, Black Butte Mine, and Leucite Hills Mine cover approximately 50,405 acres of the groundwater CIAA. The reasonably foreseeable surface disturbance from oil and gas development in the groundwater CIAA is approximately 8,080 acres. The total acres of past, present, and reasonably foreseeable future actions causing surface disturbance in the groundwater CIAA is approximately 61,106 acres. The Proposed Action would represent a less than 0.2% cumulative increase in the total surface disturbance from past, present, and reasonably foreseeable future actions in the groundwater CIAA (61,106 acres). As discussed in Section 4.10.1.1.2, the Proposed Action is expected to have minimal impacts on groundwater quantity and quality. According to the CHIA, impacts to groundwater quantity and quality from past and present mining activities in the groundwater CIAA have also been minimal (WDEQ-LQD 2014). The Proposed Action's cumulative impacts on groundwater quantity and quality, when added to the impacts from past, present, and reasonably foreseeable future actions, are also expected to be minor.

5.2.3.10. WETLANDS AND RIPARIAN ZONES

5.2.3.10.1. Wetlands

Under the Proposed Action, no NWI wetlands would be affected by the proposed mining activities. Thus, there would be no cumulative impacts to wetlands as a result of the Proposed Action.

5.2.3.10.2. Riparian Zones

Under the Proposed Action, mining activities would cause 21.1 acres of surface disturbance in Western Great Plains Riparian Woodland and Shrubland land cover type. This represents approximately 2.0% of the total amount of this land cover type in the wetlands and riparian zone CIAA. This would add cumulatively to the riparian areas disturbed by past, present, and reasonably foreseeable future actions in the wetlands and riparian zones CIAA. Areas disturbed by mining activities under the Proposed Action would be returned to their approximate original contour during reclamation. The acres of disturbance caused by the Proposed Action would be revegetated with seed mixes selected based on pre-mining vegetation communities, post-mining land use, seed availability, timing, topography, soil characteristics, and other site-specific considerations. Seed-mix species selected for reclamation have substantial browse, livestock and/or wildlife forage, or cover value and are adapted to the region.

6. MITIGATION MEASURES

Mitigation includes specific means, measures, or practices that would reduce or eliminate the effects of the Proposed Action. Mitigation measures can be applied to reduce or minimize adverse effects to biological, physical, or socioeconomic resources. No mitigation measures have been identified for the Proposed Action, based on the project design features identified in Section 2.1.1.15 (design features are specific means, measures, or practices such as standard operating procedures, stipulations, and best management practices that *make up* the Proposed Action).

7. CONSULTATION AND COORDINATION

7.1. Summary of Public Participation

As required under NEPA, OSMRE solicited public comments on the Proposed Action. The public scoping period began on June 1, 2016, and finished on July 1, 2016. OSMRE published a public notice in the *Rock Springs Rocket-Miner* newspaper, published a public notice on OSMRE's electronic bulletin board, and sent out a public scoping letter and requested comments within the 30-day public comment period. The mailing list can be found in the administrative record. Public scoping letters were sent to 140 recipients, including government entities, private companies, and landowners. Nine comment letters were received.

This EA is available on the OSMRE webpage
at http://www.wrcc.osmre.gov/initiatives/BridgerMineWY2727.shtm.

7.2. Persons, Groups, and Agencies Consulted

OSMRE initiated consultation regarding the Proposed Action in June 2016 with the following tribes:

- Shoshone-Bannock Tribes
- Eastern Shoshone Tribe
- Northern Arapahoe Tribe
- Ute Indian Tribe

Tribes are offered an opportunity to identify cultural or religious concerns, or Traditional Cultural Properties through direct government-to-government consultation with OSMRE. No cultural or religious concerns or Traditional Cultural Properties have been identified through consultation with the tribes.

7.3. List of Preparers

Tables 7-1 and 7-2 identify OSMRE and consultant staff used in the preparation of this EA.

Table 7-1. OSMRE Staff used to Prepare this Environmental Assessment

Name	Agency	Position/Project Responsibility
Marcelo Calle	OSMRE	Division Manager
Logan Sholar	OSMRE	Natural Resource Specialist
Lauren Mitchell	OSMRE	Environmental Protection Specialist
Gretchen Pinkham	OSMRE	Air Quality/Climate Change
Karen Jass	OSMRE	Geology/Physiology/Topography
Jeremy Illiff	OSMRE	Cultural/Paleontological
Flynn Dickinson	OSMRE	Water Resources
Jacob Mulinix	OSMRE	Soil Resources

Table 7-2. SWCA Environmental Consultants Staff used to Prepare this Environmental Assessment

Name	Position	Role
Jeremy Eyre, J.D.	NEPA writer	Geology/minerals, fish and wildlife, water resources, wetlands/riparian areas, topo
Gretchen Semerad, M.S.	NEPA writer	Air, cultural resources, soils, socioeconomics
Audrey McCulley, B.S.	NEPA writer	Vegetation
David Steed	Project manager	NEPA review
Rachel Johnson, B.S.	GIS specialist	All maps and GIS data
Linda Matthews	Technical editor	Technical editing
Linda Tucker-Burfitt	Technical editor	Technical ediiting
Debbi Smith	Formatter	Formatting

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