This chapter is a site-specific analysis of potential impacts that could result from the implementation of a Proposed Action or alternatives to the Proposed Action. The purpose of this chapter is to analyze and disclose potential impacts of the federal actions on the human environment, and to develop mitigation designed to reduce potential adverse impacts to the extent possible. The federal actions are the applications received by the U.S. Bureau of Land Management (BLM) described in Chapter 1, Purpose and Need, and the alternatives described in Chapter 2, Alternatives.

The potential consequences (impacts) of each alternative are described in this chapter using the same order of the two resource topics ("Human Environment and Resource Use" and "Physical Resources") presented in Chapter 3, Affected Environment. Identical organization for Chapters 3 and 4 allows the reader to compare existing resource conditions (Chapter 3) to potential impacts (Chapter 4, Environmental Mitigation and Consequences) for the same resources.

There are many different ways to assess impact, such as temporary, long term, direct, indirect, and cumulative. In this chapter, temporary and long term impacts are identified within each resource section. Direct and indirect impacts are implied within the sections, as opposed to having separate headings. Unless indicated otherwise, all impacts described in this chapter are direct impacts. Cumulative impacts for all resources are described in Section 4.5, Cumulative Impacts.

Temporary impacts are those impacts that typically occur during construction, but would not occur during operations. Long term impacts would remain over the life of the project (30 years or longer).

Direct impacts are those impacts which are caused by the Proposed Action and occur at the same time and place (40 *Code of Federal Register* [CFR] 1508.8(a)). Indirect impacts are impacts caused by the Proposed Action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts may include growth-inducing impacts and other impacts related to induced changes in the pattern of land use, population density, or growth rate, and related impacts on water and air and other natural systems, including ecosystems (40 CFR 1508.8(b)).

A cumulative impact is the impact on the environment which results from the incremental impact of the Proposed Action or alternative when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person who undertakes such other actions (40 CFR 1508.7).

No Action Alternative

In each resource section, there is a discussion of the No Action Alternative. This section describes the impacts that would result if the required permits and coal LBA described in Chapter 1 are not issued, effectively not allowing the applicant to mine, transport or lease the coal. If the No Action Alternative is selected, this proposed project would not be built and operated.

Proposed Action Alternative

In each resource section, there is a discussion of the Proposed Action Alternative. This section describes the impacts that would result from the proposed mine and facilities, mine lease area,

railroad, water pipeline, and transmission line. Temporary (i.e., construction) impacts are discussed, as well as long term (i.e., life of project [30 years] or longer) impacts. A detailed description of the proposed mitigation measures is included.

Table 4-1, Railroad Spur, Water Pipeline, and Transmission Line Alternatives Temporary and Long Term Impacts to BLM-Managed Land and Private Land, displays the temporary and long term impacts to BLM-managed land (north of the Highline Canal), privately owned land north of the Highline Canal, and privately owned land south of the Highline Canal. Assumptions and descriptions of how these numbers were calculated are addressed in the following text.

Table 4-1
RAILROAD SPUR, WATER PIPELINE, AND TRANSMISSION LINE ALTERNATIVES
TEMPORARY AND LONG TERM IMPACTS TO BLM-MANAGED LAND AND PRIVATE LAND

	Temporary Impacts				Long Term Impacts			
Linear Feature	BLM (acres)	Private North of Highline Canal (acres)	Private South of Highline Canal (acres)	Total Temporary Impacts (acres)	BLM (acres)	Private North of Highline Canal (acres)	Private South of Highline Canal (acres)	Total Long Term Impacts (acres)
Railroad Spur/ Water Pipeline	173	0	91	264	133	0	70	203
Proposed Transmission Line	86	0	< 1	86	17	0	< 1	17
Transmission Line Alternative A	30	29	< 1	59	6	< 1	< 1	6
Transmission Line Alternative B	50	2	< 1	52	10	< 1	< 1	10
Transmission Line Alternative C	53	0	< 1	53	11	0	< 1	11

Note:
BLM = U.S. Bureau of Land Management

Assumptions Common to the Proposed Railroad Spur, Water Pipeline, and all Transmission Line Alternatives

- Temporary impact calculations do not include temporary construction lay-down areas, staging areas, temporary workspaces, and material storage yards.
- Impact calculations are approximate, and are subject to minor changes based on issuance of right-of-way (ROW) grants and easements.

Proposed Railroad Spur/Water Pipeline

As discussed in Section 3.1.1, Land Ownership and Use, CAM-Colorado, LLC (CAM) must pipe water to its mining operation using existing water rights. CAM's diversions are within their allocated water rights, and would not impact senior water rights in the area.

The water pipeline would be located along the proposed railroad spur and would have identical temporary construction impacts. Since the water pipeline would be buried, there would be no long term impacts resulting from the water pipeline.

The temporary ROW width for construction was assumed to be 150 feet for the entire length of the railroad corridor. Temporary impacts to BLM-managed land include disturbance within the temporary ROW along the length of the railroad corridor on BLM-managed lands, and temporary disturbances due to construction of the concrete box under State Highway (SH) 139 and the bridge over the Highline Canal. Temporary impacts to private land south of the Highline Canal include disturbance within the temporary ROW along the length of the railroad corridor south of the Highline Canal and construction of the Mack Wash Bridge. The railroad spur does not cross private land north of the Highline Canal; therefore there are no temporary or long term impacts to private land north of the Highline Canal. Temporary topsoil stockpiles would disturb approximately 1 acre each, and there would be approximately 1 stockpile per mile of railroad spur. Temporary impacts of the railroad spur and water pipeline would include approximately 173 acres of BLM-managed land, 0 acres of private land north of the Highline Canal, and approximately 91 acres of private land south of the Highline Canal.

The long term ROW width was assumed to be 115 feet for the length of the railroad corridor. This ROW includes a permanent access road adjacent to the railroad spur for the entire length of the corridor. As previously mentioned, there would be no long term impacts associated with the water pipeline. Long term impacts of the railroad spur would include approximately 133 acres of BLM-managed land, 0 acres of private land north of the Highline Canal, and approximately 70 acres of private land south of the Highline Canal.

Assumptions Common to all Transmission Line Alternatives

There are several assumptions common to all transmission line alternatives:

- Transmission lines located along existing county roads would use the county roads as access roads. On roads containing existing transmission lines, the existing poles would be removed and an underbuild circuit would be constructed as described in Chapter 2. Transmission lines that are located along county roads without existing transmission lines would secure easements from Mesa County and would use the county roads as access roads.
- In areas north of the Highline Canal where transmission line alternatives are bounded by private land on one side and BLM-managed land on the other, the applicant would secure a transmission line ROW on BLM-managed lands and the transmission lines would be located on BLM-managed lands.
- An average of 15 poles per mile would be sited north of the Highline Canal, and an average of 17 poles per mile would be sited south of the Highline Canal (due to the need for an underbuild circuit).
- Transmission lines constructed along existing county roads would have temporary and long term impacts equal to 4 square feet per pole, as existing roads would be used for access.
- Temporary ROW for transmission line sections not running along existing county roads would be 100 feet.
- Permanent ROW for access roads not running along existing county roads would be 20 feet.

Proposed 69kV Transmission Line

The proposed transmission line would temporarily impact approximately 86 acres of BLM-managed land. The proposed transmission line would not cross any private land north of the Highline Canal; therefore there would be no temporary impacts to private land north of the Highline Canal. The proposed transmission line would follow existing county roads south of the Highline Canal, so the only temporary impacts would be due to the 4 square feet per pole disturbance. This amounts to less than 1 acre of temporary disturbance to private land south of the Highline Canal.

Long term impacts would include approximately 17 acres of BLM-managed land and less than 1 acre of private land south of the Highline Canal.

Transmission Line Alternative A

Transmission Line Alternative A follows existing county roads for the majority of the route. A new easement would need to be secured along County Road (CR) 16 north of the Highline Canal. Alternative A follows an existing easement for a transmission line and natural gas pipeline. This corridor crosses CR 16 at Coal Gulch and runs northwest to the mine (see Figure 2-18, Transmission Line Alternatives). Temporary impacts would include approximately 30 acres of BLM-managed land, approximately 29 acres of private land north of the Highline Canal, and less than 1 acre of private land south of the Highline Canal.

Long term impacts would include approximately 6 acres of BLM-managed land, less than 1 acre of private land north of the Highline Canal, and less than 1 acre of private land south of the Highline Canal.

Transmission Line Alternative B

Transmission line Alternative B follows existing ROW south of the Highline Canal, and follows the existing transmission line/natural gas pipeline easement as described for Alternative A. Temporary impacts would include approximately 50 acres of BLM-managed land, approximately 2 acres of private land north of the Highline Canal, and less than 1 acre of private land south of the Highline Canal.

Long term impacts would include approximately 10 acres of BLM-managed land, less than 1 acre of private land north of the Highline Canal, and less than 1 acre of private land south of the Highline Canal.

Transmission Line Alternative C

Transmission Line Alternative C follows existing county roads south of the Highline Canal, and follows the proposed railroad spur for approximately 3 miles north of the Highline Canal. Alternative C does not cross private land north of the Highland Canal. Temporary impacts would include approximately 53 acres of BLM-managed land, 0 acres of private land north of the Highline Canal, and less than 1 acre of private land south of the Highline Canal.

Long term impacts would include approximately 11 acres of BLM-managed land, 0 acres of private land north of the Highline Canal, and less than 1 acre of private land south of the Highline Canal.

Alternatives Carried Forward for Further Consideration

The analysis of alternatives is essential to the National Environmental Policy Act (NEPA) process and the goal of objective decision-making. This section describes the impacts resulting from several alternatives to the Proposed Action: the grade-separated railroad crossing at CR M.8, the use of noiseless crossing traffic control devices where the railroad intersects CR M.8 and CR 10, and the three transmission line alternatives.

Short Term Use vs. Long-Term Productivity

This section describes the relationship between short term uses of the environment and the maintenance and enhancement of long term productivity (40 CFR 1502.16).

Irreversible and Irretrievable Commitment of Resources

This section describes the impacts of the Proposed Action and alternatives to resources that could not be changed or are permanent (irreversible), and the impacts of the Proposed Action and alternatives to resources that could not be restored, replaced, or otherwise retrieved upon closure of the mine and decommission/reclamation of the mine and facilities associated with the mine (irretrievable) (40 CFR 1502.16).

Summary Table of Mitigation Measures

A table is presented in Appendix B, Standard Practices and Mitigation Measures, that lists applicable laws, regulations, and policies and summarizes the recommended mitigation measures for all resources.

Cumulative Impacts

Cumulative impacts for past, present, and reasonably foreseeable projects and development in the project area and in Mesa and Garfield counties are discussed. The anticipated incremental impacts of the Proposed Action are compared with impacts from other projects/development including energy development in Mesa and Garfield counties.

4.1 HUMAN ENVIRONMENT AND RESOURCE USE

4.1.1 Land Ownership and Use

No Action Alternative

Under the No Action Alternative, the development of this mine would not occur and there would be no change to the current land use in the project area.

Proposed Action Alternative

Mine and Facilities

A number of surface facilities are proposed to support the mining operation including a waste rock pile, fuel oil storage/fueling stations, an electrical substation, bathhouse/office building, outdoor material storage areas, equipment shop, warehouse, washbay, covered storage, sewage treatment plant, water tank, water treatment building, mine vent fan, transmission line, non-coal waste storage, rock dust storage, pump house, conveyor transfer building, railroad maintenance

road, water pipeline and diversion, coal preparation plant, mine access roads, and unit train loadout. The loadout would be comprised of the clean coal stockpile, reclaim tunnel, conveyor belt, batch weigh system, and loadout tower. Some of these facilities would be located on the coal lease, with the remainder on the ROW application area. See Section 2.11.6, Associated Surface Facilities, for additional description of the facilities.

Existing land uses in the mine site include dispersed recreation, livestock grazing, and wildlife use as described in Section 3.1.1, Land Ownership and Use. The McClane Canyon Mine (MCM) is located approximately 4 miles north of the proposed mine and is included within coal leases currently held by the applicant.

The mine and facilities would be located on BLM-administered lands. These lands are managed under the Grand Junction Resource Area Resource Management Plan (RMP) (BLM 1987) and North Fruita Desert Management Plan (BLM 2004). The Grand Junction Resource Area RMP identifies approximately 390,000 acres of the Book Cliffs as acceptable for further coal leasing consideration (BLM 1987). The mine and facilities are among the 390,000 acres identified in the RMP as suitable for coal leasing.

The North Fruita Desert Management Plan identifies 5,607 acres within the North Fruita Special Recreation Management Area (SRMA) with no surface occupancy (NSO) stipulations (BLM 2004). None of this acreage is within the mine or mine facilities area.

Lease Area

The future coal leasing area is estimated to be about 23,000 acres. The entire lease area is within BLM jurisdiction. Underground mining would create subsidence within the lease area as described in Section 4.2.3, Geology, and Appendix D, Subsidence. Use of BLM lands and minerals would require the mine operator to competitively obtain additional coal leases on these lands.

Existing land uses within the lease area include mineral exploration and production facilities, oil and gas development and extraction, livestock grazing, dispersed and developed recreation, and wildlife use.

Some existing gas wells overlying the lease area may be plugged or "mined around." Mine Safety and Health Administration (MSHA) Rules (30 CFR § 75.1700) require underground mines to maintain a 300-foot diameter solid coal barrier around all active or inactive gas and oil wells, unless a smaller barrier is approved by MSHA. Future oil and gas development would be constrained by coal development activities that precede applications for permit to drill (APD).

The lease area is located entirely on BLM-administered lands. As stated in the Mine and Facilities section, applicable land use plans include the Grand Junction Resource Area RMP (BLM 1987) and North Fruita Desert Management Plan (BLM 2004). The coal lease area is among the 390,000 acres identified in the RMP as suitable for coal leasing.

Railroad

The proposed railroad spur would traverse approximately 9.5 miles of BLM-administered land, and approximately 5 miles of private land. Use of federal lands would require the mine operator to obtain a ROW grant on these federal lands.

Existing land uses along the railroad route include dispersed and developed recreation, agriculture, irrigated farmland, livestock grazing, wildlife use, transportation and utility

corridors, and low-density single family residential development within rural private land parcels. Within the Town of Mack, the proposed route passes through areas zoned General Industrial District (I-2).

A "wye" (triangle) would be constructed to link the railroad spur with the main line at Mack to allow uninterrupted train flow in all directions.

The railroad is located on BLM-administered lands and private lands within the jurisdiction of Mesa County. The Grand Junction Resource Area RMP designated 234,113 acres as unsuitable for public utilities, and 606,456 acres as sensitive to utility development; the remainder of the Resource Area is designated suitable for consideration for public utilities (BLM 1987). The railroad corridor is within the area designated suitable for consideration for public utilities.

The North Fruita Desert Management Plan identifies threatened and endangered species habitat, scenic values, steep slopes, deer and elk winter range, and known locations of sensitive species as sensitive to the location of public utilities (BLM 2004). The remainder of the North Fruita Desert SRMA is designated suitable for utilities; the railroad corridor is within this area.

Private land in the project area is under the jurisdiction of Mesa County and is discussed in the Mesa Countywide Land Use Plan (Mesa County 1996) and the Loma/Mack Area Plan (Mesa County 2004). The railroad corridor is consistent with both plans.

Water Pipeline

The water pipeline would be buried along the railroad spur alignment. It would extend to a water tank located at the Red Cliff Mine site above the portal level. A smaller water tank would also be constructed near the coal preparation plant.

The proposed pipeline would traverse approximately 9.5 miles of BLM-administered land, and approximately 5 miles of private land. Use of federal lands would require the mine operator to obtain a ROW grant on these federal lands.

Existing land use along the pipeline corridor is the same as described in the Railroad section.

The water pipeline crosses BLM-administered lands and private lands under the jurisdiction of Mesa County. Compliance with these land use plans is the same as addressed in the Railroad section.

Transmission Line

Existing land uses within the proposed transmission line ROW consist of mineral exploration and production facilities, oil and gas development and extraction, livestock grazing, transportation and utility corridors, water control management by the Bureau of Reclamation (BOR), dispersed and developed recreation, agriculture, irrigated farmland, wildlife use, and low-density single family residential development within rural private land parcels.

The proposed transmission line would cross 7.1 miles of BLM lands and would not cross any private land ownership north of the Highline Canal. South of the Highline Canal, the proposed transmission line would be adjacent to 95 private parcels of land, and would not cross any private parcels of land. Table 4-2, Transmission Line Impacts to Private Land Parcels, shows the approximate number of private parcels located adjacent to the transmission line, and the approximate number of parcels crossed by the transmission line. Alternatives A, B, and C are discussed later. An underbuild distribution line would be constructed in areas with existing

distribution lines south of the Highline Canal. New transmission lines would be constructed along existing county road easements on private lands also south of the Highline Canal, and new ROWs would be secured for construction of new transmission lines on BLM-administered lands. Purchasing easements from private landowners would not be necessary, as the proposed transmission line does not cross any privately owned parcels of land north of the Highline Canal.

Table 4-2
TRANSMISSION LINE IMPACTS TO PRIVATE LAND PARCELS

Transmission Line	Number of Private Parcels Adjacent to Transmission Line*	Number of Private Parcels Crossed by Transmission Line
Proposed 69kV Line	95	0
Alternative A	90	19
Alternative B	82	5
Alternative C	96	0

Source: Mesa County Assessor, 2008
*South of the Highline Canal
kV = kilovolt

Pad or pole-mounted transformers would be used as necessary to provide electrical power to the mine facilities as described previously. Land use impacts from the pad transformers would be minimal.

The transmission line crosses BLM-administered lands and private lands under the jurisdiction of Mesa County. Compliance with these land use plans is addressed in the Railroad section.

New transmission lines would be constructed along existing county road easements on private lands, and new ROWs would be secured for construction of new transmission lines on BLM-administered lands.

Temporary Impacts

Temporary land use impacts would result from construction of the access roads, conveyor belt, material storage sites, railroad corridor, and construction lay-down areas. Temporary impacts would result from equipment and topsoil storage areas and temporary access roads. Temporary impacts to BLM-managed land and privately owned land due to the railroad/pipeline corridor and the transmission line alternatives are found in Table 4-1. Construction of the mine facilities would temporarily impact approximately 237 acres.

Construction activities of the railroad include cut-and-fill, compaction, and track laying along the railroad corridor.

Construction of the water pipeline and use of material storage sites and construction lay-down areas would result in temporary impacts to wildlife habitat, livestock grazing, and agricultural lands along the pipeline corridor. After reclamation and revegetation, wildlife habitat, livestock forage, and agricultural productivity should return to normal within approximately two growing seasons.

Long Term Impacts

Long term impacts to land use would result from the aboveground facilities associated with the mine; surface facilities would displace livestock grazing, recreation, and wildlife use from the

immediate area for the life of the project (30 years). Upon decommissioning of the mine, surface facilities would be removed and the land would be restored to its original vegetative cover per BLM policy. Long term impacts to BLM-managed land and privately owned land due to the railroad/pipeline corridor and the transmission line alternatives are found in Table 4-1. The mine facilities would permanently impact 237 acres, not including the entire waste rock pile footprint.

Permanent impacts to land use would arise from construction of benches for the mine facilities and the waste rock pile. Cuts and fills associated with construction of the loadout area would also permanently impact land use. Up to 90-foot-deep cuts are projected for the loadout area. The waste rock pile is approximately 190 acres. These areas would be permanently converted from the existing land use to energy development.

The long term impacts to land use would be the operation of a linear utility corridor for the life of the project. Land use along the railroad and pipeline corridor would be converted to a utility ROW. Construction of the railroad would result in loss of agricultural lands, livestock grazing, recreation, and wildlife habitat along the railroad corridor for the life of the project. This may also result in long term alteration of trails and lack of recreational access along the railroad and pipeline corridor.

Construction of the railroad would result in long term impacts to transportation corridors. The trains would cross public roads in four locations. The Proposed Action is a grade-separated crossing with SH 139, and at-grade crossings for CR 10, CR T, and CR M.8.

Long term impacts to land use would result from construction of the railroad corridor. As previously discussed in Chapter 2, to improve the sight distance at the CR 10 crossing, CR 10 would be realigned. This realignment of CR 10 would result in long term conversion of existing low-density residential and agricultural land use to road ROW.

Other long term impacts to land use would result from construction of the railroad corridor. To construct the rail alignment, cuts and fills would be necessary to provide a level, gentle-sloping railbed. Cuts and fills vary, with 25- to 50-foot-deep cuts and fills being common. These areas would permanently be converted from the existing land use and converted to a utility ROW.

The "wye" constructed to link the railroad spur with the main line at Mack would result in a permanent change from the existing industrial land use to utility ROW.

The proposed transmission line would have several long term land use impacts. The disturbance area associated with placement of poles would be removed from current land use for the duration of the project. Access roads may be required for the life of the project for transmission line maintenance; these roads would be revegetated upon termination of the project. The proposed transmission line and primary substation would result in conversion of existing land use to a utility ROW for the life of the project.

Mitigation Measures

Use of federal lands would require the mine operator to obtain ROW grants on these federal lands.

Some gas wells overlying the lease area may be plugged or "mined around" per MSHA Rules (30 CFR 75.1700).

All temporary construction areas would be reclaimed and revegetated per BLM policy.

Upon decommissioning of the mine, surface facilities would be removed and the land would be restored to its original vegetative cover per BLM policy. Access roads would be closed to the public, and the disturbed area would be reclaimed.

Upon project termination, the railroad would be removed, including bridges, crossing warning devices, and gate systems at road intersections, and the area would be revegetated according to BLM policy.

Appendix B, Standard Practices and Mitigation Measures, contains a list of mitigation measures; some of which would lessen impacts to other land uses.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

One proposed alternative is a grade-separated railroad crossing at CR M.8. Existing zoning classifications along the proposed railroad route at CR M.8 are I-2 (General Industrial District) and RSF-1 (Residential-Single-Family District). Land use in the immediate area of the grade-separated railroad crossing would be temporarily affected during construction of the grade-separated railroad crossing. Long term impacts to land use from this alternative would include a permanent change in land use for land acquired to construct the bridge to a utility ROW. Temporary and long term land use impacts due to the grade-separated crossing at CR M.8 are as follows:

- Temporary: A 100-foot bridge would be constructed with a construction ROW of 150 feet for a total temporary disturbance of approximately 0.3 acre
- Long term: The permanent ROW would decrease to 115 feet, yielding approximately 0.3 acre of permanent disturbance (no substantive difference from temporary)

The location of the grade-separated railroad crossing at CR M.8 is within Mesa County jurisdiction. CR M.8 is identified as a valuable corridor for transportation within the Loma/Mack Area Plan (Mesa County 2004), and this plan identifies the need for long-range planning for access and ROW to improve safety. The grade-separated crossing at CR M.8 is consistent with the Loma/Mack Area Plan.

An at-grade crossing at CR M.8 may restrict future residential, commercial, and industrial development west of CR M.8.

This alternative would have no effect on Mesa County's road circulation plan. Mesa County would retain ROWs reserved in 1890 and 1892 proclamation on non-existing roads. Mesa County would retain the rights to develop new roads west of the railroad, and rights for new roads to cross the railroad track. If new roads are constructed over the railroad track, an appropriate crossing would be constructed.

Noiseless Crossing Traffic Control Devices

There would be no long term land use impacts from noiseless crossing traffic control devices. These devices would be installed within the railroad ROW where the railroad crosses CR 10 and CR M.8, as described in Section 2.11.1, Proponent Proposed Action. Temporary impacts may result during construction; however, any construction impacts would be minor. CR 10 and

CR M.8 are under the jurisdiction of Mesa County; compliance with land use plans is the same as described in the Proposed Action.

Transmission Line Alternative A

Transmission Line Alternative A would cross 4.1 miles of BLM lands and 4.2 miles of private land ownership north of the Highline Canal. Alternative A would be adjacent to 90 private parcels of land, and would cross 19 private parcels of land north of the Highline Canal. This alternative follows CR 16 and an existing pipeline/transmission line alignment. An underbuild distribution line would be constructed in areas with existing distribution lines, and new easements and ROWs would be secured for construction of new transmission lines. Grand Valley Power (GVP) would be required to obtain ROWs grants on these federal lands. GVP would have to purchase easements or ROWs on private lands that do not currently contain transmission or distribution lines. Temporary and long term impacts to BLM-managed land and privately owned land are found in Table 4-1.

The description of existing land uses, temporary and long term impacts, and compliance with existing land use plans is the same as the Proposed Action.

Transmission Line Alternative B

Transmission Line Alternative B would cross 5.8 miles of BLM lands and 1.9 miles of private land ownership north of the Highline Canal. Alternative B would be adjacent to 82 private parcels of land, and would cross 5 private parcels of land. An underbuild distribution line would be constructed in areas with existing distribution lines, and new easements and ROWs would be secured for construction of new transmission lines. Impacts to recreational trails are described in Section 4.1.4, Recreation. GVP would be required to obtain ROWs grants on these federal lands. GVP would have to purchase easements or ROWs on private lands that do not currently contain transmission or distribution lines. Temporary and long term impacts to BLM-managed land and privately owned land are found in Table 4-1.

The description of existing land uses, temporary and long term impacts, and compliance with existing land use plans is the same as the Proposed Action.

Transmission Line Alternative C

Transmission Line Alternative C would cross 7.7 miles of BLM lands and would not cross any private land ownership north of the Highline Canal. Alternative C would be adjacent to 96 private parcels of land, and would not cross any private parcels of land. An underbuild distribution line would be constructed in areas with existing distribution lines, and new easements and ROWs would be secured for construction of new transmission lines. Impacts to recreational trails are described in Section 4.1.4, Recreation. GVP would be required to obtain ROW grants on these federal lands. Because no private lands are crossed north of the Highline Canal, GVP would not be required to obtain easements across private lands. Temporary and long term impacts to BLM-managed land and privately owned land are found in Table 4-1.

The description of existing land uses, temporary and long term impacts, and compliance with existing land use plans is the same as the Proposed Action.

4.1.2 Grazing

No Action Alternative

There would be no effects to grazing under the No Action Alternative.

Proposed Action Alternative

All of the components of the Proposed Action combined would result in approximately 452 acres of vegetation disturbance and lost livestock forage within BLM grazing allotments. At 20 acres per animal unit month (AUM), approximately 22.6 AUMs would be lost. This is not expected to result in any decrease in forage allocation within the allotments since the forage loss is such a small portion (less than 0.2 percent) of the 9,928 active AUMs available on the allotments.

Livestock access to some water sources may be changed.

Temporary Impacts

Temporary impacts such as fence crossings would occur to existing range improvements. Temporary impacts to BLM-managed land and privately owned land are found in Table 4-1. Temporary impacts would occur to slightly greater than 22.6 AUMs during the construction period and revegetation of disturbed areas during construction.

It is possible that the train operations may start wildfires. Sparks from brake shoes and carbon particles ejected from the train may ignite dried vegetation under certain conditions.

Long Term Impacts

The proposed project is expected to have a generally negative affect on Land Health due to difficulties in reclaiming the soils. Disturbed lands are not likely to meet Land Health Standards for at least 10 years following reclamation (Fowler 2007). Approximately 22.6 AUMs would be lost for the life of the mine.

A Land Health Assessment has not been done for the grazing allotments involved in the proposed project area. However, based on visual observations by BLM resource specialists, the allotments are currently considered likely to be meeting Land Health Standards (Fowler 2007).

Mitigation Measures

Fence repair or rebuilding would be done as required. If stock water sources are disrupted, water would be supplied as needed. Cattle guards may need to be installed to protect livestock from rail or vehicular traffic. If livestock are struck by trains, the applicant would be required to compensate the livestock owner.

Railroad Fires

In order to mitigate fires caused by the train, it is necessary to treat potentially hazardous vegetation within the railroad ROW. There are three basic methods of reducing ROW fire hazards: mechanical clearing (physical removal of vegetation), burning, and chemical treatment. These fire hazard reduction methods often need to be used in combination for optimum hazard reduction.

Mechanical clearing is most useful for initial clearing of heavy fuels, such as old logs, and for construction and maintenance of firebreaks. Chemical treatment is most useful for maintenance

of clearings already established. However, it can create flash-fuel problems if used as the first treatment. Burning can be used for either initial or maintenance treatment but is normally unsafe without a mechanically cleared firebreak (Union Pacific Railroad et al. 1999).

Certain fire hazards cannot be treated by removal, burning or herbicides. These might include vegetation such as moss and grass growing on rock cliffs or cut-banks, rare or endangered plant species, and short stretches of ROW where the other methods are precluded for any reason. In these situations, fire retardant chemicals should be employed, either alone or in combination with the other methods.

Fire Fighting Methods

When fires do occur on railroad property or ROW, the company has a legal responsibility to report them to the protection agency and to do all in its power to suppress the fire.

Some railroad companies use hyrailer (a vehicle that can travel on rails and roads) patrols and water tank cars in fire-prone areas to fight wildfires started by trains.

Hyrailer patrols may be timed to follow 10-15 minutes behind trains. They may have a one or two-person crew which is provided with a radio and limited firefighting tools. Unless they discover a fire while it is still very small they would usually need help in suppressing it. Such patrols are quite costly, and they are, therefore, seldom put behind every train during an entire fire season (Union Pacific Railroad et al. 1999).

Several railroad companies provide water tank cars exclusively for fire protection purposes during fire season. These large water sources (8,000-12,000 gallons each) can be of great help to fire suppression forces.

Appendix B, Standard Practices and Mitigation Measures, includes additional information on fire mitigation, seed mixes for soil stabilization, grazing use, and wildlife habitat.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Impacts to grazing under this alternative would be the same as those shown for the Proposed Action.

Noiseless Crossing Traffic Control Devices

Impacts to grazing under this alternative would be the same as those shown for the Proposed Action.

Transmission Line Alternative A

Impacts to grazing under this alternative would be the same as those shown for the Proposed Action.

Transmission Line Alternative B

Impacts to grazing under this alternative would be the same as those shown for the Proposed Action.

Transmission Line Alternative C

Impacts to grazing under this alternative would be the same as those shown for the Proposed Action.

4.1.3 Wilderness and Special Designations

No Action Alternative

Under the No Action Alternative, mining development would not occur, and there would be no impact to wilderness and special designations.

Proposed Action Alternative

The project area does not contain Wilderness, Wilderness Study Areas, Wild Horse Areas, or National Conservation Areas. Therefore, there would be no direct or indirect impacts to these areas under the Proposed Action.

The project area contains a portion of the North Fruita Desert SRMA. Recreational impacts to the North Fruita Desert SRMA are described in Section 4.1.4, Recreation.

Mine and Facilities

The mine is not located within any wilderness or special designations. Therefore there would be no direct impacts to wilderness and special designations. Direct impacts due to air emissions are addressed in Section 4.2.1, Air Quality.

Lease Area

Only a small portion of the lease area is within the North Fruita Desert SRMA; no surface activity would take place in this area. Therefore, there would be no direct impacts to wilderness and special designations. Indirect impacts due to subsidence are discussed in Appendix D, Subsidence.

Railroad

Part of the railroad route is within the North Fruita Desert SRMA. Impacts due to the location of the railroad corridor within the North Fruita SRMA are discussed in Section 4.1.4, Recreation.

Water Pipeline

Most of the proposed water pipeline would be constructed along the railroad corridor within the North Fruita Desert SRMA. After construction, the water pipeline would be buried and there would be no impact.

Transmission Line

The proposed transmission line would cross 7.1 miles of BLM lands within the North Fruita Desert SRMA. Indirect impacts due to the location of transmission line alternatives within the North Fruita SRMA are discussed in Section 4.1.4, Recreation.

Temporary Impacts

Temporary impacts would result from construction of the water pipeline, the railroad, and the transmission line. Temporary impacts to the North Fruita Desert SRMA are discussed in Section 4.1.4, Recreation.

Long Term Impacts

Long term impacts to the North Fruita Desert SRMA would include the operation of new transportation and utility corridors and changing the existing land use from an open range environment to an industrial use within the transportation and utility corridors. Long term impacts to the North Fruita Desert SRMA are discussed in Section 4.1.4, Recreation.

Mitigation Measures

No mitigation measures are necessary.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

The grade-separated crossing at CR M.8 is not located within any wilderness or special designations. Therefore there would be no impacts to wilderness and special designations.

Noiseless Crossing Traffic Control Devices

The noiseless crossing traffic control devices would not be located within any wilderness or special designations; therefore, there would be no change to wilderness and special designations.

Transmission Line Alternative A

Transmission Line Alternative A would cross 4.1 miles of BLM lands within the North Fruita Desert SRMA. Impacts are discussed within Section 4.1.4, Recreation.

Transmission Line Alternative B

Transmission Line Alternative B would cross 5.8 miles of BLM lands within the North Fruita Desert SRMA. Impacts are discussed within Section 4.1.4, Recreation.

Transmission Line Alternative C

Transmission Line Alternative C would cross 7.7 miles of BLM lands within the North Fruita Desert SRMA. Impacts are discussed within Section 4.1.4, Recreation.

4.1.4 Recreation

No Action Alternative

Under the No Action Alternative, the proposed mine development would not occur and there would be no change to existing recreation.

Proposed Action Alternative

The project area has a variety of dispersed recreation opportunities on BLM-managed land, and also contains the Highline Lake State Park, which offers camping and water-related activities.

BLM land between the Highline Canal and the Book Cliffs is within the North Fruita Desert SRMA and is managed for multiple use, with an emphasis on recreation opportunities.

Mine and Facilities

Dispersed recreation, including mountain biking, occurs in the location of the proposed mine and facilities; these areas would be permanently closed to recreation for the life of the project (30 years). There is an existing two-track road partially within the mine area that can be accessed via CR X (otherwise known as Mitchell Road or Power Line Road) that would be closed to public use. However, this area is not considered a high-use area. The BLM Bicycle Emphasis Area, primarily accessed by CR 18, is located several miles to the east of the project area and would not be impacted by mine construction or operations. Figure 3-1, Recreational Trails within the North Fruita Desert SRMA, shows the mine, associated linear features, and recreational trails within the project area.

Lease Area

Approximately 70 acres of the existing lease and approximately 811 acres of the land use application are within the North Fruita Desert SRMA (see Figure 3-1, Recreational Trails within the North Fruita Desert SRMA). No aboveground facilities would be located in the lease area within the North Fruita Desert SRMA; therefore, there would be no impacts to recreation. Indirect impacts due to subsidence are discussed in Appendix D, Subsidence.

Railroad

Nine and a half (9.5) miles of the railroad route is within the North Fruita Desert SRMA. The railroad alignment crosses four segments of BLM-managed trails.

Part of the railroad alignment is within 0.5 mile of Highline Lake State Park. The railroad alignment would not have direct impacts to recreationists at Highline Lake State Park, but would have indirect visual and noise impacts to recreational users. See Sections 4.1.8 and 4.1.9 for discussion of visual and noise impacts respectively.

Water Pipeline

The water pipeline follows the railroad alignment. Part of the water pipeline is within the North Fruita Desert SRMA, and construction of the pipeline would temporarily disturb recreational use of affected trails. Normal recreational activities would resume following pipeline construction.

Transmission Line

The proposed transmission line is located on private lands south of the Highline Canal, and would not impact recreation in this area. The portion of the transmission line that runs through the North Fruita Desert SRMA crosses six segments of trails and is within 0.5 mile of the Mack Wash loop trail for the entire extent of the transmission line route on BLM lands. The transmission line would be placed so that poles do not alter existing trails; however, access roads may directly impact trails. The transmission line may have indirect visual impacts to recreational users.

Temporary Impacts

Temporary impacts to dispersed recreation would occur during construction of the transmission line and water pipeline, as recreation areas may be temporarily closed during construction, and trails may be temporarily altered by construction impacts (e.g., temporary access roads). The

railroad would temporarily impact approximately 173 acres of the North Fruita Desert SRMA during construction. The transmission line would span existing trails, and would not directly impact trails.

Long Term Impacts

Long term impacts to recreation may result from the placement of the railroad and permanent access roads for maintenance of the transmission line. The railroad would permanently impact approximately 133 acres within the North Fruita Desert SRMA. The railroad alignment crosses four segments of trails, and the transmission line crosses six segments of trails. This may result in long term alteration of trails and lack of recreational access along these corridors.

Alternative A would have a minimal effect on the recreation issues related to the North Fruita Desert SRMA. All transmission line alternatives except Alternative A would have some effect as they cross or interrupt the existing designated trail network.

No other long term impacts to recreation would be expected except that the linear ROW with poles and conductors would result in indirect visual impacts in some areas, affecting the natural setting of recreational activities. See Section 4.1.8, Visual, for discussion of visual impacts.

Mitigation Measures

Within the North Fruita Desert SRMA, BLM would require that existing trails impacted by the mine facilities and the railroad be mitigated. One way in which this may be done would be for the Applicant to contract with the Colorado Off-Highway Vehicle Coalition to design and construct alternate trail routes for those that are closed by the mine facilities or railroad alignment. Appendix B, Standard Practices and Mitigation Measures, includes additional mitigation measures for recreation.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

The grade-separated crossing at CR M.8 is on privately owned land under the jurisdiction of Mesa County. There would be no impacts to recreation from this alternative.

Noiseless Crossing Traffic Control Devices

The noiseless crossing traffic control devices are on privately owned land under the jurisdiction of Mesa County. There would be no impacts to recreation from this alternative.

Transmission Line Alternative A

Transmission Line Alternative A is on private land south of the Highline Canal, and would not impact recreation. North of the Highline Canal, Alternative A follows CR 16 for the majority of the length of the transmission line and crosses one two-track trail. Impacts would be less than the Proposed Action.

Transmission Line Alternative B

Alternative B is on private land south of the Highline Canal and crosses one trail that is under construction on BLM land north of the Highline Canal. Impacts would be less than the Proposed Action.

Transmission Line Alternative C

Alternative C is on private land south of the Highline Canal, and would not impact recreation. North of the Highline Canal, Alternative C crosses five trail segments. Impacts would be the same as the Proposed Action.

4.1.5 Socioeconomics

Socioeconomic impacts of the Proposed Action and the alternatives would be generated by the construction and operation of the coal mine and the railroad spur built to transport the coal out of the region. The project would produce a valuable energy source, creating new jobs and new local business expenditures. In turn, secondary economic impacts would be generated in the form of additional jobs and income and increased local, state, and federal government revenue. The new jobs would likely result in increased local population and that population growth could potentially impact local government facilities and services—housing, schools, domestic water systems, etc. In the context of the broader regional and national energy economy, the development of the Red Cliff Mine would increase the domestic fossil fuel supply, improving the reliability of our national energy system. The No Action Alternative would avoid a potential increase in demand for local government services and disruption of human activities near the proposed project, but would also forego the employment, public revenue, and energy supply benefits associated with the action alternatives.

Most of the socioeconomic impacts would be felt in the Grand Valley of Mesa County. This area has a large population, a number of sizeable established communities, and a well-developed community infrastructure located within a 15- to 45-minute commute from the proposed coal mine. Construction workers who do not already reside in the area would find temporary residence in local motels or other rental housing facilities. The majority of permanent mine employees would reside in the Grand Valley. Similarly, local project expenditures for fuel, housing, equipment, services, and supplies needed for construction, development, and operation of the mine would take place in the Grand Valley.

Jurisdictions within Mesa County would receive much of the sales tax associated with the proponent's local expenditures and the ad valorem taxes (property taxes) on the railroad spur. However, because the mine and most of the coal resource would be located in Garfield County, the ad valorem taxes associated with the mining operation itself would flow to jurisdictions within Garfield County. The U.S. and the State of Colorado would share the federal royalties generated by the mine, and Colorado would receive additional revenues based on the state severance tax.

In general, socioeconomic impacts are described here in terms of the entire project—the mine and facilities, the railroad spur, and all related facilities such as the water pipeline and the transmission line. When impacts can be attributed to a specific project element, it is noted. The timing of project implementation is unknown, but this analysis assumes in general that the ramp-up to full production would be fairly rapid—about 2 years—because this scenario would produce the strongest potentially adverse impacts.

No Action Alternative

Under the No Action Alternative, the Red Cliff Mine would not be developed and no railroad spur would be constructed. There would consequently be no socioeconomic impacts, with one possible exception. The proponent has already purchased a substantial amount of property along the proposed route of the railroad spur. Should the project not go forward, the proponent may dispose of those properties which may lead to a potential socioeconomic impact if they were disposed of rapidly, putting downward pressure on prices; develop the properties which may lead to an increase in the economic return of the properties; or take no action, which may or may not have a socioeconomic impact, depending on market conditions. The No Action Alternative would avoid increased demand for local government services and disruption of human activities near the proposed project, but would also forego the employment, public revenue, and energy supply benefits associated with the action alternatives.

Proposed Action Alternative

The proposed Red Cliff Mine would have two phases, a construction phase, during which the railroad spur from the mine to the Union Pacific Railroad (UPRR) and the facilities at the mouth of the mine would be constructed, and an operational phase, during which the coal would be mined, cleaned, and shipped out.

Affected Community

The affected community, as described in Section 3.1.5, Socioeconomics, identified the following "anticipated social impacts" through scoping comments and interviews (Moore 2007):

- Loss in property values due to the railroad spur
- Isolation of 20,000 to 30,000 acres of deeded land
- Impact on rural flavor and sense of community
- A sense that the old way of life would be lost
- A redefinition of the area as an industrial corridor due to the railroad spur
- The noise of the railroad, both the horn used when coming to the crossings and the sound of the train itself
- Safety issues associated with the proposed at-grade railroad crossings at CR M.8 and CR 10
- Disruption of automobile traffic patterns due to the proposed at-grade railroad crossings at CR M.8 and CR 10, including school buses which currently operate 6 to 8 times per day at these intersections
- Displeasure with CAM's interactions with the community

In order to achieve a more coherent analysis of the social impacts and consequences, both those anticipated and expected, the analysis of the issues and concerns found through scoping and interviews were examined within the following thematic framework:

- *Property Values/Social Dislocation*: Some residents believe that building the railroad spur as proposed would reduce property values. Their concern about a potential loss in property values appears to be related to changes they foresee occurring in the character of the

landscape, from rural agricultural to semi-industrial, and concerns over safety and inconvenience issues described below. In contrast to this perspective, other community representatives, particularly as reflected in the BLM Public Scoping Report, believe that the purchases of real estate being made by CAM are already raising real estate prices.

- *An Anticipated Loss of Rural Values*: One of the social impacts most often mentioned by community members is an anticipated loss of rural values that are rooted within the affected community and the surrounding physical environment. Many community residents in the vicinity of Mack believe that the noise of the train, the disruption of agricultural activities, and changes in the visual landscape would negatively affect the rural character of the community, would present overwhelming consequences to the values they hold dear, and would give people the sense that an old way of life would be lost as a result of the mine and railroad spur.
- *Impacts on Safety*: Community concerns about decreases in transportation safety are among the impacts which might be viewed as most tangible. This interaction is often expressed as increasing the potential for accidents in relationship to school buses, and interfering with medical emergencies. Residents also use additional means of expressing their safety concerns, such as the daily frequency of the train and school bus interactions, specifically the proposed grade crossings of CR 10 and CR M.8, and on-going disruptions of routine traffic routes to which they have become accustomed. Residents readily indicate that an underpass (for both CR M.8 and CR 10) would be appropriate solutions, since it seems most apparent to them that having the railroad spur cross county roads in these two locations could increase accidents with school buses and limit access for emergencies.
- *An Industrial Corridor*: At a somewhat larger scale in terms of land use impacts on the community, the building of the railroad spur within a rural landscape is looked at as an industrial intrusion. The concern is expressed in terms of creating an "industrial corridor" within an existing residential area. Some residents have countered that the Union Pacific rail line along Interstate 70 (I-70) already exists, and there was a previous train route (the Uintah Railway) to a gilsonite mine on Baxter Pass, somewhat further to the northwest of the proposed Red Cliff Mine. Some residents anticipate that the railroad spur would over time create a wider zone, industrial in nature, which would attract associated commercial uses and functions. Much of this social impact, which is related to future real estate developments, is highly anticipatory because a number of the residents also feel they do not have clear and trustworthy information about future land use developments that might bring about additional incompatible industrial or semi-industrial uses.
- *Company Relations with the Community*: Some members of the community have expressed concern and distrust of mining in the area. Residents have asked for an increased level of communication with CAM, and a desire to have more information about future plans for mining near their communities.

Employment and Income

Table 4-3, Red Cliff Mine, Estimated Construction Employment, shows the estimated number of employees (full-time equivalents) that would be working on construction of the mine facilities, the railroad spur, and related facilities. The estimates are based primarily on information in the Proposed Action, although several categories were estimated independently. The *Earth-Moving* category includes all earth-moving equipment operators, supporting equipment operators,

laborers, and supervisors involved in the cut-and-fill earthwork necessary to prepare the railroad track bed and to implement measures to minimize soil erosion and reclaim the disturbance. The *Bridges and Culverts* category includes all equipment operators, truck drivers, laborers, and supervisors needed to deliver and install bridges and culverts along the length of the railroad spur. The *Track* category includes all equipment operators, truck drivers, laborers, and supervisors required to deliver track materials along the route and to install the materials and lay the track. The *Waterline* and *Transmission Line* categories include equipment operators, laborers, and supervisors needed to install a waterline along the length of the railroad spur and to build an electric transmission line to the mine mouth.

Table 4-3
RED CLIFF MINE, ESTIMATED CONSTRUCTION EMPLOYMENT

	Number (FTEs*)		Annualized	
	Year 1	Year 2	Year 1	Year 2
Earth-Moving	65.5		32.8	
Bridges and Culverts	26.6		13.3	
Track		44.0		22.0
Waterline**	8.0		4.0	
Transmission Line**	10.0		5.0	
Mine Facilities		72.0		36.0
Total	**110.1**	**116.0**	**55.1**	**58.0**

Notes:
* Full-time equivalents.
** Not from Proposed Action, estimated independently.

Each of the categories is described in the Proposed Action as taking about 6 months to complete. For analysis purposes, the numbers have been annualized by dividing them in half, on the assumption that half the workers working twice as long would achieve the same result. The activities have been additionally sequenced into the likely order of occurrence. Thus, the railroad spur dirtwork naturally would take place before the track was laid. It is additionally assumed that construction would occur over a period no longer than two years.

The operations work force—miners, mine mouth facility personnel, and supervisors and managers—is estimated by the Proposed Action to be 200 to 250 employees at the mine's full productive capacity of 8 million tons a year. Here, it is assumed that the level would be 250 mine employees. There are already 47 workers associated with the existing MCM that would be replaced by the Red Cliff Mine, so the net additional coal mine employment would be 203.

In addition to the jobs and expenditures directly related to each phase, additional jobs and income would be generated indirectly as a result of the economic linkages between the construction and mining sectors and other sectors of the local economy. Business and consumer expenditures by the mine and its employees would ripple through the economy, supporting indirect and induced increases in employment and income. These secondary effects are estimated using the IMPLAN (Input-Output Model for Planning) economic model with 2006 Mesa County data. IMPLAN is an analytical predictive model that evaluates economic effects based on a specific change in a producing sector (IMPLAN 2007).

Table 4-4, Red Cliff Mine, Employment and Income Impacts, describes the employment impacts estimated by the model. The secondary effects of the new direct economic stimulus provided by the Red Cliff Mine would require some time to occur, as local businesses assess their ability to meet the new demand with existing resources and the likelihood of the new demand continuing into the future. Thus the effects of construction in years 1 and 2 may not occur at all or could be smaller than estimated. Construction activities are temporary in nature and, in fact, the duration of most of the individual activities described earlier would be 6 months or less, diminishing the size of the actual impact that would occur.

Table 4-4
RED CLIFF MINE, EMPLOYMENT AND INCOME IMPACTS

Impact Type	Construction		Operations		
	Year 1	Year 2	McClane Mine	Red Cliff Mine	Change
Employment					
Direct	55	58	47	250	203
Secondary	32	30	53	336	283
Total	**87**	**88**	**100**	**586**	**486**
Income					
Direct	$2,780,956	$2,918,146	$2,209,723	$17,934,000	$15,724,277
Secondary	$1,187,594	$1,120,814	$2,011,882	$12,660,598	$10,648,716
Total	**$3,968,550**	**$4,038,960**	**$4,221,605**	**$30,594,598**	**$26,372,993**

The secondary employment effect of the mine would also require time to occur fully but the long term nature of the mining operation may encourage local businesses to expand their own operations more quickly in response to the new demand for their supplies and services. What most adds uncertainty to the timing of the secondary effects is the timing of the direct effects; that is, the rate at which mine employment is increased. The number of mine employees is directly related to the level of production, and the Proposed Action does not describe the point at which full production would be reached. For this analysis, it is assumed that full production would be reached after two years of operation and that all miners would be brought on during that two-year period. The following discussion also assumes that, once reached, the full production level of 8 million tons per year would be sustained.

The 203 mine employees would make up a 13.4 percent addition to the relatively small 2005 Mesa County mining sector, but the 486 new jobs created in total would constitute only 0.6 percent of the total 2005 Mesa County employment.

The annual personal income estimated to be generated by the proposed coal mine mirrors the employment numbers. An additional $15.7 million of direct income, generating secondary income of $10.6 million, yields a total of $26.4 million, which is equivalent to 0.7 percent of Mesa County's 2005 total personal income.

Property Values

A strong and sustained population growth over the last few years has had an upward impact on housing and other property values in Mesa County. Any population increase generated by the

Proposed Action would be part of the continuing county growth but would not be of a magnitude to further influence housing prices in any identifiable way.

There is, however, potential for the railroad spur to have a downward influence on private property values in the area through which the spur would pass. This is a fear expressed by residents living west of Mack. The railroad spur would alter the character of the CR 10 corridor, introducing an industrial feature that would not be in accord with the current agricultural and rural residential character of the landscape. Moreover, construction of the spur would define the corridor in such a way that it could be a more likely location for siting future industrial utilities and facilities, such as an overhead transmission line, a pipeline, or warehouses.

The changed character of the corridor coupled with the concerns about train noise, safety, dust, and traffic interruptions at CR 10 and CR M.8 would all tend to reduce the number of people who would wish to buy residential property in the corridor, which would in turn reduce the value of properties in the area. A number of studies have confirmed the notion that proximity to a freight railroad tends to reduce property values, by as much as 10 percent of the potential value (Jaouhari and Simons 2004, Bellinger 2006, Strand 2001). These studies indicate that properties in the immediate vicinity of the railroad are most affected, that the downward influence diminishes rapidly with distance, that the amount of train traffic matters, and that train noise and safety are among the factors influencing value. Interviews with appraisers and realtors that have experience in Mesa County confirm these findings, with the caution that the influence on prices is not absolute, and that railroad vicinity property values would still rise if the general direction of property values in the region is upward (Moore 2008). Long term impacts are addressed subsequently.

Population

The Proposed Action would create both temporary and long term increases in population in Mesa County. The total population effect depends on the extent to which the new jobs created as a result of the Proposed Action are filled by new members of the workforce, principally those who have migrated to the area for work. This is a likely scenario given the lower-than-average unemployment rates in Mesa County over the last few years and the possibility that the proponent may prefer to hire experienced underground miners from other areas rather than train local hires. This analysis assumes that all of the new jobs created would result in in-migration and that the local population would increase accordingly. An eventual increase in 486 jobs would result in an estimated 335 new households, representing a population increase of 814. This amounts to 0.6 percent of the county's estimated 2005 population.

While it is likely that virtually all of the new population would reside in Mesa County, it's not possible to determine in what communities the population would locate. The majority of the secondary jobs created by the Proposed Action would be located in the central part of the Grand Valley and people holding these jobs could choose to reside in many different communities, just as the current workforce does. Few locations are more than a 45-minute commute from the central part of the valley. Similarly, the employees of the Red Cliff Mine would be a 15-minute commute along SH 139 to I-70 at Loma, from which point most of the Grand Valley is within 30 minutes driving time.

Local Government Facilities and Services

As the previous discussion indicates, the maximum population attributable to the Proposed Action represents a very small increment to the current population of Mesa County. The additional population attributable to the project would thus have a negligible effect on government facilities and services, including domestic water, sewage treatment, emergency services, housing, and social services.

There is one possible exception to this general conclusion. The only service that the Proposed Action may potentially affect adversely would be the schools in the area served by Fruita Monument High School. This area generally includes the western half of the Redlands and the western portion of the Grand Valley from CR 24 to the Utah state line. Current enrollments at some of the elementary and middle schools feeding Fruita Monument High School and at the high school itself are near or exceeding their design capacity (Bingham 2008). If all of the new employees at the Red Cliff Mine were immigrants to the Grand Valley, and if they all were to choose to locate in the area served by Fruita Monument High School, and if they were all to arrive within a very brief period, say 2 years, then an estimated 133 new elementary, middle school, and high school students would have to be placed in an already crowded system. This scenario is cautionary, however. It is not likely to occur for several reasons: some of the new jobs may go to current residents; many of the miners new to the area would choose to live at dispersed locations throughout the Grand Valley; and the ramp-up to full production could take more than 2 years, moderating the effect of the growth in the student population. In addition, Mesa County Valley School District 51 may propose a bond issue to the voters in the fall of 2008. If a bond issue were to pass, then new schools would be constructed that would accommodate anticipated growth in the west end of the Grand Valley.

Public Revenue

Construction and operation of the Red Cliff Mine would require substantial expenditures for labor, supplies, and materials. However, the major contribution of the project toward local public revenue would be through property taxes on the mine facilities and the coal resource, severance taxes paid to the State of Colorado, much of which could eventually be returned to local jurisdictions, and federal royalty payments, 50 percent of which are returned to Colorado for dispersal to sub-jurisdictions within the state, including the county where the royalties were generated. (A recent federal appropriations bill changed the distribution to 52 percent federal and 48 percent state for one year. If this change were extended by Congress, Colorado's share of the Red Cliff Mine royalties would be less.)

The Red Cliff Mine would be subject to various taxes and royalties that would produce substantial revenue for local, state, and federal governments. Both Mesa County and Garfield County would assess ad valorem taxes on the mine facilities, including the railroad spur, and on the value of the coal in the ground. Mesa County would also receive sales taxes based on business and consumer expenditures generated by the Proposed Action. The State of Colorado would recover a severance tax on the value of a mineral resource irretrievably lost to the state. The federal government, from whom the coal resource is being leased, would receive an annual royalty payment as well as an annual rental fee.

The federal royalty for coal mined by underground methods is 8 percent of the gross value of the coal produced. When the Red Cliff Mine is producing at the proposed rate of 8 million tons per year, the annual royalty payment to the federal government would be $15.4 million, assuming an

open market price of $24.00 per ton. Historically, federal mineral royalties were split evenly between the federal government and the state of origin, which would result in a $7.7 million annual distribution to the State of Colorado. (A recent federal appropriations bill changed the distribution to 52 percent federal and 48 percent state for one year. If this change were extended by the Congress, Colorado's share of the Red Cliff Mine royalties would be approximately $7.4 million.)

Severance taxes are imposed by states on certain nonrenewable resources that are "removed from the earth" because "the value of such resources to the state of Colorado is irretrievably lost." The severance tax on coal is applied to all production after the first 1,200,000 tons produced annually. For underground mines, a 50 percent credit against the tax is also applied. The per ton severance tax rate is currently $0.54 per ton and has remained at that level since 1992. When the Red Cliff Mine is producing at the proposed rate of 8 million tons per year, the annual severance tax imposed by the state could be $1.8 million, based on an assumed open market price of $24.00 per ton.

Property taxes would be levied and collected by both Mesa and Garfield counties. Mesa County would assess property taxes on the railroad spur and other properties within the county. Garfield County, where the mine facilities and most of the recoverable coal are located, would assess property taxes on the mine facilities and on the value of the coal in the ground. When the Red Cliff Mine is producing at the proposed rate of 8 million tons per year, the annual property tax receipt due to Garfield County could be $710,035, based on the price assumption and assessment methodology of the Colorado Division of Property Taxation and on the current mill levy in western Garfield County. This amount is about 5 percent of the total 2003 property tax revenue collected by Garfield County and the school district that taxes property in the area of the Red Cliff Mine. The property tax revenue due Mesa and Garfield counties on the equipment and facilities, including the railroad spur, cannot be estimated because no information on the value of the facilities is available.

Sales taxes are imposed in Mesa County by the state, the county, and the incorporated communities in the Grand Valley. Revenues to all these jurisdictions would increase because of the additional business and consumer expenditures generated by the Proposed Action. Since the direct and indirect economic activity attributable to the mine makes up less than a 1 percent addition to the economy of Mesa County, the increased sales tax revenue would be marginal.

Mesa County and jurisdictions within the county would indirectly receive benefit of the severance taxes and federal royalties paid by the Red Cliff Mine. Jurisdictions within the county receive a direct payment equal to 15 percent of the Severance Tax Local Impact Fund's 50 percent share of the severance tax, based on the residency of mine employees. At peak production, that would be an annual payment equal to $137,700. Additionally, jurisdictions in Garfield County would receive a share of the federal royalties distributed to the state. That share has been increasing in the last few years (as the total amount of royalties received by the state increases) and has averaged about 411 percent the last two years. At that percentage, Garfield County jurisdictions would receive a total of about $850,000 annually. The combined severance and federal royalty payments that would go annually to jurisdictions in the two counties is estimated at $982,500. This amount is about 5 percent of the total resource-related revenue received by Mesa and Garfield counties in 2003.

A sizeable portion of the severance tax and federal mineral royalty receipts is placed in the Local Government Energy and Mineral Impact Assistance Program. The funds administered by this program are made available to communities impacted by mineral development. Both Mesa County and communities within the county would be eligible to receive grants and loans through this program to help address impacts produced by the Proposed Action.

Environmental Justice

As described in Section 3.1.5, Socioeconomics, the environmental justice requirement of Executive Order 12898 is that "Federal agencies identify and address disproportionately high and adverse human health and environmental effects, including the socioeconomic effects of their programs, policies, and activities on minority populations and low-income populations." *Minority populations* in this context are Hispanic, African-American, American Indian, Asian, or Pacific Islander populations that either a) exceed 50 percent in the affected area or b) are meaningfully of greater percentage than in the general population. *Low-income populations* are those whose incomes fall below the federally defined poverty threshold (CEQ 1997).

As discussed in Chapter 3, the percentage of minorities within the study area does not exceed 50 percent and is substantially lower than the percentage in the State of Colorado as a whole. Consequently, the proposed project would not disproportionately affect minority populations as defined. The percentage of the population that falls below the poverty level in the study area is not meaningfully higher than the percentage for the State of Colorado as a whole. In addition, because very few people live in or near the project area, no minority or low-income populations have been identified that would experience common conditions of environmental exposure or effects. Consequently, development would not unduly affect minority or low-income individuals in the study area.

Temporary and Long Term Impacts

Socioeconomic impacts of the Proposed Action and the action alternatives would be generated by the construction and operation of the coal mine and the railroad spur built to transport the coal out of the region. The project would produce a valuable energy source, creating new jobs and new local business expenditures. In turn, secondary economic impacts would be generated in the form of additional jobs and income and increased local, state, and federal government revenue.

The Red Cliff Mine in its proposed format would bring substantial social changes to the affected community in the vicinity of Mack, along with some likely, positive, socioeconomic benefits to the larger region. At a fundamental level, the degree of the social consequences or impacts of the Red Cliff Mine hinge upon the capacities of the community members to adapt to the character and depth of a significant industrial development within a low density, rural-residential area. Most community members who live within a 2- to 3-mile radius of the railroad spur believe that it would definitely impact the surrounding rural atmosphere and their underlying rural community values. As the residents contemplate future impacts of the project, a considerable level of uncertainty about associated social and economic changes also exists, but the latter are less focused than the impacts they anticipate from the railroad spur in particular. Mitigation measures that would assist the affected community's capacity to adapt to these social consequences could be of benefit.

An eventual increase in 486 jobs would result in an estimated 335 new households, representing a population increase of 814. This amounts to 0.6 percent of the county's estimated 2005

population. The new jobs would likely result in increased local population and that population growth could potentially impact community infrastructure—housing, schools, domestic water systems, etc.—and social well-being. In the context of the broader regional and national energy economy, the development of the Red Cliff Mine would increase the domestic fossil fuel supply, improving the reliability of our national energy.

Most of the socioeconomic impacts would be felt in the Grand Valley of Mesa County. This area has a large population, a number of sizeable established communities, and a well-developed infrastructure located within a 15-to 45-minute commute from the proposed coal mine. Construction workers who do not already reside in the area would find temporary residence in local motels or other rental housing facilities. The majority of permanent mine employees would reside in the Grand Valley. Similarly, local project expenditures for fuel, housing, equipment, services, and supplies needed for construction, development, and operation of the mine would take place in the Grand Valley.

Jurisdictions within Mesa County would receive much of the sales tax associated with the proponent's local expenditures and the ad valorem tax on the railroad spur. However, because the mine and most of the coal resource would be located in Garfield County, the ad valorem taxes associated with the mining operation itself would be received by jurisdictions within Garfield County. The United States and the State of Colorado would share the federal royalties generated by the mine and Colorado would receive additional revenues based on the state severance tax.

There is potential for the railroad spur to have a downward influence on private property values in the area through which the spur would pass. This is a fear expressed by residents living west of Mack. The railroad spur would alter the character of the CR 10 corridor, introducing an industrial feature that would not be in accord with the current agricultural and rural residential character of the landscape. Moreover, construction of the spur would define the corridor in such a way that it would be a more likely location for siting future industrial utilities and facilities, such as an overhead transmission line, a pipeline, or warehouses.

The changed character of the corridor coupled with the concerns about train noise, safety, dust, and traffic interruptions at CR 10 and CR M.8 would all tend to reduce the number of people who would wish to buy residential property in the corridor, which would in turn reduce the value of properties in the area. A number of studies have confirmed the notion that proximity to a railroad tends to reduce property values, by as much as 10 percent of the potential value. (Jaouhari and Simons 2004, Bellinger 2006, Strand 2004) These studies indicate that properties in the immediate vicinity of the railroad are most affected, that the downward influence diminishes rapidly with distance, and that train noise and safety are among the factors influencing value. Interviews with appraisers that have experience in Mesa County confirm these findings, with the caution that the influence on prices is not absolute, and that railroad vicinity property values would still rise if the general direction of property values in the region is upward.

In sum, the Proposed Action would increase Mesa County employment and income. To the extent that new jobs are filled by immigrants to the area, population would increase. The magnitude of these changes, even if they were to occur over a brief period of time, is not large enough to have a noticeable impact in and of themselves on the local community infrastructure. The Red Cliff Mine would be the source of additional revenue to local, state, and federal

governments, becoming substantial at the proposed full-production level. The addition of 8 million tons of steam coal a year to the nation's supply of fossil fuels would have a small but beneficial effect on the national energy economy.

Mitigation Measures

- *Property Values/Social Dislocation*: Potential negative impacts on property values can be in part avoided by properly addressing some of the other concerns: safety, noise, deterioration in viewsheds, etc. Some uncertainties about future developments could be mitigated by providing quality land use planning and related information to the community; e.g., through an appropriate role being played by the responsible governmental entities, such as the Mesa County Planning Commission.
- *An Anticipated Loss of Rural Values*: Landscaping measures could overcome some of the visual impact concerns. Horn noise mitigation could in part be addressed through grade separations and the noiseless crossings for CR M.8 and CR 10. The deeper social impacts on rural values could in part be addressed by working more closely with the community to enhance traditional social interactions, community cohesion, historic preservation, rural fire protection, and alleviate possible school crowding.
- *Impacts on Safety*: Recommendations by the community have been made for safer crossings, especially at CR 10 and CR M.8, by creating grade separations. Additional adaptations to the community's design suggestions about safety and road realignments would require additional public involvement in a collaborative mode in order to create satisfactory mitigation alternatives.
- *An Industrial Corridor*: Some mitigation benefits could be provided through clearer and more transparent communications about associated land use restrictions, intentions, and objectives. In the long run the role and authority of local governments in guiding compatible land uses, working directly with the community residents, would be vital to maintaining the rural quality of life within the Mack-Loma community area.
- *Company Relations with the Community*: Along with the other specific mitigation measures, a framework to improve community-company communications and relations is needed. This could take many forms, but should be based on an agreement between the parties to establish clearer expectations and open lines of communication about the mine and rail construction and operations phases. A commitment among all parties to establish a neighborly, working partnership would pay long term benefits for community sustainability, towards more effective mine operations, and for employee well-being.

Appendix B, Standard Practices and Mitigation Measures, contains additional recommended mitigation measures for socioeconomic impacts.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

The socioeconomic impacts under this alternative would be similar to those of the Proposed Action with two exceptions. The construction employment and expenditures for this crossing could be slightly more than those for the railroad spur as proposed. If so, the temporary employment and income effects associated with the construction phase of the project may be

marginally greater than those of the Proposed Action. This alternative would lessen some of the social/community concerns regarding traffic safety, emergency response times, and noise impacts.

Noiseless Crossing Traffic Control Devices

Socioeconomic impacts under this alternative would in general be similar to those of the Proposed Action. This alternative would lessen some of the social/community concerns regarding noise impacts.

Transmission Line Alternative A

Socioeconomic impacts under this alternative would be greater than those of the Proposed Action or the other transmission line alternatives. Transmission Line Alternative A would go through 19 privately-owned parcels, which would increase the level of difficulty in obtaining easements.

Transmission Line Alternative B

Socioeconomic impacts under this alternative would be slightly greater than those of the Proposed Action due to the need to cross 5 privately-owned parcels of land.

Transmission Line Alternative C

Socioeconomic impacts under this alternative would be similar to those of the Proposed Action.

4.1.6 Transportation

No Action Alternative

Under the No Action Alternative, mining development would not occur, and there would be no changes to the existing transportation system, and no construction impacts as a result of this alternative.

Future traffic volumes within the project area would continue to increase as a result of energy development and economic growth in the area. Forecast growth rate estimates provided by Mesa County (Simms 2007) indicate that this area could experience a high growth rate of 7 percent per year for the next 20 years.

Proposed Action Alternative

Mine and Facilities

Reconstruction of the intersection of CR X (also known as Mitchell Road or Power Line Road) and SH 139 would have no adverse impacts to the state highway. CR X would be designed to meet Mesa County Road and Bridge Standard requirements. By using these standards, the intersection improvements would utilize the latest roadway design standards and incorporate safety, implicitly. Once improved, CR X would be open to the public and provide access to public lands, grazing allotments, and gas transmission lines. Only the portion of CR X which crosses the Red Cliff Mine property, would have posted, restricted assess and be fenced to protect private property and keep the public safe.

CR X lies within the Grand Valley Airshed; the road surface would be asphalt or chip-n-seal to remain dust free. Traffic ingress and egress would not impact current operations as SH 139 is not congested.

Background traffic volumes within the project area would continue to increase as a result of energy development and related growth in the Grand Valley area. The Mesa County regional traffic demand model estimates the growth rate to be 7 percent per year on the roads near the towns of Mack and Loma. Colorado Department of Transportation (CDOT) estimates the traffic growth on SH 139 would be 3.6 percent per year near the Mesa/Garfield County line.

The future traffic operations and impacts were evaluated when the Proposed Action alternative would be fully functional. In five years the Red Cliff Mine would be operating at full capacity and employ 250 workers per day divided over two work shifts. The mine would continue to provide coal to the Cameo Power plant (as long as CAM holds the contract) via semi-trailer trucks that would continue to travel on SH 139 and US 6.

Traffic generated by the Red Cliff Mine is estimated to vary from a high of 470 vehicles per day (vpd), based on a single occupancy vehicle, to 260 vpd, based on an average of two employees carpooling per work shift. Car or van pools would be encouraged to minimize traffic congestion and promote safety.

The future traffic impacts were determined when the Proposed Action alternative was functioning at full capacity. While traffic to and from the site may increase 370 vpd, SH 139 would continue to operate well below the two-lane capacity threshold of 27,000 vpd. The level of service (LOS), a measure of traffic performance, is grade B and considered acceptable. At this LOS there would be no adverse impacts as a result of the Proposed Action alternative.

A state highway access permit, utility and special use permit would need to be acquired from CDOT prior to construction of the SH 139/CR X intersection. The access permit, which addresses traffic, environmental, and design issues, would require the approval of the CDOT Region 3 Regional Access Manager. Based on the CDOT Access Code, a right turn deceleration lane is anticipated for traffic ingress, and a left turn acceleration lane is not required. The final determination for the need to build turn lanes would be determined during the access control permit approval process. In addition to the access control permit, a utility and special use permit is required due to the presence of utilities at this location.

Future traffic volumes in 2026 on CR M.8 and CR 10 are estimated to be 895 and 530 vpd, respectively. Based on current travel patterns, traffic on these county roads would experience an increase in traffic ranging from 5 to 15 vpd, as a result of the Proposed Action alternative.

Emergency response to the Red Cliff Mine would improve by approximately 5 minutes, because the Proposed Action alternative is 5.4 miles closer to the hospital than the MCM.

The Proposed Action alternative would not result any long term substantial impacts to the transportation system.

Lease Area

There would be no additional impacts to the highways or traffic due to activities in the lease area.

Railroad

A grade-separated crossing at SH 139 is proposed. SH 139 would be reconstructed to cross over the proposed railroad.

CR 10 would be realigned to form a perpendicular railroad track crossing. This realignment would improve safety by improving sight distance at this location.

The railroad grade crossings at both CR M.8 and CR 10 would delay vehicles by 6.5 to 7.5 minutes at each location. During the peak hour of travel, the crossing coal train would delay an average of 14 vehicles on CR M.8 and 9 vehicles on CR 10. During off-peak hours of travel the average total number of vehicles stopped by the train on CR M.8 and CR 10 would be 5 and 3 vehicles, respectively. After the train has cleared the railroad grade crossing, the small number of queued vehicles would quickly disperse.

There is a low potential that an emergency vehicle could be delayed at either grade crossing. Since accidents are random events that can happen any time of day or night, it is unlikely that one of the four trains per day would delay the responding emergency vehicle by 6.5 to 7.5 minutes. The Mesa County Sheriff has estimated that if CR M.8 is blocked, emergency vehicle response time could be extended by up to 11 minutes if the vehicle was to drive north to cross the tracks at CR 10.

Temporary Impacts

Traffic would be temporarily impeded for 2 to 4 weeks during construction of the CR M.8 railroad grade crossing. Egress and ingress to some private property may be affected.

Traffic would be temporarily impeded for 2 to 4 weeks during construction of the realigned CR 10 at-grade crossing. Egress and ingress to some private property may be affected.

Traffic may be temporarily impeded at the intersection of SH 139 and CR X. Intersection improvements would not require closing of the state highway.

A temporary detour would be constructed on SH 139 at the location of the railroad underpass, and traffic speed may be somewhat reduced through the detour.

Long Term Impacts

Long term impacts would consist of occasional delays at CR M.8 and CR 10 during train crossings. Some local residents may choose to alter their driving patterns.

Mitigation Measures

CR X would be designed to meet Mesa County Road and Bridge Standard requirements. Since this road lies with in the Grand Valley Airshed, the road surface would be asphalt or chip-n-seal to remain dust free.

The intersection improvements would incorporate the latest design and safety standards and be designed in accordance with Mesa County and CDOT standards.

A traffic management plan would be developed during the final design of the project to minimize disruption to traffic flow. These plans would be designed in accordance with agency standards and would include maintenance of access to private property, minimizing disruption to local businesses, and provision of detours or alternate routes as needed.

Construction activities would be coordinated with agency officials to avoid the need for nighttime construction in certain sensitive areas near residents.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for transportation impacts.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Operation of a grade-separated crossing at CR M.8 would lessen transportation impacts as compared to the Proposed Action as traffic would not be required to stop when a train passes through the intersection. There would be no delay of emergency vehicles during a train's passing. Temporary construction impacts and detours would be considerably longer, as a new bridge on CR M.8 would be constructed over Mack Wash as well as the railroad grade. Bridge construction could take 6 to 9 months.

Noiseless Crossing Traffic Control Devices

Long term impacts would be similar to those described for the Proposed Action. Temporary construction impacts would be slightly greater, as it would take longer to construct the railroad crossings.

Transmission Line Alternative A

There would be no impacts to transportation from this alternative.

Transmission Line Alternative B

There would be no impacts to transportation from this alternative.

Transmission Line Alternative C

There would be no impacts to transportation from this alternative.

4.1.7 Utilities

No Action Alternative

Under the No Action Alternative, mining development would not occur, and there would be no changes to existing utilities.

Proposed Action Alternative

The development of a new mine would necessitate the creation of many new utilities, such as new electric transmission lines to the mine area, and a water pipeline. These new utilities are described in detail in Chapter 2 and are part of the Proposed Action.

The intent of this Utilities section is to describe impacts to other existing utilities that would result from any of the components of the Proposed Action being implemented.

There are no known large utilities such as large gas or oil pipelines that would be disrupted as a result of the Proposed Action.

Railroad and Water Pipeline

During the construction of the railroad and water pipeline, there may be minor utilities such as underground phone lines and small electric distribution lines that would have to be cut and replaced or moved. Identification of these small utilities would occur as part of the preconstruction efforts by the contractor who would be building each component of the Proposed Action.

Transmission Line

Construction of the transmission line would not disrupt other utilities. Where the new transmission line would displace existing distribution lines, the distribution line would be reconstructed as an underbuild line on the same poles that carry the transmission line.

Temporary Impacts

Temporary impacts may result from construction of the project linear facilities. These impacts may include temporary power outages for area residents that would be affected by the construction of the underbuild transmission line, and temporary suspension of service of the underground phone lines and small electric distribution lines.

Long Term Impacts

There would be no long term impacts to existing utilities.

Mitigation Measures

Any underground phone lines and small electric distribution lines within the railroad/pipeline ROW would be replaced or moved in accordance with all applicable federal, state, and utility provider regulations and policies. Any displaced distribution lines would be replaced with underbuild lines.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for impacts to utilities.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

No impacts to utilities would result from this alternative.

Noiseless Crossing Traffic Control Devices

No impacts to utilities would result from this alternative.

Transmission Line Alternative A

Impacts would be the same as described for the proposed transmission line.

Transmission Line Alternative B

Impacts would be the same as described for the proposed transmission line.

Transmission Line Alternative C

Impacts would be the same as described for the proposed transmission line.

4.1.8 Visual

No Action Alternative

Under the No Action Alternative, mining development would not occur, and there would be no impacts to visual resources.

Proposed Action Alternative

Visual resource impacts would vary according to viewer location and orientation. SH 139 is the main travel route within the project area. SH 139 is a designated National Scenic Byway. Negative visual influences to the scenery as viewed from the scenic byway would reduce the scenic driving quality of the byway. Development of the mine and associated facilities would occur south of and near the base of the Book Cliffs, at approximately the same elevation as SH 139, and there is little topographical relief or vegetative cover that would screen travelers' views of some of the mine facilities. Northbound travelers would have longer and more direct views of the mine site than southbound travelers. Observers in vehicles traveling at 65 miles per hour may have only fleeting views of some of the facilities.

The North Fruita Desert SRMA south of the Book Cliffs is in an undesignated Visual Resource Management (VRM) category. This area is used for recreation, and there may be some project facilities visible from different locations in the SRMA. That portion of the Grand Junction Field Office planning area in the Book Cliffs is designated as VRM Class III. The objective of this class is to partially retain the existing character of the landscape.

Three visual simulations were prepared from a Key Observation Point (KOP) along SH 139 (Figure 4-1, Photo Simulation Map). This point was selected as it provides a view of the proposed railroad crossing under SH 139 (Figure 4-2, Photo Simulation – Looking South at Railroad Alignment Crossing Under SH 139) and is a relatively high point along SH 139 to view the mine area (Figure 4-3, Photo Simulation – Looking at Mine Site). The third view, Figure 4-4, Photo Simulation – Looking North at Jeep Trail Alignment Crossing Over SH 139, is a simulation of the Jeep Trail railroad alignment as it crosses SH 139. This view is provided to give readers an idea of what a railroad overpass over SH 139 would look like. This alignment was not carried through the Draft Environmental Impact Statement (DEIS) for detailed analysis.

Mine and Facilities

Mine facilities would introduce man-made structures into the landscape that would draw attention to their size, lines, and forms that contrast with the surrounding natural appearing landscape. These structures include a unit train loadout, a coal preparation plant, package sewage treatment plant, sediment pond, office, shop, warehouse, conveyors, water tank, ventilation fan, raw coal stockpile, and a waste rock pile as described in the Proposed Action description in Chapter 2. Figure 4-3, Photo Simulation – Looking at Mine Site, is a simulation of the mine facilities. From this KOP, the loadout silos and water tower would be visible, as would the waste rock pile up against the base of the Book Cliffs. The actual mine portals and benches are not visible due to their distance from the KOP and their orientation along the Book Cliffs.

Map Extent:

Waste Rock Disposal Area

Mine Entrance

Garfield County

Mesa County

Demaree Canyon

Conveyor

County Road X

Unit Train Loadout

Access Road

Photo Simulation Location (Key Observation Point)

MM 10.9

East Salt Creek

Coyote Wash

Coal Gulch

Mack Wash

Jeep Trail Rail Alignment

Proposed Rail Alignment

County Road T

County Road 10

Government Highline Canal

139

Peckland Beede Wash

East Branch Reed Wash

County Road M.8

Water Diversion Point

Mack

70

Salt Creek

Reed Wash

Grand Valley Canal

Colorado River

6

Xcel Energy Uintah Substation

Legend

Project Area

Proposed Land Use Application Area

Coal Lease Application

Existing Coal Lease

Proposed Rail Spur

69kV Transmission Line Route

Land Ownership

BLM

BOR

STATE

PRIVATE

Jeep Trail Rail Alignment

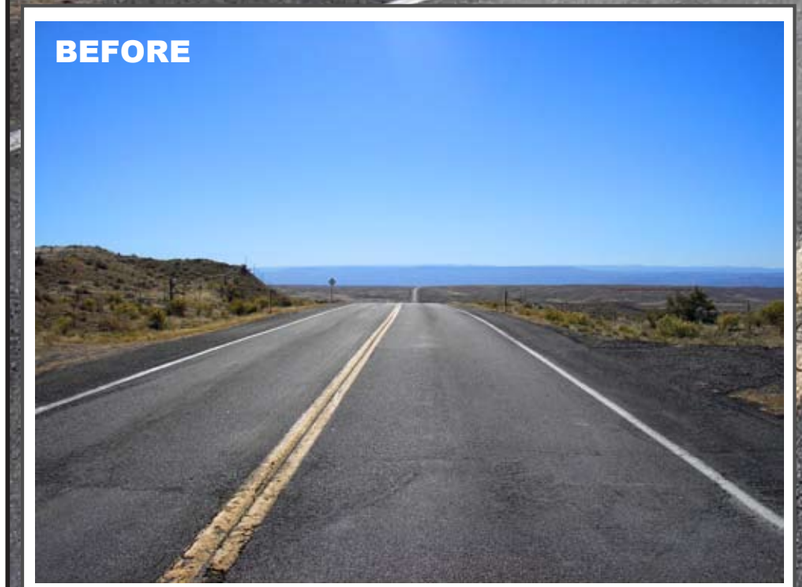
0.5 0.25 0 0.5 1 Miles

Red Cliff Mine EIS

Figure 4-1
Photo Simulation Location Map

This page intentionally left blank

AFTER

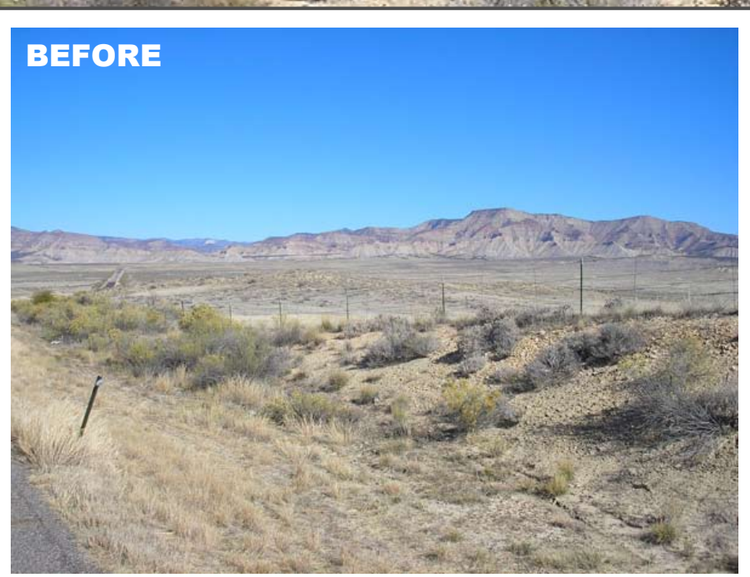


Red Cliff Mine EIS

Figure 4-2
Photo Simulation – Looking South at Railroad Alignment Crossing Under SH 139

This page intentionally left blank

AFTER

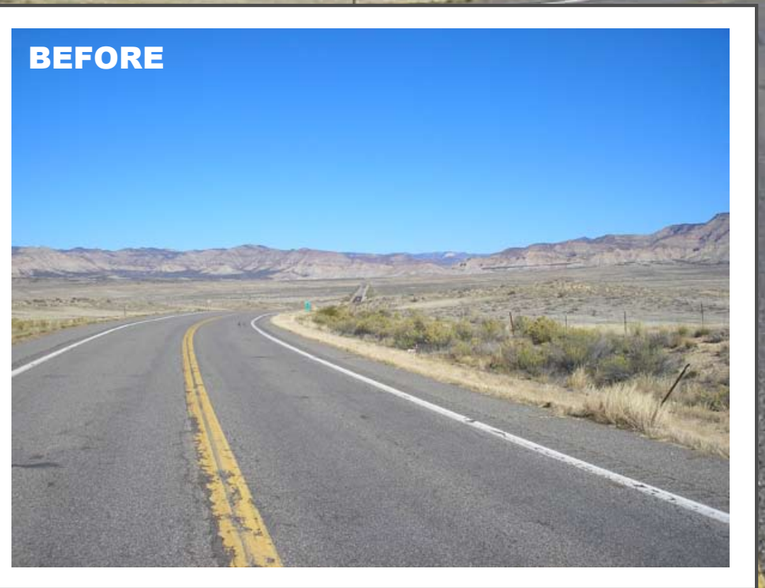


Red Cliff Mine EIS

Figure 4-3
Photo Simulation –
Looking at Mine Site

This page intentionally left blank

AFTER



Red Cliff Mine EIS

Figure 4-4
Photo Simulation – Looking North at Jeep Trail Alignment Crossing Over SH 139

This page intentionally left blank

Other mine features may be visible for varying periods of time from other locations along SH 139. The sediment ponds may draw attention due to the clearing of vegetation and the large geometric shape of the ponds. The loop track would create some visual impacts due to the 90-foot cuts necessary to maintain the required grade. The waste rock pile and coal stockpiles would draw attention due to the clearing of vegetation and the large piles of coal and waste rock.

The facilities associated with the proposed mine would be constructed on benches, which would be carved out of the existing terrain. This would create distinct contrasts with the natural topography of the area. Siting facilities on benches would draw attention to the facilities due to the contrast of the benches with surrounding topography. These facilities would be over 2 miles away from SH 139 at the closest point and would be oriented so they would not be directly exposed to SH 139. The mine and benches are located on cliff faces oriented away from some of the higher use recreation areas at the north end of CR 18 (campground and trailhead), and would not be visible from those locations

Access and maintenance roads would require the removal of vegetation and changes in the existing topography by cutting and filling of soil. After construction, the color of the exposed soil would contrast with the surrounding vegetation and be highly visible. Roads create a linear contrast in the landscape due to the contrasting soil color, changes in vegetation patterns, and changes in the natural topography, which combine to create a visible change in the landscape.

Lease Area

Most of the activities taking place within the lease area would be underground. Some minimal visual effects of subsidence (see Section 4.2.3, Geology, and Appendix D, Subsidence) could include swales, small cracks in the ground surface, and rock falls. These would be visible only to observers actually in the lease area.

Railroad

Railroad construction would result in the removal of vegetation and changes in the existing topography by cutting and filling of soil. After construction the railroad ties would contrast with the color of the surrounding landscape and be visible. Railroads create a linear contrast in the landscape due to changes in vegetation patterns, addition of railroad tracks, and changes in existing topography, which combine to create a visible change in the landscape, often visible from long distances. Figure 4-2 is a visual simulation looking south at the proposed rail crossing (with train) under SH 139, approximately 1.5 miles south of the KOP. Southbound travelers would have a view as they approached the crossing. Due to the topography, northbound travelers would probably not see the crossing until they were almost over it.

The railroad grade would be visible at various locations to local residents traveling on CR 10 and CR M.8. Visibility would be variable depending on the cuts and fills, distance from the roads, and aspect of the railroad to the road (parallel vs. perpendicular).

A portion of the railroad alignment would be within 0.5 mile of Highline Lake State Park, and would be visible from parts of the park, especially from some of the recreational facilities located on higher ground around the lake. Due to the park's distance from the mine site (approximately 7 miles), it is unlikely that mine facilities would be visible.

Water Pipeline

Temporary visual impacts would result from surface disturbance associated with construction of the water pipeline. There would be no long term impacts to visual resources, as the water pipeline would be buried parallel to the railroad grade.

Transmission Line

The proposed transmission line is adjacent to 95 parcels of private land south of the Highline Canal. The line would be constructed along county roads, in some places replacing existing lines. The transmission line and the underbuild distribution line would have the same configuration and appearance as existing lines in the project area (see Figure 2-10, Typical Cut & Fill Sections, for examples of existing structures).

North of the Highline Canal, the transmission line would cross six trails in the North Fruita Desert SRMA. Transmission line and associated access road construction would result in the removal of vegetation along the transmission line ROW. After construction the transmission lines would create a linear contrast with the surrounding natural landscape. The linear ROW with poles and conductors would result in indirect visual impacts in some areas, affecting the natural landscape. The line would be visible to recreationists using these trails.

Temporary Impacts

Temporary visual impacts would result from surface disturbance associated with construction prior to reclamation and revegetation.

Long Term Impacts

The project would require night lighting in certain locations including the office, shop, warehouse, sewage treatment plant, and active mine areas. This would create a noticeable nighttime light source, although it would be at least 2 miles from the nearest resident.

The visual impacts would combine to create a different looking landscape in portions of the project area. The physical alteration of the existing landscape would be substantial in some areas, and the existing undeveloped natural appearance of the area would change due to the industrial facilities on-site and the creation of linear features. Long term visual impacts would be associated with the railroad, transmission line, access and maintenance roads, the mine facilities and associated benches, and the waste rock pile.

Mitigation Measures

Temporary construction areas would be revegetated according to BLM policy, thus reducing visual impacts due to construction.

Mine facilities would be painted colors that would blend with the background colors as required by the Standard Design Practices in the Grand Junction RMP (BLM 1987) (unless prevented by safety or permitting requirements).

Full-cutoff lighting at the mine facilities could be used to reduce nighttime light impacts.

Upon termination of the project, the aboveground mine facilities would be removed and the area would be revegetated in accordance with BLM policy.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for impacts to visual resources.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

In addition to the visual impacts described previously, a grade-separated railroad crossing at CR M.8 would involve construction of a bridge supported by concrete capped piles. The bridge over Mack Wash and CR M.8 would be approximately 35 feet higher than the existing road grade. This would be highly visible to travelers on CR M.8.

Noiseless Crossing Traffic Control Devices

Noiseless crossing gate systems consist of a series of automatic flashing-light signals and gates where the gates extend across both the approach and departure side of roadway lanes. Unlike two-quadrant gate systems, noiseless crossing gates provide additional visual constraint and inhibit nearly all traffic movements over the crossing after the gates have been lowered (U.S. Department of Transportation [USDOT] 2002). These systems are designed to be highly visible for the purpose of increasing safety, especially when a train is approaching and crossing the county roads.

Transmission Line Alternative A

Transmission line Alternative A is adjacent to 90 parcels of land south of the Highline Canal, crosses 19 parcels of private land north of the Highline Canal, and is adjacent to one trail in the North Fruita Desert SRMA. North of the Highline Canal, the line would be parallel with and adjacent to CR 16 for over 5 miles (see Figure 2-12, Proposed Mine Facilities, Map 1 of 5). There are currently no transmission or distribution lines along CR 16 in that location. Visual impacts to residents north of the Highline Canal would be greater than the Proposed Action, as there is currently no transmission line crossing those private land parcels.

Transmission Line Alternative B

Transmission line Alternative B is adjacent to 82 parcels of land south of the Highline Canal, crosses five parcels of private land north of the Highline Canal, and crosses one trail under construction in the North Fruita Desert SRMA. Visual impacts to residents north of the Highline Canal would be greater than the Proposed Action, as there is currently no transmission line crossing those private land parcels.

Transmission Line Alternative C

Transmission line Alternative C is adjacent to 96 parcels of land south of the Highline Canal, and crosses five trails in the North Fruita Desert SRMA. Over 18,000 feet of the transmission line would parallel the railroad and water pipeline, putting the visual scars in one corridor for that length of line. The transmission line would come within 0.25 mile of SH 139 at its closest point, but is that close for only a short segment (less than 0.5 mile – see Figure 2-12, Proposed Mine Facilities, Map 1 of 5).

4.1.9 Noise

No Action Alternative

Under the No Action Alternative, mining development would not occur, and there would be no noise impacts.

Proposed Action Alternative

Mine and Facilities

Noise emissions as a result of the operation of the surface facilities for the underground mines are not expected to be a general nuisance as there are no sensitive receptors in the area. The source of noise generated by the mine and associated facilities could include automobiles, diesel trucks, locomotives, and machinery. Noise levels are not anticipated to exceed 95 dBA. Noise generated during normal operations would dissipate over a distance of 1,500 feet to 55 dBA, which is typical for this area.

Lease Area

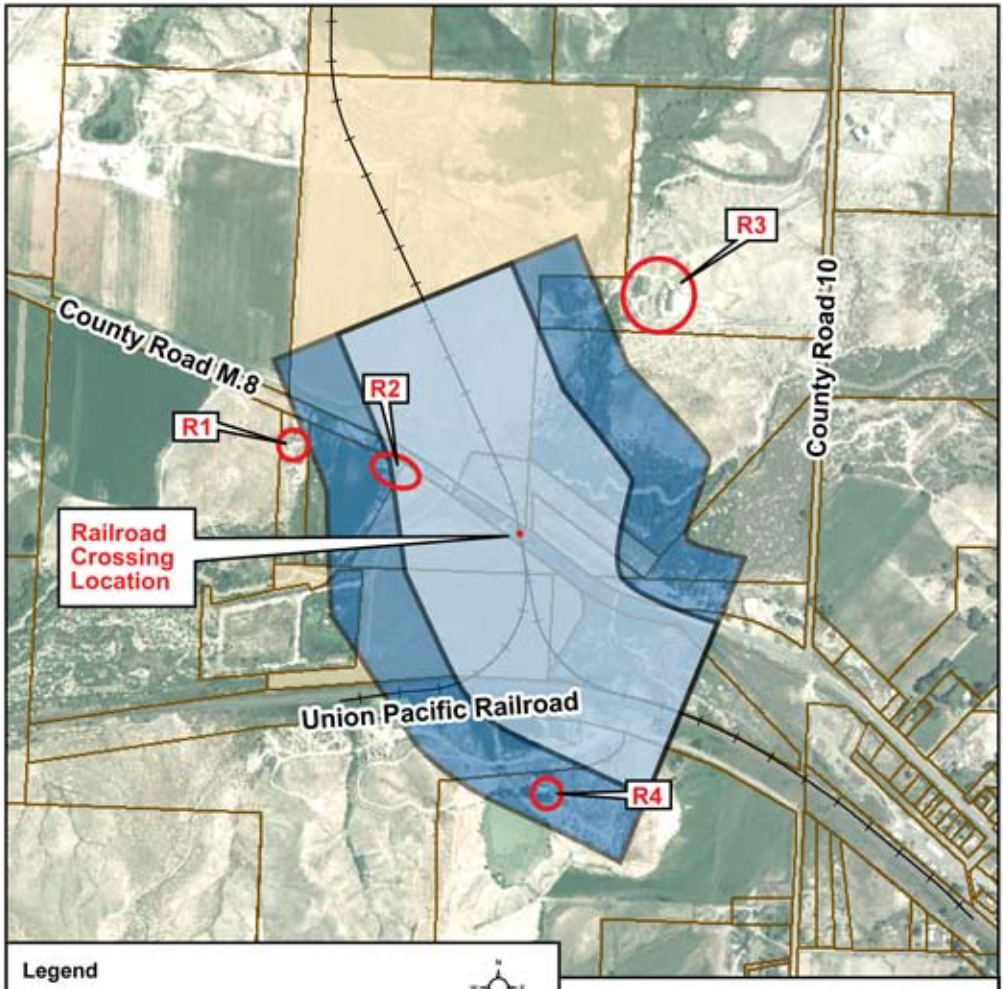
There would be a minimal noise level increase in the lease area as a result of this project. The majority of the activities in the lease area would be conducted underground, and there are no sensitive receptors in this area. Noise generated within the lease area may be heard for a distance of up to 2 miles, depending on climatic conditions. The noise generated in the lease area would be well below the 65 dBA threshold and would not require any mitigation.

Railroad

The prediction of the future horn noise levels and impacts at the proposed grade crossings of CR M.8 and CR 10 from the proposed coal train was completed using the Federal Transit Administration (FTA) Grade Crossing Noise Model. In accordance with Federal Railroad Administration (FRA) regulations for sounding railroad horns, a 102 dBA maximum A weighted sound level (L_{max}) at 100 feet from the front of the train to the road crossing was used. In addition to the maximum horn sounding level, the model considers the horn location on the locomotive, the non-train noise environment, length of impact area, train speed, train length, number of locomotives, and the future number of trains during a 24-hour period. The model calculated the distance of the 65 dBA contour and location of the moderate and severe impacts zones within the 0.5-mile long noise envelope. Unlike noise generated from increasing automobile traffic, train noise is not permanent. Normal background noise levels would resume after the train crossing has completed each pass. A discussion of the railroad horn noise impacts are summarized in the following text.

CR M.8 Grade Crossing

The results from the railroad horn noise model at the proposed CR M.8 grade crossing are shown in Figure 4-5, County Road M.8/Railroad Grade Crossing Railroad Horn Noise Impact Areas. Receptors R1 and R3 would hear the railroad horn, but levels would be below "moderately impact," as defined in Chapter 3, Table 3-6, Noise Levels Defining Impact for Transit Projects. Receptor R4 would experience moderate noise impacts when the horn is sounded up to 4 times a day. The predicted noise levels are estimated to increase 3 dBA, at these locations. Normal background noise levels would resume after the train crossing has been completed.



Red Cliff Mine EIS

Figure 4-5
County Road M.8 / Railroad Grade Crossing
Railroad Horn Noise Impact Areas

This page intentionally left blank

Receptor R2 would experience a severe noise impact when the horn is sounded at the grade crossing. The noise level during would increase by approximately 8 dBA, after which normal background noise levels would resume.

No receptors at this location would exceed the U.S. Department of Housing and Urban Development (HUD) acceptability standard of 65 dBA for a residence. Table 3-6, Noise Levels Defining Impact for Transit Projects, Category 2 shows the project noise impact exposure used to identify the level of impacts based on an existing noise exposure level of 52 dBA.

Other residences located within a mile radius of the grade crossing would hear the train horn, but would not be moderately or severely impacted by the horn noise. The noise levels would be well below the 65-dBA threshold and would not require mitigation.

In addition to train horn noise, the locomotive and coal rail cars with generate noise with each pass. Residences located within a half-mile radius of the tracks would hear train noise, but levels would be less than moderate or severe impacts. The noise levels generated by the locomotive and coal rail cars would be well below the 65 dBA threshold and would not require mitigation. Normal background noise levels would resume after the train has passed the proximity of the residence.

CR 10 Grade Crossing

The results from the railroad horn noise model at the proposed CR 10 grade crossing are shown in Figure 4-6, County Road 10/Railroad Grade Crossing Railroad Horn Noise Impact Areas. Receptor R8 would hear the railroad horn, but the level would be below the "moderate impact." Receptors R5, R6, R7, and R9 would experience moderate noise impacts when the horn is sounded up to four times in a 24-hour period. The predicted increase in noise levels vary from 1 to 6 dBA when the railroad horn is sounded.

Receptor R10 would experience a severe noise impact when the horn is sounded as the train passes by the property. The noise levels would increase approximately 12 dBA, and exceed the 65 dBA HUD standard.

Table 3-6, Noise Levels Defining Impact for Transit Projects, Category 2 shows the project noise impact exposure used to identify the level of impacts based on an existing noise exposure level of 54 dBA.

Other residences located within a mile radius of the grade crossing would hear the train horn, but impacts would be below moderate or severe. The noise levels would be well below the 65 dBA threshold and would not require mitigation.

Residences located within a half-mile radius of the tracks would hear train noise, but impacts would be below moderate or severe. The noise levels generated by the locomotive and coal rail cars would be well below the 65-dBA threshold and would not require mitigation. Normal background noise levels would resume after the train has passed the proximity of the residences.

Highline Lake State Park

The Proposed Action alternative would not directly impact the picnic area located at Mack Mesa Lake. The train, which would pass no closer than 6,000 feet from the picnic area, may be heard by park users, but this noise would be well below mitigation thresholds levels.

Water Pipeline

No noise impacts would result from this project feature.

Transmission Line

No noise impacts would result from this project feature.

Temporary Impacts

Construction equipment would be the primary source for noise that creates a temporary noise impact. This noise would be most noticeable from construction of the railroad alignment and pipeline corridor, at the grade crossings, and from trucks traveling on the roads to the daily work area. There would also be temporary noise impacts from construction of the transmission line. Construction noise at the mine facilities would dissipate before any sensitive receptors would be affected.

Noise from rock blasting would be generated during the first six months of the mine and associated linear facility startup operations. Rock blasting would be required to build the mine benches and some access roads. Rock blasting would be conducted in accordance with current mining standards to reduce injuries that may result from a premature blast, fly rock, misfires, and fumes. The air blast and vibration may be heard and felt within a 1,250-foot radius of the blast area. Vehicles traveling on SH 139 may see the dust cloud from the rock blast, but would likely not hear the sound or feel the vibrations.

Long Term Impacts

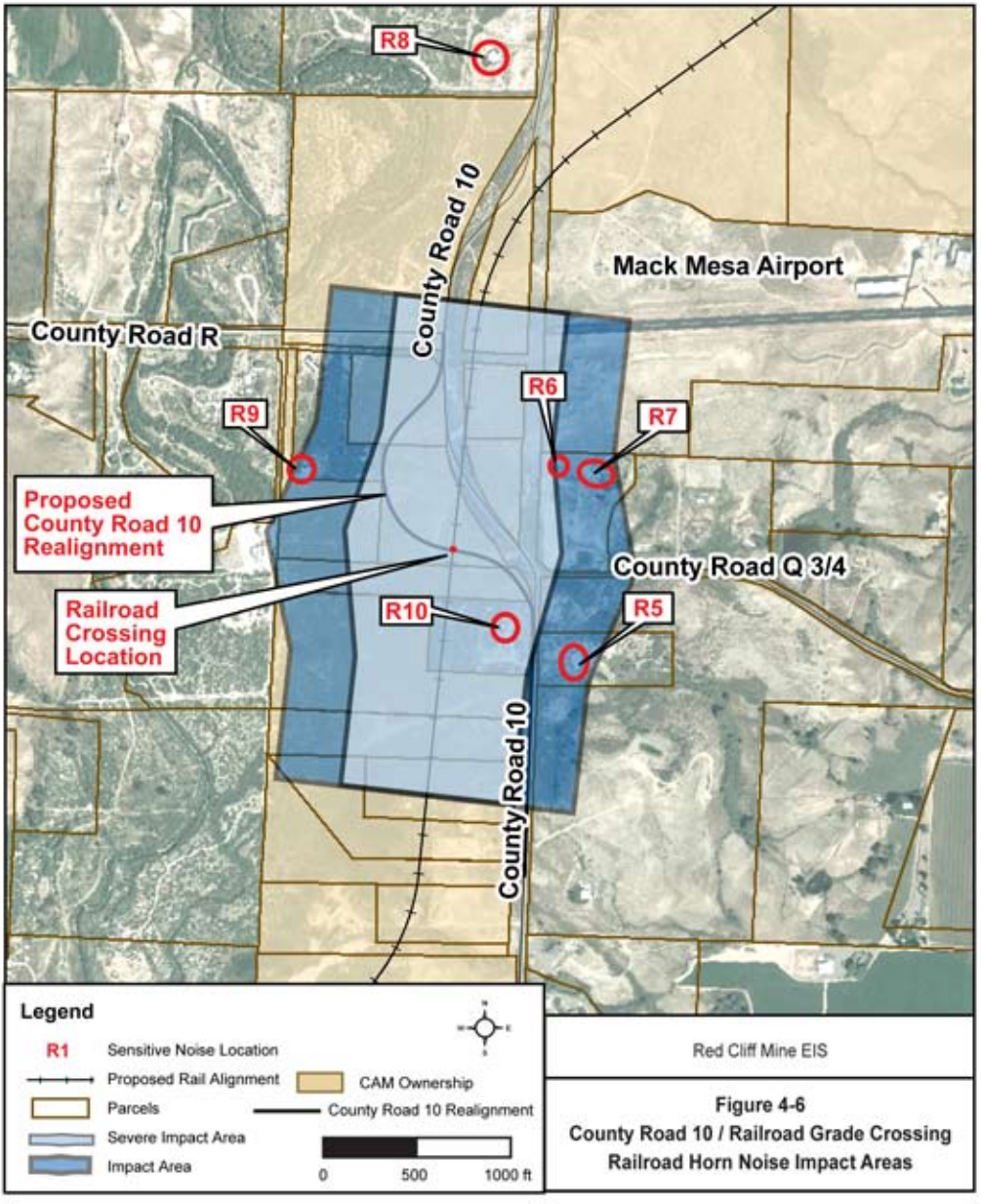
Residents in the Mack vicinity would hear train horns up to eight times per day as trains pass through the two at-grade crossings. Receptor R10, near the CR 10 grade crossing, would be severely impacted by train horn noise. The noise levels would increase approximately 12 dBA, and exceed the 65-dBA HUD standard at this receptor, with each pass of the train. There would be no long term noise impacts resulting from operations at any other location. Mine operations would generate noise, but there are no sensitive receptors in the area that would be affected. Noise may cause some wildlife to avoid the operations areas.

Mitigation Measures

The criteria to mitigate severe railroad horn noise impacts can be found in the FTA Transit Noise and Impact Assessment Manual, which has been adopted by the FRA. The criteria states that mitigation should be considered when there is a 5-dBA increase in L_{dn} or L_{eq}, and the total noise level exceeds 65 dBA. Mitigation measures include tall earth berms or noise walls to reduce noise to acceptable FTA levels. Other noise mitigation measures can include insulating the home or structure, installing noiseless crossing traffic control devices at the grade crossing to create "quiet zones," or purchasing and moving the residential property.

As mentioned in the previous chapter, the yellow shaded parcels are owned by CAM, and are not considered for assessment of noise impacts. Any dwelling units that may currently exist on these parcels are assumed to be unoccupied after the railroad is constructed.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for noise impacts.



Red Cliff Mine EIS

Figure 4-6
County Road 10 / Railroad Grade Crossing
Railroad Horn Noise Impact Areas

This page intentionally left blank

CR M.8 Grade Crossing

Noise mitigation is not required at this grade crossing location. The sensitive receptors R1, R3, and R4 would experience a minor 3-dBA increase in noise, which is below the FTA criteria requiring mitigation. Noise receptor R2 would experience an 8 dBA increase in noise, which exceeds the FTA minimum of 5 dBA, for a total noise level of 60 dBA. To be considered for mitigation, both the minimum increase and total noise levels must be equaled or exceeded. This location does not exceed the 65 dBA total noise threshold, and therefore no mitigation is required.

CR 10 Grade Crossing

Noise mitigation is required for receptor R10 at this grade crossing location. When the train passes the property and the horn is sounded, this location would experience a 12-dBA increase in noise for a total noise level of 66 dBA. This location exceeds both the 5-dBA minimum noise level increase and the 65-dBA total noise threshold.

Noise mitigation at this location should consider installing an earth berm, a concrete noise wall, a combination earth berm/concrete wall; insulating the building with sound proof material; installing a noiseless crossing traffic control device at the grade crossing; or purchasing and moving the residence. Receptors R5, R6, R7, and R9 would experience moderate noise impacts, but would not exceed the 65-dBA criteria, when the horn is sounded up to four times a day.

Construction Noise

The contractor would take appropriate measures to reduce noise from construction equipment. This would include the installation and maintenance of engine mufflers. To avoid noise impacts at night, nighttime construction may be curtailed in certain sensitive areas near residents.

Alternatives Carried Forward for Further Consideration

Alternatives were developed that could eliminate train horn noise. In addition to this noise source, locomotive noise was studied. The coal train would increase noise levels in proximity to the tracks. The horizontal distance from the center of the tracks to the severe noise impact limit for non-horn railroad noise would vary slightly along the railroad route. This variation in distance is due to the changes in background noise levels.

Grade-Separated Crossing at CR M.8

This alternative would lessen noise impacts, as a grade-separated crossing at CR M.8 would eliminate train horn noise impacts, as the horn would not be sounded at the crossing. Noise sources would be limited to locomotive and coal rail cars as the train passes through the area. Residents located within a half-mile radius of the grade-separated crossing may hear the train noise, but the analysis determined that impacts to nearby residences would be below the moderate or severe thresholds.

Noiseless Crossing Traffic Control Devices

The public requested that a grade crossing alternative be studied where the sounding the horn is not required. A noise analysis of a "quiet zone" created by installing the noiseless crossing traffic control device was completed at each road/railroad location. This analysis used similar procedures and is summarized below. The FTA train horn noise model was used to predict noise

levels from the locomotives, excluding train horn noise. The model evaluated the noise generated from three diesel locomotives per train at each railroad grade crossing.

CR M.8 Grade Crossing with Noiseless Crossing Traffic Control

The results from the railroad horn noise model, excluding train horn noise, at the proposed CR M.8 grade crossing are shown in Figure 4-7, County Road M.8 Grade Crossing with Noiseless Crossing Traffic Control Railroad Noise Impacts. For comparative purposes, a 0.5-mile noise envelope was used centered on the CR M.8 crossing. Receptors R1, R3, and R4 would hear the train with each pass, but impacts are below the moderate threshold. The predicted noise levels would increase by approximately 1 dBA for total noise level of 53 dBA. This increase in noise does not meet the FTA noise mitigation criteria, and therefore no additional mitigation is required. Residences located within a 0.5-mile radius of the grade crossing may hear the locomotive noise, but impacts would be below the moderate or severe thresholds. No further mitigation is required for this measure.

CR 10 Grade Crossing with Noiseless Crossing Traffic Control

The results from noise model at the proposed CR 10 grade crossing are shown in Figure 4-8, County Road 10 Grade Crossing with Noiseless Crossing Traffic Control, Railroad Noise Impacts, Receptors R5, R6, R7, and R8 would hear the train, but the impact is below the moderate threshold. Receptor R10 would experience a moderate noise impact. The predicted noise levels at R10 would increase by approximately 3 dBA, for a total noise level of 58 dBA. This increase in noise does not meet the FTA noise mitigation criteria, and therefore no additional mitigation is required. Residences located within a 0.5-mile radius of the grade crossing may hear the locomotive noise, but impacts would be below the moderate or severe thresholds. No further mitigation is required for this measure.

Transmission Line Alternative A

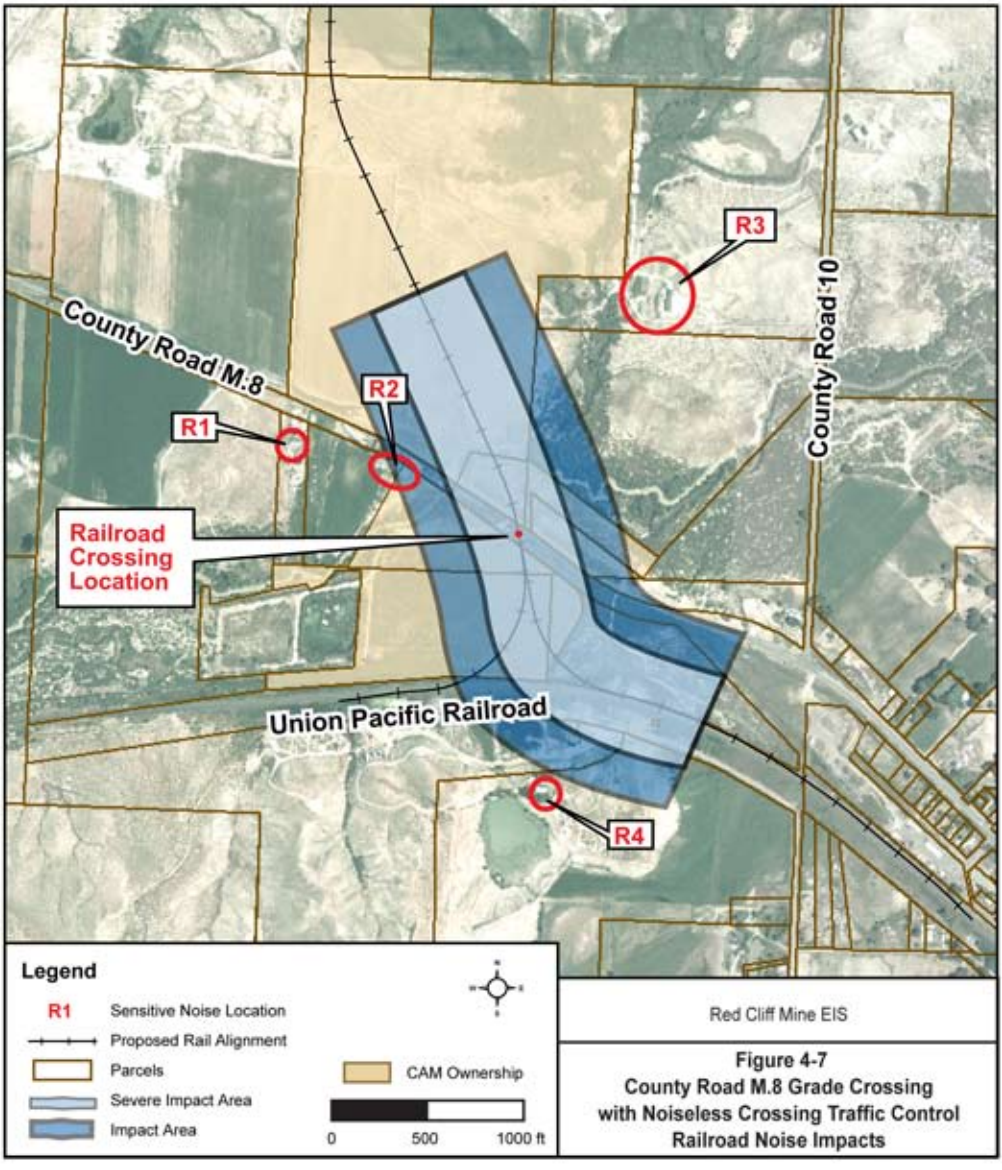
Impacts would be the same as those for the Proposed Action transmission line alternative.

Transmission Line Alternative B

Impacts would be the same as those for the Proposed Action transmission line alternative.

Transmission Line Alternative C

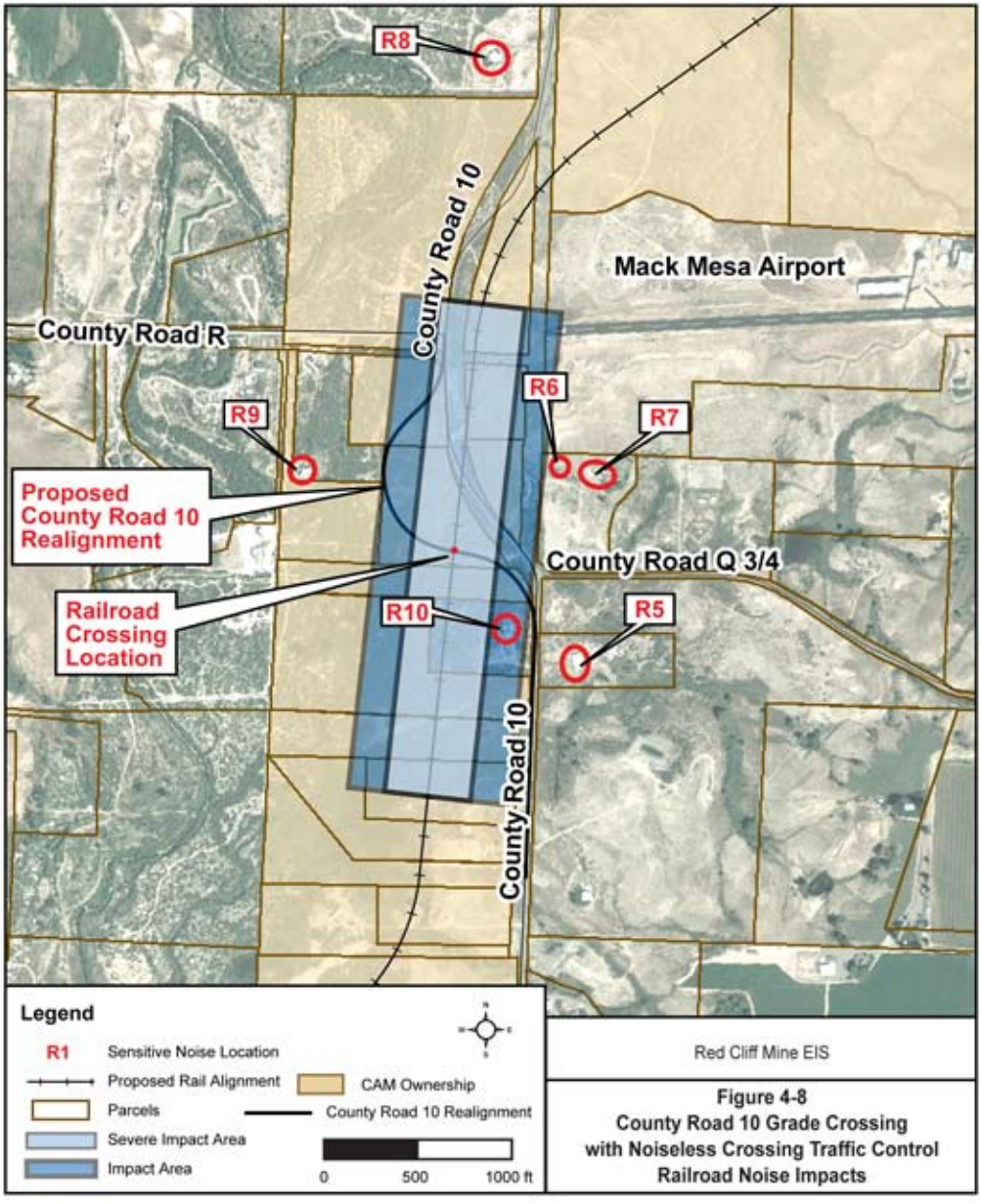
Impacts would be the same as those for the Proposed Action transmission line alternative.



Red Cliff Mine EIS

Figure 4-7
County Road M.8 Grade Crossing with Noiseless Crossing Traffic Control Railroad Noise Impacts

This page intentionally left blank



Red Cliff Mine EIS

Figure 4-8
County Road 10 Grade Crossing with Noiseless Crossing Traffic Control Railroad Noise Impacts

This page intentionally left blank

4.1.10 Hazardous Materials

No Action Alternative

Under the No Action Alternative, there would be no changes to the current management of hazardous materials in the proposed project area. Impacts would remain unchanged from existing conditions.

Proposed Action Alternative

Mine and Facilities

Operation of the proposed facilities would involve potentially toxic or hazardous materials including hydrocarbon waste, detergents, solvents, and batteries. Generated wastes would be handled in accordance with applicable regulations as described in Section 3.1.10, Hazardous Materials. Hazardous wastes generated during operation would be removed from the site by a licensed regulated waste management contractor at regular intervals and trucked to authorized facilities for recycling or treatment and disposal. The Colorado Public Utilities Commission issues annual hazardous materials transportation permits to anyone hauling hazardous materials that require placarding under 49 CFR 172 or 173. The transporter is required to provide proof of liability insurance at the time of application (Colorado Department of Public Health and Environment [CDPHE] 2008).

Waste rock would be generated through the process of separating the coal from the mined material. Waste rock would also be generated from tunneling or blasting. Sulfur-bearing material can be brought up to the surface in waste rock. When sulfide minerals come in contact with air, precipitation, and groundwater, an acidic leachate can be formed. This leachate can result in acid mine drainage (AMD), which picks up heavy metals and carries these toxins into streams or groundwater. Other toxic forming material (earth materials or waste) can also be brought up to the surface with waste rock. When these materials are acted upon by air, water, and weathering or microbiological processes, they can produce conditions in soils or water that are toxic to plant or animal life. Testing of the rock from the proposed mine site does not indicate that any sulfur-bearing material is present. Therefore waste rock from the proposed mine has been determined to be non-acid-forming or non-toxic-forming.

Lease Area

There are no known existing hazardous material sites within the lease area based on a report provided by Environmental Data Resources (EDR) (EDR 2007). The locations of hazardous materials outside of the boundary drawn by EDR are unknown, but this area is unlikely to contain hazardous materials. All activities which would involve hazardous materials within the leasing area are described in the Mine and Facilities section.

Railroad

There are no known hazardous material sites within the project area, and no known hazardous waste haul routes that transect the proposed railroad alignments (EDR 2007). The proposed railroad would not haul hazardous materials. Hazardous materials would be trucked off the mine site via the mine access road and SH 139.

In the advent of a railroad derailment no hazardous materials would be spilled or released as a result of the Proposed Action alternative. The diesel fuel, which is used to power a locomotive, is contained in doubled walled tanks and is less likely to rupture when compared to single walled fuel tanks on trucks. Diesel fuel when spilled is typically not a hazardous waste. A coal spill is not a considered a hazardous material. Section 303 of the Emergency Planning and Community Right-To-Know Act of 1986 (SARA Title III) (EPCRA) requires the preparation of Emergency Response Plans for rail emergencies. Emergency Response Plans include very specific procedures to mitigate rail derailment and any resulting spills. The Public Utilities Commission requires the establishment and maintenance of a written system safety program plan.

Water Pipeline

Construction of the water pipeline would not affect hazardous materials.

Transmission Line

Construction of the transmission line would not affect hazardous materials.

Temporary Impacts

Impacts from hazardous materials due to construction of the railroad, water pipeline, transmission line, and access road would remain unchanged from existing conditions.

Long Term Impacts

Long term impacts may result from AMD and other toxic forming material if it was created by the mining process. See the mitigation measures section for proposed mitigation.

Mitigation Measures

As described in Section 3.2.3, Geology and Minerals, rock in the project area is predominantly shale and sandstone. With little or no sulfur bearing materials, the waste rock would likely be non-acid forming. Waste rock was analyzed to determine if it is an acid-or toxic-forming material. The rock was tested and determined to be non-acid or non-toxic-forming, and it would be stockpiled within the waste rock pile as described in Section 2.11.6, Associated Surface Facilities, in accordance with applicable state regulations (2 CCR 407-2.2.04.09 through 2 CCR 407-2.2.04.11).

The facility would implement a program to reduce, reuse, and recycle materials to the extent practicable.

The facility would have a Spill Prevention, Control, and Countermeasures (SPCC) Plan (40 CFR Part 112) addressing the accidental release of materials into the environment.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures addressing hazardous materials.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Impacts from hazardous materials under this alternative would be the same as those described for the Proposed Action.

Noiseless Crossing Traffic Control Devices

Impacts from hazardous materials under this alternative would be the same as those described for the Proposed Action.

Transmission Line Alternative A

Impacts from hazardous materials under this alternative would be the same as those described for the Proposed Action.

Transmission Line Alternative B

Impacts from hazardous materials under this alternative would be the same as those described for the Proposed Action.

Transmission Line Alternative C

Impacts from hazardous materials under this alternative would be the same as those described for the Proposed Action.

4.1.11 Health and Safety

No Action Alternative

Under the No Action Alternative, there would be no changes to health and safety in the proposed project area. Impacts would remain unchanged from existing conditions.

Proposed Action Alternative

Mine and Facilities

Although proper health and safety precautions would be used at the mine, coal mining is a dangerous profession. Underground mining has one of the highest fatal injury rates of any U.S. industry, more than five times the national average compared to other industries (NIOSH 2008). Fatalities, injuries, and disasters, although less frequent than in the past, continue to occur, and health concerns posed by gases, dusts, chemicals, noise, extreme temperatures, and other physical conditions continue to result in chronic and sometimes fatal illnesses. In the last three decades, improvements in mining technology, equipment, processes, procedures, and workforce education and training have resulted in greater safety and health.

MSHA and the Colorado Division of Reclamation, Mining, and Safety (DRMS) regulate worker safety and health at mines. The Federal Mine Safety and Health Act administered by MSHA and the Coal Mine Health and Safety Rules and Regulations of the Coal Mine Board of Examiners administered by DRMS would be fully implemented during construction and operation of the project (DRMS 2008).

Construction and operation of the proposed project presents hazards to human health and safety. These hazards are in addition to the existing risks within the project area as described in Section 3.1.11, Health and Safety. All construction activities would be conducted in compliance with applicable MSHA and/or Occupational Safety and Health Administration (OSHA) regulations, depending on applicable jurisdiction. Colorado Department of Public Health and Environment

Air Pollution Control Division (APCD) requires mines to control fugitive dust by watering coal stockpiles during dry weather.

Lease Area

All activities which would involve health and safety within the lease area are described in the Mine and Facilities section.

Railroad

Traffic safety impacts due to railroad construction and operation are addressed under Section 4.1.6, Transportation. Air emission health impacts are addressed under Section 4.2.1, Air Quality. Other than traffic and air emissions, railroad construction and operation impacts to health and safety would remain unchanged from existing conditions.

Water Pipeline

Water pipeline construction and operation impacts to health and safety would remain unchanged from existing conditions.

Transmission Line

Contact with high voltage electricity can be potentially lethal. A 69,000 volt (69kV) transmission line would be required to supply the required power. Construction and operation of this transmission line would adhere to all approved codes of practices and procedures. The 69kV transmission line and the associated 12kV underbuild circuit would be designed to meet the current edition of the National Electrical Safety Code (NESC). A qualified electrical contractor would construct the 69kV transmission line. That contractor would maintain an industry standard safety program for public and employee safety at all times during construction. Typically, the contractor would meet NESC as well as OSHA rules published as 29 CFR 1910.137 and 29 CFR 1910.269. Qualified electricians and secured access and isolation procedures would reduce risks associated with high voltage.

Temporary Impacts

Impacts associated with construction may include but are not limited to:

- Dust from roads and earthwork: Hazards are associated predominantly with inhalation or other contact.
- Traffic incidents on-site: Hazards are associated with personal vehicles and construction equipment.
- Construction equipment hazards: Personnel may be at risk of interacting with construction machinery, parts from vehicles, and earth moving equipment resulting in the potential for serious injury.
- Fuel, oil or chemical leaks from equipment and vehicles: These leaks can pose health and safety risks.
- Noise: Prolonged exposure to excessive noise can cause permanent hearing losses.
- Cold and heat stress: Temperature extremes can affect worker health and safety.
- Slips, trips, and falls: Injuries associated with slips, trips, and falls may occur.

- Confined space entry and excavation and trench hazards: Hazards associated with confined space entry and excavation and trench hazards include limited or restricted means for entry or exit and cave-ins.

Long Term Impacts

Impacts associated with operation may include but are not limited to:

- Rock and roof falls: Nearly 40 percent of the 98 coal mine fatalities between 1996 and 1998 were caused by falls of ground. Underground miners are at much greater risk than surface miners. Nearly half (45 out of 101) of underground mine fatalities were attributed to roof, rib, and face falls.
- Coal Dust: Inhalation of coal dust is a health hazard. Black lung disease (also known as pneumoconiosis) is caused by inhaling coal dust. Although the 1969 Coal Mine Health and Safety Act sought to eliminate black lung disease, the American Lung Association (ALA) estimate that 400 former coal miners die of black lung each year (ALA 2008).
- Underground air quality: The air in an underground mine can easily become contaminated. Oxides of nitrogen (NO_x), carbon monoxide (CO), and carbon dioxide (CO_2) are introduced by blasting and internal combustion engines. Dust is created by virtually every aspect of the mining process. Diesel particulate matter (DPM) is present where diesel engines are operated. Without controls, every miner is subjected to health hazards ranging from eye and throat irritation to death.
- Blasting: Blasting creates a number of risks such as flying rock, dust, noise, vibration, and airblast effects. Flying rocks and airblast effects can cause serious personal injury if not properly controlled.
- Fire in coal storage and handling facilities: Coal stockpiles may combust spontaneously, which may result in fires.
- Accidents related to use of tools and machinery: Accidents related to tool and machinery use may result in personal injury or death.
- Birds and bats: Respiratory diseases such as histoplasmosis, psittacosis, and cryptococcosis can be transmitted by excretions of birds or bats. These diseases are transmitted either by inhaling the dust from feathers or droppings or inhaling contaminated soil.
- Traffic incidents on-site: Hazards are associated with use of personal vehicles and mine operation equipment.
- Chemical release to atmospheric or ground systems: Hazards are associated with accidental release of chemicals.
- Contact with high voltage electricity: Electricity use from mine lighting and the electrical operation of infrastructure would require the use of potentially lethal levels of voltage and amperage.
- Failure to provide adequate emergency treatment and response: Personal injury and death may result from failure to provide adequate emergency treatment and response.

Mitigation Measures

- Dust from roads and earthwork: Dust from earth-moving machinery would be controlled by water and dust suppression chemicals.
- Traffic incidents on-site: Construction workers operating vehicles, as well as personnel working around vehicles on-site would be trained and licensed where applicable, so that these vehicles are operated in a safe and appropriate manner.
- Construction equipment hazards: Construction vehicles and equipment would be operated within the manufacturer's specifications. All vehicles and equipment would be maintained and serviced on a regular basis. Maintenance "lock-out/tag-out" safety systems would be implemented.
- Fuel, oil, or chemical leaks from equipment and vehicles: All vehicles and equipment would be maintained and serviced on a regular basis. The facilities would have an SPCC Plan (40 CFR Part 112). The SPCC Plan would include spill prevention and containment as well as response and clean-up to an accidental spill or leak.
- Noise: Appropriate hearing protective equipment would be utilized by construction workers as required by MSHA and OSHA regulations. Employers must provide hearing protectors to all workers exposed to 8-hour time-weighted average (TWA) noise levels of 85 dB or above. This requirement ensures that employees have access to protectors before they experience any hearing loss. The OSHA publication for Hearing Conservation (OSHA 3074) provides guidance for monitoring and appropriate personal protective equipment (PPE) for construction workers.
- Cold and heat stress: Personnel training, monitoring, and correct personal protection can help mitigate the effects of temperature extremes.
- Slips, trips, and falls: Identifying and eliminating or minimizing hazards, use of proper footwear, and implementing behavioral-based training would help reduce injuries associated with slips, trips, and falls.
- Confined space entry and excavation and trench hazards: Personnel would be trained and/or knowledgeable about applicable OSHA safety training and regulations.
- Rock and roof falls: Best practices have been developed through experience and research to reduce these risks. They combine engineering design, roof support, equipment, mining methods, and human factors to create safer workplaces and work practices (NIOSH 2008).
- Coal Dust: Most of the coal transfer points and processing actions during coal production would be enclosed and, therefore, limit the amount of "fugitive" emissions. Health standard provision of the Federal Mine Safety & Health Act of 1977, Public Law 91-173 (as amended by Public Law 95-164) would be strictly adhered to.
- Underground air quality: Ventilation to supply fresh air and remove/dilute contaminants and pollutants would be a component of the mining design.
- Blasting: Blasting experts would utilize safe blast design, control of access, and evacuation warnings before blasting. Personnel in the vicinity of a blast would wear PPE, and all

personnel would observe safe distances during blasting activities. Safety procedures would be strictly adhered to.

- Fire in coal storage and handling facilities: A fire suppression system would be an element of the engineering design. Relevant site staff would complete fire safety training. An Emergency Response Plan inclusive of a local trained fire crew and proper containment and shutdown procedures would be implemented.
- Accidents related to use of tools and machinery: Equipment and machinery would be operated within the manufacturer's specifications. All equipment and machinery would be maintained and serviced on a regular basis. Employees would be trained and have current licenses where necessary. Maintenance lock-out / tag-out safety systems would be implemented.
- Birds and bats: Cleaning up affected areas would help to prevent the spread of infection. Ventilation to supply fresh air and remove/dilute contaminants and pollutants as well as proper PPE use would be components of the mining design.
- Traffic incidents on-site: Miners operating vehicles on-site would be trained and licensed, so that these vehicles are driven in a safe and appropriate manner.
- Chemical release to atmospheric or ground systems: Personnel would be trained in appropriate storage and handling and incident response. Material safety data sheets (MSDSs) would be available on-site. Chemical incidents would be included in the Emergency Response Plan.
- Contact with high voltage electricity: Construction and operation of this transmission line would adhere to all approved codes of practices and procedures. Qualified electricians and secured access and isolation procedures would reduce risks associated with high voltage.
- Failure to provide adequate emergency treatment and response: The federal government recently initiated the Mine Improvement and New Emergency Response (MINER) Act of 2006, signed into law on June 15, 2006 by President Bush. In addition to additional emergency air supply regulations, the MINER Act calls for a plan of post-accident communication between underground and surface personnel via a wireless, two-way medium, and for an electronic tracking system, permitting surface personnel to determine the location of any persons trapped underground. The new federal standards are mandated to be implemented by June 2009.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for impacts to health and safety.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Traffic safety impacts due to this alternative are addressed under Section 4.1.6, Transportation. Other than traffic, construction and operation impacts to health and safety would remain unchanged from existing conditions.

Noiseless Crossing Traffic Control Devices

Traffic safety impacts due to this alternative are addressed under Section 4.1.6, Transportation. Other than traffic, construction and operation impacts to health and safety would remain unchanged from existing conditions.

Transmission Line Alternative A

Impacts to health and safety under this alternative would be the same as those described for the Proposed Action.

Transmission Line Alternative B

Impacts to health and safety under this alternative would be the same as those described for the Proposed Action.

Transmission Line Alternative C

Impacts to health and safety under this alternative would be the same as those described for the Proposed Action.

4.2 PHYSICAL RESOURCES

4.2.1 Air Quality

A detailed Air Quality Analysis Modeling Report has been prepared for this proposed project and is included as Appendix H, Air Quality Analysis Modeling Report. The report describes the modeling methodology and predicted air quality impacts for criteria pollutants (PM_{10}, $PM_{2.5}$, NO_x, SO_2, and CO), as well as impacts to Air Quality Related Values (AQRV) (visibility deposition). Emission estimates for VOCs, a precursor to ground-level ozone, and greenhouse gases (GHGs) are also provided. The following information summarizes the potential air quality impacts from the project.

No Action Alternative

The No Action Alternative would result in air emissions remaining the same as they are today. There would be no increases in emissions of particulate matter, NO_x, SO_2, CO, VOCs, or GHGs.

Proposed Action Alternative

Construction and operation of the proposed mine would result in both temporary and ongoing emission increases to the atmosphere. Emissions were divided into three distinct groups, coinciding with the three individual phases of the project: Phase 1 – Railroad Construction; Phase 2 – Mine Area, Transmission Line, and Haul Roads Construction; and Phase 3 – Production (i.e., coal mining operations). Estimated criteria pollutant emissions from the project, grouped by project phase, are shown in Table 4-5, Projected Criteria Pollutant Emission Increases for the Proposed Red Cliff Mine (tpy), and detailed emission calculations for each type of emission source/activity are provided at the end of Appendix H, Air Quality Analysis Modeling Report.

Table 4-5
PROJECTED CRITERIA POLLUTANT EMISSION INCREASES FOR THE PROPOSED RED CLIFF MINE, (tpy)[1]

Pollutant	Phase 1 Railroad Construction	Phase 2 Construction: Mine Area/Transmission Line/Haul Roads	Phase 3 Production
NO_x	73.16	25.16	80.54
CO	23.97	8.36	10.01
SO_x	0.05	0.02	0.04
VOC[2]	3.32	1.14	3.91
PM_{10}	27.71	49.24	23.80
$PM_{2.5}$	84.10	15.62	7.14

Notes:
[1] tons per year
[2] VOC emissions are a precursor to ozone formation, along with NO_x

Based on these estimated emission rates, a minor source air quality construction permit would be required in order to begin construction of the mine area. Major source, or prevention of significant deterioration (PSD), air permitting would not be required. However, due to the amount of estimated emissions associated with the production phase, an air quality modeling analysis for the production phase emissions would likely be required by CDPHE as part of a minor source air quality construction permit application.

A "near-field" air quality dispersion modeling analysis was conducted to assess impacts occurring within 1 kilometer of the proposed mine site using the AMS/EPA Regulatory Model (AERMOD). A "far-field" air quality dispersion modeling analysis was conducted using the EPA-approved CALPUFF model to assess impacts, including those to AQRVs in Class I and sensitive Class II areas within 200 kilometers of the proposed mine area site. A brief description of both models and the various model inputs are provided in Appendix H, Air Quality Analysis Modeling Report. Short term (1-hour, 3-hour, 8-hour, 24-hour) and long term (annual) impacts were assessed for several Clean Air Act (CAA) criteria pollutants in both the near-field and far-field analyses. Additionally, potential visibility impacts and nitrogen and sulfur deposition amounts were assessed in the far-field analysis, in accordance with established air quality modeling guidance. A screening version of CALPUFF (known as CALPUFF-Lite) was used for the far-field analysis, as a conservative assessment approach.

Specific Class I and sensitive Class II areas included in the far-field analysis are listed below.

Utah

- Arches National Park (Class I Area)
- Canyonlands National Park (Class I Area)

Colorado

- Black Canyon of the Gunnison Wilderness (Class I area)
- Flat Tops Wilderness (Class I area).
- Maroon Bells – Snowmass Wilderness (Class I area)
- Colorado National Park (sensitive Class II area)
- Dinosaur National Monument (sensitive Class II area)

Five years of data were modeled in both analyses, with the specific years and meteorological data sets recommended by air quality staff at the CDPHE.

Both analyses were conducted according to the distinct project phases, since each project phase would occur separately, with the Phase 1 railroad construction occurring first, followed by the Phase 2 mine area/transmission line/haul road construction activities, and finally by the Phase 3 start of ongoing operations (also referred to as "production" in Appendix H, Air Quality Analysis Modeling Report). An expected timeline for the three project phases is included as an attachment to Appendix H.

Temporary Impacts – Criteria Pollutants

Temporary impacts would occur from those emissions generated during construction activities. Primarily, construction emissions would consist of fugitive road dust from vehicle traffic, heavy construction vehicles and mobile equipment, and soil disturbance. A small amount of construction-related emissions would be generated by fuel combustion in construction equipment and passenger vehicles.

The near-field and far-field analyses did not predict any maximum ambient concentrations exceeding the National Ambient Air Quality Standard (NAAQS) or Colorado Ambient Air Quality Standards (CAAQS) due to the two construction phases. Far-field modeling, which did not include cumulative sources, predicted a few potential temporary air quality impacts due to construction activities.

- Predicted maximum 24-hour concentrations of particulate matter less than 10 micron in diameter (PM_{10}) are higher than PM_{10} 24-hr Class I PSD Significant Impact Levels (SILs) for each year modeled, at each Class I and sensitive Class II area included in the far-field analysis. The SILs do not represent thresholds at which unacceptable impacts occur; rather they are typically employed as screening values to be used in PSD permitting to determine whether additional air quality modeling should be performed. The SILs are established conservatively low, so that larger projects going through the PSD construction permitting process would be required to perform cumulative air quality analyses. This analysis is not a permitting action and is not subject to PSD regulatory requirements. However, comparisons to the SILs are employed as a conservative threshold in assessing impacts and the need for additional modeling. While the PM_{10} 24-hr model results for construction activities are higher than the PM_{10} 24-hr SIL, the highest modeled PM_{10} 24-hr concentration in the far-field analysis (2.64 micrograms per cubic meter [$\mu g/m^3$]) is less than 2 percent of the PM_{10} 24-hr NAAQS value of 150 $\mu g/m^3$. Due to the temporary nature of these construction activities, cumulative source modeling is not required.

- Several days per year, various Class I and sensitive Class II areas are shown to have visibility impacts during the temporary construction period. Specifically, the far-field analysis provides the number of days per year when visibility changes by at least one deciview. A change of one deciview is translates to a "just noticeable" visibility change for most individuals. The majority of the visibility impacts occur at areas close to the proposed mine area, such as the Flat Tops Wilderness and the Colorado National Monument. In a few cases, visibility impacts are noted at Canyonlands National Park, Dinosaur National Monument, and Black Canyon of the Gunnison Wilderness. The maximum visibility impacts were in the Colorado National Monument, during the Phase 1 railroad construction, with 3, 6, 7, 20, and 16 days impacted in the five modeled years, respectively. It should be noted that a conservative approach was used in the CALPUFF-Lite input, to apply the light extinction coefficient for fine particulate matter to all sizes of particulate matter emissions, which may have increased the number of days predicted to have visibility impacts.
- Nitrogen deposition impacts equal to or higher than the deposition analysis threshold (DAT) of 0.005 kilogram per hectare per year (kg/ha/yr) are shown at the Colorado National Monument for both construction phases. The greatest predicted nitrogen deposition impact was 0.00876 kg/ha/yr. The DAT is the additional amount of N or S deposition within a Class I area, below which estimated impacts from a proposed new or modified source are considered insignificant. Because exceedance of the DAT at Colorado National Monument is predicted to occur only during the construction phase, no cumulative deposition analysis was performed. For comparison purposes, Federal Land Manager levels of concern for cumulative impact analysis are 3 kg/ha/yr for nitrogen and 5 kg/ha/yr for sulfur. No other nitrogen impacts exceeding the DAT were predicted, and no sulfur impacts exceeding the DAT for any area, from either construction phase, were predicted.

As mentioned earlier, these temporary impacts result in the far-field analysis, which utilized a screening-level version of the CALPUFF model (CALPUFF-Lite). Results from a CALPUFF Lite analysis are considered to be conservative assessments of air quality impacts, because a number of assumptions are made that tend to result in over-predictions of impacts. At times, CALPUFF-Lite can predict much larger impacts that would be predicted from the full version of CALPUFF. If a full version of CALPUFF were used for the far-field analysis, it is possible that some of these temporary impacts would be negated.

These impacts are temporary because they are caused by the construction activities associated with the proposed mine. The expected timeline for construction is only 1.5 years. Following the startup of mining operations, the construction emissions would cease, and air quality impacts from the construction activities would also cease.

Long Term Impacts – Criteria Pollutants

Long term impacts would occur from emissions generated as part of the Phase 3 production activities. These emissions would consist of fugitive dust from vehicles and haul trucks, storage piles, and coal conveyance at the mine site, and other criteria pollutants emitted from fuel burning equipment at the mine site. The emissions would be ongoing and long term.

No significant air quality impacts are associated with the long term emissions. All modeled criteria pollutants in the near-field and far-field analyses were lower than the respective air quality standard. No days of visibility change were noted in the far-field analysis, and all deposition rates were well below the thresholds for deposition impacts.

Greenhouse Gases

Methane, carbon dioxide (CO_2), and nitrous oxide (N_2O) would be the primary GHGs emitted from the proposed Red Cliff Mine.[1] At this time, methane and CO_2 emissions are not regulated by the US EPA or the State of Colorado from an air quality permit basis. N_2O is indirectly regulated by the state because it is a component of NO_x, which is regulated as a criteria pollutant under the Clean Air Act (CAA).

GHGs would be emitted from two primary sources at the proposed mine: (1) fuel combustion and the resulting exhaust from heavy construction equipment and vehicles (including trains), and (2) methane from mine ventilation and degasification systems. Mine ventilation systems are employed at underground mines as a key safety measure, so that explosive concentrations of methane are avoided in the mine. The ventilation systems direct large quantities of air through the mine in order to dilute the methane within the mine to safe concentrations (typically below one percent methane on a volume basis). Some mines must also employ a degasification system to supplement the ventilation air system. Degasification systems reduce methane quantities by draining gas from the coal-bearing strata before, during, and after mining, depending on the specific mining needs.

When employed, degasification system methane emissions are estimated to account for approximately one-third of total methane emissions from underground coal mining (EPA 2005). The extent of degasification systems (for safety purposes) at the proposed mine is unknown at this time and will remain unknown until specific technical data and mine experience can be gathered. However, as discussed in Section 2.9, Methane Venting, it will likely be necessary to install two or three methane degasification wells in each longwall panel. The location of the methane degasification wells and the timing of drilling are unknown at this time. Methane degasification well placement would be based on need as established by the conditions in the mine as well as surface conditions and will be designed site-specifically as the project progresses.

Methane emission estimates from the underground mine ventilation and degasification systems are based on the total methane ventilated from the mine plus the methane liberated from degasification systems, less any methane that would be recovered. There is no available Red Cliff Mine measurement data for methane emissions. Consequently, Red Cliff methane emission estimates are based on data and assumptions published in *Identifying Opportunities for Methane Recovery at US Coal Mines: Profiles of Selected Gassy Underground Coal Mines, 2002–2006* (EPA 2008a). In this study, liberated methane emissions at existing mines were calculated as an average of the results of four quarterly tests conducted in 2006 by the Mine Safety and Health Administration (MSHA). Four western Colorado coal mines are included in the report. The methane emissions at the Red Cliff Mine would be sampled quarterly by MSHA, and would be published by MSHA. Mine plans submitted to DRMS and OSM for the future coal lease area would incorporate methane emissions data obtained from the Red Cliff Mine.

[1] Methane is approximately 21 times more effective in trapping heat in the atmosphere than CO_2 over a 100-year period. N_2O traps approximately 310 times more heat than CO_2.

Red Cliff Mine methane emissions were estimated based on the specific emissions (the amount of methane released in cubic feet per ton of coal production) at the four western Colorado coal mines. To estimate Red Cliff Mine methane emissions, specific emissions from the four Colorado coal mines were averaged and the result was multiplied by the 11.4 million ton maximum coal production rate proposed for the Red Cliff Mine. As discussed in Section 2.11.2, Expand Coal Mining Production, projections for coal production are that the mine will only produce up to 3.0 million raw tpy during the first five year permit term. Table 4-6, Colorado Coal Mine Production and Methane Emissions, presents the published EPA data for the four Colorado mines and the calculated emission estimates for the Red Cliff Mine.

Table 4-6
COLORADO COAL MINE PRODUCTION AND METHANE EMISSIONS

			Estimated 2006 Methane Ventilation, Degasification and Use Data				
Mine	Company	2006 Coal Production (mm tons)	Ventilation Emissions (mmcfd)	Methane Drained through Degasification Systems (mmcfd)	Total Methane Liberated (mmcfd)	Specific Emissions (cf/ton)	Methane Used (mmcfd)
Bowie No. 2	Union Pacific	4.4	1.5	0.5	2.0	161	0.0
Elk Creek	Oxbow Mining	5.1	5.6	1.9	7.4	530	0.0
McClane Canyon	Wexford Capital	0.3	0.9	0.0	0.9	1,300	0.0
West Elk	Arch Coal	6.0	9.1	9.1	18.2	1,107	0.5
Red Cliff [1]	Mine Operator	11.4	14.5	9.7	24.2	775	0.0

Source: EPA 2008a.
Notes:
[1]Red Cliff Mine emissions estimates were derived from the averaged specific emissions for the other four Colorado mines.
cf = cubic feet
mmcfd = million cubic feet per day
mm tons = million tons

Table 4-6, Colorado Coal Mine Production and Methane Emissions, also provides quantities of methane produced from ventilation air methane (VAM) and degasification systems for each existing mine, as well as estimates for the Red Cliff Mine. While all mines have VAM systems, only some mines have methane degasification systems. However, because three of the existing Colorado mines have degasification systems and larger mines are more likely to have degasification systems, the Red Cliff Mine is assumed to have a degasification system in order to estimate emissions and provide a full discussion of potential GHG mitigation options. When degasification systems are used, EPA estimates that emissions from degasification systems account for 20 to 60 percent of total emissions. Using the average EPA estimate, Red Cliff Mine degasification emissions were assumed to be 40 percent of total potential mine emissions.

Estimated GHG emissions from the Red Cliff Mine from all mine operations, including combustion sources and methane liberation, are provided in Table 4-7, Projected Uncontrolled

GHG Emissions for the Proposed Red Cliff Mine. These emissions reflect operations at maximum capacity and full production.

Table 4-7
PROJECTED UNCONTROLLED GHG EMISSIONS
FOR THE PROPOSED RED CLIFF MINE

Source	CO_2e Emissions (tpy)
CO_2 from combustion sources	10,463
VAM emissions	2,326,554
Methane degasification emissions	1,551,036
N_2O from combustion sources	189
TOTAL	**3,888,242**

Notes:
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
N_2O = nitrous oxide
tpy = tons per year
VAM = ventilation air methane

As shown in Table 4-7, Projected Uncontrolled GHG Emissions for the Proposed Red Cliff Mine, VAM is the largest source of CO_2e emissions. Table 4-7 shows estimated GHG emissions during full production, which is expected to reflect maximum emissions. Emission estimate calculations are provided in Appendix H, Air Quality Analysis Modeling Report.

The emissions summary in Table 4-7, Projected Uncontrolled GHG Emissions for the Proposed Red Cliff Mine, provides uncontrolled GHG emissions. If vented without treatment proposed mine production (at maximum production capacity) is estimated to increase total annual CO_2e emissions within the state of Colorado by 3 percent (based on statewide emissions during 2005). Statewide GHG emissions are based on estimates included in *Colorado Greenhouse Gas Inventory and Reference Case Projections 1990–2020* (CDPHE 2007). This is equivalent to the annual CO_2 emissions of 0.76 coal fired power plants, and the CO_2 emissions from the energy use of 311,332 homes for one year (EPA 2008b). Potential climate change impacts attributable to the proposed project cannot be quantified at this time, due to the extremely complex global circulation modeling effort that would be required.

It is unknown whether methane recovery and either methane control or beneficial use would be feasible at the proposed mine. Currently, recovery is only being practiced to a small degree (capturing approximately 3 percent of total emissions) at one of the four existing Colorado coal mines profiled in the EPA report *Identifying Opportunities for Methane Recovery at US Coal Mines: Profiles of Selected Gassy Underground Coal Mines, 2002–2006* (EPA 2008a). Methane recovery and emission reduction and/or use options are discussed below.

Mitigation Measures – Criteria Pollutants and GHGs

Mitigation measures and emissions controls would be implemented to reduce particulate matter/fugitive dust emissions during both construction and ongoing production activities. Fugitive dust (PM_{10}) emissions from all vehicles traveling on non-paved surfaces during all

project phases would be controlled utilizing water or a surface surfactant. Storage piles would be watered as necessary to limit wind erosion potential and reduce fugitive PM_{10} emissions. Most coal transfer points and processing activities during coal production would be enclosed and, therefore, limit fugitive PM_{10} emissions. Mitigation measures to decrease GHG emissions during construction include:

- Use of alternative fuel construction equipment,
- Use of local building materials, and
- Recycling of demolished construction material.

With regard to GHG emissions, mitigation measures are beginning to be implemented at some coal mines. Mitigation measures to decrease GHG emissions and potentially decrease project-related climate change impacts during the production phase principally include measures designed to reduce coal mine methane (CMM) emissions (see Section 2.9, Methane Venting). Methane liberation from the mine may be reduced through mine planning, sealing previously mined areas, and degasification efforts. CMM mitigation would include methods to reduce emissions from both the ventilation air methane (VAM) and degasification systems.

EPA's *Identifying Opportunities for Methane Recovery at US Coal Mines: Profiles of Selected Gassy Underground Coal Mines, 2002–2006* (EPA 2008a) reports that significant developments in CMM recovery have occurred during the last several years. However, economic, technical, legal, and safety hurdles may limit implementation (see Section 2.9, Methane Venting).

The following paragraphs discuss potential methane recovery and control or beneficial use options. Some or all of these methods may not be feasible at the proposed mine. Additional site-specific mine information would be needed to determine whether any of the following GHG control strategies could be implemented at the proposed mine.

As shown in Table 4-7, Projected Uncontrolled GHG Emissions for the Proposed Red Cliff Mine, the two largest GHG sources at the proposed mine would be methane from the VAM and degasification systems (if a degasification system is used). Characteristics and uses of these types of emission streams are summarized below.

- VAM — The low methane concentration in VAM (typically 0.5 percent by volume) complicates methane control by oxidation/combustion or beneficial use. The low heat content of VAM and the potential for moisture or dust in VAM are limiting factors and generally restrict VAM emission reduction scenarios to non-beneficial uses since it is not a quality fuel. VAM can be destroyed in special types of thermal or catalytic oxidizers, or it can sometimes be used as combustion air for engines or turbines. In some cases, the methane concentration of VAM can be increased to make beneficial use more feasible.
- Methane Degasification Systems — Methane emissions from degasification systems have relatively high methane concentrations (above 30 percent by volume) and, depending on the type of degasification system, can be nearly pure methane. Methane liberated from degasification systems can be controlled using flares or other oxidation technologies, or can be put to beneficial use. Examples of typical beneficial uses of methane liberated from degasification systems include the following:

- Inject the methane gas into a nearby natural gas pipeline (if the methane concentration of the gas exceeds 95 percent and meets other criteria) involving the recovery of methane gas streams and collection into pipelines for sale to pipeline companies;
- Fuel power-generating equipment such as internal combustion engines or turbines (either at the mine or at nearby facilities);
- Fuel mine or nearby facility heaters, furnaces, or dryers; and/or
- Fuel for coal mine vehicles.

Methane combustion or oxidation, whether from equipment at the downstream end of pipelines, or in power generation equipment, or in flares, would result in fewer CO_2-equivalent emissions (by a factor of 21) as compared to direct methane release to the atmosphere. Note that the Red Cliff estimate from methane degasification systems shown in Table 4-6, Colorado Coal Mine Production and Methane Emissions, equates to a pipeline sales potential of 3.5 billion cubic feet per year.

Pipeline injection of coal mine methane is most often used in advance of mining using vertical methane wells drilled into the coal seam and surrounding strata. The total amount of methane recovered depends on site-specific conditions and the number of years the wells are drilled in advance of mining. Recovery of up to 70 percent of the total methane liberated is possible. However, in some very low permeability coal seams vertical wells may not be cost-effective due to limited methane flow. Also, the cost of disposing of production water may be a significant factor in determining economic viability.

Vertical methane degasification wells into the gob from the surface and horizontal degasification bore holes from within the mine coincident with mining or after mining from sealed areas typically yield lower methane concentrations which further decrease over time. The methane may still be usable with treatment for pipeline shipment, to power mine related equipment, or to augment the low methane levels 1 percent or less in the VAM, so that it may be used as combustion air, heating, or oxidizing. The primary purpose of these wells is to reduce and maintain methane in the mine at a safe level. The operator must maintain the flow for that purpose and not for the purpose of the beneficial use. The vertical methane degasification wells may recover 30 to 50 percent of the methane liberated by mining, while horizontal bore holes have a recovery efficiency of up to 20 percent. Other issues affecting the feasibility of pipeline injection include gas quality, while issues such as power pricing may impact decisions regarding power generation.

While there are demonstrated technologies using methane from degasification wells, VAM technologies are still in the developmental stage and cost information is still limited, thus they may not be feasible for the proposed project at this time. (EPA 2008a). While methane flaring reduces GHG emissions, it also wastes the methane resource. It is therefore the least favored means of reducing GHG emissions.

Several potential GHG mitigation measures have been considered and resulting GHG emissions have been estimated. The feasibility of implementing one or more of these mitigation measures at the Red Cliff Mine is not known and cannot be assessed until additional mine information becomes available. To evaluate the impact from future recovery and control of methane on GHG emissions, potential GHG emission reductions were calculated and compared to uncontrolled

GHG emissions. Since the methane recovery efficiency at the mine is not known, 40 percent recovery of methane was assumed (EPA 2008a).

The following three types of GHG control were analyzed:

- VAM emissions with recovery and oxidative control,
- Emissions from methane degasification with recovery and flaring, and
- Emissions from methane degasification with recovery and beneficial use.

Including a no-control scenario, six combinations of these three control techniques are included as potential mitigation measures. Emissions were calculated for each of these cases and the results are shown in Table 4-8, Estimated Controlled and Uncontrolled CO2e Emissions from Red Cliff Mine (tpy CO_2e). Additional assumptions and detailed emission calculations are provided on the Ventilation/Degasification GHG Emissions calculation spreadsheet in Appendix H, Air Quality Analysis Modeling Report.

Table 4-8
ESTIMATED CONTROLLED AND UNCONTROLLED CO_{2E} EMISSIONS FROM RED CLIFF MINE (tpy CO_2e)

		Control Scenarios				
	No Control	No VAM Control and Degas-ification Recovery with Flaring	No VAM Control and Degas-ification Recovery with Beneficial Use[1]	VAM Oxidative Control and No Recovery	VAM Oxidative Control and Degasification Recovery with Flaring	VAM Oxidative Control and Degasification Recovery with Beneficial Use[1]
VAM Emissions	2,326,554	2,326,554	2,326,554	304,668	304,668	304,668
Degasification Emissions	1,551,036	203,112	-147,718	1,551,036	203,112	-147,718
Total Emissions	**3,877,590**	**2,529,666**	**2,178,836**	**1,855,704**	**507,780**	**156,950**
Avoided Emissions	**1,347,924**	**1,698,754**	**2,021,886**	**3,369,811**	**3,720,640**	**1,347,924**

Notes:
[1] Assumes use as a fuel onsite or at a nearby location.
VAM = ventilation air methane

Total CO_2e emissions include methane that is emitted directly from the mine, any recovered but uncontrolled methane, and CO_2 emissions resulting from combustion.[2] For example, degasification methane that is flared is assumed to have an 87.5 percent control effectiveness in terms of CO_2e emissions (EPA 2008a). Beneficial use of methane as a substitute for another fuel

[2] The products of combustion are CO_2 and water. Therefore, CO_2 will be emitted whenever methane is recovered and combusted. However, the net atmospheric heat trapping potential of those combustion emissions is less than the net atmospheric heat trapping potential for a direct release of methane.

in power-generating equipment or heaters provides a greater GHG emission reduction benefit than combustion-based control such as flaring. With beneficial fuel use, the methane displaces fuel that would otherwise need to be produced and transported to the equipment site. EPA estimates that the value of recovering one ton of methane to be used in lieu of burning some other fuel results in a 23 ton reduction of CO_2e emissions (EPA 2008a). In comparison, destruction of one ton of recovered methane via flaring achieves an 18.25 ton reduction of CO_2e emissions.

As shown in Table 4-8, Estimated Controlled and Uncontrolled CO2e Emissions from Red Cliff Mine (tpy CO_2e), CO_2 potential emissions reductions vary from 14 percent to nearly 55 percent if one or more forms of control would be technically and economically feasible at the proposed mine. Examples of legal and safety issues that would need to be addressed before the control scenarios could be implemented are summarized below.

- Methane ownership issues — As discussed in Section 2.9, Methane Venting, coal and oil and gas resources fall under differing regulations (43 CFR 3400 for coal, and 43 CFR 3100 for oil and gas) which implement provisions of the MLA. The federal coal lease grants the lessee the exclusive right and privilege to drill for, mine, extract, remove, or otherwise process and dispose of the coal deposits in the lease; the coal lease does not grant the right to the coal lessee to capture methane gas released incident to mining. Further, the coal lease reserves the right of the Lessor (BLM) to lease other mineral deposits contained on the leased coal lands including oil and gas (BLM Form 3400-12, Section 7). A recent Interior Board of Land Appeals (IBLA) decision – the Vessels Decision – has ruled that the methane gas released by coal mining into the environment, as approved by MSHA for the protection of coal miners, is not the oil and gas deposit addressed by leasing under the MLA (Vessels Coal Gas, Inc., 175 IBLA 1, 28). Once mining occurs, the Vessels Decision holds that the oil and gas leasing (43 CFR 4100) provisions of the MLA is no longer the appropriate authority under which BLM should authorize coal mine methane capture and beneficial use. In response, BLM is currently studying alternative means of authorizing coal mine methane capture and beneficial use. In spite of this uncertainty, it may be possible for the mine operator to obtain competitive oil and gas leases from BLM for the unleased areas shown on Figure 3-9, Authorized Oil and Gas Leases within the Existing Coal Lease Application, which would allow the mine operator to drill methane degasification wells in advance of mining. This would decrease the need for methane venting and degasification systems during mining, thereby improving mine safety. This would also potentially allow for capture and beneficial uses as previously described. For those lands already leased for oil and gas, the mine operator would need to arrange with the present oil and gas lease holders to drill methane degasification wells in advance of mining. Negotiations could also include obtaining the use of methane gas in mining operations.
- Technological or economic feasibility issues — Technological and economic feasibility issues are discussed in Section 2.9, Methane Venting. Technological feasibility issues include methane gas quality; and facilities for production, processing, compression, and transportation of the gas. Economic feasibility issues include whether the volume of methane released from the mine would warrant installation of the facilities for production, processing, compression, and transportation of the gas. There are also issues related to permitting these facilities so they do not interfere with mine operations.

- Flare safety issues — As discussed in Section 2.9, Methane Venting, methane flaring at active mines has not been implemented in the United States due to safety concerns about the potential for flame propagation back down to the mine area and the possibility for explosion (Lewin 1995 as cited in EPA 2008a). At this time, methane flaring is not a generally accepted practice among miners, union parties, mine owners, and MSHA.

Given the uncertainties described above, an adaptive management process described in Section 2.9, Methane Flaring, has been proposed as part of the Proposed Action. The goal of the adaptive management process is to reduce GHG emissions to the maximum extent possible.

Approximately 60 percent of the methane vented from underground coal mines is emitted with the ventilation air, as shown in Table 4-7, Projected Uncontrolled GHG Emissions for the Proposed Red Cliff Mine. It is therefore desirable to identify a VAM technology that can be employed in the Red Cliff Mine with the approval of MSHA, DRMS, and OSM as soon as possible, and to attempt to remove obstacles that may limit use of methane degasification wells in advance of mining.

The adaptive management process would utilize the EPA Coalbed Methane Outreach Program (CMOP), and other pertinent studies to help identify and determine economic and technically feasible methods of reducing methane emissions at the Red Cliff Mine. CMOP is a voluntary program with a goal of reducing methane emissions from coal mining. CMOP works cooperatively with coal companies and related industries to address barriers to using coal mine methane instead of emitting it to the atmosphere.

The adaptive management process as described in Section 2.9, Methane Venting, would require BLM and the coal mine operator to evaluate opportunities for CMM projects on an annual basis. Beginning one year following mine plan approval, the coal mine operator will submit to BLM a report detailing the feasibility of CMM projects in regard to economic, technical, legal, and other considerations. Annually thereafter, the mine operator shall provide BLM with summaries on the status of these projects and any mitigation and/or capture methods implemented, including the effectiveness of methane capture, the percent of methane captured, any operational difficulties, and findings regarding suitability of the projects' costs and adaptability. The annual reports must also outline any legal obstacles precluding implementation of any methane mitigation and/or capture. If methane mitigation and/or capture is deemed technically, economically, and legally feasible, the mine operator and BLM will develop a schedule for implementation.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for impacts to air quality.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Impacts may be marginally lower than the Proposed Action, as vehicles would not be stopped and idling at the CR M.8 crossing.

Noiseless Crossing Traffic Control Devices

Impacts would not be substantively different from the Proposed Action.

Transmission Line Alternative A

Impacts would not be substantively different from the Proposed Action.

Transmission Line Alternative B

Impacts would not be substantively different from the Proposed Action.

Transmission Line Alternative C

Impacts would not be substantively different from the Proposed Action.

4.2.2 Cultural Resources/Native American Religious Concerns

No Action Alternative

The No Action Alternative would not affect any significant cultural resources.

Proposed Action Alternative

Mine and Facilities

Construction of the mine and related facilities would not directly impact any significant cultural resources. Indirect impacts may occur to cultural resources from changing off-highway vehicle (OHV) use.

Lease Area

The proposed lease area has not been surveyed for cultural resources; therefore, it is not known if there are any significant cultural resources that might be affected by potential future subsidence in this area. A few surveys have been conducted for other undertakings that covered portions of the proposed lease area that allow for the estimation of the types of cultural resources that may be present. These types of resources include prehistoric sheltered and open camps; prehistoric, protohistoric, and historic rock art; protohistoric wikiups; and historic irrigation ditches. All of these types of resources could potentially be impacted by subsidence. Two prehistoric sites (5GF741 and 5GF742), one historic site (5GF743), and one "suspect area" were located by the 1980 study of the McClane and Munger Canyons Mine Plan/Permit area. Any surface disturbing activities located in the vicinity of these four sites would require monitoring by a qualified archaeologist in the vicinity of these sites. There would be an approved subsidence plan in place prior to the commencement of mining that would proactively address any potential impacts to cultural resources prior to their occurrence.

Railroad

Construction of the railroad would affect one significant cultural resources, a segment of the Government Highline Canal (5ME4676). However, because the railroad would cross the canal by way of a bridge that would not physically alter the canal itself, it is likely that this impact would be determined to be No Adverse Effect.

Water Pipeline

Construction of the water pipeline would not affect any significant cultural resources.

Conveyor

The construction of the conveyor would require monitoring in the vicinity of eligible site 5GF3880. It may be that data recovery of this small site would be a more appropriate management action to avoid requiring the company to provide long term monitoring and reporting and the responsibility to protect the site because it could be destroyed because of proximity to a facility that may require maintenance and repair.

Transmission Line

The proposed transmission line corridors have not been surveyed for cultural resources; therefore, it is not known if these features would affect any significant cultural resources. Any of the transmission lines would cross the Government Highline Canal (5ME4676) but would not physically alter the canal. However, siting of the power poles and access roads is flexible; therefore, it is probable that the transmission line would be constructed without affecting any significant cultural resources. The terminus of the Proposed Action transmission line has been inventoried and would require monitoring during construction and possible mitigation if the substation is going to be located near site 5ME15398.

Temporary and Long Term Impacts

There are no anticipated temporary or long term impacts to cultural resources from the Proposed Action.

Mitigation Measures

Because the Proposed Action or the alternatives would have no adverse effect on any significant cultural resources, no mitigation measures, other than site avoidance, would be required. The proponent would need to provide monitoring during construction of the conveyor and annual monitoring of site 5GF3880 to ensure compliance with avoidance with this eligible site. Access to one eligible site, 5ME15398, would be limited by fencing potential access points. The fencing would have to prevent any access to the ridge where the site is located. The fence would be gated and locked to allow administrative access for any maintenance on the existing transmission line. The fence would be constructed prior to any construction activity. As discussed in Section 3.2.2, Cultural Resources/Native American Religious Concerns, there would be an approved subsidence plan in place prior to the commencement of mining that would proactively address any potential impacts to cultural resources prior to their occurrence.

When a transmission line alternative is selected, a cultural resources survey would be conducted.

Only two of the eligible sites are within the APE from the proposed development of the mine. 5GF3880 requires monitoring during conveyor construction. If the waste rock disposal area changes in this area of the mine project and facilities cannot avoid the site, a testing plan to determine if any remaining cultural deposits are present would be developed and submitted for review through additional consultation with the SHPO. 5ME15398 would be avoided by direct impacts from the mine project but because of its location it may be affected by secondary impacts associated with off highway vehicle use or changes in the current BLM transportation plan in this area of the North Fruita Desert Planning Area. If the road is not closed as a result of the mine development, secondary impacts would be avoided by fencing the road along the site boundary.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for impacts to cultural resources.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Construction of the grade-separated crossing at CR M.8 would not affect any significant cultural resources.

Noiseless Crossing Traffic Control Devices

Implementation of this alternative would not affect any significant cultural resources.

Transmission Line Alternative A

The proposed transmission line corridors have not been surveyed for cultural resources; therefore, it is not known if these features would affect any significant cultural resources. However, siting of the power poles and access roads is flexible; therefore, it is probable that this alternative could be constructed without affecting any significant cultural resources.

Transmission Line Alternative B

The proposed transmission line corridors have not been surveyed for cultural resources; therefore, it is not known if these features would affect any significant cultural resources. However, siting of the power poles and access roads is flexible; therefore, it is probable that this alternative could be constructed without affecting any significant cultural resources.

Transmission Line Alternative C

The proposed transmission line corridors have not been surveyed for cultural resources; therefore, it is not known if these features would affect any significant cultural resources. However, siting of the power poles and access roads is flexible; therefore, it is probable that this alternative could be constructed without affecting any significant cultural resources.

Native American Religious Concerns

There are no known issues or impacts to Native American religious concerns or access issues concerning Native American religious or traditional sites related to the No Action or any of the Action alternatives.

4.2.3 Geology

No Action Alternative

If the No Action Alternative is selected, coal would not be disturbed by exploration or mining. The coal resource and the structural and lithologic integrity of the lease tract would remain in place. The potential to recover the coal resource at some time in the future would remain.

Proposed Action Alternative

Mine and Facilities

Coal would be mined by longwall and/or room and pillar techniques. The additional impacts of mining are described in the Lease Area section in subsequent text.

Lease Area

The MCM is located within the mine lease area, and is currently being mined using room-and-pillar advance mining techniques, with overburden depths ranging from 160 to 1,200 feet. In some of the panels, pillars were robbed (mined) on retreat to maximize coal recovery. No observations have been reported of surface subsidence effects over the MCM. Estimates of maximum subsidence, tensile and compressive strains, and maximum slope changes were made over the five selected panels and are indicated by number on Figure 7 in Appendix D, Subsidence. The predicted maximum surface subsidence for the five panels ranged from 1.52 feet to 2.56 feet (Table 1, Appendix D). The predicted tensile strains would result in estimated 1-inch to 2-inch wide tensile cracks at the ground surface based on a 200 to 2,000 foot overburden thickness (Table 2, Appendix D). The MCM has extracted approximately 36 percent of Cameo Seam coal by advance room-and-pillar mining, apparently without any chimney collapse to the overlying ground surface. After a mine is closed progressive deterioration of the roof can result in chimney failures, which at shallow depths can and frequently do breach the ground surface. Areas where the overburden thickness is less than 200 feet above the Cameo Seam may exhibit subsidence at some point in the future.

Mining the coal lease tract would result in the removal of the coal resource. Coal would be mined by longwall and/or room and pillar techniques as previously described. After coal recovery, the overburden would be altered due to subsidence. A gradual lowering of the surface would occur due to the subsidence after the extraction of the coal. A more detailed description of the potential subsidence impacts is presented in Appendix D, Subsidence.

Rock falls at the outcrop could occur, but the historic burning of the coal along the outcrop would preclude a significant amount of mining close to the outcrop. Therefore, rock falls induced by mining would be less likely.

In addition, any methane within the coal seam and adjacent strata caved or fractured by mining excavation would be lost. Recoverability of any oil and gas resource present in the geologic formations below the coal seams would be reduced due to the limiting of drill pad locations. Total loss of the resource would not occur because of the possibility to directionally drill into the lower horizons.

The Hot Point outcrop fire is located near the southern edge of the existing MCM leases and is shown on Figure 2-8, Initial Mine Plan. This project would have no impact to the Hot Point fire, as coal mine operations are moving away from the fire. There would be no disturbance in the vicinity of the outcrop fire that would exacerbate the fire.

Railroad

No appreciable impact to the geologic and mineral resource is anticipated.

Water Pipeline

No appreciable impact to the geologic and mineral resource is anticipated. However, in the event of a leak from the mine facilities (e.g., water tank, pipeline), leakage could deep percolate into Mancos Shale and leach selenium.

Transmission Line

No appreciable impact to the geologic and mineral resource is anticipated.

Temporary and Long Term Impacts

Geologic Hazards

A landslide is a geologic hazard characterized by a perceptible downslope sliding or falling of a relatively dry mass of earth, rock, or a mixture of the two. Rockfalls are geologic hazards, as well, characterized by free falling rock masses. The degree of risk posed by landslides or rock-falls to proposed development is variable, ranging from low (very old, well drained, gentle slopes) to high (overhanging rocky cliffs with loose rock material on steep slopes and poorly consolidated surficial deposits). In most cases the risk of future movement can be reduced by appropriate design and construction practices (engineered excavation and grading) and by active mitigation techniques, such as: control of surface and subsurface drainage; rock tieback anchors, rock scaling, and buttressing.

A large rockfall hazard area and a landslide have been identified within the bounds of the proposed Red Cliff Mine site and rail alignment. See Figure 4-9, Surficial Geology and Geologic Hazards, Red Cliff Mine, and Figure 4-10, Surficial Geology and Geologic Hazards, Red Cliff Mine Railroad Spur.

There is a potential that mining subsidence could aggravate existing landslides and other geologic hazards. Mining-induced seismic events as a result of mining would likely occur. Based on existing information, these events are not expected to cause damage to surface resources or overlying structures.

Impacts described subsequently are for all action alternatives. The assessment of impacts from subsidence is summarized from a comprehensive assessment included as Appendix D, Subsidence, of this EIS.

Subsidence

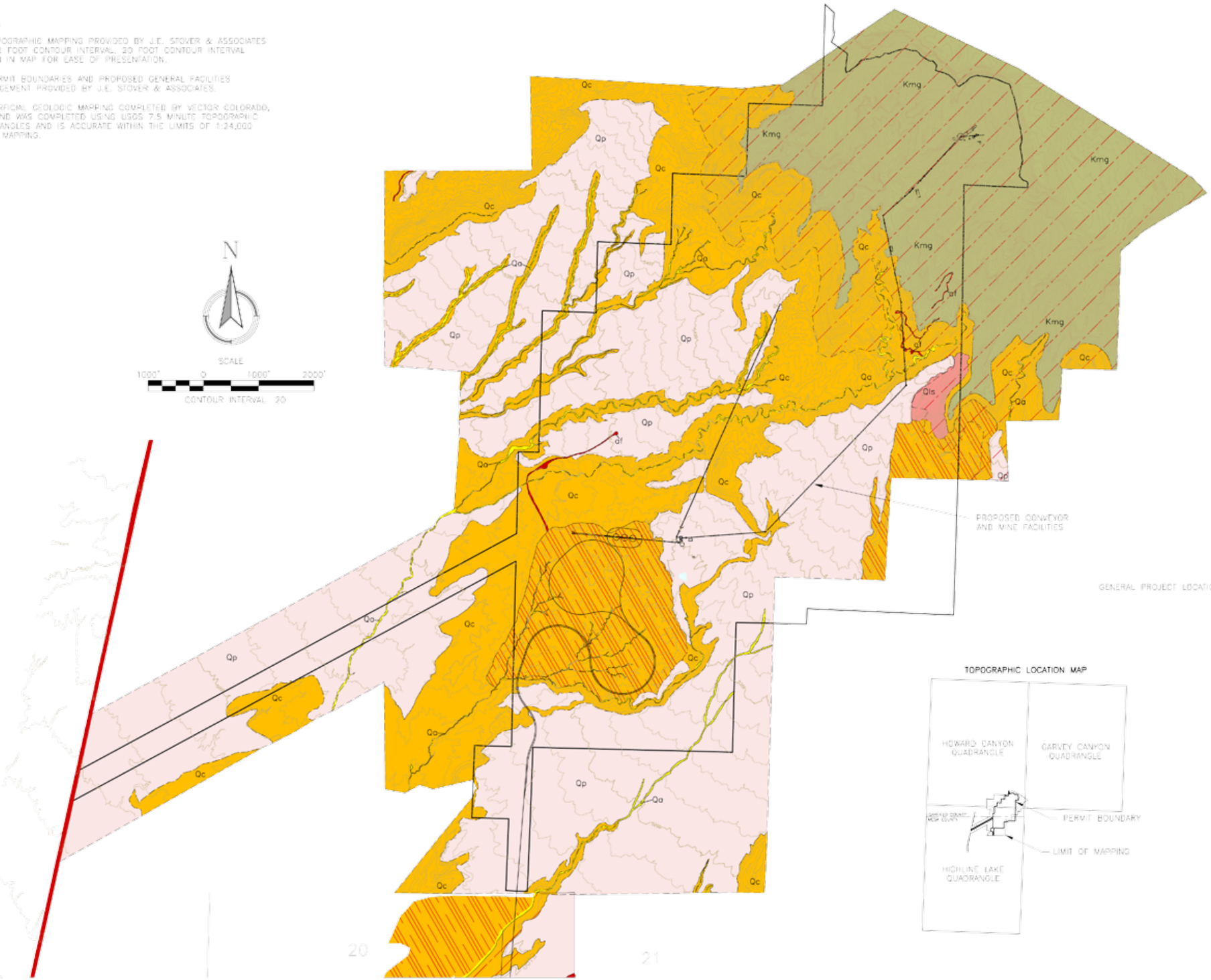
The effects of subsidence on the surface of the landscape can take several forms. Chimney caving can cause sinkholes and troughs to open up. Both cracks and ridges can form due to tension and compression strains. Subsidence trough-like depressions occur directly above and somewhat outside the panel where the coal is being extracted. On steep slopes and cliffs, subsidence may result in landslides and rockfalls. Slope change or tilt can occur on steep slopes. The time that it takes for surface manifestations to occur can be almost immediate up to over 50 years.

NOTES:

1) TOPOGRAPHIC MAPPING PROVIDED BY J.E. STOVER & ASSOCIATES WITH 2 FOOT CONTOUR INTERVAL. 20 FOOT CONTOUR INTERVAL SHOWN IN MAP FOR EASE OF PRESENTATION.

2) PERMIT BOUNDARIES AND PROPOSED GENERAL FACILITIES ARRANGEMENT PROVIDED BY J.E. STOVER & ASSOCIATES.

3) SURFICIAL GEOLOGIC MAPPING COMPLETED BY VECTOR COLORADO, LLC. AND WAS COMPLETED USING USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES AND IS ACCURATE WITHIN THE LIMITS OF 1:24,000 SCALE MAPPING.



EXPLANATION

GEOLOGIC UNITS:

af — ARTIFICIAL FILL – reworked native soils or materials placed through human activities. The manner in which this material was placed is unknown.

Qa — QUATERNARY ALLUVIUM – variegated silt, sand, clay, gravel, cobbles and boulders lining the current stream channels. This materials are derived locally from the steeper terrain to the northwest and fine downstream. There are several alluvial terraces above the present stream channel that would not plot meaningfully at the scale of this map. Alluvium lining the present stream channel is several feet thick.

Qc — QUATERNARY COLLUVIUM – variably sized and variegated residual soil and materials resulting from slope wash, rockfall and natural landscape degradation. Colluvium overlying Cretaceous Mancos shale generally consists of 5 to 10 feet of dark gray sandy, silty clay with scattered gravel. Occasional bone fossils may be found on the surface of the colluvium near the contact with the overlying Cretaceous Mesaverde group. Colluvium mantling Cretaceous Mesaverde group in the steeper portions of the mapped area to the northwest consists of less than 5 feet thickness of buff colored clayey sand with abundant gravel, cobbles and boulders. The unit mapped as colluvium generally represents the run-out zone for rockfall produced from the steeper cliffs of the Cretaceous Mesaverde group bedrock formation.

Qp — QUATERNARY PEDIMENT – 10 to 12 feet thickness of imbricated terrace gravel sloping moderately away from the steeper slopes of the Cretaceous Mancos shale and overlying Cretaceous Mesaverde group bedrock.

Qls — QUATERNARY LANDSLIDE DEPOSIT – Broad hummocky terrain sharply interrupting the predominant pediment surfaces. The mapped landslide in southeastern part of the mapped area as well as the southern portion of the landslide crossing the western permit boundary appear to be ancient (Pleistocene) based on the developed dendritic drainage pattern and lack of closed depressions. The upper portion of the eastern landslide appears more recent and occurs at the steep base of the Cretaceous Mesaverde group outcrop.

Kmg — CRETACEOUS BEDROCK – undifferentiated bedrock deposits representing Cretaceous age (deposited between approximately 144 to 65 million years before present) rocks of the Sego Sandstone, Mount Garfield Formation and Hunter Canyon Formation in ascending stratigraphic order.

SYMBOLS:

Contact between geologic units, dashed where approximated.

Potentially Unstable Slopes – areas representing rockfall hazards (i.e. rockfall source zones and run-out areas), rapid erosion potential, or areas susceptible to landsliding if existing conditions are modified through construction activities.

Area of Rapid or Accelerated Erosion (Erosional Remnant) – areas where thin colluvial soils mantle Cretaceous Mancos shale bedrock and the predominant pediment surface is absent. In these areas the pediment gravels were either precluded from initial deposition by natural topographic highs or displaced by mass wasting. There is strong evidence in these areas for rapid erosion and slope wash.

TOPOGRAPHIC LOCATION MAP

LOCATION MAP

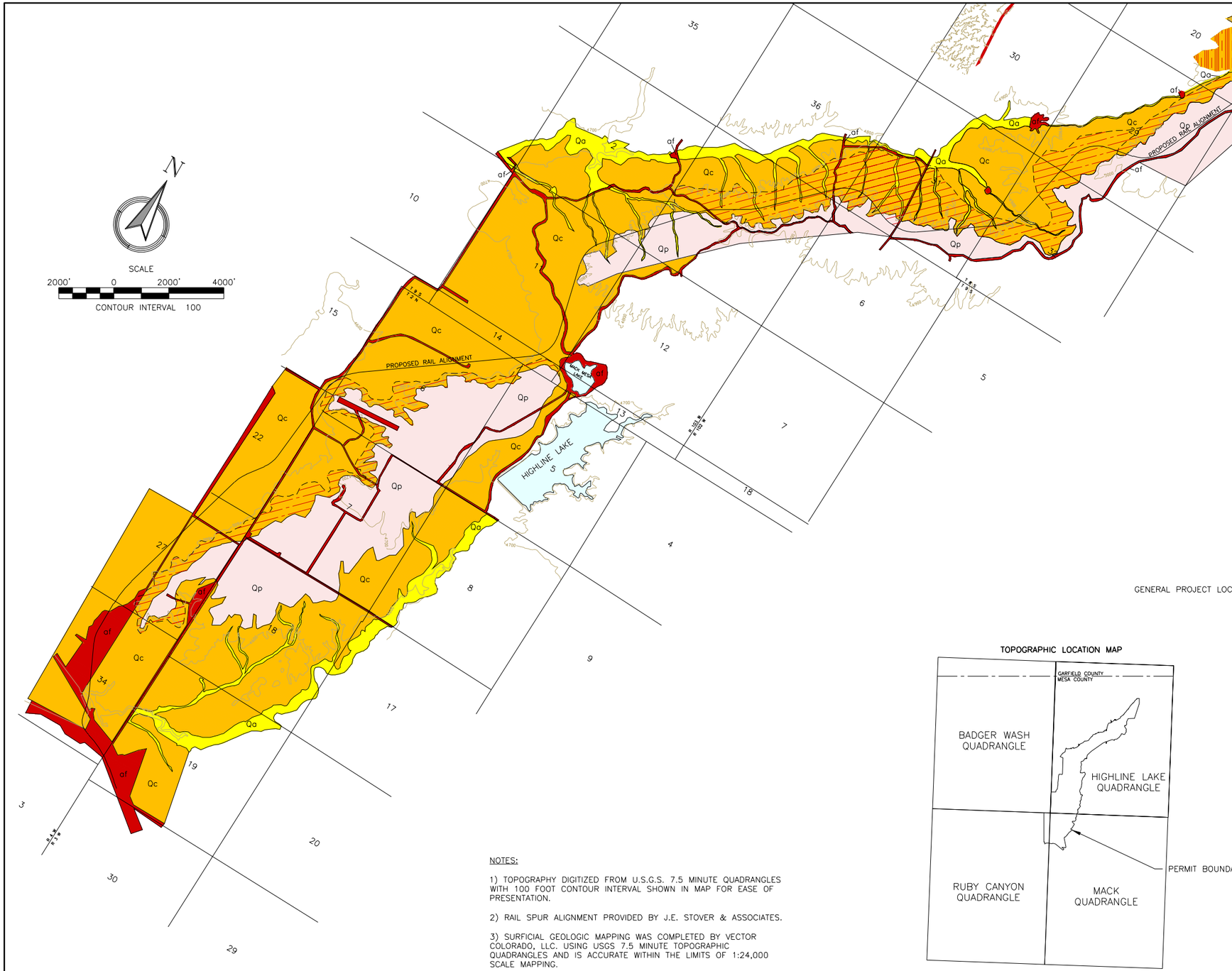
STATE OF COLORADO

Source: Vector Colorado, LLC

Red Cliff Mine EIS

Figure 4-9
Surficial Geology and Geologic Hazards
Red Cliff Mine

This page intentionally left blank



NOTES:

1) TOPOGRAPHY DIGITIZED FROM U.S.G.S. 7.5 MINUTE QUADRANGLES WITH 100 FOOT CONTOUR INTERVAL SHOWN IN MAP FOR EASE OF PRESENTATION.

2) RAIL SPUR ALIGNMENT PROVIDED BY J.E. STOVER & ASSOCIATES.

3) SURFICIAL GEOLOGIC MAPPING WAS COMPLETED BY VECTOR COLORADO, LLC. USING USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLES AND IS ACCURATE WITHIN THE LIMITS OF 1:24,000 SCALE MAPPING.

EXPLANATION

GEOLOGIC UNITS:

af — ARTIFICIAL FILL – reworked native soils or materials placed through human activities. The manner in which this material was placed is unknown.

Qa — QUATERNARY ALLUVIUM – variegated silt, sand, clay, gravel, cobbles and boulders lining the current stream channels. This materials are derived locally from the steeper terrain to the northwest and fine downstream. There are several alluvial terraces above the present stream channel that would not plot meaningfully at the scale of this map. Alluvium lining the present stream channel is several feet thick.

Qc — QUATERNARY COLLUVIUM – variably sized and variegated residual soil and materials resulting from slope wash, rockfall and natural landscape degradation. Colluvium overlying Cretaceous Mancos shale generally consists of 5 to 10 feet of dark gray sandy, silty clay with scattered gravel. Occasional bone fossils may be found on the surface of the colluvium near the contact with the overlying Cretaceous Mesaverde group. Colluvium mantling Cretaceous Mesaverde group in the steeper portions of the mapped area to the northwest consists of less than 5 feet thickness of buff colored clayey sand with abundant gravel, cobbles and boulders. The unit mapped as colluvium generally represents the run-out zone for rockfall produced from the steeper cliffs of the Cretaceous Mesaverde group bedrock formation.

Qp — QUATERNARY PEDIMENT – 10 to 12 feet thickness of imbricated terrace gravel sloping moderately away from the steeper slopes of the Cretaceous Mancos shale and overlying Cretaceous Mesaverde group bedrock.

SYMBOLS:

– – – Contact between geologic units, dashed where approximated.

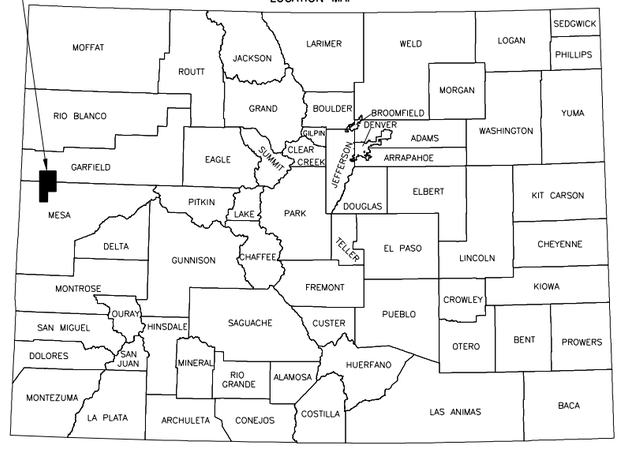
Potentially Unstable Slopes – areas representing rockfall hazards (i.e. rockfall source zones and run-out areas), rapid erosion potential, or areas susceptible to landsliding if existing conditions are modified through construction activities.

Area of Rapid or Accelerated Erosion (Erosional Remnant) – areas where thin colluvial soils mantle Cretaceous Mancos Shale bedrock and the predominant pediment surface is absent. In these areas the pediment gravels were either precluded from initial deposition by natural topographic highs or displaced by mass wasting. There is strong evidence in these areas for rapid erosion and slope wash.

GENERAL PROJECT LOCATION

TOPOGRAPHIC LOCATION MAP

LOCATION MAP



STATE OF COLORADO

Source: Vector Colorado, LLC

Red Cliff Mine EIS

Figure 4-10
Surficial Geology and Geologic Hazards
Red Cliff Mine Railroad Spur

This page intentionally left blank

It is extremely difficult to quantify the impact of geology on the extraction of coal and the resulting subsidence of the ground surface. There are some obvious generalities that can be stated with complete confidence, but predicting what would happen and where is fraught with risk. The overall geology of the coal bearing Mesaverde Group is generally known, but the site-specific geologic conditions are not fully understood because it is possible to see only outcrops and the immediate roof and floor. The coal seam and the overburden lithology are changing conditions. Differing lithologies (rock types) have differing strengths; e.g., stronger sandstones and weaker shales and mudstones. Because of the rugged terrain in the project area, subsidence-related surface impacts may change several times as the overburden depth changes along the roughly 7,300-foot to 13,500-foot lengths of the longwall panels. Subsidence, strain, and tilt predictions would be less certain than would be the case in more gentle and flatter terrain. For instance, the potentially additive subsidence on ridges would increase the tensile strain and the width of open surface cracking. However, higher compression ridges, but negligible tensile fractures, are likely to occur in narrow valley bottoms, because the overburden on both sides would try to move toward the bottom of the valley as the subsidence trough approaches and then passes the valley bottom. Consequently subsidence impacts are likely to be greater on narrow ridges and lesser in narrow valley bottoms than they would be in more subdued terrain. A springs survey is described in Section 4.2.6, Groundwater. Surface water delineations (stream and wetlands) are described in Section 4.2.7, Surface Water. Subsidence-related impacts to these groundwater and surface water features would be evaluated against baseline (pre-mining) characteristics.

Strains and displacements on steep slopes with thin alluvial cover, particularly cliffs, may cause surface fractures on the order of several inches to more than 2 feet wide and possibly 25 feet deep, compared to a fraction of an inch to a few inches wide and a few feet deep in valley bottoms at the same overburden depth. When the relief is subdued and terrain gentle, the surface fractures would be consistent in width and depth and generally follow a smoothed ovaloid around the panel perimeter. Cracks would tend to be widest (approaching 20 inches) and deepest (possibly 50 feet) along prominent joints and fractures on the steepest slopes and cliffs, which in turn, may become less stable and more susceptible to landslides and rockfalls. Landslides and rockfalls would be most likely to occur where mining approaches the outcrop, and the overburden depth is decreasing. It should be anticipated that longwall mining under the canyon walls would present a similar hazard for rock to roll out from undermined sandstone outcrops. The slopes of the canyon walls are certainly steep enough within the Red Cliff Mine project area to result in thin fragmented soil cover and, therefore, 1-foot wide surface fractures opening when undermined by a longwall panel at the shallower depths, under approximately 500 feet.

For any mining panel width and coal extraction thickness, the maximum subsidence, tilt, and strain at the ground surface should decrease with increasing overburden depth.

By itself, simply vertically lowering the ground surface would not be a problem. However, the ground surface is lowered over and near a longwall panel only as the coal between the panel headgate and tailgate pillars is progressively extracted and the longwall face is advanced. The surface subsidence trough advances with the longwall face and all sides of the longwall panel deflect downward toward the center of the panel, where the vertical subsidence is maximum. The bending of the overburden develops as the longwall panel progresses and forms a stable semi-permanent trough after the panel is completely mined. The maximum vertical subsidence over a panel is of major importance because it contributes to the magnitude of extension,

compression, and tilting. The magnitude of potentially adverse impacts decreases as the mining depth increases. Table 8, Appendix D, Subsidence, presents predicted maximum vertical subsidence for a variety of panel widths and overburden depths. Predicted vertical subsidence ranges from a maximum of 8.9 feet to a minimum of 3.2 feet. Figure 19, Appendix D shows the relationship of panel width to vertical subsidence.

The maximum horizontal tensile strains are the most serious potential hazard with respect to anticipated subsidence impacts from longwall mining in the proposed Red Cliff Mine lease area. Table 10, Appendix D, Subsidence, shows predicted maximum surface fracture widths ranging from almost 20 inches to less than 1 inch.

The conservative predicted single panel maximum slope angle changes resulting from longwall mining of the proposed project area, potentially ranging from approximately 0.5 to 12 percent (0.3 degrees to 7 degrees), would present significant hazards to overlying industrial, business, and residential uses. However, there are no such land uses over the Red Cliff Mine and none are planned. The principal tilting hazard posed by longwall mining to the undeveloped surface would appear to be tilting cliff-forming sandstone beds outcropping on the canyon walls with the potential for toppling sandstone boulders toward the canyon floors. The slopes of Big Salt Wash canyon, the major canyon in the project area, are as steep overall as 32 degrees, with walls as high as 920 feet.

A conceptual mine plan has been projected in order to estimate potential subsidence impacts (Appendix D, Subsidence). This plan assumes that the minimum overburden depth would be 200 feet above the Main Cameo Seam and the maximum overburden depth would be 2,000 feet. The planned minimum overburden depth for longwall mining is 200 feet in order to minimize (1) the potential for chimney caving to the ground surface, (2) the interception and diversion of groundwater through the mine workings, (3) the loss of surface water to the fracture zone overlying completed longwall panels, and (4) the potential development of up to 20-inch-wide surface fractures along the sides of the panels. It also assumes that the planned coal mining height ranges from 8 to 11 feet. The 11-foot maximum height was used as a conservative maximum thickness in the subsidence analysis.

Rockfall Hazards

The primary geologic hazard is quantifying the risks associated with slope instability hazards within the proposed Red Cliff Mine site. During field reconnaissance, large boulders to small cobbles were observed as source material along the near vertical cliffs, benches, and steeper slopes of the Book Cliffs in the northeastern one-third of the project area. In numerous places along the steeper slopes, colluvium boulders up to 5 feet in diameter were observed that had obviously fallen from the steeper slope uphill. Furthermore, the exposed resistant sandstone beds comprising the cliff forming rocks of the Book Cliffs are fractured such that large blocks rest above the steeply sloping to near vertical terrain at higher elevations. Weathering and freeze-thaw action occurring seasonally could potentially free a large block of this bedrock producing a rockfall. Accordingly, the risk of rockfall in much of the mine area is considered high.

Landslide Hazards

A relatively small landslide is located along the east-northeast permit boundary. The landslide does not appear to be active as there is no fresh head scarp, closed depressions, or pressure

ridges; however, sudden changes in existing conditions such as changes in groundwater conditions, slope cuts, or additional loading could reactivate this landslide. The landslide appears to be younger than the predominant pediment deposit but is sufficiently old to have developed a defined drainage at the base.

In addition to the existing landslide, areas as potentially unstable slopes (PUS) comprise steep slopes that are stable in their existing condition and present moderate to high risk of future landslides or other slope instabilities. Modifications to slope grade, loading, storm runoff, or groundwater conditions could promote conditions where risks associated with landsliding are increased.

Accelerated Erosion

Due to the loose sandy composition of the steeper slopes in the northeast and the high weathering susceptibility of the Mancos Shale, the risk of accelerated erosion is moderate to high. Additionally, there are three zones (see Figures 4-9 and 4-10) in the project area where evidence of accelerated erosion is distinctly visible. Both of these areas are marked by dendritic drainage patterns unlike the pervasive parallel drainage patterns that feed the larger streams such as Salt Wash to the southeast. Furthermore, each of the zones of rapid or accelerated erosion is marked by steep headward erosion scars and appears to be advancing upstream towards the Book Cliffs.

Other Geologic Hazards

Soil material derived from the Mancos Shale and the Mesaverde Group may contain clays that, on wetting, can swell causing damage to structures.

Old small earthen dams are scattered across the property. The area behind (upstream) these dams may contain soft soils with significant organic material that, on loading, may prove susceptible to collapse and/or differential settlement.

Mesaverde Group and Mancos Shale bedrock may contain radioactive minerals that, on decay, may produce radon gas. The presence of radon gas in structures has been identified as a potential health risk. The evaluation of risk due to the natural occurrence of radon gas at this stage of investigation is beyond the scope of this EIS.

Earthquake risk in the project area is considered low. The property is located in Seismic Zone 1 characterized by earthquakes of Modified Mercalli Intensity VI or smaller, and minor damage. No active faults have been identified in the project area that would require consideration of surface rupture.

The project area is not located in any published flood zone. The known subsurface mine workings are not within the mine plan or lease area; therefore, collapse or subsidence of mine workings is not a credible hazard.

According to soil maps prepared by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) most of the soils derived from Mesaverde Group and Mancos Shale contain high concentrations of soluble salts (i.e., calcareous and gypsiferous soils). Soluble salts present deleterious effects to concrete; therefore, on-site materials should be evaluated for potential alkali-aggregate reaction. Soils with high soluble salt concentrations are also susceptible to collapse upon loading.

Mitigation Measures

Subsidence

Mitigation of subsidence impacts can best be done by appropriate design of the mine plan. It is possible to mitigate somewhat the adverse impacts by varying panel width, by designing gateroad pillars between panels to yield when the first of two adjacent panels is mined and crush after the face of the second panel is mined past, and by positioning longwall panels with respect to a particularly important surface feature. Normally, if landslides or rockfalls are present in an area, constraints on design and construction may be necessary to minimize risk.

Longwall panels should not be completed in overburden conditions of less than 200 feet (see Figure 13, Appendix D, Subsidence). The 200-foot overburden contour extends approximately 360 feet upstream from the outcrop line in Big Salt Wash and approximately 550 feet upstream from the outcrop line in Garvey Canyon. Long term protection from chimney subsidence to the overlying ground surface can be provided in such shallow overburden by partially backfilling the entries in these two areas upon final closure of the Red Cliff Mine. No longwall or full extraction mining would occur under Big Salt Wash under the Proposed Action.

The potential for draining surface water into the Red Cliff Mine is low, but probably precludes longwall mining under stream courses and water impoundments when the bedrock overburden thickness is less than 95 feet. Big Salt Wash is particularly at risk because it also contains a road and has agricultural uses. Because there is no available depth of alluvium below any of the deeply incised canyons, and due to the absence of any data on the potential fault control of the nearly trellis drainage pattern in the project area, conservatism must be used and a minimum of 200 feet of overburden required to positively prevent water loss from longwall mining under even intermittent stream courses.

It is possible at least to partially mitigate tilting hazards and similar potential major toppling hazards in Big Salt Wash, Garvey Canyon, and along Munger Creek by designing the longwall panels to retreat toward these drainages from the north and from the south. Retreating toward these drainages would slightly flatten the slope of the canyon walls as opposed to advancing away from Big Salt Wash which would slightly steepen the canyon walls.

A conceptual mine plan has been proposed in Section 8.2 of Appendix D, Subsidence, that would mitigate potential subsidence impacts in the project area. The goals of the conceptual plan were to maximize safety, then mitigate to the extent possible subsidence impacts, and finally to maximize resource recovery. However this is not the only plan that may mitigate certain impacts, and the mine operator may develop other plans.

The mine operator would also be required to comply with state and federal regulations regarding subsidence impacts as they prepare their mine plan and permit application.

Rockfall Hazards

Based on project plans to date, a conveyor and mine portal access road would cross the boundary of the rockfall hazard area. Constructing these facilities would undoubtedly change the existing natural conditions. Therefore, site-specific engineering designs and rockfall mitigation measures would be necessary to ensure the safety of both infrastructure and personnel in these areas. Slope stability studies and, where appropriate, rockfall stability analyses should be completed for structures proposed in the rockfall hazard area.

Landslide Hazards

If the practice of avoidance is adopted for the proposed construction, risks associated with future movement of the landslide deposit are considered low.

Accelerated Erosion

Project plans should be guided by an engineering firm qualified in geotechnical engineering design.

During periods of isolated heavy precipitation or rapid snowmelt, accelerated erosion is exaggerated. Site-specific engineering designs and mitigation measures should be developed to control the flow of surface water away from the upstream headward erosion scars of the two zones.

Other Geologic Hazards

Although the anticipated loadings from the proposed Red Cliff Mine facilities would be relatively large, foundation designs should be based on results of laboratory swell/consolidation testing.

Foundation designs should be guided by results of swell/consolidation laboratory testing.

Appendix B, Standard Practices and Mitigation Measures, contains additional proposed mitigation measures for impacts to geology and subsidence.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

No appreciable impact to the geologic and mineral resource is anticipated.

Noiseless Crossing Traffic Control Devices

No appreciable impact to the geologic and mineral resource is anticipated.

Transmission Line Alternative A

No appreciable impact to the geologic and mineral resource is anticipated.

Transmission Line Alternative B

No appreciable impact to the geologic and mineral resource is anticipated.

Transmission Line Alternative C

No appreciable impact to the geologic and mineral resource is anticipated.

4.2.4 Paleontology

No Action Alternative

If the No Action Alternative is selected, no paleontological resources would be disturbed by construction, exploration, or mining.

Proposed Action Alternative

Mine and Facilities

The Wasatch Formation is classified as Class 5 (PFYC system) for paleontological resources. The Wasatch Formation has limited exposures at the highest elevations in the project area. There is a good potential for finding fossils of scientific interest throughout most of the project area.

Temporary and Long Term Impacts

Ground-disturbing activities have the potential to uncover or destroy paleontological resources.

Mitigation Measures

If any surface disturbing activities (e.g., vent shafts) are planned on areas underlain by the Wasatch Formation, the site would be surveyed by a qualified paleontologist prior to construction. This would significantly decrease the possibility of fossil destruction.

A survey would not be required prior to the BLM authorization for any activities not immediately underlain by the Wasatch Formation. However, if any fossils are noticed at anytime, the Authorized Officer must be notified so the resource can be recorded, evaluated, stabilized, or mitigated.

All persons associated with operations under this authorization shall be informed that any objects or sites of paleontological or scientific value, such as vertebrate or scientifically important invertebrate fossils, shall not be damaged, destroyed, removed, moved, or disturbed. If in connection with operations under this authorization, any of the previously mentioned resources are encountered, the operator shall immediately suspend all activities in the immediate vicinity of the discovery that might further disturb such materials and notify the BLM authorized officer of the findings. The discovery must be protected until notified to proceed by the BLM authorized officer.

As feasible, the operator shall suspend ground-disturbing activities at the discovery site and immediately notify the BLM authorized officer of any finds. The BLM authorized officer would, as soon as feasible, have a BLM-permitted paleontologist check out the find and record and collect it if warranted. If ground-disturbing activities cannot be immediately suspended, the operator shall work around or set the discovery aside in a safe place to be accessed by the BLM-permitted paleontologist.

Appendix B, Standard Practices and Mitigation Measures, includes additional proposed mitigation measures for impacts to paleontology.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Impacts and mitigation associated with construction of the railroad crossing would be identical to those described in the Proposed Action section.

Noiseless Crossing Traffic Control Devices

No impact to the paleontological resource is anticipated.

Transmission Line Alternative A

Impacts and mitigation associated with construction of the transmission line would be identical to those described in the Proposed Action section.

Transmission Line Alternative B

Impacts and mitigation associated with construction of the transmission line would be identical to those described in the Proposed Action section.

Transmission Line Alternative C

Impacts and mitigation associated with construction of the transmission line would be identical to those described in the Proposed Action section.

4.2.5 Soils

No Action Alternative

Under the No Action Alternative, the proposed project would not occur. Coal removal and the associated disturbance and impacts to soils would not occur on the additional acres of the lease.

Proposed Action Alternative

Potential soil issues in the project area may include:

- Highly saline and shallow soils, which may be difficult to re-vegetate.
- Landslides.
- Expansive soils.
- Corrosive soils.
- Erosive soils; some soils are slowly permeable and concentrate run-off during storm events.
- Soils derived from Mancos shale tend to be very sticky and slippery; unimproved roads may be impassable when wet.
- Potential impacts to prime farmland south of the Highline Canal.
- Potential impacts to biological soil crusts.

Some soils are prone to landslides and active erosion on steep slopes, indicated by gullying and piping processes. Some soils in the project area have moderate to high expansive (high shrink-swell) properties and may contain evaporite minerals that are corrosive to conventional concrete

and metal pipes. When wet, soils derived from Mancos shale become sticky and slippery, making unimproved roads virtually impassable. In moist conditions these soils contain excess water and have low bearing strength capacity, which may often result in structural damage if disturbed when wet. Saline or sodic soils may be difficult to stabilize and revegetate upon completion of construction activities, particularly on steeper slopes or slopes greater than 40 percent.

The Grand Junction RMP lists these criteria to identify management areas and potential impacts of planned actions of the project:

1. Suitability of the soil to support the project (or the soil limitations that may lessen or prevent the project's success).
2. Special safety hazards associated with particular soils or soil characteristics (i.e., slumping or mass movement).
3. Critical erosion areas in which land treatments or other practices have a high probability of reducing soil loss and degradation of water quality.
4. Slopes over 40 percent, as the susceptibility to accelerated erosion and mass movement are great.

Removal and replacement of soils during mining and reclamation would cause changes in the soil resources. In reclaimed areas, soil chemistry and soil nutrient distribution would generally be more uniform and average soil quality would be improved, because soil material that is not suitable to support plant growth would not be salvaged for use in reclamation. This would result in more uniform vegetative productivity on the reclaimed land. The replaced soil would support a stable and productive vegetation community adequate in quality and quantity to support the planned postmining land uses (wildlife habitat and rangeland).

There would be an increase in the near-surface bulk density of soil resources after reclamation. As a result, the average soil infiltration rates would generally decrease, which would increase the potential for runoff and soil erosion. Topographic moderation following reclamation would potentially decrease runoff, which would tend to offset the effects of decreased soil infiltration capacity. The change in soil infiltration rates would not be permanent because revegetation and natural weathering action would form a new soil structure in the reclaimed soils, and infiltration rates would gradually return to premining levels.

Mine and Facilities

The mine facility site would impact the following soil map units:

- Killpack-Badlands-Persayo complex; 3 to 12 percent slopes; saline
- Mesa-Avalon complex; 3 to 12 percent slopes
- Tolman-Rock outcrop-Chugcreek complex; 3 to 12 percent slopes; very stony
- Persayo silty clay loam; 3 to 25 percent slopes
- Moffat-Kompace complex; 6 to 35 percent slopes
- Chipeta silty clay loam; 3 to 30 percent slopes
- Leebench warm-Avalon complex; 3 to 12 percent slopes

The proposed mine facility is located on soil map units that have high erosive potentials (Persayo, Chipeta, and Badland); therefore, erosion and sedimentation should be mitigated during construction of the mine facility site. These soil map units formed in residuum from alkaline marine shales containing gypsum, which is corrosive to concrete and is known to lower fertility and plant water availability. Moreover, both the Persayo and Chipeta soil series have high shrink-swell capacities, which can cause structural damage to structures and foundations. When disturbing the natural land surface in these areas of shale and other soft sedimentary material, it is advised to avoid constructing in locations generally prone to landslides, including steep slopes or the base of slopes with noticeable mass movement. These attributes may cause limitations during construction and overall maintenance of the mine facility site.

Railroad

The proposed construction of the railroad spur would impact the following soil map units:

- Killpack-Persayo complex; 3 to 25 percent slopes
- Killpack-Badlands-Persayo complex; 3 to 12 percent slopes; saline
- Leebench warm-Avalon complex; 3 to 12 percent slopes
- Persayo silty clay loam; 3 to 25 percent slopes
- Killpack silty clay loam; 0 to 2 percent slopes

North of the Highline Canal, the Killpack-Persayo and Killpack-Badlands-Persayo complexes dominate the railroad spur alignment. South of the canal, the Persayo silty clay loams dominate the alignment and are primarily used as agricultural parcels. These soil map units that have high erosion potentials; therefore, erosion and sedimentation should be mitigated during construction of the mine facility site. These soil map units formed in residuum from alkaline marine shales containing gypsum, which is corrosive to concrete and is known to lower fertility and plant water availability. The Persayo soil series has high shrink-swell capacities, which can cause structural damage to structures and foundations. Moreover, the Killpack soil series formed in alluvium and residuum from saline marine shale. High salinity inhibits or eliminates re-vegetation potential in the affected area because of increased soluble salt concentrations in the root zone of the soil (NRCS 2004). Selenium also occurs naturally and is present in these sedimentary formations. This element is required in trace amounts for human and animal health, but it can have adverse health problems for livestock, wildlife, and humans when ingested in higher-than-required concentrations. The high selenium content in the region is known to have adversely affected fish and avian populations, and the salinity has impacted agricultural lands, water delivery facilities, and water quality (USGS 2007).

Transmission Line

North of the Highline Canal, the transmission line would impact the following dominant soil map units:

- Killpack-Persayo complex; 3 to 25 percent slopes
- Persayo-Blackstone complex; 6 to 45 percent slopes
- Badlands-Deaver-Chipeta complex; 25 to 99 percent slopes; extremely stony
- Mack-Avalon complex; 3 to 12 percent slopes

- Killpack-Neiberger complex; 3 to 25 percent slopes

These dominant map units are moderately to very deep, well-drained soils that formed in slope alluvium and alluvium derived from sandstone and shale on sideslopes and toeslopes of rolling shale hills. Once again, these soils have high erosion potentials, high shrink-swell capacities, and high selenium, salt, and gypsum levels.

South of the Highline Canal, the transmission line would impact the following dominant soil map units:

- Sagers silty clay loam; 0 to 2 percent slopes
- Killpack silty clay loam; 0 to 2 percent slopes
- Ustifluvents; 0 to 2 percent slopes

The Sagers and Killpack silty clay loam map units are moderately to very deep, well-drained soils that formed in alluvium and residuum from saline marine shales. These soils are on basin and valley floor remnants, alluvial fans, and stream terraces. Ustifluvents are moderately well-drained soils found on floodplains formed in alluvium derived from sandstone and shale. The soils that compose the alignment south of the canal are primarily used for agricultural production and may be irrigated. Some of these soils are considered prime farmland if irrigated, and impacts on them should be minimized.

Access Road

The proposed construction of the access road (CR X) would traverse approximately 2.4 miles and also impact the following soil map units:

- Killpack-Persayo complex; 3 to 25 percent slopes
- Killpack-Badlands-Persayo complex; 3 to 12 percent slopes; saline
- Leebench warm-Avalon complex; 3 to 12 percent slopes

The impacts, risks, and hazards associated with these soils are the same as the proposed railroad spur.

Temporary Impacts

Construction activities can have serious detrimental effects on the soils on construction sites. Topsoil removal, grading, and filling drastically reduce soil quality on these sites, resulting in long term adverse impacts on plant growth and runoff. Another construction practice is allowing heavy equipment and even smaller construction vehicles to drive or park on the site. The vehicles compact the soil and compaction lowers the rate or water infiltration and reduces the available water-holding capacity (NRCS 2004). Unimproved roads with soils derived from Mancos shale may be impassable when wet due to the sticky and slippery nature of these soils and low load bearing strength.

Erosion from construction sites has offsite environmental and economic impacts. Erosion creates two major water quality problems in surface waters and drainageways, excess nutrients and sediment. Both impacts create unwanted biological growth and turbidity that degrades the habitat for fish and other aquatic organisms. Sediment can accumulate in stream channels, lowering the flow capacity and causing more frequent flooding in areas that were never flooded or were only rarely flooded in the past (NRCS 2004).

This total area of temporary disturbance would be reduced through successful reclamation as described in the Mitigation Measures section.

Long Term Impacts

Long term impacts would result from soil-disturbing activities related to construction of the mine, facilities, and associated linear features. Impacts resulting from construction of the mine site and associated facilities could include removal of vegetation, exposure of the soil, mixing of soil horizons, soil compaction, loss of topsoil productivity, and increased susceptibility of the soil to wind and water erosion. The project would permanently impact approximately 452 acres of soil.

Mitigation Measures

Reclamation and Revegetation

Soils suitable to support plant growth would be salvaged for use in reclamation. Soil stockpiles would be protected from disturbance and erosional influences. Soil material that is not suitable to support plant growth would not be salvaged. Soil or overburden materials containing potentially harmful chemical constituents would need to be specially handled. After soil is replaced on reclaimed surfaces, revegetation would reduce erosion. The mine would construct sediment control structures as needed to trap eroded soil.

Vegetation growth should be monitored on reclaimed areas to determine if soil amendments are needed. These measures are required by regulation and are, therefore, considered to be part of the Proposed Action.

Appendix B, Standard Practices and Mitigation Measures, includes seed mixes for soil stabilization, grazing use, and wildlife habitat. Appendix B also contains a mine reclamation plan, revegetation plan, noxious weed control plan, and revegetation success monitoring plan.

Erosion and Sedimentation

In order to mitigate erosion and sedimentation on construction sites, adding mulch and seeding may protect the soil from erosion. Straw bales, silt fences, gravel bags, narrow grass strips or buffers, vegetative barriers, and terraces and diversions catch sediment and shorten slope length and the amount of erosion-prone surface. Combinations of cover and structural practices help to control erosion and sedimentation and improve soil quality. Some temporary measures, such as a silt fence at the base of the slope, do not reduce the hazard of erosion on the slope but trap some of the sediment leaving the slope.

Soils would be exposed during construction. It is essential that the exposed area is minimized and that a protective cover is established. Conservation practices that provide immediate permanent cover or provide intermittent cover are very effective in controlling erosion and runoff. Other practices, such as diversions and terraces, also help to control erosion and runoff. They provide temporary protection until vegetation becomes established, and they provide permanent protection for the site (NRCS 2004).

Saline Soils

Soil salinity can have significant impacts on soil erosion and reclamation potential. Erosion of saline soils can also have significant impacts on the water quality of downstream watersheds. Saline sediments that originate in the project area may eventually flow into the Colorado River.

Salinity levels in the Colorado River are a regional, national, and international issue and the control of sediment discharged from public lands is mandated by the Colorado River Basin Salinity Control Act of 1974. Proper land use is the BLM's preferred method of achieving salinity control, with the planning process being the principal mechanism for implementation. Impacts are to be minimized in areas with saline soils, and revegetation of previously disturbed saline soils is to be promoted to the extent possible.

The major sources of salinity are the saline soils of the Upper Colorado River basin and agricultural irrigation-return flows. Much of the soil in the Project area is derived from and overlies the Mancos Shale, a saline marine deposit which produces large quantities of solutes. Given that saline sediment and increased water runoff is one of the key pollutants in the Colorado River basin, significant investments in stormwater control and upkeep would be necessary and would help minimize erosion if properly chosen and installed. Although construction activities may affect only a relatively small acreage of land in a watershed, they can be a major source of sediment and increased water runoff because activities often leave the soil disturbed, bare, and exposed to the abrasive action of wind and water. Increased sediment and water runoff impacts water-quality and creates unwanted biological growth and turbidity that degrades the habitat for fish and other aquatic organisms (Muckel 2004).

Adding mulch, seeding, and providing sod protects the soil from erosion. Straw bales, silt fences, gravel bags, narrow grass strips or buffers, vegetative barriers, and terraces and diversions catch sediment and shorten the length of the erosive surface. Combinations of cover and structural practices help to control erosion and sedimentation and improve soil quality. Some temporary measures, such as a silt fence as the base of the slope, do not reduce the hazard of erosion on the slope but trap some of the sediment leaving the slope. The following are some basic principles of erosion and water-runoff control on construction sites (Muckel 2004):

- Divide the project into smaller phases, clearing smaller areas of vegetation.
- Schedule excavation during low-rainfall periods when possible.
- Fit development to the terrain.
- Excavate immediately before construction instead of exposing the soil for months or years.
- Cover disturbed soils with vegetation or mulch as soon as possible and thus reduce the hazard of erosion.
- Divert water from disturbed areas.
- Control concentrated flow and runoff, thus reducing the volume and velocity of water from work sites and preventing the formation of rills and gullies.
- Minimize the length and gradient of slopes (e.g., use bench terraces).
- Prevent the movement of sediment to offsite areas.
- Inspect and maintain all structural control measures.
- Install windbreaks to control wind erosion.
- Avoid soil compaction by restricting the use of trucks and heavy equipment to limited areas.
- Break up of till compacted soils prior to vegetating or placing sod.

- Avoid dumping excess concrete or washing trucks onsite.

Soil would be exposed during construction. It is essential that the exposed area is minimized and that a protective cover is quickly established. Conservation practices that provide immediate cover (sod) or provide intermittent cover (mulching and seeding) are very effective in controlling runoff and erosion. Other practices, such as diversions and terraces, also help to control runoff and erosion. They provide temporary protection until vegetation or sod become established, and they provide permanent protection for the site.

Expansive/Shrink-Swell Soils

The potential for structural damage can often be minimized or the damage avoided altogether by following certain practices. With expansive soils, the main goal is to minimize fluctuations in soil water content. Proper surface drainage, plant species choices, and long term maintenance are all important. In more arid areas, typical of the climate within the project area, excess moisture should be kept several feet away from structures and foundations (NRCS 2004).

Landslides/Slope Failure

Slope failure and landslides have the potential to occur especially in areas of shale and other soft sedimentary material. The deepest cuts and fills would be located in the proposed loadout area of the project. Cutting and filling of steep slopes (>15 percent) should be avoided wherever possible. If a steep slope exists, all water flowing onto the slope should be redirected with diversions or a slope drain. Silt fence at top and toe of the slope must be anchored well, although this measure may not provide adequate protection by itself. On steep slopes, jute netting and erosion control blankets (geotextiles) should be used in conjunction with seeding or mulching, as seeding alone may not be effective (EPA 2008). Professional assistance should be sought before earth-moving and stabilization of cut and fill slopes begins. Geotechnical engineers should usually be brought in to remediate a slope failure. Slope failures are both dangerous and complex, and any remediation work should involve skilled and experienced geologists and engineers (Muckel 2004). Some of the basic principles of erosion and water-runoff control on construction sites listed in the Saline Soils section should be implemented.

Important Farmlands

There are several soil series south of the Highline Canal classified as prime farmland if irrigated. Efforts to minimize human impacts should be made by concentrating traffic and activities within confined areas.

Biological Soil Crusts

Efforts to minimize human impacts to biological soil crusts should be made by concentrating traffic and activities within confined areas.

Soil Compaction

Soil compaction problems can be reduced or eliminated through use of proper management practices. If compaction occurs in the top six to eight inches of the soil, tillage tools such as a chisel plow or moldboard plow can be used to shatter the compacted layer. However, if compaction is below eight to ten inches, tillage tools such as a subsoiler, ripper, or paraplow may be needed. By breaking up subsurface compaction, natural processes (such as root penetration, soil microbial activity, water infiltration, and freeze-thaw cycles) would be accelerated and would be more capable of returning the soil to a pre-disturbance condition. Defining both

vulnerability to and recoverability from soil compaction is dependent upon the natural patterns of plant and soil heterogeneity and initial disturbance type. Recovery estimates are highly variable for arid environments with severe compaction range from 70 to 680 years, but are dependent on the severity of compaction and the vigor of natural processes that operate locally to alleviate compaction (Webb 2002, Prose and Wilshire 2000). The following are preventative measures that could be taken to minimize soil compaction:

- Reduce traffic – Traffic is the major cause of excessive soil compaction. The more often equipment travels across a site, the greater the opportunity for soil compaction. Reduce the number of passes.
- Reduce tire pressure to reduce surface compaction – While reduced tire pressure would not reduce subsurface compaction, it would reduce surface compaction. Low pressure tires or dual wheels would reduce the degree of surface soil compaction but may increase the area compacted. The soil must support the weight of the equipment. Duals or low pressure tires simply spread out the weight.
- Reduce traffic under wet conditions – Soil is more compressible when wet. Traffic during high moisture conditions may compact soil, whereas the same traffic under dry conditions would not. As the soil dries, it has a higher soil strength, making it less susceptible to compaction. A dry soil supports traffic more readily than a wet soil. In addition, compaction stresses generated from the same wheel would be transmitted deeper in wet soils.
- Control traffic – Whenever possible, restrict all equipment to specific tracks or traffic lanes through the field, leaving the rest of the site essentially uncompacted. This requires some equipment management but may be well worth the effort.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Impacts to soils from this alternative would include temporary impacts to soils from construction of the bridge over Mack Wash and the railroad grade and raising the grade of CR M.8. The grade-separated crossing at CR M.8 would temporarily impact approximately 0.3 acre and permanently impact approximately 0.3 acre.

Noiseless Crossing Traffic Control Devices

Impacts of the noiseless crossing traffic control devices are the same as described in the Railroad section.

Proposed 69kV Transmission Line

The proposed transmission line would temporarily impact approximately 2.6 acres and permanently impact less than 1 acre.

Transmission Line Alternative A

The impacts to soils for this alternative would be the same as described for the proposed transmission line. However, a very small portion (less than 0.25 mile) of the transmission line crosses dissected alluvial fans associated with Big Salt Wash (see Figure 3-10, Remnant Alluvial Fans at Red Cliff Mine). These alluvial fans are vegetated with Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) in communities that are identified as critical big game

winter range. Due to the limited length of transmission line that crosses this are, impacts to big game winter range associated with the alluvial fans would be minimal. Because this alternative follows CR 16 north of the Highline Canal, impacts to soils would be slightly lower than the Proposed Action, as no new access roads would be required. Transmission line Alternative A would temporarily impact approximately 0.77 acre and permanently impact less than 1 acre.

Transmission Line Alternative B

Impacts to soils from this alternative would be slightly less than those described for the Proposed Action, as additional access would be required. Transmission line Alternative B would temporarily impact approximately 1.87 acres and permanently impact less than 1 acre.

Transmission Line Alternative C

Impacts to soils from this alternative would be slightly less than those described for the proposed transmission line due to the transmission line following the rail and pipeline corridor for 18,000 feet. This would eliminate the need for additional access for this length of transmission line. Transmission line Alternative C would temporarily impact approximately 1.73 acres and permanently impact less than 1 acre.

4.2.6 Groundwater

No Action Alternative

If the No Action Alternative is selected, alluvial and bedrock groundwater would not be impacted by mining. Groundwater beneath the lease tract would be undisturbed.

Proposed Action Alternative

Construction and operation of the mine and/or associated surface facilities may cause local impacts to alluvial and bedrock groundwater within parts of the mine area, and have been assessed as described below.

Mine Entrance and Surface Facilities

This section addresses all reasonably foreseeable potential impacts to groundwater that may result from the mine facilities to be constructed at or above the ground surface. No extraction of coal would occur at depth below the mine entrance portal or the planned mine surface facilities because the Cameo coal seam does not exist below those areas. Rather, underground mining of the Cameo coal would proceed northeastward from the mine entrance portal, and would extend to greater depths beneath the cliffs with distance from the portal. Potential impacts of the underground mining and related subsidence are described later in this section.

The mine entrance portal would be driven into the Cameo coal seam where no alluvial groundwater currently exists. Even though the Cameo coal is considered an aquifer further eastward, this coal seam is not an aquifer in the area of the mine entrance portal. In that area, bedrock groundwater only occurs in localized perched water zones above the water table. These perched water zones have limited extent, and cannot produce quantities of groundwater for any human use. In the area of the mine entrance portal, the water table exists at greater depths in the bedrock, in strata below the Cameo coal.

Table G-1 of Appendix G, Water Data and Information, contains existing permitted wells in, and within one mile of, the project area boundary; Table G-2 contains existing water rights in, and within one mile of, the project area boundary. Many livestock and domestic wells operate under "exempt" well permits, even though such permits do not grant water rights. No water well permits exist for water use in the existing coal lease area, or in the proposed ROW area. Moreover there are no water rights listed for any springs in those areas. However, there are two alluvial wells with permits for domestic use. Both these wells are more than one mile away from any proposed mining activity. One well (Permit #189882) is located more than a mile southeast of the proposed ROW area boundary, and the other well (Permit #256861) is located more than a mile to the southwest of that area.

Based on a field reconnaissance that URS hydrogeologists performed to identify springs in areas of proposed mine surface facilities, there is only one small spring (URS 4/22/2008, on Figure 3-18, MODFLOW Simulation A Groundwater Levels and Flow Into McClane Canyon Mine) in those areas. This spring is located along the alluvial drainage about 1,800 feet south of the proposed mine portal. This small spring has only been observed once, following the runoff season, but it has not been sampled for lab analysis. The source of this spring water is likely a localized perched zone in the alluvium, which is recharged by seasonal runoff along the ephemeral drainage. Because the spring is near the proposed coal conveyor belt facility, it could be impacted by mine construction or operation. For example, erosion and sedimentation along this alluvial channel during construction of the conveyor belt could reduce the spring flow. Accidental spills of fuel or oil during construction, and coal spills from the conveyor belt could adversely impact the water quality of this small spring by contributing compounds associated with liquid petroleum products.

Construction of the railroad spur and operation of the coal loading facilities could have similar impacts on the shallow groundwater in that local area if accidental spills or leaks occur. However, the alluvium is thin or absent throughout that area and thus impacts to alluvial groundwater are expected to be minimal. The mine operators are expected to implement Best Management Practices (BMPs) during operations, which would include cleaning up accidental fuel spills during construction and accidental coal spills. Therefore these proposed mine surface facilities are not expected to cause long term impacts to the flow or quality of shallow alluvial groundwater.

Of all the surface facilities associated with the mine, only the coal waste rock disposal area has the potential to cause long term changes in the quality of shallow alluvial groundwater. Poor quality leachate may be formed by infiltrating precipitation reacting with the coal waste. The leachate would likely contain elevated total dissolved solids and sulfate, and could seep into the groundwater below. However, the potential adverse impact to groundwater quality would be inconsequential because the shallow groundwater in that area is naturally poor in quality and the coal waste pile would be designed and operated to enhance runoff and minimize infiltration.

The Mancos Shale underlies the footprint of the coal waste rock disposal pile, except for a few limited areas of thin colluvium and narrow patches of alluvium lying within the small arroyos crossing that area. Along the largest arroyo crossing the coal waste rock pile footprint, a narrow deposit of alluvium contains a small amount of alluvial groundwater. The depth to alluvial groundwater in the area is approximately 19 feet based on measurements in monitoring well VB-06-10 (see Figure 3-11, Water Wells within the Project Area). Baseline quality of the shallow alluvial groundwater in the area of the waste rock pile is poor, as observed in monitoring

well VB-06-10. Total dissolved solids content of water samples collected from this well in 2007 have ranged from 15,550 to 56,530 mg/L and concentrations are elevated for several metals including arsenic, iron, manganese, selenium, and zinc.

Seepage from the pile would be reduced by limiting infiltration of precipitation. The coal waste rock pile would be constructed and keyed into natural ground with the waste rock and coal dust being compacted in lifts to provide stability. Compaction of fill in lifts would reduce the permeability of the pile, which would reduce infiltration. The surface of the pile is designed to promote runoff, which would also reduce infiltration.

Runoff from the coal waste rock pile would be captured and routed to the sedimentation ponds. Proper compaction and collection of runoff would minimize infiltration into the waste rock pile and seepage of water to the underlying alluvial groundwater. The seepage rate from the pile would be much lower than the natural recharge rate, which is about 0.5 inch/year, because of the very low permeability of the compacted, fine grained coal waste rock material, and because the surface of the pile would be graded to promote runoff. In any case, considering the poor baseline water quality, any potential infiltration from the coal waste rock pile would not degrade the alluvial groundwater quality substantially because the water quality is currently so poor. No impact to the bedrock groundwater is expected because of the great thickness of the Mancos Shale that underlies the pile. The Mancos Shale is hundreds of feet thick and has a very low hydraulic conductivity (and permeability), which restricts groundwater movement. There are no bedrock aquifers underlying the coal waste rock pile area that could be impacted by seepage from the pile.

Underground Mine in Existing Lease Area

The underground mine workings are not expected to adversely impact the flow or quality of alluvial groundwater because the workings would not directly encounter alluvial groundwater, for the reasons described in the following paragraphs. Alluvial groundwater occurs in Quaternary age sands and gravels within Big Salt Wash and East Salt Creek that extend to relatively shallow depths below those drainages. Neither of those drainages lay above or adjacent to the area below which mining is planned in the existing lease area. Mine workings would not extend beneath the alluvial groundwater located along those drainages. Where the underground mine extracts coal from deeper bedrock formations of the Mesaverde Group, the workings would be at least several hundred feet below any mapped surface drainage. Only thin, localized lenses of shallow alluvium exist along those drainages, the largest of which are Stove Canyon and Buniger Canyon. The water table is estimated to be more than 100 feet deep in those areas. Thus it is unlikely that groundwater exists in the alluvium along those drainages. Even if small amounts of shallow perched groundwater exist in some places, the coal seam is several hundred feet below the alluvium, so there would be no direct intersection of the mine and alluvial groundwater. Nonetheless, there is a potential for the mine subsidence to impact alluvial groundwater.

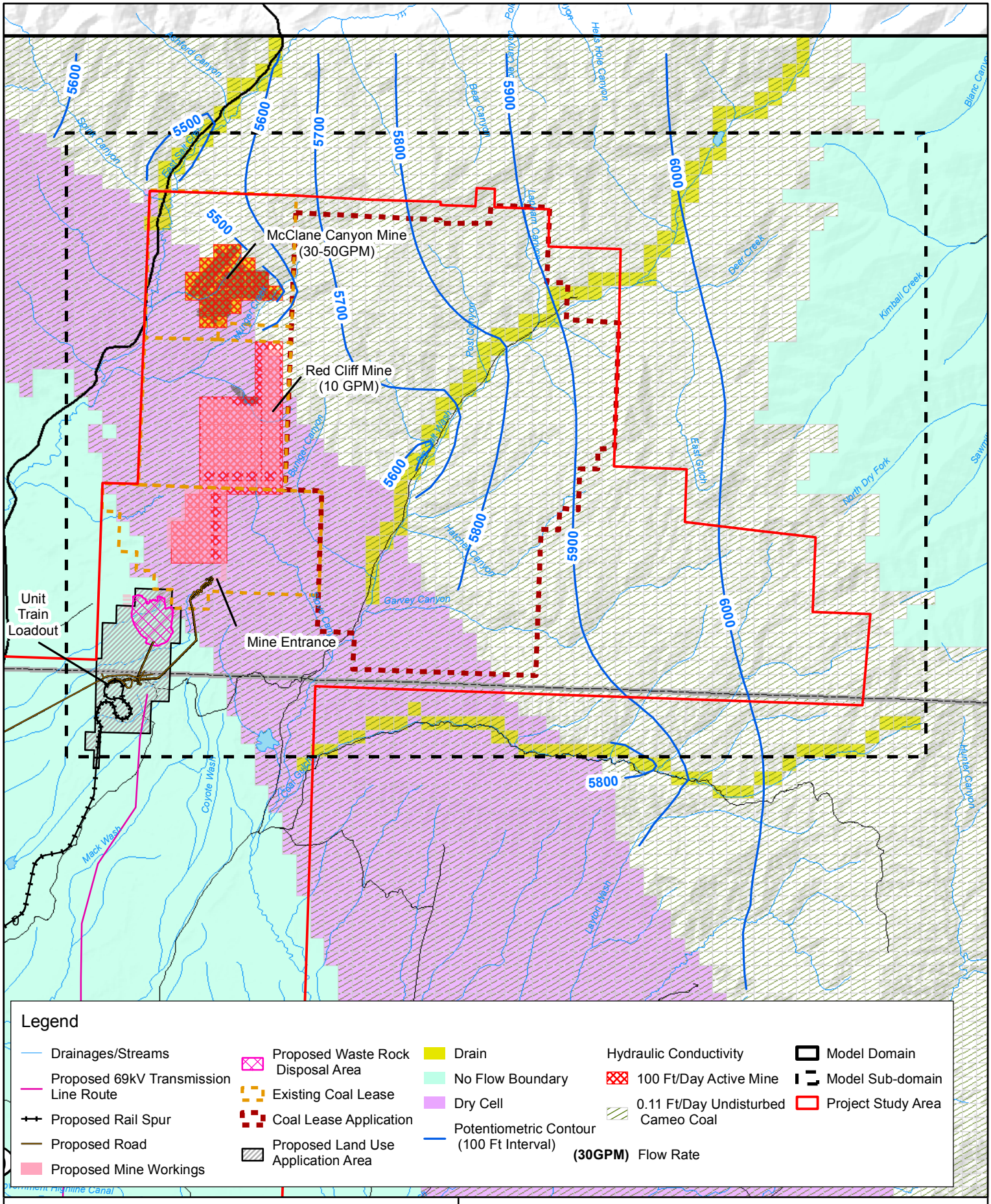
If mine subsidence causes new fractures in the bedrock below alluvium in some areas, alluvial groundwater could drain downward along the fractures and reduce groundwater levels in the alluvium. However, the mine subsidence evaluation (Appendix D, Subsidence) indicates fractures would probably extend less than 100 feet above the mined coal seam, and that the mining company can positively prevent water loss from the alluvium by maintaining at least 200 feet of bedrock overburden between all underground workings and the bottom of the alluvium. Most areas potentially containing alluvial groundwater are separated from the coal seam to be mined by much more than 200 feet of bedrock overburden.

The flow and quality of bedrock groundwater may be impacted as mining advances down-dip to the northeast. In the western part of the existing lease area, data from drill holes indicate that the overburden and the Cameo coal seam lay above the groundwater table. In those areas, only limited zones of interflow or perched water occur within the overburden. Further eastward, where the water table lies above the Cameo coal seam, it is considered to be an aquifer (Kaman Tempo 1984.)

The uppermost bedrock groundwater occurs just below or within the Cameo coal seam in wells 8-3-10 and 8-2-8 (see Figure 3-11, Water Wells within the Project Area), which are approximately 2,000 to 3,000 feet northeast of the mine entrance. Southwest of those wells, the mine workings are unlikely to encounter bedrock groundwater because the water table potentiometric surface lies below the Cameo coal seam. Thus it is unlikely that bedrock groundwater would be impacted until the mine workings reach the approximate locations of wells 8-3-10 and 8-2-8. After the mining encounters bedrock groundwater, the water would be collected and pumped from the mine, which would cause groundwater to flow toward the underground workings. As mining extends further north and east, the mine would encounter saturated groundwater conditions in the Cameo coal seam, which would increase groundwater inflows to the mine.

The MODFLOW groundwater flow model described in Section 3.2.6, Groundwater, has been used to estimate future groundwater inflows to the Red Cliff Mine within the existing lease area. For this model, the future mine limits are specified to be consistent with those in the mine permit application. In the entire area to be mined, the Cameo coal seam model layer is simulated as being actively dewatered at the same time, with a hydraulic conductivity set to 100 ft/day, to simulate active mine conditions. (Note, this value is simply assumed for the purpose of simulating the increased hydraulic conductivity in the mine workings – the assumed value is approximately 1000 times greater than the hydraulic conductivity of the Cameo coal seam prior to mining.) The MCM is also simulated as continuing to operate under a dewatered condition. A hypothetical dewatering well is located within the Red Cliff mine area, and the pumping rate was adjusted until water levels in the Red Cliff mine area match the bottom elevation of the coal seam layer in that area

The model boundaries and groundwater levels predicted by MODFLOW for these conditions are shown on Figure 4-11, MODFLOW Simulation B Groundwater Levels and Flow into McClane Canyon Mine with Red Cliff Mine Extended to Existing Coal Lease Limit. For the hydraulic parameters and hydrogeologic conditions specified, the model predicts the average inflow to the Red Cliff mine to be on the order of 10 to 40 gpm. This is in addition to the pumping rate at MCM estimated by the model to be about 24 gpm. Thus, assuming both mines would operate concurrently, the model predicts the combined flow into both mines would be about 30 to 70 gpm. If the MCM ceases dewatering in the future, it is reasonable to expect that the pumping rate from Red Cliff mine would have to increase by a similar amount (to total an average of about 50 gpm) to maintain dewatered working conditions in the mine. (Note, the model has also been used to predict the groundwater flows into the mine if it is extended further eastward into the proposed coal lease area, as described in the following section.)



Red Cliff Mine EIS

Figure 4-11
MODFLOW Simulation B
Groundwater Levels and Flow Into McClane Canyon Mine With Red Cliff Mine Extended to Existing Coal Lease Limit

This page intentionally left blank

The estimated low inflow to the mine is not expected to alter the bedrock groundwater flow regime substantially, other than in the area immediately surrounding the mine workings, because of the low hydraulic conductivity of the bedrock and coal seam. Compared to current conditions, the expanded areal extent and magnitude of the additional drawdown attributable to the Red Cliff Mine would be small. The drawdown in the groundwater bearing zones in bedrock would not affect human users of groundwater. There are no known bedrock water supply wells within the existing coal lease area or within the proposed ROW area. None of the springs in or near the existing mine lease area have been developed for use, and thus there are no water rights to any springs there. Several small springs are located on the eastern margin of the existing lease area (Figure 3-12, Spring Locations). None of these springs have been developed for human use, but they are likely used by livestock and wildlife when climatic conditions cause the springs to flow. There are no water rights associated with springs in this area that are listed in Table F-2 of Appendix G, Water Data and Information. These springs would not likely be impacted by inflow to the underground workings because they are not hydrologically connected to the Cameo coal groundwater flow system. As described in Section 3.2.6, Groundwater, these springs are fed by shallow zones of perched water in the fractured, weathered sandstone. In the eastern lease area, there are great thicknesses of relatively tight, unsaturated sandstone and shale separating those perched zones from the water table and the water-bearing Cameo coal.

The potential for mine subsidence to impact groundwater has also been assessed. Subsidence at other mines has caused new bedrock fractures to open up at the ground surface and below alluvium. It is conceivable that groundwater could drain downward along new bedrock fractures caused by mine subsidence, which could reduce groundwater levels in both the bedrock and the alluvium. Fractures extending up to ground surface could also drain water from the springs. However, the mine subsidence evaluation (Appendix D, Subsidence) indicates fractures are unlikely to extend more than 200 feet in the overburden above the mined coal seam. In most areas, alluvial groundwater is separated from the coal seam by more than 300 feet of bedrock overburden. Moreover, the mining would be planned by the mine operator to avoid creating subsidence or subsidence-induced fractures beneath any alluvial valley floor.

In the unlikely event that subsidence induced fractures were to extend up to or near the ground surface in the area where a spring now exists, it is possible the spring would cease to exist at that location. However, continued infiltration of precipitation would maintain groundwater recharge and probably cause another spring to form nearby. The new spring would likely emerge where the new fracture intersects the ground surface lower on the valley wall. Alternatively, the subsidence induced fracture may extend as far downward as the base of the Cameo coal underburden, which could cause new springs to emerge where that stratum intersects the valleys further toward the west. If subsidence caused new fractures extended to ground surface, this would cause groundwater recharge to increase compared to current conditions, which could offset some of the impacts by increasing spring flow rates.

The baseline quality of bedrock groundwater encountered in the mine is poor based on monitoring of wells in the project area. The groundwater has naturally-elevated concentrations of several major cations and anions. Groundwater near the base of the Cameo coal zone has elevated total dissolved solids concentrations ranging from 1,400 to 6,200 mg/L. Concentrations are elevated for several metal constituents including arsenic, iron, manganese, and selenium.

Mining would potentially increase the availability of inorganic and metal constituents to impact groundwater by excavating rock and coal and exposing fresh surfaces to oxygen and water.

However, the groundwater within the Cameo coal seam is neutral and has buffering capacity primarily in the form of bicarbonate (alkalinity), and acid generation is not expected. Considering the poor baseline water quality and limited inflow to the mine, the mine is not expected to substantially degrade groundwater quality beyond current conditions.

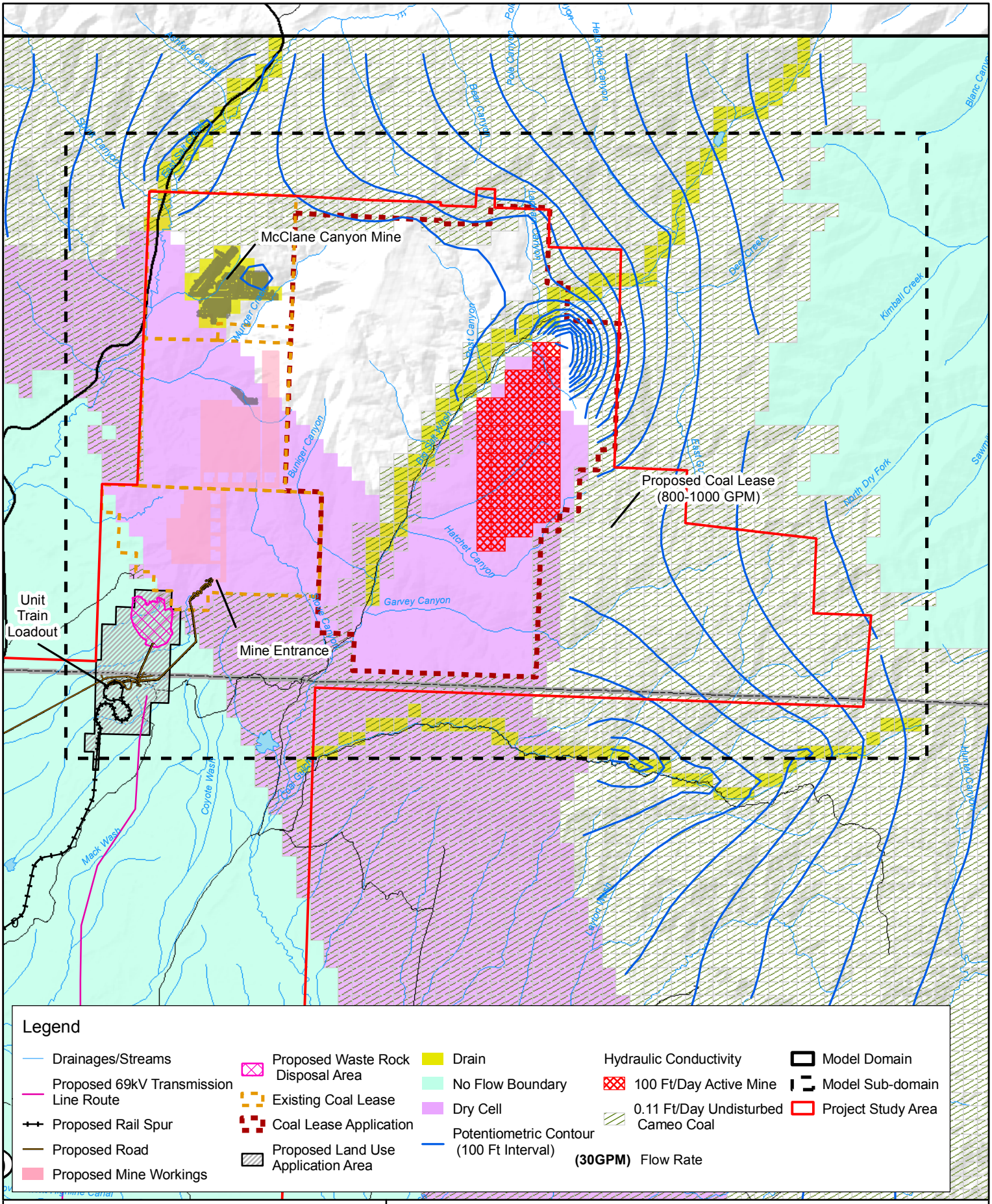
Underground Mine Expansion into Proposed Lease Area

If the new mine extends further eastward to include the proposed lease area, the impacts of the mine surface facilities on groundwater would be essentially the same as those described in the Mine and Surface Facilities section. Mining the tract would encounter bedrock groundwater that already has poor quality. As for the existing lease, the coal waste rock pile is the only surface facility that may impact groundwater. However that potential impact would be minimal because the shallow groundwater in the alluvial fan deposits is very limited in extent and naturally has poor water quality. Even though the coal waste rock pile would become much larger as mining progresses through the proposed lease area, the footprint of the pile would overlie Mancos Shale, which would restrict seepage and prevent impacts to deeper groundwater.

The underground mine workings would encounter increasing groundwater inflows as the mine progresses eastward in the proposed lease area. Again the MODFLOW model described in Section 3.2.6, Groundwater, has been used to estimate the approximate rate of groundwater inflow. For this scenario, the model includes the proposed mine area with an underground layout consistent with the maximum panel sizes used for the subsidence evaluation (Appendix D, Subsidence). The model assumes that mining has progressed to exhaust the MCM and permitted Red Cliff mine extents, and dewatering has ceased in those areas. This model is set up with the mine extended throughout the existing lease area and western part of the proposed lease area as shown on Figure 4-12, MODFLOW Simulation C Groundwater Levels and Flow into McClane Canyon Mine with Red Cliff Mine Extended into Eastern Part of Proposed Coal Lease. Areas directly under Big Salt Wash would not be mined, and thus the model cell parameters in those areas remain the same as for pre-mining conditions. The 2,000-foot overburden contour is the eastern limit of the mine area specified in the model. For all areas not within the proposed lease area, the model parameters remain the same as previously described for pre-mining conditions.

The hydraulic conductivity of the Cameo coal model layer has been increased by 100 times that of the undisturbed Cameo coal seam (from 0.11 ft/day to 11 ft/day) to represent mined out zones that would have collapsed before the final extent of open working panels shown on Figure 4-12, MODFLOW Simulation C Groundwater Levels and Flow into McClane Canyon Mine with Red Cliff Mine Extended into Eastern Part of Proposed Coal Lease. This figure also shows the extent of open working panels assumed for the final stage of mining. The open panels are specified as sinks for groundwater flow (to be extracted by hypothetical dewatering wells). Under these conditions, the model predicts that groundwater inflows would be on the order of 800-1,000 gallons per minute. Pumping of groundwater from the mine at that rate would be needed to maintain dry working conditions in the open panels beneath the proposed lease area.

After several years of operations, groundwater from dewatering operations may be used as makeup water (depending on the amount available) and therefore may reduce surface water diversion impacts. However, at the present time, the mine operator does not hold water rights for using groundwater produced from the mine. Dewatering water that could not be used for mining processes would need to be treated before discharge to meet water quality standards. Any



Red Cliff Mine EIS

Figure 4-12
MODFLOW Simulation C
Groundwater Levels and Flow Into McClane Canyon Mine With Red Cliff Mine Extended Into Eastern Part of Proposed Coal Lease

This page intentionally left blank

untreated discharges of the poor quality dewatering water would adversely impact downstream surface water resources, and thus should be avoided or appropriately managed.

Groundwater level and hence pumping capacity of three wells in the central portion of the proposed lease along Big Salt Wash could be adversely affected by mine dewatering operations if mining extends into the proposed lease area. Two of these wells (permit numbers 223205 and 223206) are shallow domestic wells. The other well (permit number 15498) is reportedly used for irrigation. The impacts to these wells are expected to be minor because mining activities that could induce subsidence below the alluvial valley floor would not be permitted.

Potential impacts of this dewatering on springs have also been assessed. There are numerous small springs within or near the proposed lease area as shown on Figure 4-12, MODFLOW Simulation C Groundwater Levels and Flow into McClane Canyon Mine with Red Cliff Mine Extended into Eastern Part of Proposed Coal Lease. (Spring locations throughout the study area are shown on Figure 3-12.) For reasons described in Section 3.2.6, Groundwater, most springs in the study area are ephemeral upland springs that would likely not be affected by mine dewatering because they are not hydrologically connected to the deeper, water-bearing Cameo coal. However, a relatively small number of springs located in valley bottoms may be connected to the water table and thus may be impacted by lowering of the water table caused by mine dewatering. For instance, it is not clear to what degree there is hydrologic connection between the water table and the valley springs located along the southern and northern margins of the proposed lease area, or those springs located to the east of the proposed lease area boundary. If some of these valley springs are directly connected to the water table, dewatering of the mine in those areas could reduce spring flows. However, the magnitude of the spring flow reduction would depend on the distance from the mine workings and the overburden thickness separating the spring and the Cameo coal seam. Flow rates at springs located more than 1 mile away from the underground mine working would probably have only a minimal reduction, which would almost certainly be less than the natural temporal variability in spring flows attributable to changes in precipitation.

Railroad

Shallow groundwater in alluvial fan deposits may be impacted by excavation associated with the railroad. To construct the rail alignment, cuts and fills would be necessary to provide a level, gentle-sloping railbed. Cuts vary, with 25- to 50-foot-deep cuts being common. The deepest cuts are located in the loadout area where 90-foot-deep cuts are projected. Monitoring well VB-06-03 (50 feet deep) is in the vicinity of the loadout area. The well has measurable water in it periodically at depths of about 40 feet. The sometimes dry conditions in the well suggest that the groundwater may be perched and not part of a continuous water-bearing unit. Water from the well has not been analyzed for inorganic or metal constituent; however, the specific conductivity of the groundwater has been measured at 13,200 µmhos/cm. The high specific conductivity indicates this groundwater has high dissolved solids content with potentially elevated concentrations of metals.

Although excavation for the railroad may intersect shallow groundwater near the loadout area, the groundwater is currently of poor quality and thus is not likely be further degraded by the project construction or operation. If any excavation encounters groundwater, the water would drain from the excavated slopes and then evaporate or re-infiltrate at lower elevations in the excavation. Substantial groundwater inflows into the excavations are not expected because

shallow groundwater is likely to be only present in perched, localized zones throughout the areas where excavations are planned.

No springs exist in the railroad spur loadout area based on the April 2008 field reconnaissance conducted by URS hydrogeologists. Further south along the rail alignment, no field survey of springs has been performed, but no springs are visible on aerial photos in those areas.

Water Pipeline

No measurable impact to alluvial and bedrock groundwater is anticipated.

Transmission Line

No measurable impact to alluvial and bedrock groundwater is anticipated.

Temporary Impacts

No temporary impacts to groundwater would occur from the Proposed Action.

Long Term Impacts

Impacts to groundwater could occur as a result of coal mining where mine workings are near or intersect subsurface water. Alluvial groundwater could be affected by seepage of water containing salts and metals leached from the coal waste rock pile or coal stockpile situated near the mine at the surface. However, the shallow groundwater in the alluvium beneath those piles is extremely saline and naturally poor in quality, thus long term impacts to that alluvial groundwater would be minimal. Because there would not be significant rates of seepage expected from any of the mine surface facilities, there would not be significant changes in shallow groundwater flow rates or flow directions.

To verify that operation of these mine surface facilities is not adversely impacting groundwater, monitoring wells would be installed southwest of, and in close proximity to, the waste rock and coal stockpiles. These monitor wells would be routinely sampled for chemical analyses, as part of the long term hydrologic monitoring program to be implemented by the mine operator.

Underground mining activities have the potential to impact the flow and quality of groundwater. After mine operations cease, the Red Cliff Mine would be closed in accordance with BLM requirements and BMPs to minimize long term impacts to water quality. Upon mine closure, the mine openings would be sealed at the ground surface to prevent access, prevent inflow of surface water, and minimize uncontrolled or undesirable outflow of affected groundwater. After dewatering of the mine workings ceases, groundwater levels would rise to approach pre-mining conditions. Long term adverse impacts to groundwater levels or quality are not anticipated to result from the underground mine.

Mitigation Measures

Appropriate mitigation measures would be required if data from the monitoring wells showed adverse impacts to groundwater. A water replacement plan for any injury to existing water sources that may be due to mining must be in place prior to mining as required by the Surface Mining Control and Reclamation Act (SMCRA) and the Colorado Surface Coal Mining Reclamation Act. Appendix B, Standard Practices and Mitigation Measures, includes additional proposed mitigation measures for impacts to groundwater.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

No measurable impact to alluvial and bedrock groundwater is anticipated.

Noiseless Crossing Traffic Control Devices

No measurable impact to alluvial and bedrock groundwater is anticipated.

Transmission Line Alternative A

No measurable impact to alluvial and bedrock groundwater is anticipated.

Transmission Line Alternative B

No measurable impact to alluvial and bedrock groundwater is anticipated.

Transmission Line Alternative C

No measurable impact to alluvial and bedrock groundwater is anticipated.

4.2.7 Surface Water

Impacts to surface water that can occur as a result of the project would be primarily from temporary actions such as the construction of the railroad spur, water pipeline, and other surface facilities and the long term operation of these facilities to support the coal mining operation. An additional long term impact to surface waters could be from the construction of the mining benches. Surface water features that may be affected due to these activities may include filling of some ephemeral drainages, impacts to streams and springs from land subsidence, and discharge of mine inflow water to local drainages. All of these activities have the potential to impact the quantity and quality of surface water runoff; however, these potential impacts can be minimized through the development and implementation of an appropriate mine plan including the design and implementation of protective measures such as BMPs to treat stormwater runoff prior to discharging to streams and springs and maintain adequate overburden above mining activities. Surface water impacts are measured by changes in water quantity and quality, typically limited to areas in close proximity to the impact and potentially within a few miles downstream of mining activities.

No Action Alternative

Surface water impacts for the project area under the No Action Alternative (i.e., if the Proposed Action was denied) would be the same as under the existing condition.

Proposed Action Alternative

Mine and Facilities

For mining operations, short term impacts are those that would occur from the time when construction of the mine and facilities begins through reclamation when vegetation has been re-established. Long term impacts are those that would persist during mining and operation.

Impacts to surface water (e.g. direct diversions out of Mack Wash) and groundwater (e.g. groundwater seepage from coal seam and overburden material into mine) that may occur under

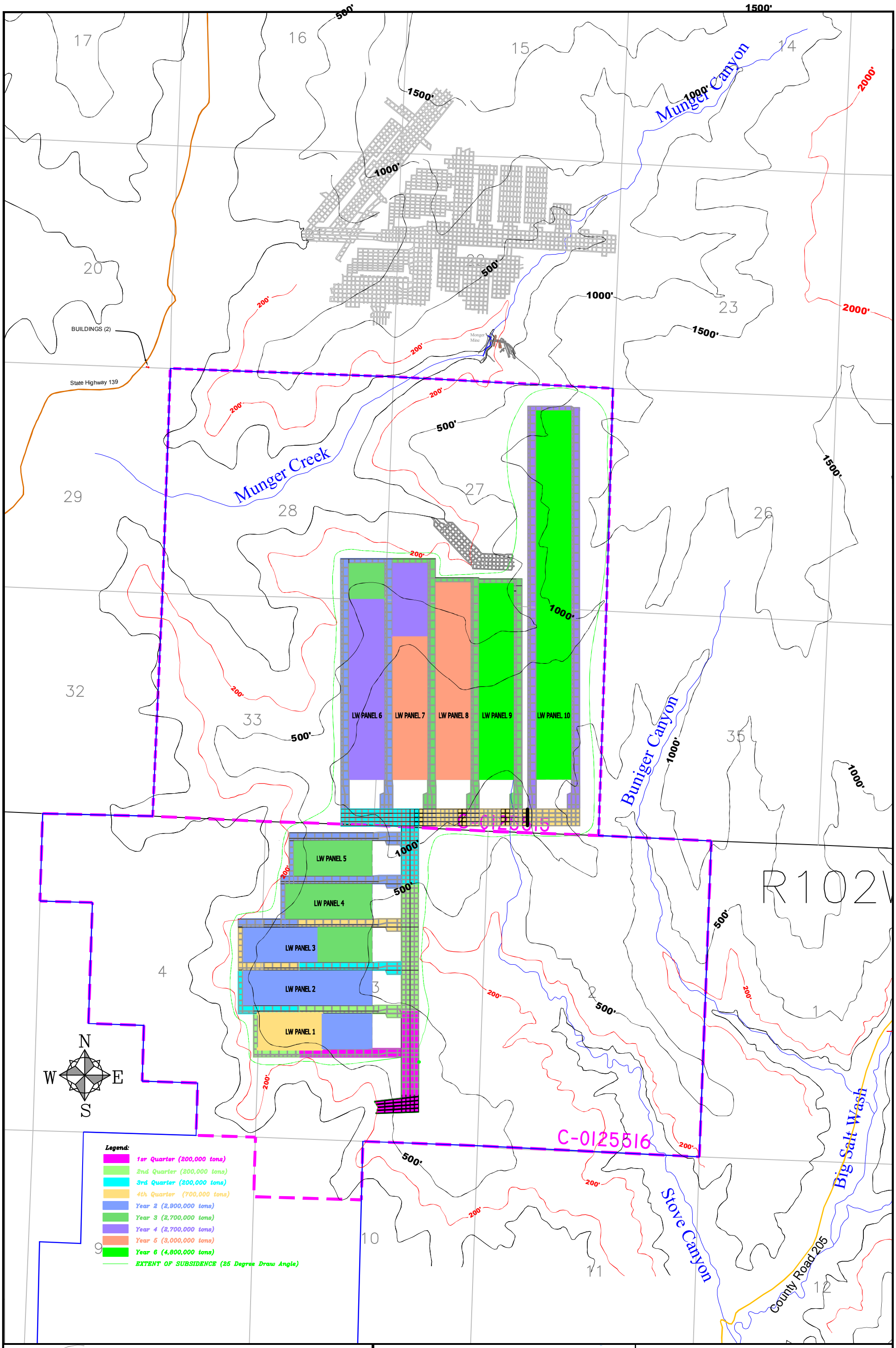
the Proposed Action alternative include effects of erosion, sedimentation, removal of vegetation, excavation, subsidence, and water diversions. During both the construction and the operation of the mine, the linear facilities associated with the mine (such as railroads, access roads, utility corridors, and transmission lines) would be designed using BMPs to minimize the affect to any surface waters they cross. Utilities would be buried under washes deep enough that they would not be affected by floods or erosion. Railroads and access roads crossing washes would use culverts to channel stormwater under the roads. They would be appropriately sized according to local requirements. The proper erosion and sediment controls would be selected, if needed, to ensure runoff from these linear facilities would not impact the surface waters.

Surface water flows in the existing coal lease could be disrupted by the effects of subsidence. Figure 4-13, Mine Plan and Overburden, shows planned mining in the first six years. All mined areas would be under a minimum of 200 feet of overburden. Note that there are no perennial streams that would be impacted and no mining is planned under Buniger Canyon or Munger Creek. Mining is planned under the upper reaches of Stove Canyon, with overburden depths of over 500 feet over the mains, and about 1,000 feet over the longwall panel where the subsidence would occur. Generally, the potential for draining surface water into the mine is low, as long as the bedrock overburden thickness is greater than 95 feet (see Appendix D, Subsidence, Section 6.1.2). Appendix D includes additional discussion of geologic and topographic factors that influence subsidence and the potential impacts to surface water, depending on the depth and type of the overburden. No alluvium has been mapped in this area (see Figure 3-10, Remnant Alluvial Fans at Red Cliff Mine Site). Based on the analysis presented in Appendix D and discussed further in this section, there is very little likelihood of surface water draining into the mine. Potential temporary impacts to ephemeral streams are discussed in Temporary Impacts in this section. There is little likelihood of long term impact to the flows of East Salt Creek.

During mining operations, runoff from the waste rock pile would be collected in ditches and contained in sediment ponds. The eight sediment ponds (A – H) are shown on Figure 2-12, Proposed Mine Facilities Map 1 of 5, through Figure 2-16, Proposed Mine Facilities Map 5 of 5. After settling the sediments, water would evaporate, infiltrate into the ground, or be released to the drainages. Runoff from other mine features such as the coal storage pile would also be collected and allowed to settle prior to infiltration or release to the drainages. Water discharged during dewatering groundwater and mining operations would also be collected in sediment ponds and then released to drainages. Drainages that would receive surface water runoff would include the ephemeral drainages that eventually drain to East Salt Creek. However, most of the runoff would seep into the ground through the sedimentation ponds and very little water is expected to drain to East Salt Creek. Groundwater drainage from the mine would settle in underground sumps and then be pumped to the surface and into ephemeral drainages, and it is unlikely that much of the water would reach East Salt Creek. Additional detail regarding the quality of the discharge is being provided in Section 4.2.6, Groundwater.

Railroad

The short term surface water impacts caused by the railroad would include those that occur during construction of the railroad in addition to a reasonable period during the reestablishment of vegetation (reclamation). Short term impacts may include excavation or filling of material, removal of vegetation, or other impacts due to construction activities. The railroad would be constructed so that any potential impacts to the streams would be mitigated by placing appropriately sized culverts or bridges. Erosion and sediment controls would also be selected



LEGEND

1000' Overburden thickness above Lower Cameo Seam (500' contour interval)

NOTE:
Overburden contours were derived using surface topography from the USGS 7.5' topographic maps and the Lower Cameo top of seam structural contour data, which was extrapolated near the coal outcrop and areas of deep cover.

Depending upon the accuracy of the topographic mapping, drill hole surveys and natural variability in structure, the Cameo coal depth of cover may be other than that depicted.

Scale 1" = 1000'

0 500 1000ft

Red Cliff Mine EIS

Figure 4-13
Mine Plan and Overburden

This page intentionally left blank

and installed to ensure the stormwater runoff from these facilities does not cause a water quality impact to the water crossings. Bridges are proposed to be constructed over the Highline Canal and Mack Wash for the railroad spur. Short term impacts associated with the construction of these bridges may include erosion, sedimentation, or removal of vegetation. Any potential construction impacts to the Highline Canal or Mack Wash would be mitigated through use of BMPs and specifically identified as part of the Construction Stormwater Permit Stormwater Management Plan (SWMP). Potential long term impacts of the bridges include the conveyance of stormwater runoff directly into these waters. Potential mitigation and proper conveyance of this runoff to rip-rap rundowns, minimizing erosion, and sediment traps to treat the water prior to discharging to these waters minimize the potential to discharge polluted stormwater. These measures are typically addressed as part of the preliminary and final bridge design process and addressed in the SWMP.

In the unlikely event of a train derailment and spill, coal or diesel fuel may reach surface water from contents of the rail cars. An emergency spill plan would be created to mitigate the likelihood that there would be a major impact to the water quality. This would be part of the mine's industrial stormwater permit or other similar plan to address spills. The UPRR also has emergency response procedures to address spills and derailments. Impacts to surface water from blowing coal dust from the trains should be minimal, as the coal would come from the coal preparation plant wet and the mining operation would employ dust suppression (watering) on their conveyor systems.

Water Pipeline

The water pipeline could cause local, short term impacts during construction of the pipeline in addition to those impacts that may occur during reclamation (i.e., a total of about 5 years). Short term impacts may result from grading and removal of vegetation and erosion associated with construction activities. Long term impacts are typically a result of impervious surfaces and areas where there are concentrated flows, such as culverts; all of which can be mitigated with proper roadside ditch design combined with velocity controls and inlet and outlet protection at culverts. Long term impacts typically occur after the 5-year construction/reclamation period, and are minimal to none, as the likelihood of pipeline failure is low, assuming the revegetation efforts are successful in obtaining 70 percent of the preexisting vegetative cover. In the unlikely event of failure, the decrease pressure and flow rate in the pipeline would be detected remotely, and flow through the pipeline would be shut off. Some flooding may occur in topographic lows and drainage channels if this occurred, which would cause erosion, the intensity of which would depend on the rate, force, and volume of the discharged water. These impacts would be mitigated with erosion and sediment controls, described further in the mitigation measures section.

The water depletion due to the diversion to the water pipeline may impact stream flows in Mack Wash. Depending upon the timing and volume of the diversion, surface water quality may be impacted through a reduction in flow and potentially water quality. CAM currently holds a 3 cfs water right at the SCMC Pump No 1 for industrial and domestic use with an appropriation date of June 7, 1982 in water case number 81CW471. This water right was made absolute (i.e., put to beneficial use) in case number 03CW228 on August 12, 2004. An alternate point of diversion is expected to be applied for to move this existing right upstream by approximately 1 mile. The impacts of this diverted water have been accounted for in the original water right and would be similar in the alternate point. CAM estimates that 1 cfs of water would be diverted on a yearly

basis. After several years of operations, groundwater from dewatering operations may be used as makeup water (depending on the amount available) and therefore may reduce surface water diversion impacts. However, at the present time, CAM does not hold water rights for the use of this groundwater, as previously discussed in Section 4.2.6, Groundwater.

CAM's existing water rights on Mack Wash are administered in the Colorado Division of Water Resources (Office of the State Engineer) priority system, in accordance with the Prior Appropriation Doctrine of first-in-time, first-in-right. If a junior water right holder would utilize any water out-of-priority, the Colorado Division of Water Resources requires an approved augmentation plan to ensure that senior water rights are not injured. An augmentation plan is a court-approved plan, which is designed to protect existing water rights by replacing water used in a new project (Colorado Division of Water Resources 2008). Augmentation plans are necessary in areas where there is a shortage of water during part or all of the year. Augmentation is a method to allow junior water rights holders to use water when a call has been placed without reducing water available to senior water rights holders. If CAM needs to utilize water out of priority, it would file an application with the Water Court, Water Division 5 (Colorado River and White River Basins) explaining exactly where the water would be obtained, where water would be used, what it would be used for, how much would be used, the source of augmentation water, when and where augmentation water would be required, and how the augmentation plan would be operated (Colorado Division of Water Resources 2008).

Table G-2 of Appendix G, Water Data and Information, lists the existing water rights within the project area boundary. Water rights up to one mile outside of the project area boundary are also listed in order to determine water rights that may be impacted if mining were to extend to the project area boundary. Through use of the augmentation plan, there would be no impacts to surface water rights.

Transmission Line

The local short term impacts for the transmission line would similar to those discussed for construction, grading, and clearing of vegetation activities. Long term impacts would be none to minimal. The proposed transmission line would span all surface water bodies; therefore, there would be no long term impacts to surface water. The short and long term impacts would be mitigated through proper design and implementation of erosion and sediment controls.

Lease Area

There would be subsidence in the lease area that could impact ephemeral and intermittent drainages. Appendix D, Subsidence, presents a discussion of the geologic and topographic factors that influence subsidence and a comprehensive analysis of the potential for surface water to be impacted and to drain into the mine. Generally, the potential for draining surface water into the mine is low, as long as the bedrock overburden thickness is greater than 95 feet (see Appendix D, Section 6.1.2). In accordance with CAM's permit application, there would be a minimum of 200 feet of overburden over mine workings. Figure 13 in Appendix D shows the overburden contours. Note that the majority of the area to be mined in the lease area has overburden of between 500 and 2,000 feet. While there may be surface fractures in the alluvium with less than 500 feet of overburden, there would be no loss of surface water into the mine, provided the fractured zone (see Figure 5, Appendix D, Mining Operations and Subsidence) is not intersected (Section 6.1.4, Appendix D). Additional discussions regarding the hydraulic conductivity of the fractured zone is included in Section 6.1.2, Appendix D.

Big Salt Wash is a perennial drainage, and would be protected through carefully planned mining operations. In accordance with Colorado DRMS regulations, there would be no longwall panels mined under Big Salt Wash, or under the alluvium as shown on Figure 3-10, Remnant Alluvial Fans at Red Cliff Mine Site. Mains or tunnels driven under Big Salt Wash would be constructed so as to prevent surface subsidence. There would be a minimum of 200 feet of overburden of competent bedrock over the mains. The rock would be drilled and tested, and the competent rock overburden measured prior to construction of the mains. Ephemeral and intermittent drainages may show slight to moderate effects of surface subsidence, depending on the location and depth of the mining operation. These temporary impacts are discussed further in the following section. Impacts would be mitigated with erosion and sediment controls, described further in the mitigation measures section.

Temporary Impacts

Temporary impacts to surface waters may result during construction, resulting in the disturbance of soils. Temporary impacts associated with construction activities may include sediment erosion and transport across the site from disturbance of soils or destruction of vegetation that could be reconstructed or revegetated. These temporary impacts ultimately result in the discharge of untreated stormwater runoff into nearby streams and water bodies. In order to mitigate temporary impacts, appropriate erosion and sediment controls would be implemented for any stormwater runoff (i.e., BMPs) to reduce sediment from entering surface water, as applicable. Impacts that occur beyond construction activities are considered long term and are discussed in the following section.

Components of the proposed project may impact the existing hydrologic features. The major streams, ditches, and reservoirs in the Red Cliff Mine project area are summarized in Table 3-19, Streams, Ditches, and Reservoirs Located within the Red Cliff Mine Project Area. The proposed mine facilities, railroad spur and/or the transmission line routes have the potential to affect these water bodies, but impacts would be mitigated through the use of structural and non-structural BMPs where feasible. The proposed project may also impact several local springs; a more complete discussion of potentially affected springs is found in Section 4.2.6, Groundwater.

Impacts on the various water features within the project area would vary based on the location and the level of construction activity necessary to construct the proposed project component (rail, transmission line, etc.) type. Overall, the soils in the area are naturally high in selenium due to the Mancos Shale geology, which tend to be released during earth disturbing activities (i.e., construction). The Mancos Shale is also a source for TDS in surface waters, which would also tend to be released during construction. Therefore, any soil disturbing activities would have the potential to increase concentrations of these constituents in nearby water bodies and would require special mitigation measures.

In the lease area, the stream gradient of an ephemeral channel could change because of differential vertical settlement due to subsidence over a short distance. In an extreme case, gradient changes may disrupt flow. Such an event is not probable in topographic conditions of the area where most stream channels are relatively steep. Flow through the drainages could temporarily be affected by a subsidence crack across a stream channel; however the crack would be expected to heal fairly quickly so the surface drainage pattern would be naturally restored. These ephemeral channels are expected to be typically dry with flow occurring during spring snowmelt and after significant precipitation events. Therefore, short term disruptions in the flow

from these streams should have very little impact on long term flows in Big Salt Wash or East Salt Creek.

Long Term Impacts

Stormwater runoff would result in long term impacts to water quality. Stormwater runoff may originate from coal and waste rock stockpiles or runoff from impervious surfaces, such as pavement. Runoff may enter into streams, washes, and irrigation ditches. With the construction and use of permanent water quality control structures, however, these impacts would be negligible. Negligible impacts to water being conveyed in the Highline Canal are expected since this water is originally diverted outside of the project area. Water quality impacts, resulting from accelerated erosion and sedimentation in stream channels and increased turbidity and salinity of surface waters due to runoff and erosion from disturbed areas, are expected to be minimal because surface water control measures are part of the project design and would be implemented as described in the mitigation measures section. Additional water quality impacts due to diversions up to 3 cfs at the SCMC Pump No. 1 out of Mack Wash would cause depletion to this wash and may impact downstream water users and water quality. The proposed project may also impact several local springs; a more complete discussion of affected springs is found in the Section 4.2.6, Groundwater. Water quality impacts due to the proposed bridges crossing over Mack Wash and the Highline Canal for the railroad spur would be mitigated with BMPs, as applicable. Discharge water from mine runoff and operations would create a long term impact to surface water quality, however impacts would be mitigated through the use of permanent structural sedimentation ponds and sediment traps as needed and other non-structural/administrative practices and training.

Based on the analysis presented in Appendix D, Subsidence, and the planned design of the mine, there would be no long term impacts to perennial or tributary streams in the existing or potential coal lease areas.

Mitigation Measures

Temporary impacts from construction could be mitigated through the use of BMPs and other mitigation measures described below. By implementing specific temporary and permanent BMPs for construction activities and long term facility operations, impacts to surface water would be minimized. A more detailed set of specific temporary (construction) and permanent (long-term) BMPs would be selected and designed during the final phase of the project when the alignments and survey are obtained. The amount of ROW for design would be sufficient to implement BMPs. A list of BMPs and guidelines for minimizing both temporary and permanent impacts to surface waters as a result of this project are provided below. Potential subsidence impacts would be mitigated through mine plan design. A water replacement plan for any injury to existing water sources that may be due to mining must be in place prior to mining as required by the Surface Mining Control and Reclamation Act (SMCRA) and the Colorado Surface Coal Mining Reclamation Act.

- Prior to construction of the mains or tunnels under Big Salt Wash, the rock would be drilled and tested, and the competent rock overburden measured. There would be a minimum of 200 feet of competent bedrock overburden over the mains under Big Salt Wash.
- Install and implement temporary BMPs for construction, including re-establishment of native vegetation.

- All applicable permits would be obtained prior to any construction activities, all regulations cited in these permits would be followed during construction and operations. Additional permitting information is presented in Chapter 1. Applicable guidelines pertaining to stormwater quality mitigation would be followed for discharge from point-sources, mine water, and sediment ponds. This includes obtaining a stormwater construction permit prior to construction. BMPs outlined in this permit (Stormwater Water Management Plan [SWMP]) shall be followed during construction.
- A SWMP would be developed that would outline the BMPs to be used for construction. Practices from the Erosion Control and Stormwater Quality Guide (ECSQG) (CDOT 2002) are outlined below. The City of Grand Junction and Mesa County have Drainage Criteria Manuals addressing similar BMPs and can also be referenced.
    - Adjacent disturbed slopes would be revegetated with native plant species to protect exposed soils from erosion (see BMP EC 1, ECSQG).
    - Where temporary or permanent seeding operations are not feasible due to seasonal constraints, mulch or other CDOT-approved methods of stabilization would be applied to protect soils from erosion (see BMP EC 2, ECSQG).
    - Erosion control blankets and ditches would be used as appropriate on newly seeded slopes to control erosion and promote the establishment of vegetation (see BMP EC 5, ECSQG). Erosion control blankets and seeding would be used to stabilize all cuts and fill surfaces. The slope of the cut and fill surface would dictate the type of erosion control blankets or turf reinforced matting and seeding to be used.
    - Temporary berms would be given priority consideration for protecting the sensitive areas in the project area (see BMP EC 8, ECSQG). Additional erosion control measures, such as silt fences and erosion bales, can be implemented, but with care and not as the sole erosion control system at the construction site.
    - Erosion logs and bales would be certified weed-free of noxious weeds.
    - Erosion logs and bales can be used as sediment barriers and filters along the toe-of-fills adjacent to water surface waterways and drainages, and at the cross-drain inlets where appropriate with additional reinforcement and in conjunction with other erosion control measures, such as temporary berms (see BMP EC 1, ECSQG).
    - Where appropriate, silt fences can be used to intercept sediment-laden runoff before it enters a water body, such as a wetland, only when they are used in conjunction with other erosion control measures such as temporary berms (see BMP EC 3, ECSQG).
    - Where appropriate, slope drains would be used to convey concentrated runoff from the top to the bottom of disturbed slopes (see BMP EC 7, ECSQG). Slope and cross-drain outlets would be constructed to trap sediment.
    - Check dams would be used where appropriate to slow the velocity of water through roadside ditches and swales (see BMP EC 9, ECSQG).
    - All culverts would be designed for 100-year flow conditions with inlet and outlet protection included.

- Temporary BMPs would be implemented to reduce selenium concentrations and selenium loading in waterways and wastewater containment areas to downstream tributaries and ultimately the Colorado River. Sediment ponds would be designed to settle out sediment, for a specific water quality capture volume, as specified in the City of Grand Junction and/or Mesa County drainage criteria manuals. Netting would be placed over open sediment ponds to prevent the exposure of migratory birds to increased selenium concentrations in the water, as well as any hazardous materials, especially petroleum products.
- All work performed on the project within the CDOT ROW would conform to Section 107.25 (Water Quality) and Section 208 (Erosion Control) of the CDOT Standard Specifications for Road and Bridge Construction.
- Construction access to the site, for items such as haul roads, crane paths, and concrete washout areas, would be planned to minimize or avoid impacts to sensitive habitats.
- Temporary stream crossing would be designed and constructed to ensure water quality is maintained in streams when construction vehicles need to cross a waterway. Construction of any specific crossing method would not cause a significant water level difference between upstream and downstream water surface elevations. Construction would also not disturb or create a barrier in the stream channel during fish migration and spawning periods.
- Temporary clear-water diversion structures would be implemented where appropriate permits have been obtained to perform work in a running stream or waterbody (see GP3, ECSQG). Diversion structures would be constructed with minimal water quality impacts. The construction impacts of diversion structures on streams shall be minimized by scheduling operations during low-flow periods and avoiding fish migrations and spawning periods.
- Concrete washout area applicable to highway improvements would be constructed at the improvement site(s) with the following specifications:
    - Suitable locations within the ROW would be set aside for a concrete truck wash-out area.
    - A pit with sufficient capacity to hold all anticipated wastewaters would be constructed at least 50 feet away from any state waters, and the bottom of the pit would be at least 5 feet higher than groundwater.
    - The area would be signed as a concrete wash-water clean-out area, and the access road leading to a paved road or highway shall have a stabilized construction entrance as detailed in the ECSQG.
- Non-structural BMPs, such as pesticide and fertilizer application guidelines and anti-icing and de-icing guidelines, would be employed to improve water quality in conjunction with BMP implementation. Other non-structural BMPs such as water quality signage adjacent to the receiving streams and irrigation ditches are examples of other tools that shall be considered for implementation.

The following BMPs address permanent, long-term mitigation as a result of the project:

- Permanent BMPs would be used where practical for use during the construction phase to improve the water quality control at the site to minimize erosion, sedimentation, and loading of selenium and salts to waterways.

- Permanent BMPs would be implemented to reduce selenium concentrations and selenium loading in waterways and sediment ponds to prevent increased concentrations to downstream tributaries and ultimately the Colorado River. Diversion ditches and sediment ponds would be designed to control runoff and prevent the release of high concentrations of selenium to the receiving water bodies.
- Bridges would be installed to decrease further aquatic and riparian impairment created by stream crossings. Diversion ditches and sediment ponds would be designed to control runoff and prevent the release of high concentrations of selenium to the receiving water bodies.
- Under the federal regulations, rail tracks are not required to be covered by a stormwater permit, and are not required to implement BMPs. However, the UPRR has emergency response procedures to address spills and derailments.
- Mitigation measures would include BMPs to reduce/prevent increased selenium concentrations to downstream tributaries during temporary construction and long term operations of the mine by stabilizing severely eroding stream channels, limiting surface-disturbing activities to the extent practicable, protecting municipal watersheds, and installing bridges with proper drainage features (e.g., downspouts with riprap at the end that daylights) for project stream crossings to decrease aquatic and riparian impairment.
- Inlet and outlet protection would be considered as part of the long term mitigation for culverts.

Appendix B, Standard Practices and Mitigation Measures, includes additional proposed mitigation measures for impacts to surface water.

Any potential impacts from this project can be even further mitigated through coordination with other agencies on watershed concerns. Several local, state, and federal agencies are involved in addressing existing water quality issues. For instance, mitigation of construction of the railroad spur, west of Mack Mesa Lake State Park, would include cooperation among the mine operator, Colorado State Parks (CSP), CDOW, and the U.S. Army Corps of Engineers (USACE).

Alternatives Carried Forward for Further Consideration

In summary, the greatest potential for impacts for the alternatives carried forward for further consideration would be during construction and would be mitigated through the proper planning and design of BMPs to mitigate stormwater runoff. The differences among these alternatives are minimal because of the regulatory requirements dictating the final stabilization of the corridors after construction.

Grade-Separated Crossing at CR M.8

This alternative includes the construction of a roadway bridge over Mack Wash. Any impacts as a result of the construction of this bridge would occur during construction activities and are temporary in nature. Temporary impacts during construction of the bridge would be mitigated with temporary erosion control measures (BMPs) that would be dictated in the SWMP to protect water crossings. Bridge drains and rundowns at the approaches to bridges can be used to convey stormwater runoff from the bridge to sediment control devices, and would be included in the design, if determined to be necessary. The size of the bridge span would dictate the volume of water that needs to be conveyed and potentially treated. Long term impacts from this alternative

may include stream channeling or impacts due to the presence of a bridge pier in the water way. Any surface water runoff from the construction of this project component would be controlled through BMPs.

Noiseless Crossing Traffic Control Devices

There is no anticipated impact from this alternative.

Transmission Line Alternative A

Impacts during construction would be slightly greater than the Proposed Action due to the line's partial location in the Big Salt Wash alluvial floodplain as discussed in Section 4.2.8, Floodplains.

Transmission Line Alternative B

Impacts during construction would be slightly greater than the Proposed Action due to the line's partial location in the Big Salt Wash alluvial floodplain.

Transmission Line Alternative C

Impacts would be slightly less than those described for the Proposed Action as the transmission line would share a corridor with the proposed railroad spur and pipeline for part of its length.

4.2.8 Floodplains

Section 2 of EO 11988 directs the BLM "to evaluate the potential effects of any actions it may take in a floodplain; to ensure that its planning programs and budget reflect consideration flood hazards and floodplain management; and before taking any action, each agency would determine the floodplain, as well as consider alternatives to avoid adverse effects within a floodplain, including not taking the action." Although FEMA has not mapped the potentially flood-prone major streams, ephemeral streams, ditches, and reservoirs, the Proposed Action and its associated construction and operational activities could result in short term and/or long term adverse impacts on floodplain areas if these water bodies cannot be avoided. The loss of floodplain from the project area, the increase in stormwater discharges from the increase in impervious surfaces, as well as the potential for increased flow velocities from the use of culverts, could increase the volume and velocity of stream flows downstream of the project area. The Mesa County Public Works Department requires that a Floodplain Development Permit be obtained prior to construction. The purpose of the permit is to minimize the likelihood of property damage to buildings or improvements in the event of a flood.

No Action Alternative

The No Action Alternative would not involve any of the proposed activities within an identified floodplain and would not encourage development within a floodplain. Therefore, this alternative is in compliance with EO 11988 and would not result in any adverse impacts to floodplains.

Proposed Action Alternative

Mine and Facilities

During construction and operation, the railroad, access roads, utility corridors, and transmission lines associated with the mine would not affect the ephemeral streams they cross. Utilities would be buried deeply enough that they would not be affected by floods. Railroad and access roads crossings would use culverts to channel stormwater under the roads.

Lease Area

Underground mining activities on the lease area would cause some degree of surface subsidence, and the mine could be designed to minimize this potential subsidence and to protect surface features deemed important. Portions of Big Salt Wash have been mapped with alluvium and a floodplain is assumed. In accordance with federal regulations regarding impacts to alluvial valley floors, the mine plan would be designed so there would be no subsidence impacts to Big Salt Wash.

Railroad

Railroad construction would result in short term adverse impacts to the floodplains associated with the streams and washes crossed by this linear construction. The railroad would be constructed to minimize impact to the flow of the waterbodies by placing appropriately sized culverts or bridges.

Water Pipeline

Water pipeline construction would result in short term adverse impacts. Potential long term impacts to floodplains could occur beyond the 5-year construction period.

In the unlikely event of pipeline failure during operation, the decreased pressure and flow rate in the pipeline would be detected remotely, and flow would stop. Some short term flooding could occur in topographic lows and drainage channels, resulting in short term adverse impacts to the floodplain.

Transmission Line

The proposed transmission line would span all floodplains; therefore, there would be no long term impacts. Temporary impacts may occur during construction.

Mitigation Measures

Temporary impacts from construction could be mitigated through the use of BMPs and other mitigation measures described under Section 4.2.7, Surface Water, as well as following local floodplain management regulations described in this section. No longwall or full extraction mining would occur under Big Salt Wash under the Proposed Action. By implementing specific temporary and long term BMPs for construction activities and long term facility operations, impacts to floodplains and alluvial valley floors would be minimized.

Appendix B, Standard Practices and Mitigation Measures, includes additional proposed mitigation measures for impacts to floodplains.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

There are no anticipated effects on floodplains from this alternative. Any potential impact due to the crossing of Mack Wash from the construction of this project component would be controlled through BMPs.

Noiseless Crossing Traffic Control Devices

There is no anticipated impact to floodplains from this alternative.

Transmission Line Alternative A

Impacts during construction would be slightly greater than the Proposed Action due to the line's partial location in the Big Salt Wash alluvial floodplain.

Transmission Line Alternative B

Impacts during construction would be slightly greater than the Proposed Action due to the line's partial location in the Big Salt Wash alluvial floodplain.

Transmission Line Alternative C

Any impacts would be similar to those described under the Proposed Action.

4.2.9 Vegetation

No Action Alternative

Under this alternative, no coal leases would be offered and no new coal mining would occur in the project area. Vegetation resources in the project area would remain in their present condition. As a result, plant community distribution, quantity, and quality within the study area would remain similar to current conditions, and plant species populations would remain similar to existing levels, or continue to change at current or similar rates. Vegetation on federal lands would continue to be subject to low levels of use in the form of recreation and grazing. The vegetation on private lands (i.e., "Residential/Agricultural" lands) would continue to be subject to moderate to intensive management and modification.

Proposed Action Alternative

The development and construction of the Proposed Action (railroad spur, electrical transmission line, access roads for construction and to the mine itself, and the portal road and mine facilities) would create approximately 452 acres of new surface disturbance, representing approximately 0.48 percent of the Study Area (Table 4-9, Vegetation Associations Impacted by Proposed Action).

Table 4-9
VEGETATION ASSOCIATIONS IMPACTED BY PROPOSED ACTION

Vegetation Association	Area (acres)	Vegetation Assoc. Disturbed (%)[1]
Shrublands	**293.56**	**0.64**
Salt Desert Shrub	194.25	0.62
Sagebrush	68.20	1.05
Greasewood	31.11	0.59
Woodlands and Forest	**97.95**	**0.37**
Piñon-Juniper	97.38	0.39
Riparian/Wetland	0.57	0.04
Commercial/Residential	**12.99**	**0.07**
Other – Talus, Rock Outcrops, Bare Soil	**47.90**	**1.28**
TOTAL	**452.40**	**0.48**

Note:
[1]This represents the percent disturbance of the area occupied by this vegetation association as indicated in Table 3-21.
% = percent

The greatest amount of disturbance associated with the Proposed Action would be within shrubland vegetation associations, especially salt desert shrub (194.25 acres) and sagebrush (68.2 acres) associations (Table 4-9, Vegetation Associations Impacted by Proposed Action). Within the entire study area, approximately 0.64 percent of the shrublands, 0.37 percent of woodlands and forests, and 1.28 percent of talus, rock outcrops, and bare soil would be directly impacted by construction and development activities.

The project is expected to have a generally negative affect on Land Health due to probable difficulties in attaining acceptable reclamation. Disturbed lands are not likely to meet Land Health Standards for at least 10 years following reclamation (Fowler 2007).

Mine and Facilities

The mine facilities and associated structures combined with roads required for construction of the railroad spur, transmission lines, mine facilities, as well as access roads, waste disposal roads, and portal roads account for approximately 237 acres of habitat disturbance, representing 52.4 percent of the total area to be disturbed.

A majority of the total 68.2 acres of the sagebrush association to be disturbed is found within the proposed facility site and would be a long term impact. These sagebrush benches at the base of the Book Cliffs contain an understory of forbs and perennial grasses, especially galleta (*Hilaria jamesii*) and Salina wildrye (*Leymus saliusa*), not found in other sagebrush stands in the area. The facility site also includes nearly all of the piñon-juniper vegetation association as well as nearly all of the talus, rock outcrops, and bare soil areas that would be impacted by this project.

Railroad

The railroad spur crosses both public and private lands and is approximately 14.5 miles in length, disturbing about 213 acres, representing 47.1 percent of the total area to be disturbed. The

southern portion of the railroad spur encompasses nearly all of the Residential/Agricultural lands impacted by the project. The northern portion of the railroad spur crosses salt desert shrub, greasewood, and some sagebrush vegetation associations.

Water Pipeline

The water line also lies within the railroad spur ROW and therefore would not create any additional disturbance.

Transmission Line

The proposed transmission line crosses 7 miles of private land and 7 miles of public land and would disturb approximately 2.6 acres, representing approximately 0.6 percent of the total area to be disturbed. The greatest amount of disturbance would take place within the salt desert shrub association (1.82 acres). Other vegetation associations that would be disturbed include sagebrush (0.38 acres), greasewood (0.24 acres), piñon-juniper (0.12 acres), bare or rocky ground (0.03 acres) and residential/agricultural lands (0.01 acres).

Temporary Impacts

Temporary impacts to vegetation and soil biological crusts represent the majority of the disturbance areas associated with the construction of the railroad spur and the transmission line. Assuming a final average bed width of 12 feet, then 192 acres (of a total 213 acres disturbed during construction) represent temporary impacts in Residential/Agricultural lands, salt desert shrub, greasewood, and sagebrush vegetation associations. All access roads and cut-and-fill slopes that are properly reclaimed represent temporary disturbances.

The 2.6 acres of disturbance associated with the transmission line represents primarily temporary impacts. If the access roads and work areas are fully reclaimed, the only long term impacts would be the vegetation displaced directly by the poles and anchor points. However, if the access roads are not properly reclaimed, they may become used by recreationists and the impacts would be long term.

Long Term Impacts

The entire mine facility site of 237 acres would be a long term impact (for at least the life of the mine) as would the 213 acres underlying the completed railroad spur.

Mitigation Measures

Impacts to vegetation may be reduced by implementing a reclamation plan that includes, among other BMPs, seeding native herbaceous and woody species immediately after the most intense disturbances have been completed. Proposed seed mixes are provided in Appendix B, Standard Practices and Mitigation Measures. They include a mixture of native grasses, forbs, and shrubs that would support grazing and wildlife. Appendix B also includes additional proposed mitigation measures for impacts to vegetation.

The existing abundance of exotic invasive species throughout much of the study area means that any surface disturbing activity would likely be colonized first by these exotics, absent any measures to reduce this risk. If weed colonization and dominance results, it may reduce the effectiveness of any plan for restoring these disturbed areas to healthy stands of native vegetation.

Because of the predominance of weedy species in much of the study area, it is likely that construction equipment would pass through weed infested areas on the way to work sites. In the short term, weeds along any potential access route should be controlled prior to entry of work-related equipment, and all equipment should be regularly power-washed when moving between sites. For the longer term, the proponent would need to provide a long term Integrated Weed Management plan to address weed issues on both private and federal surfaces. This plan should include periodic inventories, prompt treatment of discovered weeds, and long term maintenance control. The proponent would need to coordinate with the BLM Weed Management Specialist to help develop the plan for federal surfaces within the project area. For project areas on private surface, the mitigation measures such as monitoring and treatment would fall within the jurisdiction of Mesa County. Mesa County suggests that weed-free seed mixes be used to control noxious weeds. Coordination among all three entities would ensure that effective and collaborative weed management took place as a result of implementation of the Proposed Action. The plan would also ensure compliance with local, state, and federal regulations.

An aggressive reclamation plan for reestablishing desirable vegetation would help mitigate the establishment of undesirable species. As an example of one component of such a plan, an approved seed mix of desirable species should be applied immediately after an access road has been developed. The verges and center of the access road, as well as any areas of cut-and-fill, should be treated with this seed mix. In this manner, if weather conditions arise that are conducive to seed germination and establishment, there would be seeds of desirable species in place at this time. In addition to promoting establishment of native species, vegetated roadside verges would aid in controlling runoff and erosion.

Re-seeding and weed control should be continued as necessary, and at least annually, until the dominant species of each vegetation association in restored areas reaches 80 percent of the pre-disturbance condition of desirable species for the site. Reclamation standards on private surface should conform to the wishes of the landowner.

Reclamation may be enhanced by off-site weed control and native species seeding practices prior to any surface disturbing activities. Such practices may further help to reduce the threat of weeds becoming the dominant vegetation within the project development areas. A unique seed mix should be identified for each vegetation association impacted by project activities.

In areas with abundant well-developed soil biological crusts (i.e., those dominated by lichens), in particular along the route of the railroad spur north of the Highline Canal, these crusts should be removed, stored, and kept dry prior to any surface disturbing activities. A survey to clearly demarcate these areas should be performed prior to any surface disturbing areas. It is estimated that the area of well-developed crusts comprises not more than 1 acre in total area. As soon as the soils within these identified project areas have been recontoured and stabilized, the salvaged crusts should be redistributed on the affected surfaces, perhaps simultaneously with an appropriate native seed mix.

Traditional land recontouring and topsoil redistribution can result in soil homogenization that is not conducive for successful reestablishment of many native species. Thus, reclamation practices that promote soil heterogeneity at the meter-scale should be included in any reclamation plans. Such practices may include small pits, surface armoring, and other types of features that result in localized capture of nutrients and water.

The aggressive application of reclamation and weed management plans that include the previously described practices should result in at least partial mitigation of vegetation losses directly caused by the proposed project. Off-site weed control and native plant seeding could result in enhanced native vegetation cover and productivity compared to current vegetation status.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

In this alternative, an overpass for CR M.8 would be constructed over the railroad spur. This would result in additional acres of long term impacts, primarily to Residential/Agricultural lands. (The impact to affected wetland vegetation is discussed in Section 4.2.10, Wetlands and Riparian.)

Noiseless Crossing Traffic Control Devices

This alternative does not represent any alteration in the total area of ground disturbance, so it is not anticipated that any additional impacts to vegetation would occur from installation of noiseless crossing traffic control devices at railroad crossings.

Transmission Line Alternative A

Since the area to be disturbed by the proposed transmission line represents only 0.6 percent of the total project disturbance area, these alternatives each result in less than a 2-acre reduction in the total area to be disturbed.

Alternative A is similar to the Proposed Action but differs in the route of the electrical transmission line. In Alternative A the transmission line largely follows existing roads north of the canal, resulting in a 1.84 acre decrease in the total disturbance from 2.61 acres to 0.77 acre. Thus, Alternative A results in slightly decreased disturbance, totaling approximately 450.77 acres of habitat. Most of the reduced disturbance is within the salt desert shrub association (1.33 fewer acres disturbed). In large part, the overall impacts to vegetation would be about the same as the Proposed Action.

Transmission Line Alternative B

Alternative B is similar to the Proposed Action but differs in the route of the electrical transmission line. In Alternative B the transmission line originates on the same route with the Alternative A transmission line but diverges from the Alternative A route after crossing the Highline Canal. From that point it stays to the east of Alternative A, crossing mostly BLM lands, rejoining the route of Alternative A at Coal Gulch. In this alternative, the transmission line largely follows existing roads north of the canal, except where it deviates from the route of Alternative A. This alternative would result in a total of 1.87 acres of disturbance associated with the transmission corridor, 0.74 acre less than the proposed alternative but 1.1 acres more than Alternative A. The total project disturbance associated with Alternative B is approximately 451.87 acres. Compared with the Proposed Action, the reduced disturbance is nearly equally distributed among the salt desert shrub (0.22 acre less disturbance), sagebrush (0.26 acre), and greasewood (0.19 acre) associations. In large part, the overall impacts to vegetation would be about the same as the Proposed Action.

Transmission Line Alternative C

Alternative C is similar to the Proposed Action but differs in the route of the electrical transmission line. Alternative C follows the same route as the Proposed Action until it crosses the Highline Canal where it diverges in a northwesterly direction and merges with the proposed railroad spur route. This alternative would result in a total of 1.73 acres of disturbance associated with the transmission corridor, 0.88 acre less than the Proposed Action, 0.96 acre more than Alternative A, and 0.13 acre more than Alternative B. The total project disturbance associated with Alternative C is approximately 451.73 acres. Compared with the Proposed Action, the reduced disturbance is nearly equally distributed among the salt desert shrub (0.39 acre less disturbance) and sagebrush (0.33 acre) associations. In large part, the overall impacts to vegetation would be about the same as the Proposed Action.

4.2.10 Wetlands and Riparian

For the purposes of this analysis, wetlands and riparian areas are considered to be synonymous terms.

No Action Alternative

Under the No Action Alternative, there would be no impacts to wetlands or riparian areas.

Proposed Action Alternative

The Proposed Action has been designed to avoid areas with wetland characteristics wherever possible.

The Proposed Action would result in fill of approximately 0.1 acres of USACE jurisdictional wetlands due to the construction of a diversion structure in Mack Wash for the proposed water supply pipeline and would result in fill or alteration of up to 0.88 acres of non-jurisdictional wetland created by irrigation-related hydrology. Riparian areas along Big Salt Wash in the proposed coal lease area would not be impacted as Big Salt Wash would be protected from potential subsidence effects.

Since the project does not include any wetland or riparian areas on BLM lands that would be impacted, Land Health standards for these resources would not be affected.

Temporary Impacts

Temporary impacts to wetlands may occur as a result of soil erosion from construction.

Long Term Impacts

The project would potentially impact approximately 0.1 acre of USACE jurisdictional wetlands along Mack Wash as a result of installing the water diversion structure.

Mitigation Measures

Mitigation would be provided in accordance with USACE standards. Temporary impacts would be mitigated by application of standard erosion/sedimentation control measures. Wetland mitigation and monitoring would be performed in accordance with an approved USACE permit, not yet submitted. It is likely that the project would qualify for Nationwide Permit (NWP)

No. 12, Utility Line Activities, since fill would be limited to less than the 0.5 acres allowed under NWP No. 12.

Appendix B, Standard Practices and Mitigation Measures, includes additional proposed mitigation measures for impacts to wetlands and riparian.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

This alternative would impact an additional 0.33 acre of wetland as compared to the Proposed Action for a total wetland impact of 0.43 acre of jurisdictional wetlands. Additional impact would be related to replacement of the Mack Wash bridge. NWP #12 would be applicable.

Noiseless Crossing Traffic Control Devices

This alternative would have the same amount of wetland impact as the Proposed Action.

Transmission Line Alternative A

This alternative would have the same amount of wetland impact as the Proposed Action.

Transmission Line Alternative B

This alternative would have the same amount of wetland impact as the Proposed Action.

Transmission Line Alternative C

This alternative would have the same amount of wetland impact as the Proposed Action.

4.2.11 Fish and Wildlife

No Action Alternative

Under this alternative no coal leases would be offered and no new coal mining would occur in the project area. Wildlife resources in the project area would remain in their present condition. As a result, wildlife habitat distribution, quantity, and quality would remain similar to current conditions, and wildlife populations would remain similar to existing levels. Wildlife habitats would continue to be subject to low levels of use in the form of recreation and grazing.

Proposed Action Alternative

The construction of the railroad spur, transmission line, access roads for construction and to the mine itself, portal road, and mine facilities would create approximately 452 acres of new surface disturbance in currently undisturbed vegetation communities/wildlife habitats, excluding potential subsidence impacts. Impacts from creation of the rail line include direct long term loss of vegetation and wildlife habitat, loss of wildlife due to collisions, and indirect losses of available habitat due to displacement away from the railroad spur due to disturbance. While direct loss of habitat represents less than 0.5 percent of the total surface located within the project area, indirect loss of available habitat due to displacement would also occur but is difficult to measure or predict. Indirect impacts to wildlife would include decreased use by some species in the vicinity of the proposed project, and habitat fragmentation caused by intrusion of

human activities into an area that presently has low levels of human activity. Assuming decreased wildlife use within one-eighth mile of the rail facility north of the Highline Canal and aboveground mine facilities, approximately 2,203 acres may have some level of decreased use. Additional displacement may occur from increased road traffic on CR X, which would be used by construction and operations personnel. The railroad may interfere with pronghorn movement and use of adjacent habitats where the railroad has steep cuts or fills.

The predominant wildlife habitat affected by construction activities associated with the Proposed Action would be salt desert shrub/greasewood and sagebrush plant communities. Salt desert shrub/greasewood and sagebrush communities both lie within CDOW mapped winter range for deer, elk, and pronghorn (Figure 3-24, Winter & Severe Winter Range). The sagebrush benches at the base of the Book Cliffs contain an understory of forbs and grasses not found in other sagebrush stands in the area, making them important for wintering big game, especially deer. Approximately 68 acres of sagebrush would be disturbed during construction of the mine and associated facilities, including portal benches, waste rock pile, and associated access roads.

The salt desert shrub plant community would be impacted by the loss of approximately 194 acres. This represents less than 0.7 percent of the total salt desert shrub/greasewood communities within the project area. Amphibians, reptiles, and small mammals including coyote, gray fox, kit fox, badger, bobcat, spotted skunk, striped skunk, long-tailed weasel, desert cottontail rabbits, and white-tailed prairie dogs could be affected by any significant habitat loss in this plant community. White-tailed prairie dogs would be impacted the most since the railroad spur bisects seven colonies and passes near two additional colonies of the 13 colonies identified during surveys. Two other colonies lie adjacent to the CR X access road. A direct loss of habitat, reduction in useable habitat, and loss of prairie dogs during and after construction could potentially affect prairie dog populations. While there would be a loss of 194 acres of salt desert shrub/greasewood habitat, it is not anticipated that populations of any small mammal, amphibian, or reptile wildlife species in this area would be significantly impacted.

Burrowing owls, a State-Listed Threatened Species, inhabit prairie dog towns and have the potential to be affected if the habitat disturbed results in the loss of prairie dog colonies. Disturbance caused by project construction during the breeding season would likely result in failure to produce offspring, impacting the already low population numbers of burrowing owls. Burrowing owls were observed at two prairie dog colonies during the surveys (prairie dog colonies 11 and 12). Current alignment of the rail line would sever prairie dog colony no. 11 and affect the dynamics of the dog town. The railroad spur would also bisect six other prairie dog towns and would result in a permanent loss of prairie dog habitat. The bisected towns would likely continue to be connected through prairie dog movements over the tracks or through culverts under the tracks. More than 100 culverts would be installed along the railroad spur, many of them within prairie dog towns.

Raptors that utilize the project area could be affected by project activities that decrease the prey base for raptors, disrupt their hunting activities, or interrupt the breeding cycle. Based on the amount of habitat disturbed and the amount of available habitat, it is unlikely that this project would affect prey base numbers or hunting activity of raptors. Activity resulting from mine operations occurring near active raptor nests would have the potential to disturb nesting birds on cliffs or in piñon-juniper woodlands, and could cause abandonment of the nest and subsequent nest failure. This is especially true for the Golden Eagle nest observed in 2006 in the cliffs near the proposed mine portal. Species in the project area most likely to be affected would be golden

eagles and red-tailed hawks. Great-horned owls are generally more tolerant of disturbances and less likely to abandon their nests under disturbances caused by the proposed project. In order to reduce the chances for nest abandonment and subsequent nesting failure, the CDOW recommends NSO within 0.25 mile of active golden eagle nests, and no human disturbance within 0.5 mile of an active golden eagle nest from December 15 to July 15 (CDOW 2008). The CDOW recommends NSO within 0.33 mile of active red-tailed hawk nests, and no human disturbance within 0.5 mile of an active red-tailed hawk nest from February 15 to July 15 (CDOW 2008). The conveyor and haul road would be located less than 0.25 mile from the golden eagle nest, and less than 0.33 mile from the red-tailed hawk nest. Construction activities would be initiated when the nests are inactive, but would not stop if the eagles or hawks subsequently occupy the nests. However, these sites may no longer be used for nesting during the construction period and after the mine portal and associated surface facilities are constructed.

The Proposed Action alternative would impact aquatic resources through changes in water quality, water withdrawals, and physical habitat disturbance.

Water would be used for exploration, underground and surface dust control, and other mining activities and would result in continuous depletions from Mack Wash. CAM has a 3 cfs absolute water right and estimates a need for 724 acre feet/year for its mine operations. CAM expects to divert water continuously from Mack Wash at a rate of 1 cfs. Historic USGS records indicate monthly mean flow rates ranging from 1.7 to 70 cfs, with lowest average flows (1.7 to 2.7 cfs) occurring November through February, and the highest average flows (46 to 70 cfs) in April, May, September, and October. The lowest monthly mean discharge on record is 1.3 cfs. There is a potential for the Proposed Action to result in little or no flow in Mack Wash during low flow periods. Other water diversions upstream from the Proposed Action diversion would also increase the potential for Mack Wash to contain little or no flow during low flow periods. Water depletion during low flows could impact native fishes by reducing instream habitat in Mack Wash. Withdrawing water during the irrigation season at high flows and storage of water for later use during low flows would reduce water depletion impacts to the fishery. Diversions from Mack Wash would have less impact on Salt Creek downstream of the diversion. The lowest average flows in Salt Creek at Mack occur in January (11.4 cfs) and February (13 cfs), and the 1 cfs diversion would be less than 10 percent of the average monthly flow in all months. Diversions from Mack Wash would have no effect on East Salt Creek.

Construction of water diversion structures in Mack Wash could impede fish movement and intake devices could trap fish. Natural spawning of flannel-mouth suckers occurs in Salt Creek (Martin 2007). Activities that could adversely impact the flannel-mouth spawn should be avoided from March 1 to July 31.

Increased sediment load to any waterways that are tributary to the Colorado River is a major concern. All construction activities should utilize BMPs to prevent any sediment from entering drainages that enter Mack Mesa, Highline Lake, and Mack Wash.

Mine and Facilities

The mine facilities and associated structures combined with roads required for construction of the railroad spur, transmission lines, mine facilities, as well as access roads, waste disposal roads, and portal roads account for approximately 237 acres of habitat disturbance, excluding potential subsidence areas.

Railroad

The railroad spur crosses both public and private lands and is approximately 14.5 miles in length, disturbing about 213 acres. Disturbance varies in width depending on depth of cuts and height of fills.

The only year-long stream in the project area which is crossed by the railroad is Mack Wash at the CR M.8 crossing. This drainage is maintained by excess irrigation water flow out of Highline Lake and irrigation return water from adjacent farm land. Mack Wash empties into Salt Creek approximately 1.5 miles from Salt Creek's confluence with the Colorado River.

Water Pipeline

The water line also lies within the railroad spur ROW and, therefore, would not create any additional disturbance.

Transmission Line

In accordance with Table 4-1, there would be approximately 17 acres of permanent disturbance on BLM lands and less than 1 acre on private lands.

Temporary Impacts

Project activities associated with the construction of the railroad spur and water line, transmission line and access roads would reduce habitat effectiveness due to the presence of personnel and equipment during construction. The presence of activities associated with construction of the railroad spur, transmission line, and associated access roads, decreases useable habitat for many wildlife species.

In general, disturbance to aquatic resources from project construction activities would be temporary and considered minor. Bridge construction at Mack Wash and realignment of CR 10 could result in temporary increases in sediment. Sediment increases in localized areas downstream from these sites may cover substrates and reduce macro invertebrate production. An increased sediment load could impact spawning native fishes, including the round-tailed chub (State-Listed Species of Special Concern) and flannel-mouth sucker. Natural spawning of flannel-mouth suckers in East Salt Creek begins in early March and increased sediment loads via Mack Wash would interfere with spawning.

Long Term Impacts

The physical presence of the railroad spur, transmission line, and associated access roads, decreases useable habitat for many wildlife species. Infrastructure such as the railroad spur, transmission line, and access roads would fragment habitat, further decreasing habitat effectiveness. An increase in traffic from employee vehicles on access roads as well as the new train traffic in the project area would have the potential to cause more big game and other wildlife collisions resulting in the death of animals. The increased traffic from trains and vehicles, combined with the roads and train tracks themselves, would act as barriers to safe movement for wildlife. While movement of wildlife can still occur, loss of wildlife due to collisions would occur as animals attempt to cross the roads while moving from habitat to habitat.

A reduction in the amount of useable habitat at the base of the Book Cliffs could impact wintering deer, elk, and pronghorn. Activities in or near the sagebrush benches utilized by

wintering deer and elk would result in less useable habitat and could translate to fewer animals wintering in the area. A reduction in habitat effectiveness would most likely have less impact on small mammal populations because of their smaller home range.

While the removal of 68 acres of sagebrush habitat would directly reduce the amount of available winter range for big game, habitat effectiveness would be reduced because of construction activities. The projected habitat loss would have a minimal impact to other big game species such as mountain lion and black bear.

Mitigation Measures

Increased sediment load to any waterways that are tributary to the Colorado River is a major concern. All construction activities should utilize BMPs to prevent any sediment from entering drainages that enter Mack Mesa, Highline Lake, and Mack Wash (see Section 4.2.7, Surface Water).

Avoiding construction during the prairie dog breeding season between March 1 and June 15 would reduce impacts to prairie dogs inhabiting railroad spur crossings or adjacent areas. Young and adults would be more mobile after June 15 and able to relocate themselves to avoid construction equipment.

The following mitigation measures would be used for nesting raptors. Pre-construction surveys would be conducted to determine whether active nests are present in the vicinity of proposed construction activities if construction would occur during the nesting season (March 1 through July 31). Where active raptors are found, construction would be avoided where feasible within protective buffer zones around the nest, including 0.5 mile for golden eagle and 0.33 mile for red-tailed hawks.

Wildlife-vehicle collisions could be reduced by placing speed limits of 35 miles per hour on all access roads and restricting use of roads traversing winter range areas to essential personnel.

By implementing proper drainage and sediment control measures, avoiding construction during the spawning and immediate post spawning season (March 1 to July 31), and timing construction activity during the low flow period, the effects on macroinvertebrates and native fishes would be minimized.

Construction of water diversion structures that do not impede fish movement and placement of 0.25-inch screens on water intake devices to preclude entrainment of fish would reduce direct impacts to the native fishery.

Limiting access to winter range areas between December 1 and March 1 could reduce impacts to wintering deer, elk, and pronghorn.

Losses to wildlife habitats could be partially mitigated through the use of effective reclamation of disturbed areas and habitat enhancements. Immediate reclamation of all temporary access roads and staging areas used during construction in sagebrush habitats could help alleviate impacts to existing big game winter range. Habitat enhancements done in adjacent off-site areas could further offset winter range habitat lost during project construction. With adequate reclamation for disturbed areas and off-site habitat enhancement, loss of sagebrush habitat is not likely to affect the total population numbers of wintering deer, elk, and pronghorn in this area. Proposed seed mixes are provided in Appendix B, Standard Practices and Mitigation Measures.

They include a mixture of native grasses, forbs, and shrubs suitable for use by wildlife. Appendix B includes additional proposed mitigation measures for impacts to fish and wildlife.

Pre-construction surveys of the selected transmission line route would be conducted in order to apply mitigations and avoidance on federal lands. Surveys would be conducted for federal listed, BLM sensitive, and CDOW listed species.

BLM would require the Applicant to provide signs or construct gates if they are needed to discourage unauthorized travel along the transmission line route. BLM would require raptor perch deterrents on transmission line structures.

Earthen berms would be built on each side of the railroad tracks at locations where antelope trails cross the proposed rail line. The berms would have a maximum slope of 10 percent.

A water guzzler would be placed between the Mesa/Garfield county line and the waste rock area to mitigate impacts to chukar.

Erosion control BMPs such as silt fences, berms, catch basins, seeding, mulching, and erosion control netting would be used during construction. Further details are provided in the soils and surface water sections of this chapter.

BLM would stipulate surveys and mitigation for wetland, surface water, and riparian areas as part of the coal lease.

Natural spawning of flannel-mouth suckers occurs in Salt Creek (Martin 2007). Activities that could adversely impact the flannel-mouth spawn would be avoided from March 1 to July 31.

Wildlife crossings of the conveyor would be created by elevating the conveyor or burying it in a culvert in appropriate locations.

Raptor perch deterrents would be installed on all transmission line towers.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

Construction of the grade-separated crossing at CR M.8 could result in temporary increases in sediment and would result in the permanent removal of a small amount of vegetation at the location of the crossing.

Noiseless Crossing Traffic Control Devices

Temporary and minor impacts to vegetation would result from the installation of the noiseless crossing traffic control devices.

Transmission Line Alternative A

Alternative A is similar to the Proposed Action but differs in the route of the transmission line. In Alternative A the transmission line originates at a point north of the Xcel Energy Uintah Substation and parallels the Proposed Action transmission line until it crosses the Highline Canal. There would be approximately 6 acres of disturbance on BLM lands and less than 1 acre of disturbance on private lands (Table 4-1).

Wildlife habitat disturbance within all plant communities remains the same except for the salt desert shrub/greasewood plant community, which is less affected under this alternative. Overall impacts to wildlife and wildlife habitat would be less than the Proposed Action.

Transmission Line Alternative B

Alternative B is similar to the Proposed Action but differs in the route of the transmission line. In Alternative B the transmission line originates on the same route with the Alternative A transmission line but diverges from the Alternative A route after crossing the Highline Canal. From that point it stays to the east of Alternative A, crossing mostly BLM lands. Alternative B disturbs approximately 10 acres of habitat on BLM lands and less than 1 acre on private lands. Wildlife habitat disturbance within all plant communities remains the same except for the salt desert shrub/greasewood plant community, which is less affected under this alternative. Overall impacts to wildlife and wildlife habitat would be less than the Proposed Action.

Transmission Line Alternative C

Alternative C is similar to the Proposed Action but differs in the route of the transmission line. Alternative C follows the same route as the Proposed Action until it crosses the Highline Canal where it diverges in a northwesterly direction and ties into the railroad spur route. There is less new disturbance with this route than any of the other transmission line routes including the Proposed Action since it converges with the railroad spur corridor for 3 miles. Alternative C disturbs approximately 11 acres of habitat on BLM lands and less than 1 acre on private lands. Wildlife habitat disturbance within all plant communities remains the same except for the salt desert shrub/greasewood plant community, which is less affected under this alternative. Overall impacts to wildlife and wildlife habitat would be less than the Proposed Action.

4.2.12 Threatened and Endangered Species

No Action Alternative

Under this alternative no coal leases would be offered and no new coal mining would occur in the study area. Threatened, Endangered, and Sensitive species (TESS) resources in the study area would remain in their present condition. As a result, wildlife habitat distribution, quantity, and quality for these species would remain similar to current conditions and populations would remain similar to existing levels. TESS habitats on federal surface would continue to be subject to current low levels of use in the form of recreation and grazing. These habitats on private lands would continue to be subject to moderate to intensive management and modification.

Proposed Action Alternative

Federally Listed Threatened and Endangered Species

According to the USFWS, species on the Federal Threatened and Endangered Species list that might be affected by the project include four endangered Colorado River fish: Colorado pikeminnow (*Ptychocheilus lucius*), bonytail chub (*Gila elegans*), the razorback sucker (*Xyrauchen texanus*), and humpback chub (*Gila cypha*); the threatened Uinta Basin hookless cactus (*Sclerocactus glaucus*), the candidate DeBeque phacelia (*Phacelia submutica*); and the endangered black-footed ferret (*Mustela nigripes*).

Colorado River Fishes

These four endangered Colorado River fishes are not present in the study area, but the required effects analysis area for the fish includes the Salt Creek drainage. Any water depletions brought about by this project are governed by the programmatic biological opinion issued to the BLM for minor water depletions in the Upper Colorado River Basin, #ES/GJ-6-CO-94-F-017 (June 13, 1994). Water depletions in areas tributary to the Colorado River require consultation with USFWS as part of the Recovery Implementation Program for Endangered Fish Species in the Upper Colorado River (Recovery Program). The Recovery Program was established in 1988 to mitigate for water depletion impacts to federally-listed fish species. To ensure the survival and recovery of the listed species, water users may be required to make a payment to the Recovery Program. The payment would be required if any single incremental withdrawal volume exceeds 100 acre-feet (annual average).

The project proponent estimates a total water depletion of approximately 724 acre-feet per year. Since the CAM water right has been rarely used in the past, the entire 724 acre feet/year would be considered as new depletion. Additional requirements resulting from ongoing BLM/USFWS consultation would be included as terms of the ROW grant, and the USFWS would be issuing a Biological Opinion.

Uinta Basin Hookless Cactus

No individuals of this species were observed during field surveys and it is unlikely that habitat suitable for these plants would be disturbed during the construction of the Proposed Action or alternatives. Therefore, this species would likely not be affected by this project.

DeBeque Phacelia

No individuals of this species were observed during field surveys and it is unlikely that habitat suitable for these plants would be disturbed during the construction of the Proposed Action or alternatives. Therefore, this species would likely not be affected by this project.

Black-footed Ferret and White-tailed Prairie Dog Colonies

Active prairie dog colonies are an essential element of black-footed ferret habitat. Of the thirteen white-tailed prairie dog colonies observed within the study area, only one (Colony #1; Figure 3-23, Wildlife Observations) met the minimum criteria for potential black-footed ferret habitat. This colony was likely greater than 200 acres in extent and the estimated burrow density was 16/acre. However, it is not known whether this colony was within 4.34 miles of a similar sized colony since areas outside the prescribed study area were not surveyed by WestWater biologists.

No black-footed ferrets have been observed in the study area, and based upon the limits of the biological surveys, no potential habitat was observed. Therefore this species would likely not be affected by the loss of prairie dog habitat.

BLM Sensitive Species

According to the BLM Grand Junction Field Office, the following BLM Sensitive Species might be impacted by the proposed project: bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), burrowing owl (*Athene cunicularia*), kit fox (*Vulpes macrotis*), sensitive bats, Botta's pocket gopher (*Thomomys bottae*), midget faded rattlesnake (*Crotalus viridis concolor*), milk snake (*Lampropeltis triangulum*), long-nosed leopard lizard (*Gambelia*

wislizenii), Great Basin spadefoot (*Spea intermontana*), northern leopard frog (*Rana pipiens*), Colorado round-tailed chub (*Gila robusta*), Grand buckwheat (*Eriogonum contortum*), DeBeque milkvetch (*Astragalus debequaeus*), cliffdweller's cryptanth (*Cryptantha elata*), and Grand Junction camissonia (*Camissonia eastwoodiae*).

Bald Eagle, Peregrine Falcon, and Burrowing Owl

The project area is more than three miles from the nearest known bald eagle nests and is unlikely to have any effect on this species. Similarly, the nearest known peregrine falcon nests are 8 miles away; the project is unlikely to have any adverse effect on peregrine falcon. The project may affect burrowing owls, which are known to occur in the general vicinity. In order to minimize adverse impacts, no human encroachment would occur within 150 feet of nest sites from March 15 to October 31 (CDOW 2008). In addition to potential direct and indirect effects on the burrowing owls, the project would also affect habitat by reducing the number of prairie dog burrows on prairie dog colonies crossed by the rail alignment.

Kit Fox

No individuals or sign (dens, tracks, scat) of this species were observed during biological surveys. While no known kit fox dens would be affected, the project is within the historic range of this species and could result in some impairment of available habitat for kit fox. The railroad spur would bisect historic range, but includes more than 100 culverts that could potentially be used by kit fox. In addition, kit fox could pass over the tracks in most locations. Recreational use of construction roads after the end of construction could adversely affect kit fox through increased human activity.

Sensitive Bats

The project would result in the loss of a very small portion of the available foraging habitat for bats in the vicinity of the project. One pond would be eliminated that may provide habitat for sensitive bat species.

Botta's Pocket Gopher

Botta's pocket gopher is present along portions of the rail alignment with deep soils. The proposed project would result in impairment of a small amount of the available habitat for this species and potential loss of individuals directly in the construction area.

Midget Faded Rattlesnake and Milk Snake

No individuals of these species were observed during biological surveys of the study area; however, potential habitat for these species was observed. None the less, it is unlikely that the proposed project would affect these species.

Long-nosed Leopard Lizard

A minimum of five individuals were observed during the biological surveys. There is abundant potential habitat for the lizard in this area and the project is unlikely to result in adverse impacts to the overall population and distribution of the species. The project may result in loss of individuals and a minor decrease in the amount of available habitat.

Great Basin Spadefoot and Northern Leopard Frog

No individuals of Great Basin spadefoot were observed during biological surveys of the study area. It is unlikely that the proposed project would affect this species.

The proposed project would result in a small decrease in suitable habitat for northern leopard frog due to replacement of irrigation ditches with pipes, and losses of individuals during construction.

Colorado Round-tailed Chub

The only fish habitat affect by the proposed project would be located at the new water diversion in Mack Wash. Construction of the diversion would have minimal impacts on round-tailed chub. During operation, withdrawals of water from Mack Wash may decrease the amount and quality of available habitat in Mack Wash. Mack Wash exhibits strong seasonal fluctuations in flow associated with the irrigation season, and adverse effects of the diversion would likely be restricted to periods of low flow in winter, when withdrawal of 1 cfs could result in depletion of flow by up to 75 percent of the lowest recorded mean monthly discharge of 1.3 cfs, and up to 60 percent of the lowest monthly average of 1.7 cfs in February. The diversion would have less effect on instream habitat in Salt Creek, for which the lowest average monthly flow is 11.4 cfs in January.

Grand Buckwheat

This species is abundant within parts of the study area. In a report prepared by WestWater Engineering (WestWater 2007) it was estimated that 36.6 acres of Grand buckwheat habitat (approximately 20 acres of which is currently occupied habitat) within the salt desert shrub vegetation association would be disturbed by activities associated with the proposed project. This would result in the loss of 26,307 Grand buckwheat (with a 95 percent confidence interval of 18,047-34,567) plants extrapolated from an average density within occupied habitat of 0.33 plants per square meter.

This loss represents 2.3 percent of the Grand buckwheat population estimated from samples within a 3,064-acre "Search Area." The area of the proposed project is a small proportion of the overall range of this species and thus the number of Grand buckwheat lost during this project is likely much less than 2.3 percent of the global population.

Typically, the loss of 2.3 percent or less of a population that likely consists of over one million individuals would not be likely to be the proximal cause of the type of decline that would require listing in the foreseeable future.

However, the loss to the population may be larger than the direct effects of removing 2.3 percent of the individuals during this project. For example, there is a positive relationship between population size and fitness, and this relationship has a tendency to be stronger in rare species (Leimu et al. 2006). Others have found this relationship to be of a similar magnitude in both common and rare species (Honnay and Jacquemyn 2007). Thus, any action that results in a decrease in population size would decrease the overall population fitness. This fitness loss is the consequence of the loss of genetic material from the population. However, it may be necessary to assess the strength of this relationship experimentally for each population. Additionally, the fact that there is a reduction in fitness does not automatically mean that this reduction would result in a significant decline in population abundance.

DeBeque Milkvetch, Cliffdweller's Cryptanth, and Grand Junction Camissonia

No individuals of these species and no areas of suitable habitat were observed during the biological surveys. It is unlikely that the proposed project would affect these species.

Mine and Facilities

The mine facilities and associated structures combined with roads required for construction of the railroad spur, transmission lines, mine facilities, as well as access roads, waste rock disposal, and portal roads account for approximately 237 acres of habitat disturbance. No habitat or individuals of the above federally listed threatened or endangered species are likely to be affected by this portion of the proposed project. This area does include desert shrub, sagebrush, and piñon-juniper woodland and abundant rabbits, all of which are important components of kit fox habitat. However, no individuals or sign (dens, tracks, scat) were observed during biological surveys and it is unlikely that the proposed project would affect this species.

Railroad

The railroad spur crosses both public and private lands and is approximately 14.5 miles in length, disturbing about 213 acres. This portion of the proposed project crosses seven white-tailed prairie dog colonies and passes adjacent to two other colonies that could afford habitat for the endangered black-footed ferret. However, as noted above, no black-footed ferrets have been observed in the study area and none of the observed prairie dog colonies meets the minimum requirements for suitable habitat. Therefore this species would likely not be affected by the loss of prairie dog habitat that would result from construction of the railroad spur.

This area does include desert shrub, sagebrush, and abundant rabbits, all of which are important components of kit fox habitat. However, no individuals or sign (dens, tracks, scat) were observed during biological surveys and it is unlikely that the proposed project would affect this species.

This area includes fairly dense stands of saltbush, greasewood, rabbitbrush, and cheatgrass on clay soils, especially east of Highway 139 to the proposed facility site. A minimum of five long-nosed leopard lizards were observed within the study area during the biological surveys. This species could be affected by this portion of the proposed project. However, there exists a large amount of suitable habitat available for this species within the study area, thus it is not anticipated that the disturbance of the proposed project would affect the overall population distribution or abundance.

The distribution and abundance of the Grand buckwheat within the study area includes much of the proposed railway alignment north of the Highline Canal. Approximately 36.6 acres of Grand buckwheat habitat (approximately 20 acres of which is currently occupied habitat) within the salt desert shrub vegetation association would be disturbed by activities associated with the proposed project. This would result in the loss of 26,307 Grand buckwheat individuals. This loss represents 2.3 percent of the Grand buckwheat population estimated from samples within a 3,064-acre "Search Area." The area of the proposed project is a small proportion of the overall range of this species and thus the number of Grand buckwheat lost during this project is likely much less than 2.3 percent of the global population. The loss of 2.3 percent or less of a population that likely consists of over one million individuals is unlikely to cause the type of population decline that would require listing in the foreseeable future.

Water Pipeline

The water pipeline lies within the railroad spur ROW and therefore would not create any additional disturbance.

Transmission Line

The proposed transmission line crosses 7 miles of private land and 7 miles of public land and would disturb approximately 2.6 acres. This portion of the proposed project may include habitat for kit fox, long-nosed leopard lizard, and the Grand buckwheat. However, biological surveys have not yet been completed for this potion of the project, so it is necessary to estimate the potential impacts from aerial images of the transmission line alignment.

Approximately 70 percent of the alignment (1.82 acres) is within the salt desert shrub community that may include Grand buckwheat habitat. If all of this 1.82 acres is occupied Grand buckwheat habitat, then there would be an estimated 2,430 additional individuals removed during construction of the transmission line (assuming an average density of 0.33 plants per square meter). This high estimate represents a 9 percent increase in the estimated loss of 26,307 Grand buckwheat individuals caused by construction of the railroad alignment. During the Grand buckwheat population estimation study, approximately 55 percent of potential habitat was observed to be occupied. If this holds true in the vicinity of the transmission line, then approximately 0.99 acres of occupied habitat would be disturbed, resulting in an estimated additional 1,322 individuals removed, representing a 5 percent increase in the total Grand buckwheat loss.

Temporary Impacts

Construction activities associated with the Proposed Action alternative could impact Threatened, Endangered, and Sensitive aquatic species through changes in water quality, water withdrawals and physical habitat disturbance. Bridge construction at Mack Wash, installation of a water diversion and intake structure, and realignment of CR 10 could result in temporary increases in sediment. Sediment increases in localized areas downstream from these sites may cover substrates and reduce macro invertebrate production. Any localized increases in sediment would not affect downstream areas of the Colorado River inhabited by the four federally-listed fish species.

Water would be used for exploration, underground and surface dust control, and other mining activities and would result in depletions from Mack Wash. CAM has a 3.0 cfs absolute water right with estimated needs of 724 acre-feet per year for its mine operations. CAM expects to divert water continuously from Mack Wash at a rate of 1 cfs. Historic USGS records indicate monthly mean flow rates ranging from 1.7 to 70 cfs. There is a potential for the Proposed Action to result in little or no flow in Mack wash during low flow periods. Such events are also possible due to other water diversions upstream from the Proposed Action diversion addition of this water diversion is likely to increase the potential for little or no flow in Mack Wash.. Water depletion during low flows could impact endangered Colorado River fishes and the state-listed round-tailed chub.

Construction of water diversion structure in Mack Wash could impede fish movement and intake devices could trap Colorado River fishes. Water depletion during low flows or during the spawning and immediate post spawning period (March 1 to July 31) could impact native fishes.

Long Term Impacts

Project activities associated with the Proposed Action alternative could have the potential to affect several of the sensitive species identified by the BLM (Section 3.2.13, Threatened and Endangered Species) and State of Colorado Species of Special Concern. Project activities associated with the construction of the railroad spur and water line, transmission line, and access roads would reduce habitat effectiveness due to the presence of personnel and equipment during construction. The physical presence of the railroad spur, transmission line, and associated access roads decreases useable habitat for many wildlife species, including sensitive species. Infrastructure such as the railroad spur, transmission line, and access roads also fragment habitat, further decreasing habitat effectiveness. An increase in traffic from employee vehicles on access roads as well as the new train traffic in the study area would have the potential to cause more wildlife collisions resulting in the death of animals. The increased traffic from trains and vehicles combined with the roads and train tracks themselves would also act as barriers to safe movement for wildlife. While movement of wildlife can still occur, loss of wildlife due to collisions would occur as animals attempt to cross the roads while moving from habitat to habitat. Of the sensitive wildlife species identified by the BLM, only the long-nosed leopard lizard was noted during the surveys. Because of the large amount of suitable habitat present within the study area it is not anticipated that the number of acres disturbed by this project would affect this species.

The completion of the railroad may result in the fragmentation of the Grand buckwheat population. Habitat fragmentation has significant effects on reducing effective population size and population genetic diversity (Honnay and Jacquemyn 2007). However, whether the project disturbance would lead to isolation of parts of the population is unknown and depends on certain aspects of Grand buckwheat biology that have not been investigated. One piece of evidence found during the recent study (WestWater 2007) is suggestive that the Grand buckwheat is sensitive to population size. The two smaller areas of occupied habitat both had significantly lower population densities than what was found in the larger areas of occupied habitat. The loss of 2.3 percent or less of a population that likely consists of over 1 million individuals is unlikely to cause the type of population decline that would require listing in the foreseeable future.

Mitigation Measures

Endangered and Sensitive Fish Species

Because the project involves water depletions to the Upper Colorado River system, formal consultation would be required under Section 7 of the Endangered Species Act for impacts to the four endangered Colorado River fishes. Mitigation would be governed by the programmatic biological opinion for minor water depletions in the Upper Colorado River Basin, #ES/GJ-6-CO-94-F-017 (June 13, 1994) and would involve a one-time payment to the Upper Colorado River Recovery Program. The USFWS would issue a Biological Opinion for this project.

BMPs to contain and reduce sediment discharge into Mack Wash and other drainages would minimize impacts to aquatic species. Netting would be placed over open wastewater containment areas to preclude exposure of migratory birds to increased selenium concentrations, as well as any hazardous materials, especially petroleum products. Bridges would be installed to decrease further aquatic and riparian impairment created by stream crossings.

Construction of water diversion structures that do not impede fish movement and placement of 0.25-inch screens on water intake devices to preclude entrainment of fish would reduce impacts to the native fishery.

Withdrawing water during the irrigation season at high flows and storage of water for later use during low flows periods and during fish spawning would reduce water depletion impacts to the fishery.

Grand Buckwheat

Given the lack of definitive evidence that there would be, or would not be, significant project impacts on Grand buckwheat, a number of practices should be implemented in order to minimize and/or mitigate these potential impacts. These practices include:

1. Collect seeds each fall prior to and during the project, to be stored and used during reclamation and revegetation following project completion.
2. Separate and reserve the top 1 to 3 inches of soil from areas of high Grand buckwheat density at the initiation of ground disturbing activities. This volume of soil would contain the seed bank. Since the longevity and viability of Grand buckwheat seeds is unknown, this practice may result in more useful seeds. Separating and reserving the top 12 inches of soil dilutes the seedbank and thus does not serve as an adequate mitigation practice.
3. Aggressively control weeds in areas of potential habitat. During the baseline study it was found that Grand buckwheat was absent from plots with greater than 50 percent cover of cheatgrass or where two or more weeds each comprised over 3 percent cover.
4. Investigate whether Grand buckwheat individuals tolerate disturbance and regenerate from broken branches as do some other species in the genus.
5. Investigate whether Grand buckwheat individuals can be successfully transplanted by digging up and moving some individuals that are found within the proposed project disturbance area.
6. Perform follow-up monitoring adopting the sampling protocols of the baseline study (WestWater 2007). Those study plots should be relocated and sampled periodically to identify trends in the population numbers. It may be necessary to identify additional plots if an objective is to assess whether trends in abundance in the fragmented areas differs from trends in the larger, intact occupied habitat areas.

Other Species

Impacts that could affect potential prey base for the black-footed ferret and kit fox could be reduced by avoiding construction during the prairie dog breeding season between March 1 and June 15. This would reduce impacts to prairie dogs inhabiting railroad spur crossings or adjacent areas. Young and adults would be more mobile after June 15 and able to relocate themselves to avoid construction equipment.

Raptor perch deterrents would be installed on all transmission line towers to prevent increased predation on kit fox, prairie dogs, and other species, and to protect raptors from electrocution.

The project would follow CDOW's *Recommended Survey Protocol and Actions to Protect Nesting Burrowing Owls* (CDOW 2007), which includes pre-construction surveys where

construction would occur between March 15 and October 31, and avoidance of construction within 150 feet of active burrowing owl burrows.

All construction-related temporary roads and trails would be reclaimed as quickly as possible after construction and BLM would post signs, construct gates, and patrol to discourage use of reclaimed access areas. This mitigation would benefit kit fox, long-nosed leopard lizard, and other species.

Pre-construction surveys of the selected transmission line route would be conducted in order to apply mitigations and avoidance on federal lands. Surveys would be conducted for federally listed, BLM sensitive, and CDOW listed species.

Appendix B, Standard Practices and Mitigation Measures, includes additional proposed mitigation measures for impacts to threatened and endangered species.

Alternatives Carried Forward for Further Consideration

Grade-Separated Crossing at CR M.8

In this alternative, an overpass for CR M.8 would be constructed over the railroad spur. This would result in an additional 3.3 acres of long term impacts, including 2.97 acres of Residential/ Agricultural lands and 0.33 acres of wetlands. No additional impacts to TESS are anticipated.

Noiseless Crossing Traffic Control Devices

There would be no additional ground disturbance as a result of this alternative, thus there would be no change in the impacts to threatened and endangered species if this alternative is adopted.

Transmission Line Alternative A

Alternative A is similar to the Proposed Action alternative but differs in the route of the transmission line. This alternative reduces the amount of salt desert shrub vegetation disturbed by the project by 73 percent to 0.49 acres. Because this represents potential Grand buckwheat habitat, this alternative may result in a decrease in total impacts to this species. Assuming 55 to 100 percent of this vegetation association is occupied habitat (see discussion of this in the Transmission Line section) then 360 to 654 Grand buckwheat individuals may be removed during construction of this alternative.

Disturbance of other vegetation associations remains nearly the same for this alternative. Overall, impacts to TESS and their habitats would not differ greatly from the Proposed Action alternative.

Transmission Line Alternative B

Alternative B is similar to the Proposed Action alternative but differs in the route of the transmission line. This alternative reduces the amount of salt desert shrub vegetation disturbed by the project by 12 percent to 1.6 acres. Because this represents potential Grand buckwheat habitat, this alternative may result in a decrease in total impacts to this species. Assuming 55 to 100 percent of this vegetation association is occupied habitat (see discussion of this in the Transmission Line section) then 1,175 to 2,137 Grand buckwheat individuals may be removed during construction of this alternative.

Disturbance of other vegetation associations remains nearly the same for this alternative. Overall, impacts to TESS and their habitats would not differ greatly from the Proposed Action alternative.

Transmission Line Alternative C

Alternative C follows the same route as the Proposed Action alternative until it crosses the Highline canal where it diverges in a northwesterly direction and ties into the railroad spur route. There is less new disturbance with this route than any of the other transmission line routes including the Proposed Action transmission route since it converges with the railroad spur corridor for 3.4 miles. This alternative reduces the amount of salt desert shrub vegetation disturbed by the project by 21 percent to 1.43 acres. Because this represents potential Grand buckwheat habitat, this alternative may result in a decrease in total impacts to this species. Assuming 55 to 100 percent of this vegetation association is occupied habitat (see discussion of this in the Transmission Line section) then 1,050 to 1,910 Grand buckwheat individuals may be removed during construction of this alternative.

Disturbance of other vegetation associations remains nearly the same for this alternative. Overall, impacts to TESS and their habitats would not differ greatly from the Proposed Action alternative.

4.3 SHORT TERM USE VS. LONG-TERM PRODUCTIVITY

This section describes the relationship between short term uses of the environment and the maintenance and enhancement of long term productivity (40 CFR 1502.16). Short term uses are impacts to the environment that generally occur on a year-to-year basis during construction and operation of the mine and facilities (e.g., water use). Long term productivity is the ability of the land to provide resources for the future, based on reclamation measures and long term management objectives. The local short term impacts and uses of the resources by the Proposed Action are consistent with the maintenance and enhancement of long term productivity for the project area.

Relationships between short term uses of the environment and long term productivity occur in many resource areas. An example is the removal of vegetation from sites within the project area, thus preventing the vegetation from being used for forage by livestock and wildlife. However, after reclamation, the vegetation would re-establish and return to its previous use, and the long term productivity of the vegetation would not be altered.

Short term uses of the Proposed Action include:

- Land Ownership and Use – temporary use of land during construction and operation
- Grazing – temporary removal of vegetation during construction prevents livestock from foraging. Fragmentation of habitat due to the rail corridor may occur but is unknown at this time.
- Wilderness and Special Designations – during the construction period, part of the North Fruita Desert SRMA would be temporarily disturbed
- Recreation – during the construction period, several recreational trails within the North Fruita Desert SRMA would be temporarily disturbed

- Socioeconomics – economic benefits due to project construction and operation, railroad noise, loss of property values along the railroad corridor, loss of rural values due to industrial facilities
- Transportation – traffic delays at CR M.8 and CR 10 due to railroad crossing; detour at railroad crossing of SH 139 during construction; increased railroad traffic through the valley
- Utilities – construction and operation of transmission lines, water pipelines, and railroad
- Visual – visual impacts due to physical alteration of the land (i.e., benches, railroad, waste rock pile)
- Air Quality – increased air emissions from construction and operation of the mine
- Geology and Minerals – removal of coal from the lease area
- Soils – disturbance of soils during construction
- Groundwater – dewatering of groundwater during mining
- Surface Water – use of surface water during construction, operation, and maintenance
- Vegetation – disturbance to vegetation during construction
- Wetlands and Riparian – temporary impacts to wetlands and riparian areas during construction
- Fish and Wildlife – removal of water from Mack Wash may impact fish and removal of vegetation may impact wildlife forage and habitat. Disruption of travel corridors and migration routes may occur due to the railroad corridor, the transmission line, and mine facilities
- Threatened and Endangered Species – water depletion in Mack Wash may affect Colorado River Fishes habitat

Productivity of many resources would be restored upon closure of the mine, removal of infrastructure, and after revegetation/reclamation efforts. Long term productivity includes:

- Land Ownership and Use – return of land to previous land use
- Grazing – areas removed from grazing may be restored after revegetation. A permanent loss of 1 percent of forage would occur.
- Wilderness and Special Designations – removal of project features would return impacted areas of the North Fruita Desert SRMA to prior use
- Recreation – removal of project features would allow for impacted trails in the North Fruita Desert SRMA to be re-used
- Socioeconomics – decrease in local economic stimulation, restoration of property values and rural values upon removal of the railroad corridor
- Transportation – removal of traffic disturbance due to railroad crossings
- Air Quality – air emissions would cease
- Soils – soils would be reclaimed and revegetated

- Groundwater – bedrock groundwater would no longer be pumped after mine closure
- Surface Water – water depletions would cease in Mack Wash
- Vegetation – vegetative cover would re-establish, thus restoring forage and wildlife habitat
- Fish and Wildlife – forage and habitat would be restored
- Threatened and Endangered Species – due to the lack of water depletions in Mack Wash, Colorado River Fishes habitat would not be impacted

Short term uses of resources would irretrievably commit certain resources. This is discussed in more detail in Section 4.4, Irreversible and Irretrievable Commitment of Resources.

4.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The BLM must consider if the effects of the Proposed Action and alternatives cannot be changed or are permanent (that is, the impacts are irreversible). The BLM must also consider if the impacts on resources would mean that once gone, the resource could not be replaced; in other words, the resource could not be restored, replaced, or otherwise retrieved (NEPA §102(c)(v)).

Irreversible resource commitments are those that can not be undone, except perhaps in the extreme long term. This applies primarily to non-renewable resources or those resources that are renewable only over long periods of time. Irretrievable resource commitments are those that are lost for a defined period of time. This applies primarily to resources that would be lost during the 30 year life of mine.

The irreversible and irretrievable effects of producing coal from the Red Cliff Mine would be minimal.

4.4.1 Resources Not Requiring Irreversible and Irretrievable Commitment of Resources

The following resources do not require irreversible and irretrievable commitment of resources: recreation, wilderness and special designations, transportation, utilities, noise, hazardous materials, health and safety, air quality, and floodplains.

4.4.2 Irreversible and Irretrievable Resource Commitments

Land Ownership and Use

After the project is completed, the mine, facilities, and all utilities associated with the project would be decommissioned and reclaimed, as feasible.

Irreversible commitment of resources would arise from construction of benches for the mine facilities, cutting of rock for the railroad corridor, and the waste rock disposal area. Under the Proposed Action, permanent benches would be constructed in the coal leasing area for facilities associated with the mine, existing land would be cut up to 90 feet in some areas, and a waste rock pile of approximately 190 acres would be created. These areas would not return to their current land use upon closure of the mine, as the topography of the land would be permanently altered and the land would not be able to be returned fully to its previous state before construction of the mine.

Grazing

Temporary loss of forage may result during construction and operation of the mine. Less than one percent of the forage in the affected grazing allotments would be permanently lost.

Socioeconomics

After the project is completed, the railroad corridor would be decommissioned and reclaimed. Any decrease in property values along the railroad corridor would be restored to previous values, depending on market conditions. Loss of rural values due to the industrial corridor would be restored upon removal of the railroad.

Visual

Temporary visual impacts may result during the construction phase of the project; once vegetation re-establishes, visual quality would return to its previous state.

Benches carved from rock at the mine site, cutting of rock for the railroad corridor, and the waste rock pile would result in irreversible visual impacts. Visual impacts may also result from subsidence.

Cultural Resources

Any disturbance of cultural resource sites could result in an irreversible commitment of resources. However, there are no projected impacts to cultural resources.

Geology and Minerals

The mining of the coal from the lease tract would be an irretrievable use of the coal resource. However, the extraction of the coal would make the resource available for use by society. Care in underground mine planning should be taken in order to avoid an irretrievable loss of possible future coal resources located adjacent to the proposed coal lease.

Some gas resources located in the lease area would be lost due to the coal recovery and venting of methane. Depending on the location of the underground disturbance, some gas recovery may be feasible during or following the conclusion of mining. Under the Proposed Action, the methane resource would be lost.

Paleontology

Any disturbance of paleontological resource sites could result in an irreversible commitment of resources. However, if discovered prior to the physical loss, research values could be preserved for use in interpreting the fossil record. There are no projected impacts to paleontological resources.

Soils

Disturbance to soils would occur during construction; topsoil would be retained and temporary construction areas would be reclaimed.

The cut areas for railroad and access road construction are disturbed areas that would not be reclaimed.

Groundwater

Bedrock groundwater would be pumped from the mine; upon mine closure, groundwater would not be pumped.

Surface Water

Over the life of the project (30 years), water would be withdrawn from Mack Wash. Upon mine closure, water would no longer be withdrawn.

Vegetation

Disturbance to vegetation would occur during construction. Temporary construction areas would be revegetated and reclaimed.

Wetlands and Riparian

Wetlands and riparian areas would be impacted in the long term as a result of railroad construction and operation. After removal of the railroad and reclamation/revegetation, the wetland and riparian areas would be restored to their original productivity.

Fish and Wildlife

Temporary loss of vegetation may result during construction and operation of the mine, possibly resulting in loss of wildlife habitat and forage. Once vegetation re-establishes, wildlife would be able to use the area.

Threatened and Endangered Species

Temporary water depletions may occur in Mack Wash; this may potentially affect the Colorado River Fishes habitat in Mack Wash. Upon closure of the mine, depletions would not occur in Mack Wash due to this project.

Mine Construction and Operation

Construction and operation of the mine and associated facilities was not addressed previously in the document as a resource, as aspects of construction and operation are addressed within many different resources. In this case, the act of constructing the mine and associated features contains several irreversible and irretrievable commitments of resources:

- Commitment of labor and energy during construction, including the consumption of fossil fuels associated with the use of construction equipment.
- Commitment of labor and energy during operation, including the consumption of fossil fuels associated with the use of mining equipment and facility operations.

- Use of materials required to construct the project infrastructure, including aggregate, cement, and petroleum products, and metals for the rails.
- Temporary disturbance to vegetation, soils, and wildlife habitat.
- Visual impacts.
- Impacts to gas resources as previously described.

4.5 CUMULATIVE IMPACTS

4.5.1 Methodology

This section provides an analysis of the cumulative impacts of past, present, or reasonably foreseeable projects on various natural and human resources. Cumulative impacts may result when the environmental impacts associated with a proposed project are added to temporary or long term impacts associated with past, present, or reasonably foreseeable future projects. Although the individual impact of each project might not be significant, the additive impacts of multiple projects could be.

4.5.2 Actions Considered for the Cumulative Impact Analyses

Energy development has recently experienced rapid growth in the west due to market conditions and national energy policy. Due to the abundance of natural gas and mineral resources in northwest Colorado, this area has experienced unprecedented growth in resource extraction. Actions considered for this cumulative impact analysis are those actions related to mining and energy development in northwest Colorado, and effects of projected population growth on residential and commercial development and traffic increases. The cumulative impact analysis area is defined as Mesa and Garfield counties, where the mine and facilities would be located unless stated otherwise.

The potential cumulative impacts of climate change on the project and the project's contribution to global climate change are discussed by resource within this section. The assessment of impacts of climate change has not been formalized, and it is not yet possible to quantify the net impact of climate change with confidence, therefore cumulative impacts of climate change would be discussed qualitatively. While impacts of global climate change are likely to be most evident in Polar Regions, the causes of global climate change and the contribution of emissions from fossil fuels to those causes are global in scope. Consequently, mining and energy development activities in northwest Colorado need to be viewed in that context. In 1990, fossil fuel combustion produced 78 percent of all GHG emissions in the state and in 2015 is estimated to produce 87.2 percent of Colorado's GHG emissions (CDPHE 1998).

Past Projects

Mesa and Garfield counties are historic mining counties. Commodities mined in the past include coal, copper, radium, uranium, vanadium, oil shale, and marble. Several towns in these counties were founded in support of the mining industry.

Mesa County was Ute Indian Territory until 1881 when the area was opened up for immigrants. Mining has been prevalent in Mesa County since 1882 (Mesa County 1996). There are several boom-and-bust cycles of oil shale development in the history of Mesa County. Oil shale was first discovered in 1917, and the boom faded in 1925. Other booms were short-lived during the 1940s and in 1957. In the 1970s new technology fueled a regional boom that lasted until 1983 (Mesa County 1996).

Mesa County has a long history of copper, radium, vanadium, and uranium mining (Mesa County 1996). Copper was mined in the Unaweep area between 1899 and 1902. Radium was recovered from the early 1900s to 1923. Vanadium was mined near Loma and Gateway in the 1940s, and uranium was mined in the late 1940s and early 1950s.

Garfield County has a history of coal mining since the late 1800s (Crook and Cullen n.d.). Marble was historically mined near the town of Marble, and coke was produced from coal in coke ovens near Glenwood Springs. Oil shale also saw a boom in the 1970s and early 1980s in Garfield County; Battlement Mesa was founded by Exxon in the early 1980s during the most recent oil shale boom (Crook and Cullen n.d.).

Table 4-10, Historical Mine Permits – Mesa and Garfield Counties, Colorado, lists a summary of historical mining permits in Mesa and Garfield counties prior to 1974.

Table 4-10
HISTORICAL MINE PERMITS
MESA AND GARFIELD COUNTIES, COLORADO

Commodities Mined	Permit Acreage
Mesa County	
Coal	0
Sand and gravel	1,205.9
Gravel	56.7
Sandstone	9.0
Quartz	5.0
Borrow material for construction	78.9
Uranium	18.5
Uranium, vanadium	202,143.8
Vanadium	0.3
Garfield County	
Coal	0
Oil shale	10,103.0
Sand and gravel	810.6
Gravel	19.0
Borrow material for construction	14.0
Sandstone	7.4

Source: Colorado Division of Reclamation Mining and Safety. No date.
Note: Data is comprised of expired mining permits prior to 1974.

Present and Reasonably Foreseeable Future Projects

Resource extraction continues to be prevalent in Mesa and Garfield counties. Current activities include natural gas extraction; coal mining; oil shale mining; sand and gravel mining; borrow material for construction mining; and minimal mining of gold, quartz, granite, limestone, and uranium.

Energy activity within Mesa and Garfield counties has grown significantly, particularly relating to natural gas. Garfield County is currently the third largest producer of natural gas in Colorado (Garfield County 2002). Garfield County has processed the highest number of APDs in 2007, with a total of 2,550 permits processed (40 percent of the total for the state), and Mesa County is sixth in the state, at 293 permits processed (5 percent of the total for the state) (COGCC 2007). Six major Conditional Use Permit requests were reviewed by the Mesa County Board of County Commissioners in 2007 for pipelines, compressor stations, and processing facilities needed to refine and transport natural gas (Mesa County 2007b).

It is projected that Garfield County well development would continue forward at a fairly consistent rate of about 1,000 wells per year over the next 10 to 15 years. Given about 3,900 wells at present, the projected total is between 15,000 to 20,000 wells in the county by 2022 (Garfield County 2007). Estimates of surface disturbance associated with oil and gas development approximate the surface disturbance associated with each well pad at 3 acres, and the disturbance associated with the access roads at 4 acres per mile, with an average of 5 miles of access road for each well pad (BLM 2007). Using these estimates, the associated range of disturbance for the projected total is between 345,000 and 460,000 acres of disturbance.

Several commodities are currently mined in Mesa and Garfield counties. There are currently four active (not producing) coal permits in Mesa County, and five active (four out of five are not producing) coal permits in Garfield County. To date, four coal mine applications are under review in Mesa County.

Table 4-11, 2007 Coal Production in Colorado, lists the current producing coal mines in Colorado and the amount of coal produced from each mine in 2007. The MCM is the only producing mine in the project area; this mine is located approximately 3 miles north of the proposed Red Cliff Mine. Between January and December 2007, over 36 million tons of coal was extracted in Colorado (Colorado Division of Reclamation, Mining, and Safety 2008).

Table 4-11
2007 COAL PRODUCTION IN COLORADO

Mine Name	County	Production (tons)
Bowie # 2 Mine	Delta	5,480,571
McClane Canyon	Garfield	247,120
Elk Creek Mine	Gunnison	4,823,662
West Elk Mine	Gunnison	6,893,096
King Coal Mine	La Plata	462,736
King II Mine	La Plata	7,434
Colowyo Coal Mine	Moffat	5,621,924
Trapper Strip	Moffat	2,477,549
New Horizon Mine	Montrose	406,279

Table 4-11
2007 COAL PRODUCTION IN COLORADO

Mine Name	County	Production (tons)
Deserado	Rio Blanco	1,424,019
Foidel Creek Mine	Routt	8,290,894
	TOTAL	**36,135,284**

Source: Colorado Division of Reclamation, Mining, and Safety 2008
Note: Total production is from 1/2007 through 12/2007.

Figure 4-14, Counties with Active Coal Production in Colorado, shows the counties in Colorado that currently contain producing coal mines. With the exception of La Plata County, all of the currently producing coal mines are located in northwest Colorado. The National Mining Association (NMA) expects that, over the long term, coal production and use would frequently set annual records (NMA 2007). It is reasonably foreseeable that coal mining would continue in northwest Colorado.

Mesa and Garfield counties have numerous active sand and gravel permits. Both counties have a small number of borrow material for construction and sandstone permits. Mesa County has one active gold permit, one active quartz/granite permit, and one application in review for uranium mining. Garfield County has several active oil shale permits, limestone permits, and one application in review for gravel. See Table 4-12, Active Mine Permits – Mesa and Garfield Counties, Colorado, for acreage totals for all active mine permits in Mesa and Garfield counties.

Table 4-12
ACTIVE MINE PERMITS
MESA AND GARFIELD COUNTIES, COLORADO

Commodities Mined	Permit Acreage
Mesa County	
Coal	10,114.0
Sand and gravel	4,216.6
Gravel	323.5
Borrow material for construction	96.1
Sandstone	8.4
Gold	5.0
Quartz, granite	9.3
Garfield County	
Coal	3,678.5
Oil shale	6,192.8
Sand and gravel	2,247.6
Gravel	86.7
Borrow material for construction	9.8
Sandstone	3.3
Limestone	68.0

Source: Colorado Division of Reclamation Mining and Safety. No date.

It is reasonably foreseeable that energy development activities would continue in Mesa and Garfield counties due to increasing energy prices and the Energy Policy Act's (2005) objective to increase production of domestic coal reserves. When final figures are calculated, it is predicted that the total number of APDs processed in Colorado in 2007 would be approximately 6,280, which represents a 4 percent increase from the number of APDs approved in 2006 (COGCC 2007). Annual APDs increased by 1,592 percent in Garfield County between 1996 and 2006, and APDs increased by 2,309 percent in Mesa County over the same time period (COGCC 2007) (see Table 4-13, Annual Applications for Permit to Drill). Mining experienced the largest growth in employment in Mesa County between 2004 and 2005, rising 50.1 percent (Colorado Department of Labor and Employment 2006). It is projected that the support activities for mining industry in Mesa County would grow 53.2 percent between 2004 and 2014 (Colorado Department of Labor and Employment 2007 as cited in Mesa County 2007b).

Table 4-13
ANNUAL APPLICATIONS FOR PERMIT TO DRILL (APDs)

County	1996 APDs	2006 APDs	Percent Increase
Garfield	109	1,845	1,592
Mesa	11	265	2,309

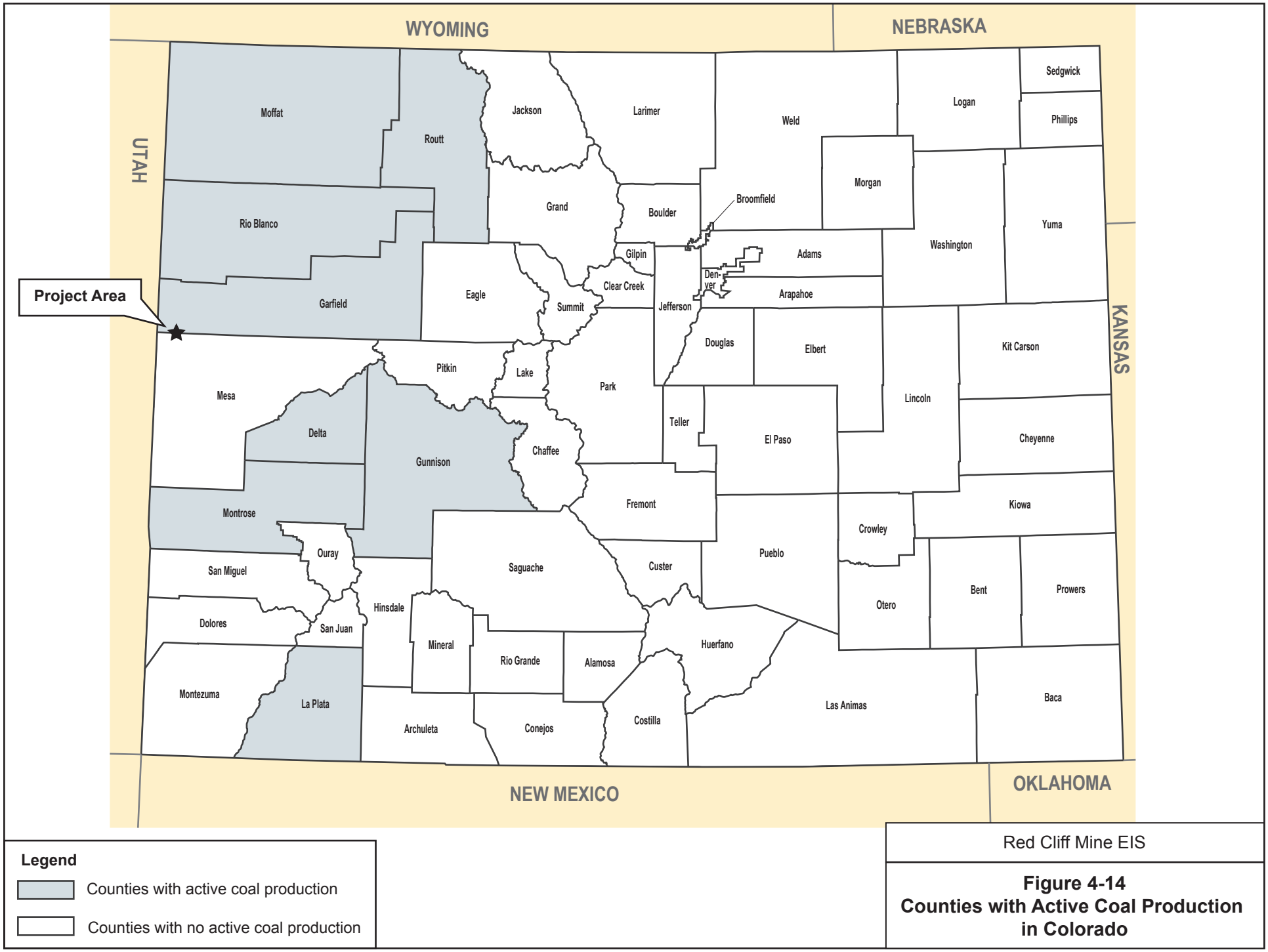
Source: Colorado Oil and Gas Conservation Commission, 2007
Note:
APD = Application for Permit to Drill

Other than CAM's application, there are currently no formal plans or applications for coal leasing before the BLM near the project area. Additional NEPA documentation would be required on any applications submitted.

As a result of the energy boom, land use and development is growing in Mesa and Garfield counties. Within the project area in Mesa County, there are approximately 20 active development applications for residential, commercial, and agricultural development as of mid-2008 (Mesa County 2008a). There are no major highway projects planned in Mesa County within the project area (Mesa County 2008a).

Outside of the project area, there are approximately 125 development applications in Mesa County for small developments, and CDOT is planning minor improvements to I-70 and minor road and bridge improvements within Mesa County. A permit was approved by Mesa County in 2007 to reopen two underground uranium mines near Gateway, approximately 40 miles south of the project area (Mesa County 2008b).

Garfield County issued approximately 650 building permits between January 2007 and May 2008, none of which occur in the project area (Edinger 2008). According to CDOT (2008), there are four construction projects planned for Garfield County in 2008, none of which are within the project area.



Legend

Counties with active coal production

Counties with no active coal production

Red Cliff Mine EIS

Figure 4-14
Counties with Active Coal Production in Colorado

This page intentionally left blank

4.5.2.1 Cumulative Impacts by Resource

Resources Not Evaluated for Cumulative Impacts

The project area is not located in any areas of critical environmental concern; designated, eligible, or potentially eligible wild and scenic rivers; prime or unique farmlands; or wilderness areas. This project would not significantly contribute to climate change impacts to these areas.

There would be no effects on wild horses or burros, health and safety, or hazardous materials. Since any impacts to wetland or riparian areas would be mitigated and there would be no net loss, there would be no contribution to cumulative effects for these resources.

Land Ownership and Use

Past Land Use Cumulative Impacts

Historic Mesa and Garfield counties were largely based on farming, ranching, and mining; this trend continues today.

According to the Loma/Mack Area Plan (Mesa County 2004), Loma began as an agricultural center and saw two periods of growth in the 1910s and the 1930s. Mack was established as a company town for railroad and asphalt workers.

Western Garfield County, where the project area is located, is largely unpopulated, and historic land use includes farming, ranching, and mining.

Present and Future Land Use Cumulative Impacts

Much of the land in Garfield County within the project area is public land managed by the BLM; there are few privately owned parcels. Land ownership in Mesa County within the project area is public land managed by the BLM, state, and private ownership. BLM manages lands in and around the project area for livestock grazing, drilling, wells, range management, wildlife habitat, watershed protection, tourism, and recreation.

Land use in the project area within Garfield County is largely BLM-managed activities, including livestock grazing, mining, and recreation. There are few private holdings used for farming and ranching. Land in the project area is currently zoned open space and resource lands within Garfield County.

Land use within the project area in Mesa County is primarily farming, ranching, recreational, and residential; with residential and commercial in Mack and Loma. Land is zoned agricultural, forestry, transitional district in the project area in Mesa County, with the exception of Mack and Loma, which have various residential, commercial, and industrial zoning districts.

The project area outside of Mack and Loma is sparsely populated, and private land is used primarily for agriculture. Highline Lake State Park is within the project area, and is managed by the CSPs for recreation. The project area north of the Highline Canal is largely unpopulated, as the majority of land is managed by BLM. Much of this land is within the North Fruita Desert Area, and is managed for recreation.

CR M.8 and SH 139 are the main transportation corridors within the project area.

Future land use in the project area includes an increase in recreation and resource extraction.

Residents of Loma and Mack desire two distinct community cores with mixed use business and services, and higher-density residential development. As distance from the core increases, residential densities should decrease, and business and commercial services should be restricted or prohibited entirely (Mesa County 2004). Mesa County acknowledges the value of open lands and encourages the preservation of open land, not only for the maintenance of the County's economy, but also for the assurance of the continued availability of land for food production, the enjoyment of scenic beauty, recreation, and natural resource usage (Mesa County 1996).

Mesa County Zoning Regulations regulate mineral extraction as a conditional use in the AFT. Conditional uses are not considered a right by ownership. Conditional uses must meet certain established criteria, including compatibility with surrounding land uses, adequacy of design, and available public services (Mesa County 2000).

At present, Mesa County plans to improve road safety by bringing county roads up to standards for ROWs, building road connections when appropriate and feasible, and maintaining the railroad corridor (Mesa County 2004).

Mesa County is projected to have a 66 percent increase in mining, a 124.3 percent increase in support activities for mining, and a 137.8 percent increase in oil and gas extraction between 2006 and 2016 (Colorado Department of Labor and Employment 2008).

Cumulative land use impacts in Garfield County in the project area in the future may include increased recreation and resource extraction. Most of the population centers are in eastern Garfield County, in Glenwood Springs, Rifle, and Carbondale. Much of eastern Garfield County has become bedroom communities to support the growing ski industry in Aspen (in Pitkin County) (Crook and Cullen n.d.). Garfield County anticipates development of recreational opportunities for summer and winter sports including fishing, hunting, hiking, back country skiing, various forms of shooting sports, and other forms of recreation on both public and private lands (Garfield County 2002). Currently, BLM has no plans for recreational development in Garfield County.

A developing trend in western Garfield County is small scale "dude ranches" and private fishing retreats. The proximity of the lower Douglas and Baxter Pass areas to the growing Grand Junction area, coupled with the kinds of up-scale retreats being developed in nearby Eagle and Routt counties as a trend, suggests that there may be pressure in the future to develop scenic bottom lands with water rights into small scale resorts and tourism activity centers (Garfield County 2002). The variety of attractions and geography/geology of the area probably also lends itself to the development of some small eco-tourism and place-based topical field trip opportunities in the future (Garfield County 2002). Informal recreation activity is a growing concern in the area as nearby population pressures increase (Garfield County 2002).

Currently, Garfield County acknowledges ROWs, public access, and all-terrain vehicle use on county roads as potential current and future cumulative land use impacts (Garfield County 2002). Future transportation projects include general road maintenance and improvements (Garfield County 2002). Long-range transportation planning issues would include regulatory issues, ROWs, and communication strategies with specialized user groups (Garfield County 2002).

Garfield County anticipates an increase in natural gas extraction and other resource extraction. As previously mentioned, Garfield County expects a peak natural gas workforce in 2017 (Garfield County 2007).

Global Climate Change Cumulative Impacts to Land Use

While this project would not significantly increase CO_2 concentrations in Colorado, it may contribute to climate change when combined with other projects in the area.

Global climate change may affect land use in the project area and vicinity. The potential effects of global climate change could alter water supply, food security, sea level fluctuations, increasing levels of ultraviolet radiation, and natural variances in the ecosystem (ACIA 2004). This may result in a change to land use if the current natural system changes. For example, if net precipitation levels decrease and soil moisture drops, the consequences to selected Colorado crops and livestock could be moderate to severe, especially along the western slope (CDPHE 1998), and current agricultural lands may no longer be suitable for their current land use.

Cumulative Impacts of Land Use on Global Climate Change

Previous land use, including energy extraction, mining, and energy development, may have contributed to global climate change. The history of agriculture and rangeland land use in the cumulative impact area may have contributed to global climate change. Agriculture may contribute to global climate change through farm machinery emissions. However, modification to grazing practices, such as rotational grazing, may lead to GHG reductions through soil carbon sequestration and may affect emissions of methane and nitrous oxide (N_2O) (EPA 2006).

Grazing

The cumulative impact area is defined as the project area. Some of the acreage lost to energy development would diminish the amount of available grazing lands. The contribution of this project would result in approximately 452 acres of vegetation disturbance and lost livestock forage within BLM grazing allotments. Since the forage loss is such a small portion (<0.2 percent) of the 9,928 active AUMs available on the allotments, the contribution to overall cumulative loss is insignificant.

Global Climate Change Cumulative Impacts to Grazing

There is potential for global climate change to impact rangelands. The combination of increases in CO_2 concentration, in conjunction with changes in rainfall and temperature, were found to be likely to have significant impacts on rangelands, with production decreases in semiarid regions (Easterling et al. 2007). This may result in result in reductions of forage quality and palatability, possibly leading to compounding feed problems (CDPHE 1998). Where low nutritional production from rangelands is already a chronic problem, this effect could be pronounced (CDPHE 1998).

In the event that climate change was to lead to upward transition of altitudinal zones in the mountain ranges, growing seasons in the mountains would likely be longer. An earlier growing season in the mountains could make it possible for ranchers to move their livestock into the higher-elevation ranges, while a later fall could allow them to bring their animals out later. The result could be a longer summer grazing season (Wagner 1998).

Cumulative Impacts of Grazing on Global Climate Change

As stated in Section 4.1.1, Land Ownership and Use, historical rangeland management practices in the cumulative impact area may sequester carbon and other GHGs.

Recreation

The cumulative impact area is defined as the project area. Cumulative impacts to recreation would be minimal, as the amount of land removed from recreation is negligible compared to the total acreage of recreational lands in the project area.

Global Climate Change Cumulative Impacts to Recreation

Many types of outdoor recreation are weather-dependent. Snowpack is the basis for the skiing industry and other winter recreation, while snowmelt and runoff provide water for summer recreational use.

Changes in precipitation and temperature regimes may either positively or negatively impact different sectors of the recreation industry. For example, the skiing industry would be negatively affected by a shorter skiing season due to early- and late-season rains. On the contrary, an earlier snowmelt might positively affect the rafting industry, allowing river tours to begin earlier in the year.

Wildlife provides the basis for fishing, hunting, and other sectors of the recreation industry. Wildlife-associated recreation attracted over 3.5 million hunters to the Rocky Mountain Region in 1996, an average of 48 percent of our population (USFWS 1997 as cited in Toweill 1998).

Cumulative Impacts of Recreation on Global Climate Change

Cumulative impacts of recreation on global climate change include automobile emissions of recreationists traveling to recreation areas, and emissions due to OHV and other recreational vehicle use.

Socioeconomics

The cumulative impact assessment area for socioeconomics includes Mesa and Garfield counties, since most of the new employment and population produced by the Proposed Action would be resident in Mesa County, and because both Mesa and Garfield counties would receive tax and royalty revenue generated by this project. Mesa County's employment, income, and population have all been growing rapidly in the recent past, largely the result of two factors: the county's emergence as the regional support and service center for oil and gas development in western Colorado and the popularity of the area for relocating retirees.

The county's population grew at a rate of over 2 percent annually from 2000 to 2005, and that rate is expected to continue. The 2010 population is projected at 144,711; the year 2015 population at 162,268. The potential population increase of 814 attributable to the Proposed Action would represent about 5 percent of the growth that Mesa County is expected to have between 2010 and 2015.

The unemployment rate in Mesa County decreased from approximately 6.5 percent in January 2004 to 4.8 percent in January 2006 (Colorado Department of Local Affairs 2007). The unemployment rate in Garfield County decreased from 4.4 percent in 2004 to 2.2 percent in September 2007 (On Board LLC 2008). The total natural gas workforce operating in Garfield County is projected to peak at about 5,300 workers in approximately 2017, and then gradually decline to an ongoing maintenance workforce of less than 2,900 workers (Garfield County 2007). About 50 percent of these workers would be based out of Garfield County, with most of the remainder commuting in from companies based in Mesa County (Garfield County 2007).

Federal mineral royalties, state severance tax receipts, and local property tax receipts to jurisdictions in both Mesa and Garfield counties have grown rapidly over the last decade due to the explosive growth of oil and gas development in the area. These revenues should continue into the foreseeable future. The Proposed Action would add to that revenue stream, contributing as much as 5 percent to the total resource-related revenue that Mesa and Garfield counties would receive annually.

Global Climate Change Cumulative Impacts to Socioeconomics

Global climate change could impact socioeconomics within the project area. Changes in climate may affect people's lifestyles and livelihoods, as discussed throughout Section 4.5, Cumulative Impacts. Economic vulnerability to climate change is generally higher in areas whose economies are closely linked with climate-sensitive resources, such as agricultural industries, water demands, and tourism (Wilbanks et al. 2007). The most substantial economic impacts related to climate change within the project area are discussed in the following text.

Decreases in rangeland productivity could result in a decline in the overall contribution of the livestock industry to Colorado's economy. Because of the sheer size of this component within Colorado's economy this could detrimentally affect not only the livestock industry but many related industries as well (CDPHE 1998).

A change in the precipitation amount and timing due to projected climate-change scenarios would probably necessitate major infrastructural improvements including more dams and reservoirs, water-delivery systems (e.g., culverts, pumps), storm-sewer systems, and/or treatment plants.

Energy demand may increase with climate change. Higher summer temperatures may lead to an increase in demand for air conditioning, and colder winter temperatures may lead to an increased demand for heat. In order to satisfy these demands, larger-capacity power plants (or maximizing capacity of existing plants) with the associated increase of fuel consumption and changes in energy-delivery systems to accommodate the additional loads may be required (U.S. National Assessment of the Consequences of Climate Change 1998).

As previously mentioned, cumulative impacts to recreation from climate change could negatively or positively affect the recreation industry, manifesting in increased or decreased revenue to different sectors of the recreation industry.

Weather inversion patterns related to climate change may be detrimental to public health, as particulate matter would increase during inversion events. This would result in increased economic costs to treat public illness related to this problem, and to treat the problem itself. Current technology has the capability to treat air pollution, and laws are in place to insure that people breathe clean air, but capping air-pollution levels comes at a high cost (U.S. National Assessment of the Consequences of Climate Change 1998).

Increased drought and water availability may be side effects of climate change. A lack of water may negatively impact the recreation industry, livestock industry, and agriculture industry in Colorado. Water availability may also negatively affect municipalities and utilities.

Cumulative Impacts of Socioeconomics on Global Climate Change

Not applicable.

Transportation

The increase in traffic due to energy development and related growth in Mesa and Garfield counties is expected to have an impact to the transportation system. These impacts could include adding more rural roads to accommodate development, the potential for more vehicle collisions as a result of increased traffic, and more wear and tear on the existing transportation system. The relatively small increase in vehicular traffic as a result of this project would be an insignificant addition to traffic increases in Garfield and Mesa counties.

Global Climate Change Cumulative Impacts to Transportation

The total emissions from the transportation sector represent 27.7 percent of Colorado's 1990 carbon dioxide emissions from fossil fuel combustion (CDPHE 1998). However, the proposed use of a railroad to transport 8,000,000 tpy of coal is the most environmentally efficient method of transporting materials. Railroad locomotives currently meet EPA Tier 2 emission standards and would meet (probably earlier than the required dates) the Tier 3 and 4 emission standards that take effect in 2012 and 2015. Each railcar carries the equivalent of 4.5 truck loads of coal. A 120-car train with five locomotives would replace the equivalent of 540 trucks.

Transportation systems, including roads, runways, and railroad corridors, could be washed out by flooding due to climate change. See the Floodplains discussion of this section for additional discussion.

Cumulative Impacts of Transportation on Global Climate Change

Emissions from the railroad and worker vehicles during mine construction and operation may contribute to global climate change.

Utilities

Cumulative impacts to utilities would be limited to utility upgrades associated with increased residential development to house workers.

Global Climate Change Cumulative Impacts to Utilities

As discussed in the Socioeconomics discussion of this section, change in the precipitation amount and timing due to projected climate-change scenarios would probably necessitate major infrastructural improvements.

Current storm-sewer systems may be taxed by weather-pattern changes such as more intense summer storms. The capacity of these systems would likely have to increase in order to offset economic and social effects of flooding (U.S. National Assessment of the Consequences of Climate Change 1998).

Cumulative Impacts of Utilities on Global Climate Change

Indirect impacts to global climate change may result from emissions during construction of utilities. Direct impacts to global climate change may result from operation and maintenance of utilities and associated facilities.

Visual

The visual landscape of Mesa and Garfield counties is changing due to industrial, commercial, and residential development. With the addition of gas wells, pipelines, new subdivisions, roads, transmission lines, and commercial establishments, the visible rural character of the landscape is

changing on private and BLM lands. This project would add incremental changes to cumulative landscape changes. Due to the widespread nature and areal extent of the foreseeable changes, the contribution is not substantial.

Global Climate Change Cumulative Impacts to Visual Resources

As discussed in subsequent text within this section, climate change may impact amount of surface water, vegetation distribution patterns and amounts, and soil stability. All of these impacts would result in changes to the visual characteristics of the project area.

Cumulative Impacts of Visual Resources on Global Climate Change

Not applicable.

Noise

As energy and related development continues in Mesa and Garfield counties, the general background noise levels would rise. Perception of this would depend somewhat on where the noise generators are located. Many of the new wells and associated facilities may be located in areas with few receptors. Other generators such as increased vehicular noise would be located in areas of higher population densities and thus be more perceptible. Currently 11 trains per day (on average) pass through Mack and sound their horns for the at-grade crossings. This project would contribute to the rise in noise levels from barely perceptible (such as at the mine site) to moderate affects. The train horn noise would be the most perceptible and would add to the number of times the residents in the vicinity of Mack and along the UPRR would hear train horns. When considered with the magnitude of the projected regional growth, other project noise would be an insignificant contribution to the background levels.

Global Climate Change Cumulative Impacts to Noise

Global climate change would have no effect on noise.

Cumulative Impacts of Noise on Global Climate Change

Not applicable.

Air Quality

The cumulative impact area is based on the areas modeled in Chapter 3. With respect to current activities, past projects, and the currently proposed mine, the air quality impact analysis discussed earlier in this chapter provides a simplified cumulative analysis through the examination of near-field impacts. The near-field analysis, which considered impacts within 1 kilometer of the proposed mine site, is an assessment of air quality with a given "background" pollutant concentration added into the final modeled value. The background values for each modeled pollutant were recommended by CDPHE staff and/or from data collected by the CDPHE. The most recent years of representative data were chosen for background concentrations, in order to better simulate a cumulative air quality impact analysis.

The appropriate background concentration was added to all modeled concentrations in the near-field analysis, and the total concentrations were compared to applicable federal and state air quality standards. Total concentrations for most pollutants were under 50 percent of the applicable standard, indicating that the area has "room to grow" before any cumulative negative impacts occur. Total concentrations of short term (1-hour) carbon monoxide, as well as PM_{10}

and $PM_{2.5}$, were in a range of 40 to 70 percent of the applicable standards, indicating that the area might have less "room to grow" for those pollutants.

The far-field analysis does not provide a similar simplified approach to a cumulative analysis. However, the far-field analysis results (for the production/operation phase) show negligible impact to ambient air standards, visibility, and deposition in the Class I and sensitive Class II areas (with an exception for 24-hour PM_{10} in the Colorado National Monument). Despite the expected growth in the oil and gas and mining sectors in the region, the far-field analysis results indicate that significant growth would be necessary, perhaps more than what is planned now, before a cumulative air quality impact would be observed in the far-field. PSD permitting procedures include thorough cumulative analyses for major facilities before a construction permit is granted, with the idea that cumulative negative impacts at Class I areas should be prevented and controlled through the air quality construction permitting process. Additionally, the CDPHE is required to conduct cumulative modeling analyses periodically throughout the state in order to prevent negative impacts from occurring.

The expected oil and gas operations entering this area would be expected to have a minimal impact on CO, VOC, SO_2, and particulate matter. Statewide emission regulations for the oil and gas industry require controls on oil and gas equipment for NO_x, CO, and VOC emissions, and recently promulgated federal regulations addressing reciprocating engines would require NO_x, CO, and VOC emission controls on new or modified equipment used at oil and gas facilities. Sulfur dioxide and particulate matter emissions are generally not a concern with oil and gas operations.

Future planned mining operations in northwest Colorado, in conjunction with existing facilities and this proposed mine, could possibly result in future cumulative particulate matter impacts. As noted earlier, the near-field analysis conducted for this proposed mine shows that total PM_{10} and $PM_{2.5}$ concentrations (including the background concentrations) are within 40 to 70 percent of the particulate ambient standards. Over time, if extensive mining industry growth continues, a cumulative particulate matter impact could be encountered in west/northwest Colorado. However, both state and federal air quality construction permit processes require modeling assessments for many projects, and these assessments often involve cumulative analyses in order to discover and mitigate cumulative impacts before any construction permits are issued.

Global Climate Change Cumulative Impacts to Air Quality

Localized air-pollution levels (particulate, ozone) may increase due to climate change. Inversion development patterns might change with increased atmospheric moisture. More frequent and longer-lasting inversion events may trap high levels of particulate in the inverted atmosphere; this would have a detrimental effect on the public's health but would also impose an economic cost on society to treat both the health and pollution problem (U.S. National Assessment of the Consequences of Climate Change 1998).

Cumulative Impacts of Air Quality on Global Climate Change

The project's contribution to global climate change is 3,888,242 tons per year of CO_2e or an estimated 3 percent increase of total annual CO_2e emissions within the state of Colorado (based on statewide emissions during 2005) (CDPHE 2007). This is equivalent to the annual CO_2 emissions of 0.76 coal-fired power plants and the CO_2 emissions from the energy use of 311,332 homes for one year (EPA 2008b).

It is not possible within the scope of this analysis to estimate or calculate the effect that GHG emissions from this project would have on global warming. However, a study of global climate change in the Rocky Mountain/Great Basin region was reported in the *US National Assessment of the Potential Effects of Climate Change and Variability: Rocky Mountain / Great Basin Region* (Wagner et al. 2003).

The study concluded that possible climate changes could reduce stresses on the region's water resources due to increased overall precipitation, primarily in the form of rain. However, reduced snowpack and earlier melting could change the timing and availability of water in the region, and could adversely affect winter sports. Climate changes could also alter natural ecosystems. Intensification of extreme events would be expected due to climate change, including more frequent and potentially more intense forest and range fires, drought, and floods. Climate change impacts attributable to the proposed project cannot be quantified due to the extremely complex global circulation modeling effort that would be required.

Cultural Resources/Native American Religious Concerns

Impacts to cultural resources in Mesa and Garfield counties are increasing due to industrial, commercial, and residential development. With the addition of gas wells, pipelines, new subdivisions, roads, transmission lines, and commercial enterprises, cultural resources are likely being impacted on private and BLM lands. As this project would not directly impact any significant cultural resources, contributions to cumulative impacts would be minimal and insignificant.

Global Climate Change Cumulative Impacts to Cultural Resources/Native American Religious Concerns

Archaeological evidence is preserved in the ground because it has reached a balance with the hydrological, chemical, and biological processes of the soil. Short and long cycles of change to these parameters may result in a poorer level of survival of some sensitive classes of material. And the conditions for conservation of archaeological evidence may be degraded in the context of increasing soil temperature. Climate change may impact the amount of surface water, vegetation distribution patterns and amounts, and soil stability. Climate change may also alter the degree and frequency of severe storm events that could lead to increased erosion. All of these impacts could result in changes to archaeological sites.

Cumulative Impacts of Cultural Resources/Native American Religious Concerns on Global Climate Change

Not applicable.

Geology and Minerals

Mining may contribute or aggravate landslide movements and small seismic events. Given the natural geologic instability in the area, this determination is difficult to quantify.

Global Climate Change Cumulative Impacts to Geology and Minerals

Global climate change would have no effect on geology and minerals.

Cumulative Impacts of Geology and Minerals on Global Climate Change

Not applicable.

Paleontological Resources

Impacts to paleontological resources in Mesa and Garfield counties are increasing due to industrial, commercial, and residential development. With the addition of gas wells, pipelines, new subdivisions, roads, transmission lines, and commercial enterprises, paleontological resources are likely being impacted on private and BLM lands. This project would add incremental changes to cumulative paleontological resources impacts. Due to the widespread nature and areal extent of the foreseeable changes, the contribution is not substantial.

Global Climate Change Cumulative Impacts to Paleontological Resources

Similar to cultural resources, paleontological evidence is preserved in the ground because it has reached a balance with the hydrological, chemical, and biological processes of the soil. Short and long cycles of change to these parameters may result in a poorer level of survival of some sensitive classes of material. Conditions for conservation of some sensitive types of paleontological evidence may be degraded in the context of increasing soil temperature. Climate change may impact the amount of surface water, vegetation distribution patterns and amounts, and soil stability. Climate change may also alter the degree and frequency of severe storm events that could lead to increased erosion. All of these impacts could result in changes to paleontological resources.

Cumulative Impacts of Paleontology on Global Climate Change

Not applicable.

Soils

Cumulatively, hundreds of thousands of acres of soil would be impacted in the reasonably foreseeable future. Project impacts of approximately 452 acres would be an insignificant addition to the cumulative total for Mesa and Garfield counties.

Global Climate Change Cumulative Impacts to Soils

Nitrous oxide is produced from natural soil processes and the application of commercial fertilizer to soil. The application of commercial nitrogen fertilizers increases soil's nitrogen source and thus increases nitrogen oxide emissions. According to the CDPHE (1998), Colorado's 1990 nitrous oxide emissions from the Fertilizer Use Sector represent 0.8 percent of the state's total GHG emissions in the baseline year, ranking seventh quantitatively; and in 1990, the sector emitted 2,793 tons of N_2O, which equated to 865,963 tons of carbon dioxide equivalent emissions.

The ability of ecosystems to sequester carbon is likely to be constrained by levels of nitrogen ability and fixation, as well as availability of other key nutrients (Hungate et al. 2003, as cited in Fischlin et al. 2007). Colorado forests contain approximately 40 percent of all soil carbon in the state. Hence, forests and forest soils play a significant role in the carbon cycle as source (e.g., deforestation, and forest degradation) and sinks (e.g., reforestation, afforestation) of carbon (CDPHE 1998). Climate change impacts to vegetation are addressed in subsequent text.

The U.S. Environmental Protection Agency (EPA) models suggest a marked decrease in soil moisture over some midcontinental regions during the summer (EPA 1997). Drought is addressed in the surface water discussion of this section.

Even though Colorado's forest soils can act as carbon sinks, net carbon storage in Colorado's forests may not increase because of the associated stimulation of soil organic matter decomposition by soil warming (CDPHE 1998). Increases in net primary productivity could be offset by increased soil respiration due to the warmer temperatures (CDPHE 1998). Therefore, it is possible that net ecosystem productivity may not change or could decrease due to climate change.

Cumulative Impacts of Soils on Global Climate Change

Previous land use practices in the cumulative analysis area include farming and ranching. Application of fertilizers to soils may contribute to global climate change; deforestation and degradation of soils may contribute to global climate change. However, soils may also sequester carbon.

Groundwater

The cumulative impact area is defined as the project area boundary. Within the project area, there is alluvial and bedrock groundwater that could be impacted by the mine and/or associated surface facilities. The mine is not expected to impact the flow or quality of alluvial groundwater because it would not encounter alluvial groundwater. Once bedrock groundwater is encountered, the water would be collected and pumped from the mine, which would induce a groundwater flow direction toward the underground workings of the mine. However, the inflow to Red Cliff Mine is not expected to alter the regional bedrock groundwater flow regime substantially other than the area immediately surrounding the mine workings because of the low hydraulic conductivity of the bedrock and coal seam.

Of the surface facilities associated with the mine, the waste rock pile has the potential to impact shallow alluvial groundwater. A waste rock pile would be constructed and keyed into natural ground with waste rock being compacted in lifts to provide stability. Proper compaction and collection of runoff would minimize infiltration of water to the underlying alluvial groundwater. Considering the poor baseline water quality, any potential infiltration from the waste pile is not expected to degrade the alluvial groundwater quality substantially beyond current conditions. The proposed project would perform all suitable reclamation activities to meet Colorado Groundwater Quality Standards at compliance well locations, resulting in no cumulative downgradient impacts to the regional groundwater.

Global Climate Change Cumulative Impacts to Groundwater

The lack of historic groundwater data makes quantifying climate change impacts to groundwater infeasible. Historically, non-climatic factors such as irrigation have led to lowering of the groundwater table. Groundwater systems respond more slowly to climate change than surface water systems. However, climate change would affect groundwater recharge rates and groundwater levels due to a shifting of recharge towards winter, earlier runoff, thawing of permafrost, changes in vegetation, and increased magnitude of floods (Kundzewicz et al. 2007). Cumulative changes that impact groundwater recharge (e.g., changes in precipitation, runoff timing, variations in evapotranspiration associated with vegetation changes, or wildfire, etc.) could affect groundwater levels. Climate shifts to hotter, dryer environments would be expected to lead to decreased groundwater levels, which could reduce the presence and volume of springs discharge, baseflow to streams, and available pumping resources.

Cumulative Impacts of Groundwater on Global Climate Change

Not applicable.

Surface Water

The cumulative impact area is the project area and watershed. Past impacts to water quality have been a result of the naturally occurring high intensity storm events that have caused the selenium-laden soils to erode and wash sediment downstream to the Colorado River. Due to the naturally occurring high concentrations, segments of the Colorado River are impaired for selenium. Cumulative impacts on surface water bodies affected by the Proposed Action would be limited primarily to water bodies that are affected by other projects within the same watershed, such as the construction and long term impacts from other energy development in the area and associated municipal communities growing to meet the population to support the energy development. Direct in-stream impacts associated with construction runoff and increased sediment loads during initial storm events following construction would have the greatest impacts on surface water resources for all activities. Following a short term period of increased erosion potential during construction, there should be little impact to surface-water hydrology due to construction and operation of the Proposed Action. The CDPHE-Water Quality Control Division (WQCD) requires a construction stormwater permit and industrial stormwater permit to minimize the impacts of these activities. With the applicant complying with the CDPHE-WQCD permitting requirements, long term impacts would be minimal, and sediment and selenium contributions to the Colorado River insignificant.

Global Climate Change Cumulative Impacts to Surface Water

According to the EPA (1997) and Kundzewicz et al. (2007), warmer climate would lead to earlier spring snowmelt, resulting in increased streamflows in winter and spring and decreased streamflows in summer and fall. Most of Colorado's reservoirs are small in relation to total runoff; therefore, earlier snowmelt could reduce the reliability of many water supply systems within the state by limiting the amount stored for use in summer. These effects could be mitigated if summer rainfall increases (EPA 1997).

A warmer climate would increase the risk of floods and drought (Wetherald and Manabe 2002, IPCC 2007, as cited in Kundzewicz et al. 2007). Snowmelt is forecasted to occur earlier in the year and less abundant in the melt period, potentially leading to increased risk of drought in snowmelt-fed basins in the summer and fall when water demand is the highest (Barnett et al. 2005, as cited in Kundzewicz et al. 2007). Increased drought in the project area could result in decreased water availability for public consumption and recreation. Drought may also affect vegetation, fisheries, soils, wildlife habitat, and the likelihood of increased occurrence and/or more extensive wildfires. Decreased water availability may result in negative economic impacts to the livestock industry, recreation industry, utilities, and farming/ranching as described in the socioeconomics discussion within this section.

Cumulative Impacts of Surface Water on Global Climate Change

Not applicable.

Floodplains

The cumulative impact area is the floodplains within and surrounding the project area. The cumulative impact on the floodplain would be the effect of floodwater storage during storm

events. As the floodplains in the region are altered, their ability to provide floodwater storage capacity for the region would be diminished. All of the potentially future developments in the region have the possibility to impact floodplains cumulatively in the regions by either direct construction within the floodplain or by creating impervious surface areas that could increase the volume of water within the floodplains in this region. Because this project would not alter the capacity for floodwater storage, it would not contribute to the cumulative impacts to regional floodplains.

Global Climate Change Cumulative Impacts to Floodplains

Global climate change may lead to temperature increases, which may, in turn, result in earlier spring snowmelt that may lead to flooding. As identified in the U.S. National Assessment of the Consequences of Climate Change (1998), flooding may threaten public works that would require major infrastructural changes. Major highways and side roads could be washed out, inundated, or broken apart by increased frost-heave occurrences. Airport runways and railroad corridors are also subject to similar climate-related damages disrupting other links in the transportation system. These types of disruptions not only require major economic investments in repair or rebuilding, but also could affect individuals' economic livelihood. Increased commuter time, higher food and other goods transportation costs, increased fuel taxes to cover road-construction costs, were identified as a few of the likely economic and social consequences climate changes may inflict (U.S. National Assessment of the Consequences of Climate Change 1998).

Cumulative Impacts of Floodplains on Global Climate Change

Not applicable.

Vegetation

The cumulative impact area is the project area. The greatest amount of disturbance associated with the Proposed Action would be within shrubland vegetation associations, especially salt desert shrub (194 acres) and sagebrush (68 acres) associations (Table 4-9, Vegetation Associations Impacted by Proposed Action). Within the entire study area, approximately 0.64 percent of the shrublands, 0.37 percent of woodlands and forests, and 1.28 percent of talus, rock outcrops, and bare soil would be directly impacted by construction and development activities.

Impacts of the Proposed Action would be an insignificant contribution to cumulative impact on vegetation and invasive species that are part of the overall impacts of energy-related vegetative disturbance in Mesa and Garfield counties. Reasonably foreseeable disturbance of native vegetation is estimated to be hundreds of thousands of acres.

Global Climate Change Cumulative Impacts to Vegetation

Vegetation growth is governed by soil moisture, precipitation, temperature, evaporation, solar radiation, and GHG concentrations. Vegetation models have shown that conifer forests would shift northward and that lower-elevation forest ecotones would stay about the same or rise slightly in the Rockies and Colorado Plateau due to climate change (Neilson 1998).

As previously mentioned in the soils discussion of this chapter, Colorado forests contain approximately 80 percent of all above ground carbon in vegetation and about 40 percent of all soil carbon and play a significant role in the carbon cycle. In some cases, the forests' sink role might enhance forest growth due to carbon dioxide fertilization. As a general rule, forest

productivity and the diversity of species would increase with temperature, nutrient availability, and precipitation (CDPHE 1998).

The frequency and intensity of drought conditions across Colorado could increase as net precipitation levels decrease and soil moisture drops (CDPHE 1998). The consequences to selected Colorado crops and livestock could be moderate to severe, especially along the western slope and eastern plains (CDPHE 1998).

In addition, a large fraction of Colorado forests could be lost in response to increased summer droughts resulting from decreased water availability (CDPHE 1998). Additionally, since water shortages during part of the year already impact Colorado forests, this effect could be amplified by intensification of summer soil water deficits. The overall impact could be an increase in the incidence of summer drought and an increase in forest disease, pest outbreaks, and mortality (CDPHE 1998). A direct result of this could be to increase the probability of forest fires and extend the hazard to areas that are not now affected. In areas of the state with large quantities of built up fuel, particularly Colorado's Front Range forests, the risk of increased forest fires may be exacerbated (CDPHE 1998).

Cumulative Impacts of Vegetation on Global Climate Change

Historical activities in the project area have included disturbance of vegetation through development and other construction projects, agriculture, and restoration of vegetation. Any cumulative vegetation-disturbing activity may contribute to global climate change through the release of CO_2 sequestered in vegetation and soils. Any revegetation efforts would decrease impacts on global climate change due to carbon sequestration.

Fish and Wildlife

It is estimated that energy development in Mesa and Garfield counties would impact hundreds of thousands of acres of wildlife habitat. Habitat effectiveness would also be reduced due to fragmentation and increased access. The loss of 68 acres of sagebrush habitat at the base of the Book Cliffs would contribute to the loss of CDOW mapped winter range for deer, elk, and pronghorn in the project area (see Figure 3-24, Winter & Severe Winter Range). The contribution to the regional loss would be insignificant.

Global Climate Change Cumulative Impacts to Fish and Wildlife

As discussed in the vegetation discussion within this section, climate change models predict that vegetation types would migrate northward due to climate change, thus potentially altering current wildlife habitat.

As previously addressed in the recreation discussion within this section, wildlife contributes to the recreation industry, and climate change may negatively affect wildlife, thus impacting the recreation industry.

As discussed in Toweill (1998), climate-related changes that might have an impact on wildlife include the following:

- Water availability and water quality
- Changes that affect the timing of plant development would affect the availability of food and shelter for many species of wildlife
- Changes in plant distribution

- Changes in wildlife habitat distribution and availability.

Changes in migration patterns due to climate change may also negatively affect wildlife. A study done in Colorado found that if animal movements are disrupted by changing snow patterns, increased wildlife mortality may result (Inouye et al. 2000 as cited in Fischlin et al. 2007). Natural disturbances (e.g., avalanches, fire, etc.) are strongly dependent on climate and may prevent recruitment and limit migration responses of wildlife (Fischlin et al. 2007).

Cumulative Impacts of Wildlife on Global Climate Change

Not applicable.

Threatened and Endangered Species

Reasonably foreseeable regional development has the potential to impact Threatened, Endangered, and Sensitive aquatic species in the Colorado River Basin through changes in water quality, water withdrawals, and physical habitat disturbance. The diversion of up to 3 cfs of water from Mack Wash, combined with other upstream water diversions, may lead to cumulative effects on threatened and endangered aquatic species in Mack Wash. However, the effects of water diversion would be mitigated with payment to the USFWS Recovery Program. This water depletion and potential impacts to Mack Wash would be an insignificant contribution to potential regional impacts.

Global Climate Change Cumulative Impacts to Threatened and Endangered Species

Global climate change impacts to Threatened and Endangered species would be identical to global climate change cumulative impacts to fish and wildlife.

Cumulative Impacts of Threatened and Endangered Species on Global Climate Change

Not applicable.

4.5.2.2 Summary of Impacts and Mitigation Measures

Table 4-14, Summary of Impacts of Each Alternative Compared to the Proposed Action, contains a comparison of each alternative to the Proposed Action by each resource discussed within this document. The intent of this table is to help decision-makers and the public understand how the impacts of the grade-separated crossing at CR M.8; noiseless crossing traffic control devices; and Transmission Line Alternatives A, B, and C compare to the Proposed Action.

Appendix B, Standard Practices and Mitigation Measures, lists all of the applicable laws, regulations, policies, additional BLM/Cooperating Agency recommended mitigation and enhancements, and operator-proposed features to mitigate impacts by resource.

Table 4-14
SUMMARY OF IMPACTS OF EACH ALTERNATIVE COMPARED TO THE PROPOSED ACTION

	Alternative				
Resource	Grade-separated Crossing at CR M.8	Noiseless Crossing Traffic Control Devices	Transmission Line Alternative A	Transmission Line Alternative B	Transmission Line Alternative C
Land Ownership and Use	Long term impacts to land use from this alternative would include a permanent change in land use for land acquired to construct the bridge to a utility ROW. Temporary and permanent land use impacts due to the grade-separated crossing at CR M.8 are as follows: • Temporary: A 100-foot bridge would be constructed with a construction ROW of 150 feet for a total temporary disturbance of approximately 0.3 acre • Long term: The permanent ROW would decrease to 115 feet, yielding approximately 0.3 acre of permanent disturbance (no substantive difference from temporary)	Same as Proposed Action.	Additional private lands north of the Highline Canal would be required for construction of the transmission line.	Additional private lands north of the Highline Canal would be required for construction of the transmission line.	Same as Proposed Action.
Grazing	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Wilderness and Special Designations	Same as Proposed Action.	Same as Proposed Action.	Transmission Line Alternative A would cross 4.11 miles of BLM lands within the North Fruita Desert SRMA as compared to 7.09 miles crossed by the Proposed Action. Therefore, impacts of Alternative A would be less than the Proposed Action.	Transmission Line Alternative B would cross 5.83 miles of BLM lands within the North Fruita Desert SRMA as compared to 7.09 miles crossed by the Proposed Action. Therefore, impacts of Alternative B would be less than the Proposed Action.	Transmission Line Alternative C would cross 7.69 miles of BLM lands within the North Fruita Desert SRMA as compared to 7.09 miles crossed by the Proposed Action. However, 3.4 miles would parallel the railroad/pipeline corridor; therefore, impacts of Alternative C would be less than the Proposed Action.
Recreation	Same as Proposed Action.	Same as Proposed Action.	Transmission Line Alternative A crosses 1 trail as compared to 6 trails crossed by the Proposed Action. Therefore, impacts to recreation under this alternative would be less than the Proposed Action.	Transmission Line Alternative B crosses 1 trail as compared to 6 trails crossed by the Proposed Action. Therefore, impacts to recreation under this alternative would be less than the Proposed Action.	Transmission Line Alternative C crosses 5 trails as compared to 6 trails crossed by the Proposed Action. Therefore, impacts to recreation under this alternative would be less than the Proposed Action.
Socioeconomics	The construction employment and expenditures for this crossing could be slightly more than those for the rail spur as proposed. If so, the temporary employment and income effects associated with the construction phase of the project may be marginally greater than those of the Proposed Action. This alternative would lessen some of the social/community concerns regarding traffic safety and noise impacts.	Socioeconomic impacts under this alternative would in general be similar to those of the Proposed Action. This alternative would lessen some of the social/community concerns regarding noise impacts.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.

Table 4-14
SUMMARY OF IMPACTS OF EACH ALTERNATIVE COMPARED TO THE PROPOSED ACTION

	Alternative				
Resource	Grade-separated Crossing at CR M.8	Noiseless Crossing Traffic Control Devices	Transmission Line Alternative A	Transmission Line Alternative B	Transmission Line Alternative C
Transportation	Construction of a grade-separated crossing at CR M.8 would lessen transportation impacts as compared to the Proposed Action, as traffic would not be required to stop when a train passes through the intersection. Traffic safety would be better.	Same as Proposed Action	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Utilities	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Visual	A grade-separated railroad crossing at CR M.8 would involve construction of a bridge supported by concrete capped piles. The bridge over Mack Wash and CR M.8 would be approximately 35 feet higher than the existing road grade. This would be highly visible to travelers on CR M.8.	Noiseless crossing gate systems consist of a series of automatic flashing-light signals and gates where the gates extend across both the approach and departure side of roadway lanes. Unlike two-quadrant gate systems, noiseless crossing gates provide additional visual constraint and inhibit nearly all traffic movements over the crossing after the gates have been lowered (USDOT 2002). These systems are designed to be highly visible for the purpose of increasing safety, especially when a train is approaching and crossing the county roads.	Transmission line Alternative A is adjacent to 90 parcels of land south of the Highline Canal, crosses 19 parcels of private land north of the Highline Canal, and is adjacent to 1 trail in the North Fruita Desert SRMA. North of the Highline Canal, the line would be parallel with and adjacent to CR 16 for over 5 miles (see Figure 2-12, Proposed Mine Facilities, Map 1 of 5). There are currently no transmission or distribution lines along CR 16 in that location. Visual impacts to residents north of the Highline Canal would be greater than the Proposed Action, as there is currently no transmission line crossing those private land parcels.	Transmission line Alternative B is adjacent to 82 parcels of land south of the Highline Canal, crosses 5 parcels of private land north of the Highline Canal, and crosses 1 trail under construction in the North Fruita Desert SRMA. Visual impacts to residents north of the Highline Canal would be greater than the Proposed Action, as there is currently no transmission line crossing those private land parcels.	Transmission line Alternative C is adjacent to 96 parcels of land south of the Highline Canal, and crosses 5 trails in the North Fruita Desert SRMA. Over 18,000 feet of the transmission line would parallel the railroad and water pipeline, putting the visual scars in one corridor for that length of line. The transmission line would come within 0.25 mile of SH 139 at its closest point, but is that close for only a short segment (less than 0.5 mile).
Noise	A grade-separated crossing at CR M.8 would reduce noise impacts as compared to the Proposed Action, as the horn would not be sounded at the crossing. Noise impacts would be limited to the passing of the train.	This alternative would eliminate the need for train horns at either or both at grade crossings; substantially lowering the noise impacts.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Hazardous Materials	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Health and Safety	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Air Quality	Impacts may be marginally lower than the Proposed Action, as vehicles would not be stopped and idling at the CR M.8 crossing.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Cultural Resources	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Paleontology	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Geology	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.

Table 4-14
SUMMARY OF IMPACTS OF EACH ALTERNATIVE COMPARED TO THE PROPOSED ACTION

	Alternative				
Resource	Grade-separated Crossing at CR M.8	Noiseless Crossing Traffic Control Devices	Transmission Line Alternative A	Transmission Line Alternative B	Transmission Line Alternative C
Soils	Impacts to soils from this alternative would include temporary impacts to soils from construction of the bridge over Mack Wash and the railroad grade and raising the grade of CR M.8.	Same as Proposed Action.	The majority of impacts to soils would be similar as described for the Proposed Action. Because this alternative follows CR 16 north of the Highline Canal, impacts to soils would be slightly lower than the Proposed Action, as no new access roads would be required.	Impacts to soils from this alternative would be slightly less than those described for the Proposed Action, due to reduced acres of disturbance.	Impacts to soils from this alternative would be slightly less than those described for the proposed transmission line due to the transmission line following the rail and pipeline corridor for 3.4 miles. This would eliminate the need for additional access for this length of transmission line.
Groundwater	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Surface Water	Same as Proposed Action.	Same as Proposed Action.	Impacts during construction would be slightly greater than the Proposed Action due to the line's location in the Big Salt Wash alluvial floodplain.	Impacts during construction would be slightly greater than the Proposed Action due to the line's location in the Big Salt Wash alluvial floodplain.	Same as Proposed Action.
Floodplains	Same as Proposed Action.	Same as Proposed Action.	Impacts during construction would be slightly greater than the Proposed Action due to the line's location in the Big Salt Wash alluvial floodplain.	Impacts during construction would be slightly greater than the Proposed Action due to the line's location in the Big Salt Wash alluvial floodplain.	Same as Proposed Action.
Vegetation	Long term impacts to vegetation would result from construction of a grade-separated crossing at CR M.8. Impacts would be slightly greater due to the larger footprint of the bridge and grade.	Same as Proposed Action.	Alternative A results in slightly decreased disturbance compared to the Proposed Action, with 6 acres of disturbance on BLM lands and less than 1 acre on private lands.	Alternative B results in slightly decreased disturbance compared to the Proposed Action, with 10 acres on BLM lands and less than 1 acre on private lands.	Alternative C results in slightly decreased disturbance compared to the Proposed Action, with 11 acres on BLM lands and less than 1 acre on private lands.
Wetlands and Riparian	This alternative would impact an additional 0.33 acres of wetland as compared to the Proposed Action for a total wetland impact of 0.43 acres of jurisdictional wetlands. Additional impact would be related to replacement of the Mack Wash bridge. NWP #12 would be applicable.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.	Same as Proposed Action.
Fish and Wildlife	Construction of the grade-separated crossing at CR M.8 could result in temporary increases in sediment and would result in the permanent removal of a small amount of vegetation at the location of the crossing as compared to the Proposed Action.	Same as Proposed Action.	Alternative A results in slightly decreased habitat disturbance compared to the Proposed Action.	Alternative B results in slightly decreased habitat disturbance compared to the Proposed Action.	Alternative C results in slightly decreased habitat disturbance compared to the Proposed Action.

Table 4-14
SUMMARY OF IMPACTS OF EACH ALTERNATIVE COMPARED TO THE PROPOSED ACTION

	Alternative				
Resource	Grade-separated Crossing at CR M.8	Noiseless Crossing Traffic Control Devices	Transmission Line Alternative A	Transmission Line Alternative B	Transmission Line Alternative C
Threatened and Endangered Species	Same as Proposed Action.	Same as Proposed Action.	This alternative reduces the amount of salt desert shrub vegetation disturbed by the project by 73% to 0.49 acres. Because this represents potential Grand buckwheat habitat, this alternative may result in a decrease in total impacts to this species. Assuming 55-100% of this vegetation association is occupied habitat then 360 to 654 Grand buckwheat may be removed during construction of this alternative.	.This alternative reduces the amount of salt desert shrub vegetation disturbed by the project by 12% to 1.6 acres. Because this represents potential Grand buckwheat habitat, this alternative may result in a decrease in total impacts to this species. Assuming 55-100% of this vegetation association is occupied habitat then 1,175 to 2,137 Grand buckwheat may be removed during construction of this alternative	There is less new disturbance with this route than any of the other transmission line routes including the Proposed Action transmission route since it converges with the railroad spur corridor for 3.4 miles. This alternative reduces the amount of salt desert shrub vegetation disturbed by the project by 21% to 1.43 acres. Because this represents potential Grand buckwheat habitat, this alternative may result in a decrease in total impacts to this species. Assuming 55-100% of this vegetation association is occupied habitat then 1,050 to 1,910 Grand buckwheat may be removed during construction of this alternative.