3.15 SOILS

This section addresses potential impacts to soils from the Proposed Route and Route Alternatives during construction, operation, and decommissioning. The primary reason to define impacts to soils is to reduce, minimize, or mitigate effects to soils from all phases of the Project. This section analyzes the potential impacts of the Project on soil erosion, soil compaction, and soil permanently removed from productivity due to the presence of roads and structures. In some cases, geologic features, such as landslides and shallow bedrock, could have an impact on soils. Those cases are also discussed in Section 3.14 – Geologic Hazards. Prime farmland is presented as a soil characteristic here and soil impacts to agricultural operations are also discussed in Section 3.18 – Agriculture. The discussion of hydric soils here supplements the broader discussion of wetlands found in Section 3.9 – Wetlands and Riparian Areas.

3.15.1 Affected Environment

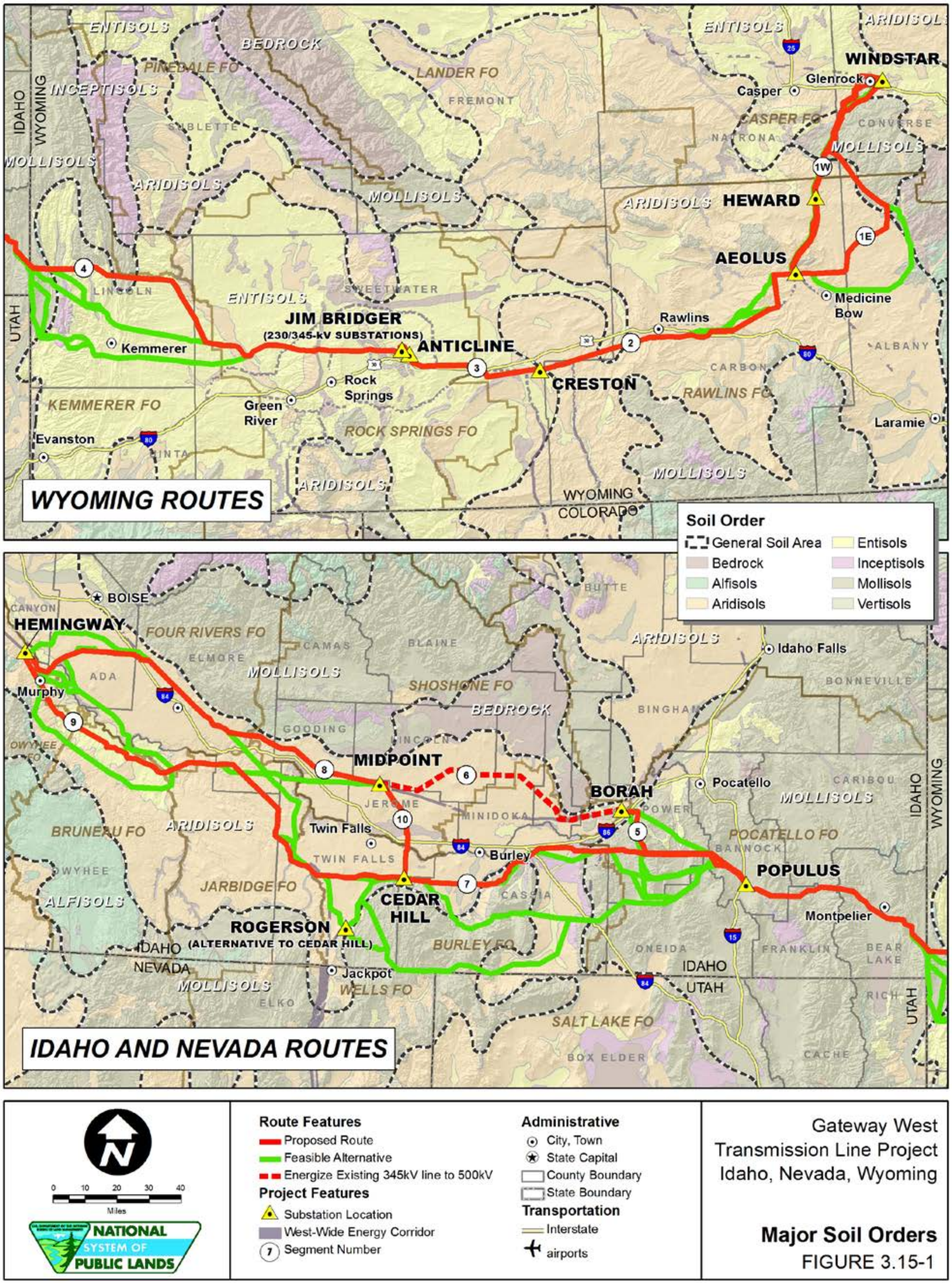
This section discusses those aspects of the environment that could be impacted by the Project. It starts with a discussion of the Analysis Area considered, identifies the issues that have driven the analysis, and characterizes the existing conditions across the Proposed Action in Wyoming, Idaho, and Nevada.

3.15.1.1 Analysis Area

The Project crosses several major soil orders (Figure 3.15-1). These soil orders closely match the physiographic regions (Figure 3.14-1). The mountainous parts of the Project area are slightly cooler than the valleys, receive more precipitation, and more readily support plant growth. The valley soils of southern Wyoming and Idaho support desert conditions, with less plant growth and infrequent summer precipitation. Soil found in the mountainous areas, including the Laramie Mountains in the northern part of Segment 1 and the mountainous areas in Segments 4 through 7 along the Idaho/Wyoming border and into southeast Idaho and northern Nevada, consist mainly of Mollisols with minor areas of Inceptisols and Alfisols. The Order Mollisol includes a variety of soils formed mainly under grasslands. These soils have a strong organic component formed by the decomposition of grass and other vegetation, which results in very productive soils. These soils, if properly preserved or reclaimed, should be favorable for revegetation.

Soil in the valley portions of Segments 1, 2, and 3, and the Snake River Plain in portions of Segments 7, 8, 9, and 10 predominantly consist of Aridisols. Aridisols are found in dry climates, and contain subsurface horizons in which clay, calcium carbonate, silica, salts, and/or gypsum have accumulated. They are usually not suitable for agriculture unless irrigation water is provided. Revegetation in these areas may be more difficult due to lack of water, or revegetation may need to proceed in a wetter portion of the year.

In the Green River Basin portion of Segment 4, soils consist predominantly of Entisols. Entisols are typically shallow or sandy, lacking in organic matter, and generally do not contain well-developed soil layers. The lack of water, scarce organic matter, and sandy soil conditions could require special considerations to complete revegetation in this portion of the Project.



Gateway West Transmission Line Project Idaho, Nevada, Wyoming

Major Soil Orders
FIGURE 3.15-1

The Analysis Area for soils was defined in a GIS file by buffering the centerlines of the Proposed Route and Route Alternatives out 0.5 mile on either side of the centerlines and dissolving the buffers into a single polygon for each segment. This distance was used because it encompasses the area of greatest activity during construction and operation and it is estimated any Project impacts to Project soils would occur primarily within 0.5 mile of the disturbance.

3.15.1.2 Issues to be Analyzed

The following soil related issues were brought up by the public during public scoping (Tetra Tech 2009a), raised by federal and state agencies during scoping and agency discussions, or are issues that must be considered as stipulated in law or regulation:

- What would be the effect on soil erosion, and the potential for increased soil erosion from Project construction, operations, and decommissioning?
- What would be the effect on Project soils from compaction by vehicle and equipment traffic?
- What effect would topsoil disturbance have on soil productivity after construction and reclamation?

3.15.1.3 Regulatory Framework

Soil erosion is governed by regulations contained in USEPA's stormwater management regulations, derived as part of the CWA.

Environmental Protection Agency – Clean Water Act

Under the Clean Water Act, the NPDES stormwater program requires operators of construction sites one acre or larger (including smaller sites that are part of a larger common plan of development) to obtain authorization to discharge stormwater under an NPDES construction stormwater permit. The development and implementation of SWPPPs is the focus of NPDES stormwater permits for regulated construction activities.

Most states, including Wyoming and Nevada, are authorized to implement the stormwater NPDES permitting program. USEPA remains the permitting authority in a few states (including Idaho), territories, and on most land owned by Native American sovereign nations. For construction (and other land-disturbing activities) in areas where USEPA is the permitting authority, operators must meet the requirements of the USEPA Construction General Permit. In Wyoming and Nevada, compliance with state requirements would be necessary for construction stormwater activities. Each state has their own permits and requirements, although both are modeled after the USEPA program.

Federal agencies have handbooks and other guidance documents that govern soil management that would be applicable in their jurisdiction. Applicable Forest Service Handbooks (FSHs) for evaluating soil conditions on NFS lands include the following:

- FSH 2509.18 Soil Management Handbook (Forest Service 1991b)

- FSH 2509.22 Soil and Water Conservation Practices Handbook (Region R1/R4; Forest Service 1988)
- FSH 2509.25 Watershed Conservation Practices Handbook (Forest Service 2006)

BLM RMPs vary by BLM FO. Some RMPs contain quantitative soil requirements that would be applicable to the Project.

The BLM maintains a guidance document for permitting and drilling oil and gas wells. This document, called the Gold Book, also contains general standards for road construction and construction stormwater BMPs and is used as a guideline for construction activities on the Gateway West Project. The WWE Corridor PEIS (DOE and BLM 2008), a guidance document for location of preferred cross-country utility ROWs, references the BLM Gold Book as being useful for construction stormwater procedures for linear facilities. The State of Wyoming State Reclamation Policy and BLM's Rawlins District RMP (Appendix 36) also provide requirements for soil reclamation that would be complied with in the appropriate Project areas.

3.15.1.4 Methods

The environmental effects analyses completed for this assessment were conducted using readily available data and GIS files derived from preliminary centerline and component design for the Proposed Route and Route Alternative (see Section 3.1 – Introduction for details on development of these files). In all cases, after analysis of impacts was complete and where impacts were identified, Proponent-proposed measures to reduce impacts were reviewed for sufficiency. Where those measures were determined to be insufficient, additional measures were identified.

Soils data were obtained from the NRCS databases. The NRCS STATSGO database provides soil data on a state-wide basis. The STATSGO data were reviewed to identify soil factors that could affect soil erosion, soil compaction, or leading to difficulty in re-establishing vegetation during Project reclamation. STATSGO data were available for all factors, except prime farmland in Wyoming. To attain Wyoming prime farmland information, the NRCS Soil Survey Geographic database (county-level soils database) was reviewed but no prime farmland was found to be present in the Wyoming portion of the Project. In general, prime farmland requires an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or alkalinity, an acceptable content of salt or sodium, and few or no rocks. Its soils are permeable to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding. At least some of these conditions, especially a short growing season and lack of water, are typically deficient in southern Wyoming soils, hence the absence of prime farmland in the Wyoming portion of the transmission line routes.

In 2010, drilling began in some areas to support geotechnical evaluations for transmission line structures. The drilling was conducted on public land and private land where landowner permission was obtained. As of the date of this draft EIS, available information includes a total of 124 boreholes that were advanced along Segments 1 through 4. Total depths drilled ranged from 15 feet to 66.5 feet. Drilling logs were reviewed to evaluate Unified Soil Classifications on soil from 0 to 5 feet below ground surface. Soils containing silt and/or fine sand were presumed to be erodible by wind or water. The locations of borings containing silt or sand soils were compared to the locations of highly erodible soils presented in the STATSGO database. Soils described as gravel were compared to the STATSGO areas for stony rocky soils. The locations of soil described as sand or gravel were compared to the locations of droughty soils as described by STATSGO. Where differences were found between the boring logs and the STATSGO database, they are noted in the text below. Otherwise, the following methods were used to evaluate Project soil conditions.

Wind Erodibility

The STATSGO data for wind erodibility group was reviewed for each segment's Analysis Area. The STATSGO database divides wind erodibility potential into eight categories based on slope, soil type, and wind characteristics. It was assumed that groups 1 through 4 represent soils that are highly erodible, with wind erodibility ranging from greater than 310 tons per acre per year (T/A/Y – Group 1), to 86 T/A/Y – Group 4. Groups 5 through 8 range from 56 T/A/Y (Group 5) to Group 8 – 0 T/A/Y.

To assess the impacts to soil from wind erodibility, the centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO wind erodibility GIS data file and the area for each wind erodibility group (in acres) was determined. Soils in groups 1 through 4 (greater than or equal to 86 T/A/Y) were considered highly wind erodible. Highly wind erodible soils were expressed as a percentage of the total Analysis Area for the segment. To disclose overall impacts by segment, the area containing highly wind erodible soil was identified along the construction and operations disturbance areas of the Proposed Route and compared to the highly erodible soil areas for the construction and operations disturbance areas of the feasible alternatives.

Erosion Potential by K Factor

K Factor is a soil erodibility factor that measures a soil's potential to erode, and also the rate of runoff as measured compared to a "standard" condition. According to information provided on the U.S. Department of Energy, Pacific Northwest National Laboratory website (DOE 2003b), soil K Factors can range from 0.02 to 0.6. Therefore, low K values were assumed to range from 0.02 to 0.25, moderate K values from 0.25 to 0.37, and high K values greater than 0.37. The value of 0.37 and above was selected to define high K value because it was one of the values reported in the STATSGO GIS data file.

To assess the erodibility of soil, the centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO K Factor GIS data file and the area for K Factor group (in acres) was determined. High K Factor soils were determined, and their area expressed as a percentage of the total Analysis Area for the segment. To disclose overall soil erodibility impacts by segment, the areas with high K Factor were identified within the construction and operations disturbance areas of the Proposed Route and compared to the high K Factor areas in the construction and operations disturbance areas of the feasible alternatives.

Steep Slopes

Soil disturbance on steep slopes would be more prone to soil erosion. The Rawlins FO RMP (Albany, Sweetwater and Carbon Counties, Wyoming; BLM 2008a) indicates that approval is necessary for surface disturbances on slopes greater than 25 percent. To assess Project areas with steep slopes, a slope inclination of 25 percent or greater to define steep slopes was used. The centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO GIS data file and the area with steep slopes (in acres) was determined. The area with steep slopes was expressed as a percentage of the total Analysis Area for the segment. To disclose the proportion of steep slopes by segment, the areas with steep slopes were identified within the construction and operations disturbance areas of the Proposed Route and compared to the steeply sloped areas in the construction and operations disturbance areas of the feasible alternatives.

Soil T Factor

The soil T Factor is an indicator of soil loss tolerance, or the amount of soil loss that can be tolerated for a soil to remain productive. Soils with a low T Factor would be more sensitive to the effects of erosion than soils with higher T Factors. The Forest Service Soil Management Handbook (Forest Service 1991b) presents an example threshold soil loss tolerance of 2 T/A/Y for deep soils or 1 T/A/Y for shallow soils; however, it indicates that actual soil loss tolerance standards may vary. The Caribou-Targhee NF has adopted these tolerances in their Forest Plan. In their RMP Final EIS, the High Desert District, Rawlins FO BLM states that soil loss should not exceed 2 T/A/Y following reclamation (BLM 2008a). Given the Forest Service and at least one BLM district guideline of 2 T/A/Y soil loss tolerance, the effects analysis herein utilized this soil loss tolerance of 2 T/A/Y as a guideline.

For the analysis, each segment Analysis Area was examined and the percent of area containing a low T Factor (≤ 2 T/A/Y) determined. To assess the areas with low soil loss tolerance, the centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO T Factor GIS data file and the area for T Factor group (in acres) was determined. Low T Factor soils were determined, and their area expressed as a percentage of the total Analysis Area for the segment. To disclose overall impacts to low soil loss tolerance soils by segment, the areas with low T Factor were identified within the construction and operations disturbance areas of the Proposed Route and compared to the low T Factor areas in the construction and operations disturbance areas of the feasible alternatives.

Prime Farmland

According to the NRCS, prime farmland contains soils with the best physical and chemical characteristics for production of food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. In general, prime farmlands have an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. The soils are permeable to water and air.

Prime farmlands are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding (Forest Service 1991b).

The NRCS separates prime farmland into several categories. For this analysis, prime farmland with no restrictions, prime farmland when irrigated, and prime farmland when drained, were used to describe prime farmland. For the prime farmland analysis in this section, the centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO Prime Farmland GIS data file. The prime farmland acreage was then determined, expressed as a percentage of the total Analysis Area for the segment. To disclose overall impacts to prime farmland by segment, the prime farmland areas were identified within the construction and operations disturbance areas of the Proposed Route and compared to the prime farmland areas in the construction and operations disturbance areas of the feasible alternatives. Section 3.18 – Agriculture presents further information on the Project's impacts to agriculture, including prime farmland.

Soil Compaction

The areas where compaction could occur are coincident to the disturbance acreage. Different soil types have different susceptibility to compaction; however, as a conservative measure, it was assumed that if the soil is disturbed by construction equipment or operations vehicles, there is at least some potential for soil compaction. Although all soil is susceptible to compaction to varying degrees, wet soils are more readily compacted than dry, and clay loam or finer soils with poor drainage characteristics were assumed to be highly compaction prone.

To assess the areas with highly compactable soil, the centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO GIS data files showing clay loam or finer soil texture, and somewhat poorly drained to very poorly drained soil drainage characteristics. Soils meeting both the texture and drainage characteristics were defined as highly compactable, and the acreage of soils meeting these criteria was determined. The area of highly compactable soil (in acres) was expressed as a percentage of the total Analysis Area for the segment. To disclose overall impacts from highly compactable soils by segment, the highly compactable soil areas were identified within the construction and operations disturbance areas of the Proposed Route and compared to the highly compactable soil areas in the construction and operations disturbance areas of the feasible alternatives.

Stony-Rocky Soil

The NRCS Soil Survey Manual (1993) defines soil particles as being less than 2 millimeters (mm) in diameter. Particles larger than 2 mm, including gravel, cobbles, stones, and boulders, are coarse fragments. Soil with at least 20 percent coarse fragments was defined as stony-rocky soil. Rocks greater than 75 mm include cobbles, stones, and boulders. Stony-rocky soil containing predominantly gravel could reduce vegetation success because gravel competes with plant roots for space and does not retain moisture as well as fine-grained soils. Soils containing large quantities of cobbles and larger rocks provide the same impediments to revegetation as gravel. They also interfere with mechanical cultivation equipment such as plows, soil augers, and seed drills.

To assess the impacts to revegetation efforts from stony-rocky soils, the centerlines of the Proposed Route and Route Alternatives in each segment were compared to the STATSGO GIS data file for soils containing greater than 20 percent by weight soil particles greater than 2 mm and the area of stony-rocky soils (in acres) was determined. The proportion of stony-rocky soils was expressed as a percentage of the total Analysis Area for the segment. To disclose overall impacts by segment, the area containing stony-rocky soils was identified along the construction and operations disturbance areas of the Proposed Route and compared to the stony-rocky soil areas for the construction and operations disturbance areas of the feasible alternatives.

Droughty Soil

Droughty soils contain a texture of sandy loam or coarser and are moderately to excessively well drained. Due to their low water-holding capacity, droughty soils may not hold enough water within the root zone to support plant life, making revegetation difficult. In the Project EPMs (see Appendix C-1), the Proponents commit to mulching and stabilizing droughty soils to minimize wind erosion and conserve soil moisture (SW-13). A soil was considered droughty if it has sandy loam or coarser texture, and drainage class of moderately to excessively well drained.

To assess the impacts to droughty soils, the centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO GIS data files for soils with sandy loam or coarser texture and drainage class moderately to excessively well drained. The droughty soil acreage was then determined, and the acreage was expressed as a percentage of the total Analysis Area for the segment. To disclose the overall extent of droughty soil by segment, the droughty soil areas were identified within the construction and operations disturbance areas of the Proposed Route and compared to the droughty soil in the construction and operations disturbance areas of the feasible alternatives.

Shallow Bedrock

According to NRCS soil descriptions, shallow bedrock is defined as bedrock occurring within 20 inches of ground surface. Bedrock is considered as moderately deep between 20 and 40 inches, as deep from 40 to 60 inches, and as very deep if greater than 60 inches. The bedrock classifications from shallow to deep were examined and are referred to as “shallow bedrock” because they occur within 5 feet of ground surface, the area where most Project disturbance would occur. Blasting would be necessary in the footings of transmission line towers and possibly other structures, in areas where shallow bedrock would be encountered. This blasting could result in mixing of topsoil and subsoil, and an increase in the stony-rocky component in these areas, making revegetation difficult. The STATSGO database provided a category for bedrock of 51 inches below ground surface; therefore, the analysis here assumes that bedrock less than 51 inches that is disturbed during construction could negatively affect revegetation efforts. The evaluation of bedrock in this section is strictly relative to a soil’s ability to sustain revegetation. Section 3.14 – Geologic Hazards and Section 3.16 – Water Resources define shallow bedrock at a deeper level, and the effects presented in the other sections are relative to destabilizing geological hazards (Section 3.14) or blasting effects to groundwater wells (Section 3.16). This is the reason for the differing definitions of shallow bedrock and the different percentages of shallow bedrock in the Analysis Areas.

To assess the impacts to revegetation efforts from shallow bedrock, as defined above, the centerlines of the Proposed Route and Route Alternatives in each segment were compared to the STATSGO GIS data file for soil profiles listing bedrock at 51 inches or less below ground surface. The proportion of soil having shallow bedrock was expressed as a percentage of the total Analysis Area for the segment. To disclose overall shallow bedrock impacts by segment, the acreage of shallow bedrock was identified along the construction and operations disturbance areas of the Proposed Route and compared to the amount of soil containing shallow bedrock (in acres) for the construction and operations disturbance areas of the feasible alternatives.

Hydric Soil

Hydric soils are formed under saturation, flooding, or ponding for sufficient period to develop anaerobic characteristics in the upper soil horizon. Hydric soils, combined with surface water or shallow groundwater and indicative vegetation species, are necessary indicators of wetlands. Disturbance of hydric soils may result in decreased water storage capacity of soil, decreased soil porosity, and decreased ability to replace hydrophytic vegetation. The STATSGO database delineates hydric soils, and the areas of hydric soil were reviewed in the Analysis Areas, and the amount of hydric soil was compared between the Proposed Route and feasible alternatives.

The estimated extent of wetlands, based strictly on vegetation mapping conducted for this project, is more fully discussed in Section 3.9 – Wetlands and Riparian Areas. Section 3.9 also contains mitigation measures proposed to protect wetlands and hydric soils. All areas estimated as wetlands in Section 3.9 presumably contain hydric soils. However, substantially more wetland acreage is estimated from the vegetation mapping when compared to the amount of hydric soils reported in the STATSGO database. The actual extent of wetlands (and therefore hydric soils) would be determined after a route has been selected.

To assess the areas with hydric soils based on the STATSGO data, the centerlines of the Proposed Route and Route Alternatives in each segment were overlaid on the STATSGO GIS data file for hydric soils and the acreage was determined. The hydric soil proportions were determined and their area expressed as a percentage of the total Analysis Area for the segment. To disclose overall impacts to hydric soils by segment, the hydric soil areas were identified within the construction and operations disturbance areas of the Proposed Route and compared to the hydric soil areas in the construction and operations disturbance areas of the feasible alternatives.

3.15.1.5 Existing Conditions

The Project area contains soils of several major soil orders, including Entisols, Aridisols, and Mollisols. Also included are small areas of Inceptisols and Alfisols in mountainous areas. The soil orders, and the physical characteristics listed in the Section 3.15.1.4 –

Methods above, were used to summarize existing soil conditions. Table 3.15-1 presents soil factors that were used to characterize Project soil conditions.

Erosion Potential

The soil characteristics of wind erodibility, K Factor, and slope were used to evaluate erosion potential. All of the segments contain at least some soil with a high potential for wind erosion. Nearly all of the soils in Segments 3 and 6 are highly wind erodible (98 percent). Soils in Segments 2, 4, and 10 have high wind erosion potential in at least 50 percent of their Analysis Areas. Only the Segment 5 Analysis Area contains a low percentage of wind erodible soil, at 5 percent. The erosion potential (high K Factor) ranged from 2 percent for Segment 2 to 63 percent for Segment 5. K Factor data suggest that Segments 1 through 4 have much lower erosion potential compared to Segments 5 through 10. Segments 5 and 7 are much steeper than any of the other segments, with steep slopes over 30 percent of their area. The other segments range from 0 to 14 percent steep slopes. Taken collectively, all of the Analysis Areas contain at least one characteristic that would result in vulnerability to soil erosion. Segments 2, 3, 4, 6, and 10 contain the highest potential for wind erosion, Segments 5, 7, 8, 9, and 10 contain high percentages of area with high erosion potential (K Factor). Segments 5 and 7 have the steepest slopes.

Soil Loss Tolerance

There are large areas with low soil loss tolerances in nearly all of the Analysis Areas. A review of T Factors within the Analysis Areas indicates that Segment 2 has no land designated as low soil loss tolerance, but all other segments contain moderate to high percentage of area with low soil loss tolerances. Segments 3, 4, 6, 8, and 9 contain low soil loss tolerances in 50 percent or greater of their areas.

Prime Farmland

Prime farmland soils provide an important economic base to southern Idaho. Dry land and irrigated farming covers the majority of private land in southern Idaho and 28 to 41 percent of Segments 5, 7, 8, 9, and 10 contain prime farmland. Much of the prime farmland in Idaho is currently used for farming. Areas of prime farmland soil that are not currently used would be good candidates for revegetation, provided the sites contain adequate moisture. A short growing season and lack of water result in the absence of prime farmland in Wyoming.

Soil Reclamation Potential

Several soil factors were used to evaluate the soil's potential for use in soil reclamation and revegetation, including soil order, soil compaction potential, stony-rocky soil, droughty soil, hydric soil, and depth to bedrock.

A review of the STATSGO soil data indicates that highly compaction-prone soil is rare. Two percent of Segment 4 contains highly compaction-prone soil; otherwise, it was absent in all other segments. The sandy desert soils found in most of the Project area are not especially prone to compaction.

Table 3.15-1. Soil Factors in the Gateway West Project Analysis Area (percent of area)

Segment Number	Total Analysis Acreage	Erosion Factors			Sensitive Soils		Factors Affecting Reclamation					Permanent Soil Loss
		Highly Wind Erodible[1/]	High K Factor[2/]	Slope Greater Than 25%	Low T Factor[3/]	Prime Farmland[4/]	Highly Compaction Prone[5/]	Stony / Rocky[6/]	Droughty[7/]	Shallow Bedrock[8/]	Hydric Soil	
1	177,561	36	–	14	19	–	–	19	55	10	–	<1
2	77,268	60	2	–	–	–	–	0	60	–	–	1
3	35,635	98	21	1	74	–	–	1	79	67	–	1
4	262,621	57	18	11	50	–	2	28	63	38	4	<1
5	102,093	5	63	36	35	37	–	38	40	8	–	<1
6	1,304	98	2	–	75	18	–	–	98	47	–	<1
7	292,396	23	49	34	43	41	–	41	52	12	–	<1
8	159,253	40	41	–	69	28	–	1	53	16	–	<1
9	229,434	48	43	1	60	32	–	10	42	42	–	<1
10	21,877	55	60	–	38	35	–	16	38	21	–	<1

1/ Includes wind erodibility groups ≥86 T/A/Y
2/ Includes K Factors ≥ 0.37 T/A/Y
3/ Includes T Factors ≤ 2/T/A/Y
4/ Idaho data from STATSGO, Wyoming data from Soil Survey Geographic database.
5/ Includes moderately to poorly drained soils with clay loam or finer textures.
6/ Includes soil with 20 percent or more by weight rocks ≥ 2 mm (gravel, cobbles, stones, or boulders).
7/ Includes sandy loam or coarser texture and moderately to excessively well drained soils.
8/ Includes exposed bedrock (from soil texture) and depth to bedrock less ≤ 51 inches.

The greatest percentage of stony-rocky soil in the Analysis Area is present in Segments 4, 5, and 7 with stony-rocky soils covering 28 to 41 percent of the Analysis Areas. The other segments contain less than 20 percent stony-rocky soil. Fourteen soil borings were drilled where no gravel was noted on the boring logs, despite being identified by STATSGO as stony-rocky soil. Two boreholes contained gravel soils, although STATSGO did not identify stony-rocky soil. These differences suggest that the percentage of actual stony-rocky soil may be slightly different than that reported here and in Table 3.15-1.

Shallow bedrock is found in all segments except Segment 2. Droughty soil is common throughout the Project. Segments 1, 2, 3, 4, 6, and 8 contain at least 50 percent droughty soil. According to the STATSGO database, hydric soils are not common in the Analysis Area; they are found only in 4 percent of the area of Segment 4. However, future Project wetland delineations would probably result in the discovery of additional hydric soil acreage.

Permanent Soil Loss

The acreage of permanent soil loss equals the operations disturbance area (the area beneath the Project structures and access roads). For the Proposed Route, the permanent soil loss is estimated at 3,029 acres, less than 1 percent of the Analysis Area.

3.15.2 Direct and Indirect Effects

This section is organized to present effects to soils from construction, then operation, followed by decommissioning activities for the proposed Project. Route Alternatives are analyzed in detail in Section 3.15.2.3. There is a Design Variation involving use of two single-circuit structures proposed by the Proponents for Segments 2, 3, and 4 (see Section 2.2 for details), which is analyzed in Section 3.15.2.4 and a Structure Variation that is analyzed in Section 3.15.2.5. The Proponents have also proposed a Schedule Variation, analyzed in Section 3.15.2.6, in which one of the two single circuits to be constructed in Segments 2, 3, and 4 and a portion of Segment 1W would be built on an extended schedule with construction beginning approximately 2.5 years after completion of the initial construction.

Mitigation measures or EPMs are presented in detail within this section only if it is the first time they have been discussed in Chapter 3; all other measures are referenced or summarized. A comprehensive list of all Proponent-proposed EPMs and Agency-required mitigation measures can be found in Table 2.7-1 of Chapter 2.

Plan Amendments

Proposed amendments are summarized in Table 2.2-1 of Chapter 2 and detailed in Appendices F and G. Amendments are needed to permit the Project to cross various areas of BLM-managed and NFS lands. Effects described for areas requiring an amendment in order for the Project to be built would only occur if the amendment were approved. Amendments that alter land management designations could change future use of these areas. No amendments specific to soils are proposed for the Project and no impacts to soils resulting from approving the amendments beyond the impacts of the Project are anticipated.

3.15.2.1 No Action Alternative

Under the No Action Alternative, the Proposed Action would not be constructed or operated. No Project-related impacts to soils would occur.

3.15.2.2 Effects Common to All Action Alternatives

Construction

Construction Erosion Effects

Project construction activities that would affect soils include clearing, grubbing, and grading along the ROW and at additional temporary workspaces; trenching; backfilling; excavating; and construction of permanent structures, such as transmission line towers, access and service roads, co-generation sites, and substations. The total Project construction disturbance area consists of approximately 16,000 acres, which is approximately one percent of the Analysis Area. The construction disturbance area was calculated by establishing an assumed construction disturbance area around all Project features, such as transmission line towers, regeneration sites, substations, staging areas, laydown yards, and access roads. This predicted area was entered into a GIS database and compared to the areas of the various soil factors used for the soils analyses using the methods described in Section 3.15.1.4. The estimated soil effects within the construction disturbance area are presented in Table D.15-1 in Appendix D. Ground clearing during construction would increase the potential for erosion. Certain soils within the Project area would be more sensitive to soil impacts, including soils with a low soil loss tolerance, and soils qualifying as prime farmland. Removal of protective vegetation would expose soil to potential wind and water erosion. The construction acreage is larger than the operations area due to the need for tower erection areas at each structure, laydown yards, staging areas, and tensioning sites. The areas used only for construction would be reclaimed as soon as possible, which may include regrading to original land contours, topsoil replacement, and revegetation.

Portions of all Segments except Segment 2 contain areas with low soil loss tolerance, defined as soil loss tolerance less than or equal to 2 T/A/Y. EPMs and Agency-proposed mitigation measures would be used to minimize soil losses. When effectively used, these would ensure that soil loss is minimized and soil loss tolerances would meet applicable RMP and Forest Plan guidelines.

Prior to construction, wetland delineations would be necessary in areas crossing or adjacent to assumed wetlands. At that time, the amount of hydric soils/wetlands would be re-evaluated and measures would be implemented to preserve or reclaim those acreages during construction and operation. The procedures presented in the Reclamation Plan (Appendix C-2), EPMs included in Appendix C-1, and the mitigation measures contained in Section 3.9 – Wetlands and Riparian Areas would be used to minimize effects to hydric soils and wetlands. FSH 2509.22, Soil and Water Conservation Practices, contains mitigation measures for hydric soils to be used on NFS land.

Reclamation would be necessary in disturbed soil areas. Appendix C-2 presents a Framework Reclamation Plan that the Proponents would use for Project reclamation. The Framework Reclamation Plan presented in Appendix C-2 and the EPMs presented in Appendix C-1 also contain many BMPs that would be used during Project construction, operations, and reclamation. Erosion in all areas could be exacerbated unless revegetation efforts are implemented as soon as possible following disturbance.

Construction on Sensitive Soils

For the effects analysis, soils with low soil loss tolerances and prime farmland soils were combined and considered as sensitive soils due to the special characteristics that separate them from other Project soils. Potential soil impacts to prime farmland from transmission line construction include soil erosion, damage to the agricultural land drainage and irrigation systems, mixing of topsoil and subsoil, potential loss of topsoil, and soil compaction. Prime farmland within the construction zone would be unavailable to agriculture during the construction interval. Construction on soil with low soil loss tolerance may cause erosion. If blasting is necessary for placement of foundations, the rocky component of soils may increase in blasting areas. Based on all of the soil factors, it appears that accounting for droughty, rocky conditions would be most critical to successful revegetation.

It may be necessary to build construction access roads on sensitive soil areas, including highly erosive soils, steep slopes or near NHT trails. These construction roads would be restored and an alternative access route would be designated for operations.

The reclamation measures presented in Appendix C-2 and EPMs in Appendix C-1 would keep soil losses to a minimum. Areas not also used for operations would be reclaimed as soon as possible following construction.

Soil Compaction

Soil compaction would occur in the construction disturbance area from driving vehicles and heavy equipment over the soil. Areas under roadways, structures, and high-use areas would be most affected. Some soils, such as very fine-grained, poorly drained soil have the greatest potential for soil compaction; however, all soil would have some potential for soil compaction, and compacted soil would need to be ripped, loosened, or otherwise treated using BMPs at the end of the Project to restore their productivity.

Accidental Spills

During construction, use of trucks, heavy equipment, or stored supplies could result in accidental discharge of fuel, lubricants, automotive fluids, or other chemicals. Although the potential exists, these chemical releases would be accidental, occasional, and of limited extent. BMPs for construction housekeeping, spill prevention, and cleanup would be used to prevent and remediate accidental chemical releases. Therefore, chemical releases would not result in widespread or long-term effects to Project soils.

The Proponents have identified and are committed to implementing extensive EPMs related to controlling soil erosion in accordance with NPDES requirements and spill prevention and containment in accordance with industry standards. These EPMs are listed in Appendix C-1, Attachments B and C, and are included below.

SW-1 The appropriate NPDES permits for construction activities that disturb one acre or more of land will be obtained from the Department of Environmental Quality and USEPA or their designees.

SW-2 NPDES permit requirements will be met. This includes implementing and maintaining appropriate BMPs for minimizing impacts to surface water.

SW-3 One or more responsible persons will be designated to manage stormwater issues, conduct the required stormwater inspections, and maintain the appropriate records to document compliance with the terms of the NPDES permit.

SW-4 The SWPPPs will be modified as necessary to account for changing construction conditions.

SW-5 The SWPPPs will identify areas with critical erosion conditions that may require special construction activities or additional BMPs to minimize soil erosion.

SW-6 Migration of construction-related sediment to all adjacent surface waterbodies will be prevented.

SW-7 Stormwater BMPs will be maintained on all disturbed lands during construction activities, as described in the SWPPP.

SW-8 Approved sediment and erosion control BMPs will be installed and maintained until disturbed areas meet final stabilization criteria.

SW-9 Temporary BMPs will be used to control erosion and sediment at staging areas (equipment storage yards, fly yards, lay down areas) and substations.

SW-10 The construction schedule may be modified to minimize construction activities in rain-soaked or muddy conditions.

SW-11 Damaged temporary erosion and sediment control structures will be repaired in accordance with the SWPPP.

SW-12 Upon completion of construction, permanent erosion and sediment BMPs will be installed along the transmission line within the ROW, at substations, and at related facilities in accordance with the SWPPPs.

SW-13 In areas of droughty soils, the soil surfaces will be mulched and stabilized to minimize wind erosion and to conserve soil moisture in accordance with the SWPPPs.

SPC-1 Construction industry standard practices and BMPs will be used for spill prevention and containment.

SPC-2 Construction spills will be promptly cleaned up and contaminated materials hauled to a disposal site that meets local jurisdictional requirements.

SPC-3 All staging areas will contain fueling areas with containment. Where fueling must be conducted along the ROW, the plan will specify BMPs.

SPC-4 If an upland spill occurs during construction, berms will be constructed with available equipment to physically contain the spill. Absorbent materials will be applied to the spill area. Contaminated materials will be excavated and temporarily placed on and covered by plastic sheeting in a containment area a minimum of 100 feet away from any wetland or waterbody, until proper disposal is arranged.

SPC-5 If a spill occurs which is beyond the capability of on-site equipment and personnel, an Emergency Response Contractor will be identified and available to further contain and clean up the spill.

SPC-6 For spills in standing water, floating booms, skimmer pumps, and holding tanks will be used as appropriate by the contractor to recover and contain released materials on the surface of the water.

SPC-7 If pre-existing contamination is encountered during operations, work will be suspended in the area of the suspected contamination until the type and extent of the contamination is determined. The type and extent of contamination; the responsible party; and local, state, and federal regulations will determine the appropriate cleanup method(s) for these areas.

SPC-8 The SPCC Plan will include details on the types and quantities of absorbent and protective materials (e.g., visqueen, booms) that must be readily available to construction personnel and requirements for the restocking of materials.

SPC-9 Materials such as fuels, other petroleum products, chemicals, and hazardous materials including wastes will be located in upland areas at least 500 feet away from streams, 400 feet for public wells, and 200 feet from private wells.

SPC-10 Pumps and temporary fuel tanks for the pumps will be stored in secondary containment. Containment will provide a minimum volume equal to 110 percent of the volume of the largest storage vessel located in the yard.

The Agencies have identified the following mitigation measures to provide additional protection of soils during construction. The Agencies recommend that these measures be applied to the entire route:

SOIL-1 Efforts will be made to preserve topsoil and minimize mixing with subsoil. In agricultural areas, the landowner or land management agency will be asked to provide input on placement of removed topsoil. The Wyoming State Reclamation policy and applicable Agency management plan requirements for soil management will be followed. Soil disturbances in agricultural areas will be developed to minimize impacts to existing agricultural activities where possible. Unless the landowner or land management agency specifically approves otherwise, the Proponents will prevent the mixing of topsoil with subsoil by stripping topsoil from the portion of the construction work area that will be restored (construction pad, storage yards, and fly yards) in actively cultivated or rotated croplands and pastures and other areas at the landowner's or land-managing agency's request. Where topsoil segregation is required, the Proponents will maintain separation of salvaged topsoil and subsoil throughout all construction activities. Immediately after construction, topsoil will be restored to the areas not dedicated to operational requirements and revegetated as specified in the EPMs (see also measure AGRI-6 in Section 3.18 – Agriculture).

SOIL-2 The Proponents will submit a Compaction Monitoring Plan for review and Agency approval prior to construction that specifies the conditions under which construction will either not start or will be shut down due to excessively wet soils. Conditions will be measurable in the field and easy to demonstrate to construction workers.

SOIL-5 Disturbed soil will not be allowed to support the growth of noxious weeds, or invasive weedy species. Prevention of noxious weeds will apply to all phases of the Project.

SOIL-6 Detrimental soil disturbance such as compaction, erosion, puddling, and displacement will be limited or mitigated to meet long-term soil productivity goals on NFS lands. Treatment should include road ripping, frequent waterbars, cross-ditching (e.g., rolling-dips), or other methods to reduce compaction while preventing gully formation. Ripping pattern should be altered to a crossing, diagonal, or undulating pattern of tine paths to avoid concentrated runoff patterns that can lead to gullies.

SOIL-7 The Proponents are responsible for monitoring to ensure soil protection is achieved and providing monitoring reports on reseeding success or other methods to stabilize soils to the Forest Service by the end of each growing season for areas on NFS lands.

SOIL-8 Reclamation of all temporary disturbances on NFS lands (such as road cuts) should include replacement of material to original contours. Re-compaction to pre-existing compaction percentage (which should be identified before disturbance) should be included in the plan. Guidelines for streambank re-compaction to maximize vegetative regrowth and mechanical stability are covered in USACE publication ERDC TN-EMRRP-SR-26 (Goldsmith et al. 2001).

SOIL-9 On federal land, follow land management plan requirements on the location of waste material (silt, sand, gravel, soil, slash, debris, chemical, etc.).

SOIL-10 On NFS lands, soil resources will be inventoried to National Cooperative Soil Survey Standards, and the volumes and suitability of soil resources for reclamation will be determined prior to disturbance.

SOIL-11 In specific sensitive areas (such as erosive soils or steep slopes) on lands managed by the Kemmerer FO, the access road used for construction will be restored and an alternative access route for operations designated.

Operations

Operations Erosion Effects

The erosional effects from Project operations would consist of soil disturbances necessary to maintain the transmission lines in working order and conduct necessary repairs. Stormwater BMPs, including erosion and sediment control structures, as well as new culverts would require inspection, maintenance, and repair through the operational life of the Project to minimize soil erosion or sedimentation to surface water. The Proposed Route operations disturbance area is about 3,000 acres, or approximately 19 percent of the construction area disturbance. Due to the smaller size of the operations area, the erosion effects in this area would be much less than for the construction area but would last for a much longer time. The operations area consists of buffered areas surrounding transmission line towers, regeneration sites, substations, access roads, and other areas that would remain during Project operations. The predicted operations area was entered into a GIS database and compared to the areas of the various soil factors used for the soil analyses using the methods described in Section 3.15.1.4. The estimated effects to soil within operations disturbance areas are presented in Table D.15-2, Appendix D.

The treatment of soils in the operations area would result in more stable soil conditions than those found during construction. For instance, substations would be covered with free draining rock, which would isolate native soil from erosive conditions. Roads retained for operations would be seeded with a grass mix and allowed to revegetate and thereby minimize the surface exposed to erosive conditions. For normal maintenance activities, an 8-foot portion of the road would be used and vehicles would drive over the vegetation. For non-routine maintenance requiring access by larger vehicles, the full width of the access road may be used. Access roads would be repaired, as necessary, but not be routinely graded again to minimize impact to vegetation. Appendix C-1, Attachment B, includes EPMs that specify that stormwater protection measures would be employed to minimize erosion and sedimentation to surface water.

Sensitive Soil Effects

Reclamation after construction would minimize effects to soils with low soil loss tolerance during the operations phase of the Project. The area of loss of prime farmland would be less than during construction but for the longer time interval, 50 years compared to 2 years for construction.

Soil Compaction

No additional soil compaction would occur during Project operations. Vehicle travel would occur predominantly on established access roads.

Permanent Soil Loss

The area under the footprint of structures would result in a long-term loss of that acreage to other productive soil uses. Structures in the operations area were considered to result in “permanent” soil loss. However, it is not really permanent, and following Project decommissioning, those areas would be reclaimed for other beneficial uses. The acreage of permanent soil loss would depend on the route alternatives selected; the longer the route, the more acres of soil that would be permanently removed from production.

The Proponents have identified and are committed to implementing extensive EPMs related to controlling soil erosion in accordance with NPDES requirements and spill prevention and containment in accordance with industry standards. These EPMs are listed in Appendix C-1 and are listed in the preceding section.

Decommissioning

Decommissioning would result in temporary soil effects of approximately the same magnitude as during construction; therefore, the same practices used during construction to minimize effects to the soil would be used during decommissioning activities. All transmission line structures and associated features would be removed, and disturbed areas would be reclaimed. Based on the descriptions of soil orders, the Mollisols found in Segments 1, 4, 5, and 7 were assumed to be most suitable for reclamation and revegetation, given the assumed slightly wetter, cooler climate in these segments; existing grassy vegetation; and the organic content of these soils. Variations in soil properties, including wind and water erosion potential, soil moisture, texture, and drainage characteristics, would cause soils to be affected differently in regard to erosion potential, compaction potential, and their suitability for reclamation and revegetation.

Decommissioning activities would include excavation to remove structures. This temporarily exposes bare soil to erosional effects. Grading may occur to restore natural land contours, or to spread stockpiled topsoil onto reclaimed land. Reclaimed roads would be ripped to reduce compaction. During decommissioning, those areas with “permanent” topsoil removal would be reclaimed, and revegetated to pre-construction conditions. These activities would result in temporary exposure of bare soil to increased erosion.

The Agencies have identified the following mitigation measures to protect soils during decommissioning and the Proponents have agreed to incorporate them in their EPMs:

SOIL-3 During decommissioning, some obviously compacted areas, such as established service roads, will require loosening prior to revegetation. If necessary to re-establish vegetation, the Proponents will use a ripper blade, till, or similar instrument to loosen the surface soil layer.

SOIL-4 Reclamation will include revegetation unless pre-existing conditions were not vegetated (rocky areas, agricultural fields). On public land the appropriate agency will provide input on the extent of reclamation, the type of vegetation to be planted, and the monitoring necessary to ensure reclamation success.

3.15.2.3 Proposed Route and Alternatives by Segments

This section details the differences among alternatives for soils effects from Project construction, operations, and decommissioning. Tables D.15-1 and D.15-2 in Appendix D present the results of soil analyses for the Proposed Route and Route Alternatives.

Segment 1E

Segment 1E, as proposed, would link the Windstar and Aeolus Substations in south-central Wyoming with a 100.6-mile 230-kV single-circuit transmission line. Twenty acres of the expansion of Windstar and Aeolus Substations and 0.5 acre for one regeneration site are attributed to Segment 1E. Alternative 1E-A is a 16.1-mile alternative along the north end of Segment 1E, which was the Proponents' initial proposal before moving the Proposed Route at the suggestion of local landowners to avoid the more settled area around Glenrock. Alternative 1E-B is 21.4 miles longer than the Proposed Route but is being considered by the Proponents because it would avoid a Wyoming-designated sage-grouse core area to the east. The BLM has required the consideration of Alternative 1E-C, which parallels Segment 1W 230-kV lines into the Aeolus Substation (see Appendix A, Figure A-2).

As shown in Table D.15-1 in Appendix D, the construction of the proposed Segment 1E would result in disturbance of approximately 1,096 acres that would be exposed to the effects of soil erosion and compaction. There would be 5 acres of disturbance, distributed along the Proposed Route for Segment 1E, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. About 26 percent of the Segment 1E construction disturbance area would contain soil with high wind erosion potential and 18 percent of the construction disturbance area would contain steep slopes. About 21 percent of Segment E would have a low soil loss tolerance. Approximately 25 percent of the Proposed Route would contain stony-rocky soil.

Table D.15-1 lists the acreages of the soil factors for each alternative that would be disturbed during construction. As shown in Table D.15-1, Alternative 1E-A would have less disturbance than the comparison portion of the Proposed Route. This is because Alternative 1E-A would be adjacent to the Proposed Route for Segment 1W(c) and would use the same fly yards and staging areas. These acreages are accounted for in Segment 1W(c). Alternative 1E-B is 21.4 miles longer than the comparison portion of the Proposed Route. The soils would be similar in both cases but the disturbed acreages for the various soil types would be proportionately larger in Alternative 1E-B than in the comparison portion of the Proposed Route. Alternative 1E-C would parallel the Proposed Route for Segment 1W(a) and be substantially shorter than the comparison portion of the Proposed Route. Alternative 1E-C would use the same fly yards, staging areas, and some of the access roads that are accounted for in Segment 1W(a). As a result, Alternative 1E-C would disturb considerably less acreage than the comparison portion of the Proposed Route.

Table D.15-2 in Appendix D lists the acreages of the soil factors for each alternative that would be impacted by operations. For the Proposed Route, 283 acres would be disturbed. Each alternative would have a proportionately larger or smaller disturbance area, depending primarily on the relative length of the alternative compared to Segment

1E. Alternative 1E-C would be the most favorable, resulting in a disturbance area of 92 acres.

As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction. Similar construction equipment is involved. Therefore, the disturbance acreages presented in Table D.15-1 are indicative of the acreages that would be impacted during decommissioning of Segment 1E or any of the alternatives. The final step of decommissioning, however, is reclamation. This step would restore the areas to pre-construction conditions and mitigate future soil impacts, although the preponderance of droughty soils will make reclamation challenging.

A portion of the Proposed Route for Segment 1E is located on the Medicine Bow-Routt NFs (see Tables D.15-3 and D.15-4). The Proposed Route would affect approximately 25 acres during construction and 8 acres during operations. None of the soils crossed on the Medicine Bow-Routt NFs are highly erodible. Alternatives 1E-A and 1E-B would not be located in the Medicine Bow-Routt NFs. Alternative 1E-C would affect approximately 12 acres during construction and 4 acres during operations, which is 13 and 4 acres, respectively, less than the comparison portion of the Proposed Route. There would be a long-term loss of 5 acres of productive soils from the Segment 1E Proposed Route and 3 acres from Alternative 1E-C. The effects on NFS lands are shown in Tables D.15-3 and D.15-4.

Segment 1W

Segment 1W is composed of two parts, Segment 1W(a) and 1W(c), both of which would consist of a new 230-kV line for part of their length and a reconstruction of an existing 230-kV line for the remaining part. Segment 1W(a) would be about 76.5 miles long, and would extend from the Windstar Substation to the Aeolus Substation. Segment 1W(c) would be about 70.6 miles long, and would extend from the Dave Johnson Power Plant to the Aeolus Substation. Alternative 1W-A is a 16.2-mile alternative located near the town of Glenrock, which was the Proponents' initial proposal before moving the Proposed Route at the suggestion of local landowners in order to avoid the more settled area around Glenrock. Twenty acres of the proposed expansion at the Windstar and Aeolus Substations are attributed to Segment 1W(a) and 3 acres of the expansion at the Heward Substation and 17 acres of the expansion at the Windstar and Aeolus Substations are attributed to Segment 1W(c). There are no Route Alternatives proposed south of that point (see Appendix A, Figure A-2).

As shown in Table D.15-1, construction of the proposed Segment 1W(a) would disturb approximately 623 acres. The construction disturbance area of proposed Segment 1W(c) would be 817 acres. There would be 3 acres of disturbance, distributed along these segments, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. Alternative 1W-A would be shorter than Segment 1W(a) and mostly parallels Segment 1W(c). As a result, the disturbance effects associated with construction of Alternative 1W-A would be greater than for the comparison portion of Proposed Route (see Table D.15-1).

As shown in Table D.15-2, the operations areas of Segment 1W(a) and 1W(c) Proposed Routes would result in the permanent disturbance of 182 acres and 144 acres of soil, respectively. As described in the previous paragraph relating to construction, Alternative 1W-A would result in a somewhat smaller disturbance acreage during operations than the comparison portion of the Proposed Route because it is shorter.

Approximately 29 percent of the soil in Segment 1W is considered droughty and soils are moderately wind erodible. As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction and as shown in Table D.15-1 for each segment of Alternative 1W-A. The final step of reclamation would restore the areas to pre-construction conditions and mitigate future soil impacts. The droughty portions of the alternative will make reclamation challenging.

A small portion of Segment 1W would be located on the Medicine Bow-Routt NFs (see Tables D.15-3 and D-15-4). The construction and operations phases of the Proposed Route for Segment 1W(a) would affect 16 acres and 5 acres, respectively. The Proposed Route for Segment 1W(c) would affect 27 acres and 4 acres, respectively. None of the soils crossed on the Medicine Bow-Routt NFs acreage are highly erodible. There would be a long-term loss of 2 acres of NFS land for the Segment 1W(a) Proposed Route and 4 acres for the Segment 1W(c) Proposed Route. Alternative 1W-A is not located in the Medicine Bow-Routt NFs.

When reviewing all of the soil factors, the Proposed Route would result in the least overall impacts to soil in Segment 1W, mainly due to fewer erosional effects and avoidance of shallow bedrock.

Segment 2

Segment 2, as proposed, would link the Aeolus and Creston Substations in southeast Wyoming with two 500-kV circuits on one structure. One circuit would be operated at 230 kV during the initial phase of the Project. Its total proposed length is 96.7 miles. Fifty-two acres of the expansion of the Aeolus Substation and the construction of the Creston Substation and 0.5 acre for one regeneration site are attributed to Segment 2. There are three Route Alternatives, two of which are near the community of Fort Fred Steele. Alternative 2A at 28.4 miles long is being considered by the BLM because it remains in the WWE corridor nearer the town and the state historic site, and Alternative 2B, at 6.2 miles, is closer to the community than the comparison portion of the Proposed Route and was the initially proposed route before the Proponents responded to local suggestions and relocated the Proposed Route farther to the south. Alternative 2C is a 24.4-mile alternative located north of Hanna, Wyoming. It is being evaluated at the recommendation of the Wyoming Governor's office to follow a utility corridor approved by that office for minimizing effects to sage-grouse (see Appendix A, Figure A-3).

As shown in Table D.15-1, Segment 2 construction would disturb approximately 1,544 acres of soil. There would be 4 acres of disturbance distributed along Segment 2 associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. The Proposed Route and Route

Alternatives would be highly wind erodible, with 5 percent of the Proposed Route considered highly erodible. Segment 2 would not contain soil with low soil loss tolerance, and no prime farmland would be present. About 53 percent of the soils would be considered droughty; however, stony-rocky soil is not present. Overall, there would be little difference with respect to soil disturbance impacts between the Proposed Route for Segment 2 and Alternatives 2A, 2B, and 2C. The soils conditions would be similar because the routes would be in relative close proximity to each other. Alternative 2B would result in about 77 percent of the disturbance as the comparison portion of the Proposed Route. The differences in soil effects between the Route Alternatives and the Proposed Route would be minor.

As shown in Table D.15-2, the Segment 2 operations area would comprise 401 acres. The disturbed area associated with operations in all of the alternatives would be approximately the same as in the respective comparison portion of the Proposed Route. This is because their lengths would be nearly identical.

As noted above, Segment 2 would contain 53 percent droughty soil, which would affect the success of reclamation. Rocky soils and shallow bedrock would be absent. As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction as shown in Table D.15-1. As noted in the preceding construction paragraph, there would be little difference between the disturbance footprint of the Proposed Route for Segment 2 or any of the alternatives, although Alternative 2B would result in a slightly less acreage. There would be less difference during decommissioning than construction because the overall lengths are nearly identical. The droughty nature of the soils throughout Segment 2 would make restoration challenging. No NFS land would be present in Segment 2.

Segment 3

Segment 3, as proposed, would link the Creston and Anticline Substations in southeast Wyoming with two 500-kV circuits on one structure. One circuit would be operated at 230 kV during the initial phase of the Project. Its total proposed length between those two substations is 46.7 miles. Sixty-nine acres of the construction of the Anticline and Creston Substations are attributed to Segment 3. Segment 3 would also link the Anticline and Jim Bridger Substations with a 4.3-mile 230-kV line and a 5.5-mile 345-kV line and includes the 10-acre expansion of the Jim Bridger 345-kV Substation. There are no alternatives proposed along this segment (see Appendix A, Figure A-4).

As shown in Table D.15-1 in Appendix D, Segment 3 construction would disturb about 863 acres. There would be 3 acres of disturbance, distributed along Segment 3, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. Nearly all of the soil in Segment 3 would be highly wind erodible and 71 percent would be droughty. A total of 29 percent would be classified as highly erodible, 65 percent have a low soil loss tolerance, and 60 percent have shallow bedrock. There would be no prime farmland in Segment 3. Most of the soils in the Proposed Route for Segment 3 would be subject to wind erosion and they are not well-suited to support good vegetative cover. There are no Route Alternatives in Segment 3. The nature of the soils in Segment 3 makes it especially important that disturbance during construction be minimized and as much acreage as possible be restored for operations when construction is complete.

Operations of the Proposed Route in Segment 3 would result in a disturbance area of 219 acres. As during construction, the soils in this segment would be susceptible to wind erosion. It will be important to minimize traffic during operations to reduce soil erosion potential and maintain the vegetation in restored construction areas.

Over 70 percent of the Proposed Route for Segment 3 would be considered droughty. The soil would not be very rocky, but 47 percent of the Analysis Area would be occupied by shallow bedrock. As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction as shown in Table D.15-1. The droughty characteristics of the soils in the Proposed Route for Segment 3 would make restoration of disturbed areas following decommissioning challenging. Therefore, as during construction, disturbance of soils should be kept to the minimum possible. No NFS land would be present in Segment 3.

Segment 4

Segment 4, as proposed, would link the Anticline Substation near the Jim Bridger Power Plant in southwestern Wyoming with the Populus Substation in Idaho with two 500-kV circuits on one structure. Its total proposed length is 203 miles. Eighty-nine acres of the construction of the Anticline Substation and the expansion of the Populus Substation and 1.5 acres for three regeneration sites are attributed to Segment 4. It has six Route Alternatives in the middle portion of its route but the first 52 miles to the east and the last 61 miles to the west (in Idaho) do not have any Route Alternatives. The middle section of the Proposed Route is 90.2 miles long, and its Route Alternatives vary from 85 to 102 miles long. These alternatives were proposed by the Wyoming Governor's office (4A, paralleling the existing 345-kV lines throughout); by the BLM Kemmerer FO (4B through 4E, including edits from various cooperating agencies), with the intent to avoid impacts to cultural resources to the extent practical; and by the Proponents (4F, attempting to avoid impacts to cultural resources while still remaining north of the existing lines) (see Appendix A, Figures A-5 and A-6).

As shown in Table D.15-1, construction of the Proposed Route for Segment 4 would disturb approximately 2,846 acres. Segment 4 would contain 6 acres of disturbance associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. About 62 percent of Segment 4 soils are droughty and 46 percent are highly wind erodible. About 38 percent of the soils would have a low soil loss tolerance and about 31 percent would be highly erodible. Segment 4 would contain the only highly compactable soil along the entire transmission line, although the percentage of soil in this category would be only 4 percent, consisting of slightly more than 100 acres located in the Bear River drainage. As noted above, the Route Alternatives for the Segment 4 Proposed Route would be located in the middle portion and either decrease the segment length by 5 miles or less (Alternatives 4A and 4F) or increase the length by approximately 10 to 12 miles (Alternatives 4B, 4C, 4D, and 4E). The Proposed Route and each of the alternatives would have similar soils types. The relative construction disturbance acreages in each soil factor category are listed in

Table D.15-1 and tend to be proportional to the lengths of each alternative, with the Proposed Route generally having the least disturbed acreages in the critical soil types. The one exception is that the comparison portion of the Proposed Route would have a higher acreage in areas with slopes greater than 25 percent than all but Alternative 4F, but still only amount to about 3 percent of the length of the route. The Proposed Route in combination with Alternative 4A would have the least potential soils impacts at all stages of the Project in this segment.

According to the NRCS STATSGO database, hydric soils would be found only in Segment 4 and only in about 5 percent of the Analysis Area. The area of hydric soils predicted by STATSGO is strongly underestimated, based on the wetland analysis in Section 3.9 – Wetlands and Riparian Areas, which assumes wetlands or riparian areas are present in all segments except Segment 10. The quantity of wetlands/hydric soils would be determined after the routes have been established by conducting wetland delineations. All hydric soils would be preserved where possible or reclaimed using measures described in Section 3.9.

As shown in Table D.15-2, operations of the Proposed Route would result in permanent soil productivity loss on approximately 651 acres. The areas impacted by operations for the Proposed Route and Route Alternatives would be proportional to the relative lengths. Since the lengths vary by 5 percent less to 12 percent more than the comparison portion of the Proposed Route, the disturbed acreages would vary by similar percentages. The shorter alternatives (4A and 4F) would have the least amount of soil disturbance, followed by the Proposed Route; the longer alternatives (4B, 4C, 4D, and 4E) would have the greatest amount of disturbance.

As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction as shown in Table D.15-1. The droughty characteristics of much of the soil in Segment 4 would make restoration of disturbed areas following decommissioning challenging. Therefore, as during construction, disturbance of soils should be kept to the minimum possible. The disturbance areas during construction and operations would be proportional to the relative lengths of the Proposed Route and each Route Alternative.

Approximately 9.2 miles of the Proposed Route for Segment 4 would be located on the Caribou-Targhee NF (see Tables D.15-3 and D-15-4). This would occur in the western portion of the segment. The construction phase of the Proposed Route would disturb approximately 116 acres and operations would affect approximately 27 acres. All of the soil on the portion of the Proposed Route that crossed the Caribou-Targhee NF would be highly erodible, based on the NRCS STATSGO database. However, based on the Soil Survey for the Caribou NF (Forest Service 1990b), approximately 23 acres would be on soils with a high erosion potential and approximately 3 acres would be on unstable soil. Shifting the route 200 to 300 feet to the north for the last mile of the route on the Caribou-Targhee NF would avoid the unstable area and approximately 5 acres of soil with a high erosion potential. None of the soil would have low soil loss tolerance. The Project would result in a long-term loss of 27 acres of productive soil. None of the Route Alternatives would cross the NF.

A review of all the soil factors indicates the shorter alternatives (4A and 4F) would have the least disturbance, followed by the Proposed Route, and then the longer alternatives (4B through 4E).

Segment 5

Segment 5, as proposed, would link the Populus and Borah Substations with a 54.6-mile single-circuit 500-kV line. Forty-four acres of the expansion of the Populus and Borah Substations are attributed to Segment 5. There are five Route Alternatives including two proposed by the BLM to avoid the Deep Creek Mountains (5A and 5B; 8 miles and 19 miles longer than the comparison portion of the Proposed Route), one preferred by Power County that crosses the Fort Hall Indian Reservation (5C; 6 miles shorter than the comparison portion of the Proposed Route), one originally proposed by the Proponents (5D; 10 miles shorter than the comparison portion of the Proposed Route but located within more agricultural lands), and one proposed by Power County as an alternative approach to the Borah Substation (5E) (see Appendix A, Figure A-7).

As shown in Table D.15-1, the Proposed Route for Segment 5 construction would disturb about 982 acres. There would be 1 acre of disturbance, distributed along the Proposed Route, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. Soils in this segment would have low wind erodibility, but would be predominantly highly susceptible to water erosion. All soils would be droughty. There would be a moderate quantity of low soil loss tolerance soil. About 37 percent of Segment 5 routes would consist of stony-rocky soils. Steep slopes occupy 36 percent of the Analysis Area, the highest percentage of any segment. Prime farmland makes up 37 percent of the Analysis Area. The disturbance areas during construction of Segment 5 and each alternative are listed on Table D.15-1. The soils in the Route Alternatives would be similar to the soils in the Proposed Route; therefore, the impacts would be mostly proportional to the lengths of the various routes. However, Alternatives 5A and 5B would increase the area with steep slopes, whereas Alternative 5C reduces that area compared to the Proposed Route. This is important because the combination of steep slopes and the large percentage of soils that are susceptible to water erosion, which is aggravated by steeper slopes, would make Alternative 5C have the least potential propensity for soil erosion. The least impact overall would result from the combination of the eastern portion of Segment 5 up to where Alternative 5C begins, then follow Alternative 5C to 5E, and then to the Borah Substation. The longest route with the greatest disturbance area would be Alternative 5B. Also, Alternatives 5A and 5B would traverse substantially more prime farmland than the comparison portion of the Proposed Route or Alternative 5C. Alternatives 5D and 5E would be minor adjustments to the western portions of the Proposed Route and would not have distinguishable soil impacts compared to the Proposed Route.

Operations in Segment 5 would result in the soil loss of 175 acres, 31 percent of which is in prime farmland. Table D.15-2 details the disturbance acreages for Segment 5 and the alternatives that will be maintained during operations. The greatest difference between these would be the amount of prime farmland disturbed. As noted in the previous paragraph, Alternative 5C would be the most favorable because it would have the least disturbance to prime farmland and the least amount of steep slopes.

Alternatives 5A and 5B result in the most disturbance to prime farmland. Alternatives 5D and 5E would be minor adjustments to the western portions of the Proposed Route and would not have distinguishable soil impacts compared to the Proposed Route.

As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction as shown in Table D.15-1. The droughty characteristics in combination with the steep slopes and soils subject to water erosion of the soils in the Proposed Route and Route Alternatives for Segment 5 would make restoration of disturbed areas following decommissioning challenging. Therefore, disturbance of soils should be kept to the minimum possible during restoration. The disturbance areas during construction and operations would be proportional to the relative lengths of the Proposed Route and each alternative. However, as noted above, Alternative 5C would have the least area of steep slopes and be shortest overall. Therefore, this alternative would have the least disturbance and be the most readily restored compared to either the Proposed Route or the longer alternatives.

Segment 6

Segment 6 is an existing transmission line linking the Borah and Midpoint Substations; it is now operated at 345 kV but would be changed to operate at 500 kV. This segment has no Route Alternatives. Existing support structures would be used and impacts would be limited to within approximately 0.25 mile from each substation to allow for moving the entry point into the substation to the new 500-kV bay. Thirty-one acres of the expansion of the Borah and Midpoint Substations are attributed to Segment 6. Changes in the two substations would allow it to be operated at 500 kV (see Appendix A, Figure A-8).

Construction activities would disturb 65 acres of highly erodible, droughty soil with low soil loss tolerance. The permanent soil loss would be equivalent to the operations disturbance area, approximately 61 acres. Segment 6 has no alternatives and would affect no NFS land.

Segment 7

Segment 7, as proposed, would link the Populus and Cedar Hill Substations with a 118.1-mile single-circuit 500-kV line. Forty-two acres of the expansion of the Populus and the construction of the Cedar Hill Substations and 1 acre for two regeneration sites are attributed to Segment 7. In addition to the Proposed Route, which is principally on private lands, Route Alternatives have been proposed by the BLM to avoid the Deep Creek Mountains (7A and 7B; which are 5 miles and 11 miles longer than the comparison portion of the Proposed Route), by local landowners (7C, 7D, 7E, 7F, and 7G, which all represent minor adjustments proposed to address local issues), by local landowners to avoid private agricultural lands (7I or the State Line Route, which is 55 miles longer than the Proposed Route and would require 0.5 acre for an additional regeneration site), and by the Proponents to avoid the State Line Route (7H, which is 10 miles longer than the Proposed Route). Alternative 7J, which is a variant of the State Line Route also proposed by local landowners, would not terminate at the Cedar Hill Substation. This alternative, referred to as the Rogerson Alternative, would require a different substation be constructed near a 345-kV existing transmission line (approximately 24 miles southwest of the Cedar Hill Substation; see Appendix A, Figure A-9). The tables and discussion in this document compare 7J (202.1 miles) with the corresponding portion of Segment 7/9 (118.1 miles of Segment 7 and 25.8 miles of Segment 9, for a total of 143.9 miles). All other Segment 7 alternatives are compared to Segment 7 of the Proposed Route (118.1 miles) only.

As shown in Table D.15-1, construction of the Proposed Route for Segment 7 would disturb 1,804 acres. There would be 5 acres of disturbance, distributed along the Proposed Route, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. There would be a relatively low percentage of soils subject to wind erodibility (23 percent), but 96 percent would be considered highly susceptible to water erosion, and 30 percent have a low soil loss tolerance. Prime farmland makes up 39 percent of the Segment 7 Analysis Area and 38 percent of the soils are droughty. Steep slopes would occur in 33 percent of the area, second only to Segment 5. The disturbance areas during construction of the Proposed Route and Route Alternatives are listed on Table D.15-1 in Appendix D. The soils in the Route Alternatives would be similar to the soils in the Proposed Route; therefore, the impacts would be mostly proportional to the lengths of the various routes. Alternatives 7A and 7B, when compared to their equivalent portion of the Proposed Route, would be longer and proportionately increase the areas falling in steeper slopes with erosion susceptible soils. They would be less favorable than the comparison portion of the Proposed Route. Alternatives 7C, 7D, 7E, 7F, and 7G would be relatively minor adjustments to the Proposed Route. With the exception of Alternative 7F, which would disturb only about 20 percent of the prime farmland acreage as the comparison portion of the Proposed Route, there would be only minor differences to the impacts on soils during construction for these alternatives. Alternatives 7H, 7I, and 7J are longer than the comparison portion of the Proposed Route. These alternatives would affect less prime farmland than the comparison portion of the Proposed Route; however, Alternatives 7H, 7I, and 7J would result in greater effects to other soil categories, due to their longer lengths. Soils with greater than 20 percent stony-rocky soil would generally occur only in Alternatives 7H, 7I, and 7J. All of these alternatives would substantially increase the acreages of steep slopes and exposure to highly water erosion–susceptible soils compared to the Proposed Route. The Proposed Route in combination with Alternative 7F would result in the least overall impacts to soils during construction.

During operations, the Proposed Route disturbance area would result in the direct loss of 231 acres of land, 47 percent of which is prime farmland. The effects to agricultural land are further discussed in Section 3.18 – Agriculture. Table D.15-2 in Appendix D details the operations disturbance acreages for the Proposed Route and Route Alternatives. For the same reasons discussed for construction impacts, the Proposed Route in combination with Alternative 7F would result in the least overall impacts to soils during operations. The major Alternatives 7A, 7B, 7H, 7I, and 7J would all be longer and would increase the disturbance acreages in proportion to their relative lengths, with Alternatives 7A and 7H resulting in less disturbance than 7B or 7I, respectively.

As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction as shown in Table D.15-1 in Appendix D. The droughty characteristics in combination with the steep slopes and soils subject to water erosion of the soils in Segment 7 would make restoration of disturbed areas following decommissioning challenging. Therefore, disturbance of soils should be kept to the minimum possible during restoration. For the same reasons discussed for construction impacts, the Proposed Route in combination with Alternative 7F would result in the least overall operations impacts to soils.

The Proposed Route would not cross the Sawtooth NF; however, Alternatives 7H and 7I would cross the NF. Alternative 7H would affect approximately 167 acres on the Sawtooth NF during construction and 26 acres during operations. Approximately 99 acres and 21 acres, respectively, would be located in areas with low soil loss tolerance; approximately 75 acres and 7 acres, respectively, would be rated as highly erodible.

Alternative 7I would affect approximately 448 acres on the Sawtooth NF during construction and 94 acres during operations. Approximately 306 acres and 55 acres, respectively, would be located in areas with low soil loss tolerance; approximately 337 acres and 72 acres, respectively, would be rated as highly erodible. Alternative 7J would affect approximately 251 acres on the Sawtooth NF during construction and 53 acres during operations. Approximately 176 acres and 32 acres, respectively, would be located in areas with low soil loss tolerance; approximately 158 acres and 35 acres, respectively, are rated as highly erodible.

In comparing all of the soil factors, the Proposed Route in combination with Alternative 7F would result in the least overall impacts to soils. The major Alternatives 7A, 7B, 7H, 7I, and 7J would all be longer than the comparison portion of the Proposed Route or Alternatives 7C, 7D, and 7E and would, therefore, increase soil disturbance proportionally. If Alternatives 7H 7I, and 7J are not selected, there would be no impacts to soils on the Sawtooth NF.

Segment 8

Segment 8, as proposed, would link the Midpoint and Hemingway Substations. This 131-mile single-circuit 500-kV transmission line would stay north of the Snake River until crossing through the SRBOP parallel to an existing 500-kV transmission line before ending at the Hemingway Substation. Thirteen acres of the expansion of the Midpoint Substation and 0.5 acre for a regeneration site are attributed to Segment 8. There are five Route Alternatives: 8A, which follows the WWE corridor but crosses the Snake River and I-84 twice (while the Proposed Route would stay north of this area); 8B and 8C, which represent the old routes originally proposed by the Proponents but that have now been changed to avoid the cities of Kuna and Mayfield, respectively; 8D, which represents a small revision involving a rebuild of the existing transmission line to move both away from the National Guard Maneuver Area; and 8E, which was proposed by the BLM in order to avoid crossing the Halverson Bar non-motorized portion of the Guffey Butte-Black Butte Archaeological District (see Appendix A, Figure A-10).

As shown in Table D.15-1, construction of the Proposed Route for Segment 8 would disturb about 2,125 acres. There would be 1 acre of disturbance, distributed along Segment 8, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. A total of 36 percent of the Analysis Area is highly wind erodible, and 69 percent is highly susceptible to water erosion. About 61 percent of the soils in the Proposed Route are droughty. Low soil loss tolerance soil makes up 68 percent of the Analysis Area and 28 percent is prime farmland. The disturbance areas during construction of Segment 8 and each alternative are listed on Table D.15-1. The soils in the Route Alternatives would be similar to the soils in the Proposed Route; therefore, the impacts would be mostly proportional to the lengths of the various routes. Alternative 8A would replace the first 51 miles of the Proposed Route with a 53-mile alternative route. The soil impacts between these two routes would be substantially different with respect to the acreages with low soil loss tolerance and prime farmland. For both soil conditions, Alternative 8A would have substantially less impact to these soil conditions. Alternatives 8B and 8C would be generally less favorable than the comparison portion of the Proposed Route and, in comparison, increase the acreages in these sensitive soil types. Alternative 8D would be a minor variation that would have similar impacts on soils as the comparison portion of the Proposed Route. Alternative 8E would contain more acres, including more highly erodible acres and more acres of droughty soil. However, there would be slightly less shallow bedrock in Alternative 8E than in the comparison portion of the Proposed Route. The route with the least impact to soils during construction would be Alternative 8A in combination with the Proposed Route from the end of Alternative 8A to Hemingway.

During operations, the Proposed Route would affect 246 acres, 19 percent of which would be prime farmland. Table D.15-2 in Appendix D details the operations disturbance acreages for Segment 8 and its alternatives. For the same reasons discussed for construction impacts, the Proposed Route in combination with Alternative 8A at the eastern end would result in the least overall operations impacts to soils. Alternatives 8B and 8C would have similar impacts as the comparison portion of the Proposed Route during the operational life of the Project.

As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction as shown in Table D.15-1 in Appendix D. The droughty soils found mainly in the Proposed Route and Alternatives 8A and 8B would make restoration challenging. As noted in the construction paragraph above, the overall route with the least impact on soils would be Alternative 8A in combination with the remainder of Segment 8. Apart from the reduced acreages in Alternative 8A compared to the comparison portion of the Proposed Route, however, the remaining Alternatives (8B, 8C, and 8D) would not be substantially different from the Proposed Route. No NFS land would be crossed in Segment 8.

Segment 9

Segment 9, as proposed, would link the Cedar Hill and Hemingway Substations with a 161.7-mile single-circuit 500-kV transmission line which skirts the Jarbidge and Owyhee Military Operating Areas to the north, then follows the WWE corridor just north of the Saylor Creek Air Force Range, passing through Owyhee County before entering into the Hemingway Substation. Fifteen acres of the construction of the Cedar Hill Substation and 1 acre for two regeneration sites are attributed to Segment 9. There are eight

Route Alternatives proposed, including 9A, which was the Proponents' Proposed Route until moving to avoid the Hollister area; 9B, which is being considered by the BLM because it follows the WWE corridor and parallels existing utility corridors; 9C, which was the Proponents' Proposed Route until moving to avoid the Castleford area; and 9D and 9E, proposed by the Owyhee County Task Force, that cross more public lands north and south of the Proposed Route, respectively, than the Proposed Route. Most of Alternative 9D would be within the SRBOP. Alternatives 9F, 9G, and 9H were proposed to avoid crossing the non-motorized area south of C.J. Strike Reservoir. Alternatives 9G and 9H provide an alternate route location south of Alternative 8E (see Appendix A, Figure A-11).

As shown in Table D.15-1 in Appendix D, construction of the Proposed Route for Segment 9 would disturb 2,670 acres. There would be 4 acres of disturbance, distributed along the Proposed Route, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. Soil in this segment would contain moderate proportions of highly wind and water erosion susceptible soils. Some 65 percent of the soils would have a low soil loss tolerance, approximately one-third of the soils would be prime farmland, and essentially all of the soils a would be re droughty. Shallow bedrock may be present in 44 percent of the area and droughty soils make up about 55 percent of the Proposed Route.

The disturbance areas during construction of the Proposed and Alternative Routes are listed on Table D.15-1 in Appendix D. The soils in the Route Alternatives would be similar to the soils in the Proposed Route; therefore, the impacts would be mostly proportional to the lengths of the various routes. With the exception of Alternative 9E, which would be about 11 miles longer than the comparison portion of the Proposed Route, all of the alternatives would be essentially the same length and therefore have mostly similar soil impacts as their comparison portions of the Proposed Route. However, Alternatives 9A, 9B, 9C, and 9D would all impact substantially more prime farmland than the Proposed Route. Therefore, with respect to sensitive soils, the Proposed Route would have the least impact. Alternative 9E would slightly decrease the impact to prime farmland, but it would be longer and generally increase the overall disturbed acreage during construction and be also less favorable than the comparison portion of the Proposed Route.

During operations, the Proposed Route would affect 359 acres, of which 28 percent would be prime farmland. Table D.15-2 details the operations disturbance acreages for the Segment 9 Proposed Route and Route Alternatives. For the same reasons discussed for construction impacts, the Proposed Route would be the most favorable route. This distinction is primarily based on less disturbance to prime farmland and, in the case of Alternative 9E, less overall disturbance due to its shorter length.

As noted in Section 3.15.2.2, decommissioning and reclamation would result in temporary soil disturbance of approximately the same magnitude as during construction as shown in Table D.15-1 in Appendix D. The droughty soils found along the Proposed Route and its alternatives would make restoration challenging. As noted in the construction paragraph above, the Proposed Route would result in less soil impacts during decommissioning and reclamation than any of the five alternatives. No NFS land would be crossed in Segment 9.

Segment 10

Segment 10, as proposed, would link the Cedar Hill and Midpoint Substations with a 33.6-mile single-circuit 500-kV line, following a WWE corridor for most of its distance. Twenty-eight acres of the expansion of the Midpoint Substation and of the construction of the Cedar Hill Substation are attributed to Segment 10. There are no Route Alternatives proposed along this segment (see Appendix A, Figure A-12).

As shown in Table D.15-1, construction of the Proposed Route for Segment 10 would disturb 549 acres. There would be less than 1 acre of disturbance, distributed along the Proposed Route, associated with cut and fill methods and the installation of temporary and permanent culverts where access roads cross streams. This segment would have wind and water erosion susceptible soils. Low soil loss tolerance soil occupies 42 percent of the Analysis Area, prime farmland covers 26 percent, and 37 percent of the soils are droughty. There are no alternatives to compare and contrast with the Proposed Route.

As shown in Table D.15-2 in Appendix D, Proposed Route operations would result in a soil disturbance of 81 acres, 16 percent of which would be prime farmland. There are no alternatives to compare and contrast with the Proposed Route.

Similar to all segments with droughty soils, restoration of the areas to their original condition prior to construction would be challenging. There are no alternatives to compare and contrast with the Proposed Route. No NFS land would be crossed in Segment 10.

3.15.2.4 Design Variation

A Design Variation is being considered that would consist of constructing two single-circuit lines in Segments 2 through 4 instead of a single double-circuit line (which is the design assessed above). The disturbance footprint of the two single-circuit towers is greater than that of the double-circuit tower, in part because the requested ROW would be wider, but also because helicopter-assisted construction could be implemented in these areas due to the lighter weight of the towers, which would require additional fly yards. The additional ROW space and the fly yards would cause additional temporary disturbance during construction. Across Segments 2, 3, and 4, the additional disturbance of the single-circuit tower alternative ranges from 25 to 30 percent greater than the comparable portions of the double-circuit tower disturbance under the proposed design. The two single circuits require more ground disturbance, but would be designed and constructed to the same standards as the Proposed Action. The Design Variation would disturb more acreage and would expose 25 to 30 percent more soils to erosion effects, soil compaction, and permanent soil losses than the proposed double-circuit line. Table D.15-5 in Appendix D summarizes the soil effects for the Design Variation. The operations and decommissioning stage would also see 25 to 30 percent higher impacts because of the greater area.

3.15.2.5 Structure Variation

The proposed guyed Structure Variation would add four guy wires about 140 feet long from a point about 100 feet up in each tower to four guy anchors spaced in a square around the tower (Appendix B, Figure B-6). The guy anchors would fall within the disturbed area around each tower. Therefore, there is no appreciable difference in impact on soil resources from the use of this Structure Variation when compared to the use of self-supporting lattice towers.

3.15.2.6 Schedule Variation

The Schedule Variation uses the two single-circuit Structure Variation described above but extends construction over a longer time frame. Initially, only one of the eventual two single-circuit lines would be constructed, with the second to be constructed at a later date. The Schedule Variation proposes that the first single-circuit transmission line in Segments 2, 3, and 4 would be built as soon as a ROW grant is issued, but that the second line would not begin construction until late 2018. This would mean nearly 2 years between the end of construction for the first line and beginning of construction for the second line. Any staging areas and fly yards that had been used for the first stage would have been revegetated after construction was complete and would have to be cleared again. There would be two sets of construction disturbances, adding movement, noise, and dust to the area of construction in two instances in any given area. In the short term, the potential for the Project to impact soils would be reduced when compared to the Proposed Action and Design Variation due to the fewer number of structures erected. However, the short-term reduction in soil impacts would be lost with construction of the second line. The overall net impact of this schedule variation would be to increase the total amount of soil acreage disturbed during construction. The impacts on operations and decommissioning (assuming the latter takes place for both lines at the same time) would be negligible.

3.15.3 Mitigation Measures

To minimize or avoid impacts on soils, the Proponents have committed to EPMs that would be implemented Project-wide as outlined in this section and in Appendix C.

The following mitigation measures identified by the Agencies are required on federally managed lands. The Agencies recommend that the Proponents incorporate the measures into their EPMs and apply them Project-wide.

SOIL-1 Efforts will be made to preserve topsoil and minimize mixing with subsoil. In agricultural areas, the landowner or land management agency will be asked to provide input on placement of removed topsoil. The Wyoming State Reclamation Policy and applicable Agency management plan requirements for soil management will be followed. Soil disturbances in agricultural areas will be developed to minimize impacts to existing agricultural activities where possible. Unless the landowner or land management agency specifically approves otherwise, the Proponents will prevent the mixing of topsoil with subsoil by stripping topsoil from the portion of the construction work area that will be restored (construction pad, storage yards, and fly yards) in actively cultivated or rotated croplands and pastures and other areas at the landowner's or land-managing agency's request. Where topsoil segregation is required, the Proponents will maintain separation of salvaged topsoil and subsoil throughout all construction activities. Immediately after construction, topsoil will be restored to the areas not dedicated to operational requirements and revegetated as specified in the EPMs.

SOIL-5 Disturbed soil shall not be allowed to support the growth of noxious weeds, or invasive weedy species. Prevention of noxious weeds shall apply to all phases of the Project.

SOIL-7 The Proponents are responsible for monitoring to ensure soil protection is achieved and providing monitoring reports on reseeding success or other methods to stabilize soils to the Forest Service by the end of each growing season for areas on NFS lands.

SOIL-8 Reclamation of all temporary disturbances on NFS lands (such as road cuts) should include replacement of material to original contours. Re-compaction to pre-existing compaction percentage (which should be identified before disturbance) should be included in the plan. Guidelines for stream bank re-compaction to maximize vegetative regrowth and mechanical stability are covered in USACE publication ERDC TN-EMRRP-SR-26 (Goldsmith et al. 2001).

SOIL 9 On federal land, follow land management plan requirements on the location of waste material (silt, sand, gravel, soil, slash, debris, chemical, etc.).

SOIL-10 On NFS lands, soil resources will be inventoried to National Cooperative Soil Survey Standards, and the volumes and suitability of soil resources for reclamation will be determined prior to disturbance.

SOIL-11 In specific sensitive areas (such as erosive soils or steep slopes) on lands managed by the Kemmerer FO, the access road used for construction will be restored and an alternative access route for operations designated.

In addition, the following mitigation measures have been proposed by the Agencies and adopted by the Proponents:

SOIL-2 The Proponents will submit a Compaction Monitoring Plan for review and Agency approval prior to construction that specifies the conditions under which construction will either not start or will be shut down due to excessively wet soils. Conditions will be measurable in the field and easy to demonstrate to construction workers.

SOIL-3 During decommissioning, some obviously compacted areas, such as established service roads, will require loosening prior to revegetation. If necessary to re-establish vegetation, the Proponents will use a ripper blade, till, or similar instrument to loosen the surface soil layer.

SOIL-4 Reclamation will include revegetation unless pre-existing conditions were not vegetated (rocky areas, agricultural fields). On public land the appropriate agency will provide input on the extent of reclamation, the type of vegetation to be planted, and the monitoring necessary to ensure reclamation success.

SOIL-6 Detrimental soil disturbance such as compaction, erosion, puddling, and displacement will be limited or mitigated to meet long-term soil productivity goals on NFS lands. Treatment should include road ripping, frequent waterbars, cross-ditching (e.g., rolling-dips), or other methods to reduce compaction while preventing gully formation. Ripping pattern should be altered to a crossing, diagonal, or undulating pattern of tine paths to avoid concentrated runoff patterns that can lead to gullies.

Under the CWA, the NPDES stormwater program requires operators of construction sites to obtain authorization to discharge stormwater under an NPDES construction stormwater permit. A key component in stormwater management is the development of BMPs to prevent soil erosion, and sediment migration to nearby surface water bodies. The Proponents will adhere to state and federal stormwater requirements to mitigate the soil effects during construction, operations, and decommissioning.