

Energy Gateway South Transmission Project

Draft Soils Report

Prepared by:

Environmental Planning Group
Salt Lake City, Utah

Prepared for:

Ashley National Forest (Duchesne Ranger District)
Manti-La Sal National Forest (Ferron, Price, and Sanpete Ranger Districts)
Uinta National Forest (Heber-Kamas and Spanish Fork Ranger Districts)

February 2014

Nondiscrimination Notice

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, sex, religion, age, disability, sexual orientation, marital status, family status, status as a parent (in education and training programs and activities), because all or part of an individual's income is derived from any public assistance program, or retaliation. (Not all prohibited bases apply to all programs or activities.)

If you require this information in alternative format (Braille, large print, audiotape, etc.), contact the USDA's TARGET Center at (202) 720-2600 (Voice or TDD).

If you require information about this program, activity, or facility in a language other than English, contact the agency office responsible for the program or activity, or any USDA office.

To file a complaint alleging discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, or call toll free, (866) 632-9992 (Voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (800) 845-6136 (in Spanish). USDA is an equal opportunity provider, employer, and lender.

You may use USDA Program Discrimination Complaint Forms AD-3027 or AD-3027s (Spanish) which can be found at: http://www.ascr.usda.gov/complaint_filing_cust.html and http://www.ascr.usda.gov/es_us/sp_complaint_filing_cust.html or upon request from a local USDA office.

Declaración de política de no discriminación de USDA

El Departamento de Agricultura de los Estados Unidos (USDA por sus siglas en inglés), prohíbe la discriminación en sus programas y actividades ya sea por raza, color, nacionalidad, sexo, religión, edad, incapacidad, orientación sexual, estado civil, estado familiar, su estado como padre o madre (en programas de educación y adiestramiento), ya sea que todo o parte de los ingresos provengan de cualquier programa de asistencia pública de las personas, o por represalias. (No todas las prohibiciones se aplican a todos los programas o actividades).

Si usted necesita la información de este anuncio en un formato diferente (Braille, letras grandes, o por medio de sonido, etc.), llame al Centro TARGET del Departamento de Agricultura al teléfono 202-720-2600 (voz y TDD).

Si usted necesita información sobre este programa, actividad o instalaciones en un idioma diferente del inglés, llame a la agencia del Departamento que maneja este programa o actividad, o a cualquier oficina del Departamento de Agricultura.

Para someter una queja de discriminación, escriba al USDA, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, o llame gratis al 1-866-632-9992 (voz). Para llamadas TDD, llame al USDA al número 1-800-877-8339 o (800) 845-6136 (en Español). Usted puede usar la forma de discriminación AD-3027 o AD-3027 en Español, la cual se puede encontrar en: http://www.ascr.usda.gov/es_us/sp_complaint_filing_cust.html o puede obtener en cualquier oficina local del Servicio Forestal. El Departamento de Agricultura ofrece oportunidades de programas y de empleo libres de discriminación.

Table of Contents

Introduction.....	1
Overview of Issues Addressed	2
Affected Environment.....	3
Existing Condition.....	3
Desired Condition.....	5
Environmental Consequences.....	8
Methodology	8
Results	11
Summary of Effects	27
Monitoring Recommendations	28
References.....	29

List of Tables

Table 1	Landtype Associations Crossed by Project Alternative Routes by Forest Unit	4
Table 2	Access Levels and Potential Areas of Ground Disturbance	8
Table 3	Water and Wind Erosion Susceptibility	11
Table 4	Water and Wind Erosion Susceptibility miles of residual impact.....	12
Table 5	Uinta National Forest Landtype Associations Crossed by Alternative COUT-A and Acres of Disturbance	13
Table 6	Manti-La Sal National Forest Landtype Associations Crossed by Alternative COUT-A and Acres of Disturbance	14
Table 7	Uinta National Forest Landtype Associations Crossed by Alternative COUT-A-1 and Acres of Disturbance	15
Table 8	Manti-La Sal National Forest Landtype Associations Crossed by Alternative COUT-A-1 and Acres of Disturbance	16
Table 9	Ashley National Forest Landtype Association Crossed by Alternative COUT-B and Acres of Disturbance	17
Table 10	Uinta National Forest Landtype Associations Crossed by Alternative COUT-B and Acres of Disturbance	17
Table 11	Manti-La Sal National Forest Landtype Associations Crossed by Alternative COUT-B and Acres of Disturbance	18
Table 12	Uinta-Wasatch-Cache National Forest Landtype Associations Crossed by Alternative COUT-C and Acres of Disturbance	19
Table 13	Manti-La Sal National Forest Landtype Associations Crossed by Alternative COUT-C and Acres of Disturbance	20
Table 14	Manti-La Sal National Forest Landtype Associations Crossed by Alternative COUT-H and Acres of Disturbance	21
Table 15	Manti-La Sal National Forest Landtype Associations Crossed by Alternative COUT-I and Acres of Disturbance.....	22
Table 16	Summary of Estimated Ground Disturbance and Vegetation Clearing.....	27

Acronyms

Applicant	PacifiCorp, doing business as Rocky Mountain Power (Applicant for right-of-way grant)
BLM	Bureau of Land Management
COUT	Colorado to Utah – U.S. Highway 40 to Central Utah to Clover alternative routes
COUT BAX	Colorado to Utah – U.S. Highway 40 to Baxter Pass to Clover alternative routes
EIS	Environmental impact statement
LRMP	Land and resource management plan
Project POD	Energy Gateway South Transmission Project Plan of Development
RFFA	Reasonably foreseeable future actions
SITLA	School and Institutional Trust Lands Administration (State of Utah)
USDA USFS	U.S. Department of Agriculture U.S. Forest Service

Introduction

In December 2008, PacifiCorp (doing business as Rocky Mountain Power, the Applicant) submitted an Application for Transportation and Utility Systems and Facilities on Federal Lands (Standard Form 299) to the Bureau of Land Management (BLM) and the U.S. Forest Service (USFS) for constructing, operating, and maintaining the Energy Gateway South Transmission Project (Project). In response, the BLM, as the lead agency, in coordination with the USFS and other cooperating agencies, is preparing an environmental impact statement (EIS) and land-use plan amendments to evaluate and disclose the potential Project-related environmental impacts that could result from the action proposed by the Applicant (Proposed Action) and alternatives of the Proposed Action. The Applicant's interests and objectives, the purpose of the federal action, and a description of the Project are provided in more detail in Chapters 1 and 2 of the Draft EIS (BLM 2014).

As proposed, approximately 400 to 540 miles of 500-kilovolt overhead transmission line would be constructed for the Project depending of the route selected. The spacing between tower structures typically would be between 1,000 and 1,500 feet (or 4 to 5 structures per mile). The exact height of each structure would be governed by topography and safety requirements for conductor clearance, which is a minimum of 35 feet. Project access roads would include existing roads, existing roads that require improvement, and new access roads. Existing roads (no improvement) generally include paved or all-weather surfaces that meet the Applicant's road construction standards. Existing roads (improvement required) generally include those roads that may need widening and could include blading, re-establishing drainage features, boulder and rock removal, tree removal, bridge and culvert construction, and installation of wash crossings. New roads include the construction of new, permanent access roads that meet the Applicant's road standards. Access roads typically would go directly from structure to structure, except on hillsides, ridgebacks, rock-outcrop areas, wash crossing, treed areas, or in areas where sensitive environmental resources could be avoided or where spur roads from existing access would be shorter than new transmission structure-to-structure roads.

Approximately 1,425 miles of alternative routes, through 16 counties in the states of Wyoming, Colorado, and Utah are being evaluated for the transmission line and associated facilities (e.g., access roads and temporary construction workspaces). Portions of the alternative routes cross three national forests—the Ashley, Uinta, and Manti-La Sal.

Soil resources on National Forest System lands potentially would be affected by surface-disturbing activities associated with the Energy Gateway South Transmission Project. Each national forest is governed by a Land and Resource Management Plan (LRMP) (Ashley [USFS1986a], Uinta [USFS 2003], and Manti-La Sal [USFS 1986b]) in accordance with the National Forest Management Act of 1976. These plans outline management direction, including desired future conditions, suitable uses, monitoring requirements, goals and objectives, and standards and guidelines. Monitoring of conditions on a national forest ensures projects are conducted in accordance with plan direction and determines effects that may require a change in management direction.

This report presents a description of soil resources on the Ashley, Manti-La Sal, and Uinta-Wasatch-Cache National Forests crossed by the Project. The report also assesses the predicted effects on soil resources associated with each alternative route, including the No-Action Alternative (i.e., a special-use authorization for the Project to cross federal lands would not be granted and the transmission line and ancillary facilities would not be constructed on USFS-administered land) with consideration of the implementation of design features of the Proposed Action for environmental protection and mitigation measures identified for the Project. Finally, this report discusses whether the Project would comply with the LRMPs.

Overview of Issues Addressed

Surface-disturbing activities associated with construction, operation, and maintenance of the Project could result in disturbance of soil resources on land administered by the USFS. Use and/or improvement of existing access roads (which includes construction of spur roads), construction of new access roads, establishment of other permanent and temporary disturbances to support construction (i.e., area occupied by transmission line structures, communication regeneration facilities, structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures), and clearing of overstory and or tall vegetation within the right-of-way could affect soil resources by removing the surface soil, cutting into slopes, compacting the soil, ponding when heavy equipment are operated in wet conditions, and increased soil temperatures. These potential disturbances could result in loss of soil resources through accelerated erosion via removal of stabilizing vegetation and increased surface runoff due to reduced infiltration due to soil compaction (Grace and Clinton 2007; Luce and Black 2001).

Issue Indicators

Construction of the Project would result in disturbance to soils. Disturbance anticipated would occur from compaction, ground cover removal, disturbance of sensitive soils types, and erosion. At this phase in the development of the Project, detailed engineering has not been developed because of the costs associated with performing engineering for all alternative routes. Thus, a model was developed to predict the amount of disturbance that could be expected for the various alternative routes being studied. Modeling developed predicts the amount of permanent and temporary disturbance from Project facilities, based on the Project description, and disturbance anticipated from improvement to existing access roads, and the construction of new access. The analysis of the potential effects on soils resources on USFS-administered lands crossed by the Project relies on the predictive modeling developed for comparison of the alternative routes and includes:

1. Miles of the transmission line and the associated amount of permanent and temporary disturbance (in acres) estimated on USFS-administered land as follows:
 - a. Temporary disturbance includes structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures;
 - b. Permanent disturbance includes the area to be occupied by the transmission structures and communication regeneration stations.
2. The predicted amount (in acreage) of disturbance from use and/or improvement of existing access and from construction of new access on USFS-administered land.
3. Anticipated amount (in acres) right-of-way vegetation clearing that could occur (based on Applicant's Project description).

The following text provides a summary of how and why each Soil Indicator is used to evaluate effects on soil resources.

Soil Indicator 1: Estimated number of transmission line structure sites estimated amount of disturbance from temporary and permanent disturbances of U.S. Forest Service-administered lands.

An estimate of the amount of temporary and permanent disturbance provides an indicator of the extent of ground-disturbance and associated potential impacts on soil resources by component of the Project. These components would require the removal of the surface soils and potentially cutting into to slopes further exposing previously buried and stable soil resources to erosion by water or wind.

Soil Indicator 2: Estimated acreage of ground disturbance on U.S. Forest Service-administered lands by access road construction.

The Project would require access to structures and other Project components during construction, operation, and maintenance. The Project would use existing access to the extent practical; however, existing access could require improvement and or spur roads to be constructed from the existing access to Project components. Where existing access would not be used, new access roads would be developed to access Project components. The estimated extent (acres) of disturbance associated with access road development provides another indicator of the amount of disturbance anticipated from the construction of the Project. This estimate is modeled taking into account the predicted level of disturbance associated with the type and extent of existing access associated with each alternative route and the topography of the landscape (e.g., slope) associated with the various alternatives. Incorporated into the access model are the assumptions that (1) using existing access generally would lead to a lesser extent of disturbance of soil resources than areas that would require development of new access and (2) areas with flat topography would require a lesser extent of disturbance than roads on rolling or steep terrain.

Soil Resource Indicator 3: Estimated extent of overstory/tall vegetation removal within the Project right-of-way.

Removal of vegetation, more than 5 feet in height, would be necessary within the right-of-way of the Project in accordance with the National Electric Safety Code and the Applicant's standards for line safety. Right-of-way vegetation clearing within the 250-foot-wide right-of-way could require the movement of heavy logging equipment within the right-of-way, which could result in soil disturbance. Also, maintaining a cleared right-of-way could result in elevated surface soil temperatures due to reduction in tree shade.

Affected Environment

Existing Condition

Soil resources on the Ashley, Uinta-Wasatch-Cache, and Manti-La Sal National Forests have been and are currently being affected by a wide range of factors including livestock grazing, timber sales, roads and trails, and dispersed recreation.

Soil surveys describe the soil profile and the related vegetation. Soil associations and/or landtypes are groups of soils geographically associated in a characteristic, repeating pattern. Soil associations and/or landtypes have been mapped using geomorphic features or landforms within the various forest units (Table 1).

Landtype/Soil Association	Ashley National Forest	Uinta National Forest	Manti-La Sal National Forest
Allen Creek-Rock Outcrop-Squaretop		✓	
Rial-Bigbug		✓	
Bigbug-Longridge		✓	
Squaretop-Longridge		✓	
Landslide Association		✓	
Structurally Controlled Landscape-Shale		✓	
Stream Canyon Association		✓	
Tectonic Mountain		✓	
Anthro Plateau	✓		
Avintaquin Canyon	✓		
Spanish Fork Mountain Ridglands			✓
Wasatch Plateau			✓
Wasatch Monocline			✓
Mancos Shale Lowlands			✓

- **Allen Creek-Rock Outcrop-Squaretop.** This soil association is present in the bottom of the Willow Creek Basin and is derived from mudstones, shales, and fine sandstones and is quite erosive (USFS 2011).
- **Rial-Bigbug.** This soil association is present along slopes of the Willow Creek drainage, is derived from shales, and is erodible with some potentially to exhibit shrink/swell properties (USFS 2011).
- **Bigbug-Longridge.** This soil association is present along slopes of the Willow Creek drainage, is derived from shales, and is erodible with some potentially to exhibit shrink/swell properties (USFS 2011).
- **Squaretop-Longridge.** This soil association is present along slopes of the Willow Creek drainage, is derived from shales, and is erodible with some potentially to exhibit shrink/swell properties (USFS 2011).
- **Landslide Association.** This landtype is characterized as ancient landslide deposits. This landtype is composed of soil and rock material that in the past lost cohesion, likely due to elevated moisture, and flowed downslope (USFS 1976).
- **Structurally Controlled Landscape-Shale.** This landtype is present throughout the Uinta-Wasatch-Cache National Forest section of the Project and includes soils derived from Tertiary-aged shales of the Green River and Flagstaff Formations (USFS 1976). Being derived from shales, soils of this landtype typically are erodible and may be unstable in some areas.
- **Stream Canyon Association.** This landtype association is the most widely distributed unit in the national forest and consists of a variety of soil and rock material deposited by streams. The variability of material type combined with changing slopes leads to a wide degree of surface stability within this landtype (Lopez 1980).
- **Tectonic Mountain.** This landtype association is present on ridgelines and slopes and typically includes poorly developed soils and bedrock exposures (Lopez 1980).

- **Anthro Plateau.** This landtype association consists of plateau lands dissected by long canyons with comparatively wide, flat bottoms cut through calcareous sandstones and marly, shale-like mudstones of the Green River and Uinta Formation (USFS 2009). Soils of this landtype are derived from shales, sandstones, and siltstones, which are erodible; especially the steep slopes of the Green River and Uinta Formations.
- **Avintaquin Canyon.** This landtype association consists of dissected plateau lands underlain by marly, shale-like mudstones of the Green River and Uinta Formations (USFS 2009). Soils of this landtype are derived from shales, sandstones, and siltstones, which are erodible; especially the steep slopes of the Green River and Uinta Formations.
- **Spanish Fork Mountain Ridgeland.** This landtype association includes lower slopes and valleys of the Thistle Highlands and Indianola-Thistle valleys derived from Flagstaff Formation limestones.
- **Wasatch Plateau.** This landtype association includes horsts, grabens, canyons, and escarpments with soils derived from Black Hawk Formation sandstone and shale, Mesa Verde Group sandstone and shale, North Horn Formation sandstone and shale, and Flagstaff Formation limestone on slope ranging from flat to steep. Soils derived from the North Horn Formation are the most unstable and would potentially experience slope instability or mass movement.
- **Wasatch Monocline.** This landtype association includes canyons in North Horn Formation sandstones and shale on steep slopes and canyon walls. Soils derived from North Horn Formation bedrock often are unstable and potentially would experience slope instability or mass movement.
- **Mancos Shale Lowlands.** This landtype association includes pediments derived from the Mancos Shale on plains. This landtype is the least likely of the landtypes on the Manti-La Sal crossed by the Project to experience slope failure due to its composition and topography.

Desired Condition

The management goals and objectives for soil resources established in the LRMPs for each national forest reflect the desired condition of the soil resources and are listed below, including general direction and standards and guidelines.

Ashley National Forest

Soil, Water, and Air

Management Goal and Objective

Goal 2 is stated in the LRMP as improving and conserving the basic soil and water resources. The relevant management objective is to maintain or improve soil stability, site productivity, and repair or stabilize damaged watersheds.

Standards and Guidelines

- a. Stabilize road corridors and control road use to reduce soil erosion.
- b. Stabilize areas damaged by fire, mining, or other events.

Uinta National Forest

Standards and Guidelines

- a. Maintain or improve long-term soil productivity and hydrologic function of the soil by limiting activities that would cause detrimental soil disturbance. Detrimental soil disturbance consists of severely burned soils, loss of ground cover, or detrimental soil displacement, erosion, ponding, or compaction, as defined in Forest Service Handbook 2509.18 and applicable Intermountain Region supplements.
 - i. Avoid land use practices that reduce soil moisture effectiveness, increase average erosion, cause invasion of exotic plants, and reduce abundance and diversity of forbs in the long-term (some short-term practices that would seem to contradict this direction may be beneficial in the long-term).
 - ii. Maintain at least 70 percent of potential effective ground cover to provide nutrient cycling and protect the soil from erosion in excess of soil loss tolerance limits.

Manti-La Sal National Forest

Soil Resource Management

General Direction 1

Maintain or improve soil productivity and watershed qualities within the ecological site capabilities.

Standard and Guideline

- a. Provide soil resource inventories, interpretations, and evaluation at the appropriate intensity level for projects that could adversely affect the soil resource or where the success or failure of the project depends on soils management.

General Direction 2

Minimize adverse, man-caused impacts on the soil resource including accelerated erosion, compaction, contamination, and displacement.

- A. Protect or conserve topsoil when conducting surface-disturbing activities.
- B. Provide adequate drainage and revegetation on areas capable of supporting vegetation disturbed during construction or other surface disturbing activities to stabilize the area and control soil erosion.
- C. Stabilize and/or close and rehabilitate non-system roads where significant resource damage is occurring.
- D. Use soils and materials data for road and trail design.
- E. Control livestock and big-game grazing so plant cover is not reduced to less than the amount needed for soil and watershed protection.

Standards and Guidelines

- a. Maintain soil erosion losses at or below soil loss tolerance values as defined by the Soil Conservation Service as modified by the USFS (refer to Soil Erodibility and Soils Loss Factors for Utah Soils [USDA 1977])
- b. Add mulch, fertilizer, and other soil amendments as necessary to reduce soil erosion and increase vegetative growth.
- c. Design continuing mitigation or rest rotation practices and follow-up maintenance activities to ensure that vegetation ground cover exceeds 80 percent of adjacent similar undisturbed sites.
- d. Use appropriate design guides for sediment controlling structures.

Geologic Resource Management

General Direction 1

Complete appropriate order of geologic inventory and as appropriate geotechnical investigation in areas where proposed activities or uses could:

- A. Be endangered by geologically related hazards, such as land instability, earthquakes, subsidence, land instability, earthquakes, and subsidence etc.
- B. Or increase risks of subsidence, land instability, ground water pollution, or diversion.

General Direction 2

Monitor identified geologic hazards for effects on management activities.

General Direction 3

Assure that appropriate geotechnical and/or geologic data are included in design and construction of facilities, or other developments so as to minimize the potential of inducing failure.

Standards and Guidelines

- a. Maintain soil erosion losses at or below soil loss tolerance values as defined by the Soil Conservation Service as modified by the USFS (refer to Soil Erodibility and Soils Loss Factors for Utah Soils [USDA 1977])
- b. Add mulch, fertilizer, and other soil amendments as necessary to reduce soil erosion and increase vegetative growth.
- c. Design continuing mitigation or rest rotation practices and follow-up maintenance activities to ensure that vegetation ground cover exceeds 80 percent of adjacent similar undisturbed sites.
- d. Use appropriate design guides for sediment controlling structures.

Environmental Consequences

Methodology

The best available soils data for the national forests was obtained from State Soil Geographic Database, Soil Survey Geographic Database, and Natural Resources Conservation Service soil surveys. Landtype associations were used as the base mapping unit for this analysis as these units were of a consistent scale and availability between the three forest units. Geologic data were obtained from the Geologic Map of Utah (scale of 1:500,000) (Hintze et al., 2000).

For Soil Indicator 1, the total extent of disturbance (in acres) due to construction of components (excluding access roads) was estimated over the entire length of an alternative route using the Applicant’s Project description for temporary and permanent disturbance. Temporary disturbance includes disturbance associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures. Permanent disturbance includes the area occupied by transmission structures and communication regeneration stations. Temporary and permanent disturbance (as defined above) associated with construction of the Project was assumed to occur at a constant density per mile and was calculated based on the total estimated disturbance. The estimated density of disturbance (in acres per mile) was used to calculate the extent of effects on soil types crossed. For purposes of route comparison, these temporary disturbances equate to approximately 11.5 acres of disturbance per mile of the alternative route reference centerline. The permanent disturbances equate to approximately 0.3 acres of disturbance per mile of the alternative route reference centerline. See Section 2.3, Project Description, of the Draft EIS (BLM 2014).

For Soil Indicator 2, six levels of access (Table 2) were identified to represent predictions of the general types of access (i.e., use existing roads, improve existing roads, or construct new roads) and the estimated amount of disturbance anticipated for each access level. The access-level disturbance predictions have been developed to be conservative to ensure predictions for ground disturbance are not underestimated in relation to actual disturbance and impacts. For purposes of analyzing impacts on resources and assessing likely ground disturbance associated with access routes, six access levels, based primarily on slope and area of ground disturbance per mile of alternative route centerline, were developed based on information provided in the Applicant’s Project description.

TABLE 2 ACCESS LEVELS AND POTENTIAL AREAS OF GROUND DISTURBANCE		
Access Level	Description and Assumptions for Analysis	Area of Ground Disturbance (acres) ¹
1	Use existing road (0 to 15 percent slope) within half the distance of the typical span from the Project centerline, 1.25 miles of existing access roads per mile of transmission line, 60 percent of existing access roads would require 8-foot-wide improvements (including cut-and-fill), 0.625 miles of 22-foot-wide spur roads (including cut-and-fill) per mile of transmission line, 100-foot-long by 10-foot-wide pullout areas required for every 1,000 feet of access road. ²	2.8
2	Use existing road (greater than 15 percent slope) within half the distance of the typical span from the Project centerline, 2.25 miles of existing access roads per mile of transmission line, 60 percent existing access roads would require 12-foot-wide improvements (including cut-and-fill), 1.125 miles of 32-foot-wide spur roads (including cut-and-fill) per mile of transmission line, 100-foot-long by 10-foot-wide pullout areas required for every 1,000 feet of access road. ²	6.7

TABLE 2 ACCESS LEVELS AND POTENTIAL AREAS OF GROUND DISTURBANCE		
Access Level	Description and Assumptions for Analysis	Area of Ground Disturbance (acres) ¹
3	Construct new access road (0 to 8 percent slope), 1.25 miles of new 20-foot-wide road (including cut-and-fill) per mile of transmission line, 100-foot-long by 10-foot-wide pullout areas would be required for every 1,000 feet of access road. ³	3.2
4	Construct new access road (8 to 15 percent slope); 1.5 miles of new 24-foot-wide road per mile of transmission line, 100-foot-long by 10-foot-wide turnout areas required for every 1,000 feet of access road. ⁴	4.5
5	Construct new access road (15 to 30 percent slope); 2.0 miles of new 29-foot-wide road per mile of transmission line, 100-foot-long by 10-foot-wide turnout areas would be required for every 1,000 feet of access road. ⁴	7.3
6	Construct new access road (greater than 30 percent slope); 2.5 miles of new 55-foot-wide road per mile of transmission line, 100-foot-long by 10-foot-wide turnout areas would be required for every 1,000 feet of access road. ⁴	17.0
NOTES: ¹ Numbers are approximate ² Includes Existing Roads – No Improvement and Existing Roads – Improvements Required as described in Appendix B, Section 2.5 of the Draft Environmental Impact Statement (EIS) ³ Includes New Roads – Bladed, New Roads – Overland Travel and Temporary Roads as described in Appendix B, Section 2.5 of Draft EIS ⁴ Includes New Roads – Bladed and Temporary Roads as described in Appendix B, Section 2.5 of Draft EIS		

For Soil Indicator 3, the Project would require transmission right-of-way vegetation clearing in accordance with the PacifiCorp clearing specifications and vegetation management plans. To identify the potential amount of tall and/or overstory vegetation clearing, vegetation types within the Project area with the potential to grow 5 feet tall (e.g., conifer, fir, spruce, pine, aspen, mountain shrub, pinyon-juniper, riparian) were identified using a composite of land cover and National Wetland Inventory (U.S. Fish and Wildlife Service 2012) GIS data, locations where these vegetation types coincide with the Project right-of-way where identified as vegetation to be removed.

The distance crossed by the reference centerline of each alternative route on USFS-administered land and estimated extent (in acres) of disturbance of each soil unit are calculated by link, a subset of each alternative route. The results are detailed in the comparison of alternative routes in the Comparison of Action Alternatives section below (Refer to Table 5 through Table 15).

Geographic and Temporal Scope of Analysis

In this analysis, the geographic scope of analysis for soil resources is 1 mile on either side of the reference centerline of each alternative route. This geographic scope is assumed to be broad enough to encompass any soil resources that potentially would be affected by Project access roads.

The temporal scope for the analysis was 5 years for construction and reclamation (i.e., when temporary environmental effects would be anticipated to return to a preconstruction condition). For operation and maintenance, long-term environmental effects would be anticipated to remain for the life of the Project (approximately 50 years).

Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

Past and present and reasonably foreseeable future actions (RFFA) that could have a cumulatively significant impact on soil resources together with the Project on all of the national forest units crossed by alternative routes considered for the Project are discussed in this section.

Ashley National Forest

Past and Present

Past and present actions that could have a cumulatively significant impact on soil resources together with the Project include oil and gas development on the Berry Petroleum South Unit, oil and gas development on units in the BLM Vernal Field Office, and on Utah School and Institutional Trust Lands Administration (SITLA) active oil and gas leases; habitat and rangeland projects in the BLM Vernal Field Office; and areas of historical fires between 2000 and 2012.

RFFAs include the proposed TransWest Express transmission project and activities occurring on Utah Division of Wildlife Resources forest, rangeland, and riparian watershed restoration focus areas.

Manti-La Sal National Forest

Past and present actions that could have a cumulatively significant impact on soil resources together with the Project include oil and gas development for Ferron Natural Gas Project, SITLA active oil and gas leases, and Utah Division of Oil, Gas and Mining gas well pads; the Deer Creek coal lease/coal mine, Flat Canyon coal lease tract, SITLA active coal leases, and the Skyline Mine; vegetation management for the Millers Flat Project (maintenance activities), and the Shalom Electric Boulger timber salvage; the proposed Narrows Reservoir; areas of historical fires between 2000 and 2011; and range improvements by the Manti-La Sal National Forest.

RFFAs include the proposed TransWest Express Transmission Project, actions associated with the proposed Narrows Reservoir project (e.g., proposed highway relocation, quarries [sand and gravel], tunnel, pipeline), and activities occurring on Utah Division of Wildlife Resources forest, rangeland, and riparian watershed restoration focus areas.

Uinta National Forest

Past and present actions that could have a cumulatively significant impact on soil resources together with the Project include a communication facility for the central Utah telephone fiber optic line; oil and gas development for the Lake Canyon exploration and development agreement boundary, and SITLA active oil and gas leases: the Sheep Creek vegetation management project; residential developments for the Strawberry Highlands Lost Bear, Strawberry, and Willow Creek phases; areas of historical fires between 2000 and 2012; range improvements such as waterlines, cattle guards, gates and inventoried improvements such as fences, tanks, and troughs developed by Uinta National Forest.

RFFAs include the proposed TransWest Express transmission project, the Sheep Creek trail; and Utah Division of Wildlife Resources forest, rangeland, and riparian watershed restoration focus areas.

Results

No-Action Alternative

Under the No-Action Alternative, there would be no direct or indirect effects on soil resources associated with the Project. Current management of the national forest units would continue unchanged. Other utility projects may be permitted in similar areas resulting in similar impacts on soil resources as those described for the Project. Grazing allotments and timber sales would continue as would their associated impacts on soil resources from vegetation removal, trampling, and heavy-equipment movement. No new access roads associated with the Project would be constructed in support of the Project reducing potential for increased unintended access by recreationists or all-terrain vehicles.

Comparison of Action Alternatives

For any alternative route selected, the construction, operation, and maintenance of the Project would result in both direct and indirect effects on soil resources due to ground disturbance. Direct effects associated with construction activities could include the following:

- Accelerated soil erosion in areas where construction-related activities have disturbed or altered the land surface by exposing soils (temporary)
- Accelerated soil erosion in areas where construction-related activities have altered the contours of the land surface (temporary)
- Compaction of soil resources by construction vehicles, equipment, and activities at structure sites and along new access routes (temporary)

Also, maintenance activities associated with the Project could result in compaction by maintenance vehicles along permanent access roads.

Indirect effects associated with the construction, operation, and maintenance of the Project would include the construction of permanent access roads that could be used by the general public to access currently inaccessible areas, potentially resulting in accelerated erosion by water or wind (permanent), and the degradation of land surface and loss of soil productivity resulting from accelerated soil erosion (temporary to permanent).

For additional discussion of impact levels, refer to Section 3.2.2.4.2, Impact Assessment and Mitigation Planning in the Draft EIS (BLM 2014).

The number of miles crossing of areas with erosion susceptibility is presented by alternative route in Table 3. Table 4 provides the number of miles of residual impacts on soil resources with water and wind erosion susceptibility.

Alternative Route	Water Erosion Susceptibility (miles)			Wind Erosion Susceptibility (miles)		
	High	Moderate	Low	High	Moderate	Low
COUT BAX-B	0.2	1.7	–	0.5	3.0	13.4
COUT BAX-C	0.2	1.7	–	0.5	3.0	13.4
COUT BAX-E	0.1	0.1	–	–	–	7.7
COUT-A	7.3	1.5	3.0	–	2.9	17.1
COUT-A-1	7.5	0.4	2.7	–	3.5	16.1

TABLE 3 WATER AND WIND EROSION SUSCEPTIBILITY						
Alternative Route	Water Erosion Susceptibility (miles)			Wind Erosion Susceptibility (miles)		
	High	Moderate	Low	High	Moderate	Low
COUT-B ¹	9.1	0.5	7.9	–	1.0	18.1
COUT-C ²	6.2	0.5	0.9	–	1.0	8.2
COUT-H	0.1	0.1	–	–	–	7.7
COUT-I	0.2	1.7	–	0.5	3.0	13.4

NOTES:
¹Estimates for Alternative COUT-B are similar for the COUT-B route variations.
²Estimates for Alternative COUT-C are similar for the COUT-C route variations.

TABLE 4 WATER AND WIND EROSION SUSCEPTIBILITY MILES OF RESIDUAL IMPACT				
Alternative Route	Water Erosion Susceptibility Impact (miles)		Wind Erosion Susceptibility Impact (miles)	
	Moderate	Low	Moderate	Low
COUT BAX-B	0.2	1.7	0.5	16.4
COUT BAX-C	0.2	1.7	0.5	16.4
COUT BAX-E	0.1	0.1	–	7.7
COUT-A	7.3	4.5	–	20.0
COUT-A-1	7.5	3.1	–	19.2
COUT-B ¹	9.1	8.4	–	19.1
COUT-C ²	6.2	1.4	–	9.2
COUT-H	0.1	0.1	–	7.7
COUT-I	0.2	1.7	0.5	16.4

NOTES:
¹Estimates for Alternative COUT-B are similar for the COUT-B route variations.
²Estimates for Alternative COUT-C are similar for the COUT-C route variations.

The following sections present the results of the analysis conducted for each additional soil indicator by alternative route.

Alternative COUT BAX-B

Alternative COUT BAX-B crosses land administered by the Manti-La Sal National Forest. This alternative crosses 22.4 total miles split among Links U539 (2.3), U629 (11.6 miles), and U630 (8.5 miles). Impacts on soil resource along Alternative COUT BAX-B would be similar on USFS-administered land to those described for Alternative COUT-I.

Alternative COUT BAX-C

Alternative COUT BAX-C crosses land administered by the Manti-La Sal National Forest. This alternative route crosses 22.4 total miles split among Links U539 (2.3), U629 (11.6 miles), and U630 (8.5 miles). Impacts on soil resources along Alternative COUT BAX-C would be similar on USFS-administered land to those described for Alternative COUT-I.

Alternative COUT BAX-E

Alternative COUT BAX-E crosses land administered by the Manti-La Sal National Forest. This alternative route crosses 11.3 total miles along Link U600. Impacts on soil resources along Alternative COUT BAX-E would be similar on USFS-administered land to those described for Alternative COUT-H.

Alternative COUT-A

Alternative COUT-A crosses land administered by both the Uinta and Manti-La Sal National Forests. On the Uinta National Forest, this alternative route crosses 18.4 total miles split among Links U424 (6.2 miles), U429 (3.8 miles), and U433 (8.4 miles). It is estimated that Alternative COUT-A would result in approximately 413 acres of surface disturbance due to temporary and permanent disturbance from Project components and access road improvements/construction (Table 5). Furthermore, it is estimated that 217 acres of clearing of overstory and/or tall vegetation (vegetation with potential to grow taller than 5 feet) within the transmission line right-of-way would occur along this alternative route on the Uinta National Forest.

**TABLE 5
UINTA NATIONAL FOREST LANDTYPE ASSOCIATIONS
CROSSED BY ALTERNATIVE COUT-A AND ACRES OF DISTURBANCE**

Landtype Association	Link	Mileage ¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres) ⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres) ²	Permanent Disturbance (Acres) ³		
Allen Creek-Rock Outcrop-Squaretop	U424	1.0	11.5	0.3	16.0	27.6
Rial-Bigbug	U424	2.9	33.4	0.9	42.1	76.4
Bigbug-Longridge	U424	1.9	21.9	0.6	22.0	44.5
	U429	2.0	23.0	0.6	12.5	36.1
Squaretop-Longridge	U424	0.4	4.6	0.1	2.7	7.4
	U429	1.4	16.1	0.4	8.2	24.7
Landslide Association – 1	U433	0.3	3.5	0.1	2.0	5.6
Stream Canyon Association – 4	U433	1.2	13.8	0.4	8.4	22.6
Stream Canyon Association – 10	U433	1.1	12.7	0.3	3.1	16.1
Stream Canyon Association – 12	U433	1.0	11.5	0.3	11.9	23.7
Stream Canyon Association – 15	U429	0.4	4.6	0.1	6.8	11.5
	U433	1.7	19.6	0.5	16.7	36.8
Tectonic Mountain – 1	U433	0.3	3.5	0.1	2.0	5.6
Tectonic Mountain – 5	U433	2.2	25.3	0.7	36.8	62.8
Tectonic Mountain – 8	U433	0.6	6.9	0.2	4.2	11.3
Total Miles		18.4	Estimated Total Acres of Disturbance			412.7

NOTES:

¹Miles crossed by alternative route reference centerline

²Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures

³Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations

⁴Estimated amount of disturbance from existing and new access roads

On the Manti-La Sal National Forest, this alternative route crosses 1.7 total miles along Link U621. It is estimated that Alternative COUT-A would result in approximately 39 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 6). Furthermore, it is estimated that 20 acres of clearing of overstory and/or tall vegetation in the transmission line right-of-way would occur along this alternative route on the Manti-La Sal National Forest.

TABLE 6 MANTI-LA SAL NATIONAL FOREST LANDTYPE ASSOCIATIONS CROSSED BY ALTERNATIVE COUT-A AND ACRES OF DISTURBANCE						
Landtype Association	Link	Mileage¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres)⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres)²	Permanent Disturbance (Acres)³		
Spanish Fork Mountain Ridgeland-Thistle Highlands	U621	0.7	8.1	0.2	10.9	19.2
Spanish Fork Mountain Ridgeland-Indianola-Thistle Valleys	U621	1.0	11.5	0.3	7.3	19.1
Total Miles		1.7	Estimated Total Acres of Disturbance			38.3
NOTES: ¹ Miles crossed by alternative route reference centerline ² Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures ³ Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations ⁴ Estimated amount of disturbance from existing and new access roads						

Alternative COUT-A-1

Alternative COUT-A-1 crosses land administered by both the Uinta and Manti-La Sal National Forests. On the Uinta National Forest, this alternative route crosses 18.0 total miles split among Links U424 (6.2 miles), U433 (8.4 miles), and U428 (3.4 miles). It is estimated that Alternative COUT-A-1 would result in approximately 406 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 7). Furthermore, it is estimated that 212 acres of clearing of overstory/tall vegetation in the transmission line right-of-way would occur along this alternative route on the Uinta National Forest.

**TABLE 7
 UINTA NATIONAL FOREST LANDTYPE ASSOCIATIONS
 CROSSED BY ALTERNATIVE COUT-A-1 AND ACRES OF DISTURBANCE**

Landtype Association	Link	Mileage ¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres) ⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres) ²	Permanent Disturbance (Acres) ³		
Allen Creek-Rock Outcrop-Squaretop	U424	1.0	11.5	0.3	16.0	27.8
Rial-Bigbug	U424	2.9	33.4	0.9	42.1	76.4
	U428	0.7	8.1	0.2	5.1	13.4
Bigbug-Longridge	U424	1.9	21.9	0.6	22.0	44.5
	U428	2.2	25.3	0.7	16.7	42.7
Squaretop-Longridge	U424	0.4	4.6	0.1	2.7	7.4
Landslide Association – 1	U433	0.3	3.5	0.1	2.0	5.6
Stream Canyon Association – 1	U433	1.2	13.8	0.4	8.4	22.6
Stream Canyon Association – 10	U433	1.1	12.7	0.3	3.1	16.1
Stream Canyon Association – 12	U433	1.0	11.5	0.3	11.9	23.7
Stream Canyon Association – 15	U428	0.4	4.6	0.1	1.7	6.4
	U433	1.7	19.6	0.5	16.7	36.8
Tectonic Mountain Association – 1	U433	0.3	3.5	0.1	2.0	5.6
Tectonic Mountain Association – 3	U428	0.1	1.2	0.0	1.7	2.9
Tectonic Mountain Association – 5	U433	2.2	25.3	0.7	36.8	62.8
Tectonic Mountain Association – 8	U433	0.6	6.9	0.2	4.2	11.3
Total Miles		18.0	Estimated Total Acres of Disturbance			406.0

NOTES:

¹Miles crossed by alternative route reference centerline

²Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures

³Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations

⁴Estimated amount of disturbance from existing and new access roads.

On the Manti-La Sal National Forest, this alternative route crosses 1.7 total miles along Link U621. It is estimated that Alternative COUT-A-1 would result in approximately 38.3 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 8). Furthermore, it is estimated that 20 acres of clearing of overstory and/or tall vegetation in the transmission line right-of-way would occur along this alternative route on the Manti-La Sal National Forest.

TABLE 8 MANTI-LA SAL NATIONAL FOREST LANDTYPE ASSOCIATIONS CROSSED BY ALTERNATIVE COUT-A-1 AND ACRES OF DISTURBANCE						
Landtype Association	Link	Mileage¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres)⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres)²	Permanent Disturbance (Acres)³		
Spanish Fork Mountain Ridgeland- Thistle Highlands	U621	0.7	8.1	0.2	10.9	19.2
Spanish Fork Mountain Ridgeland- Indianola-Thistle Valleys	U621	1.0	11.5	0.3	7.3	19.1
Total Miles		1.7	Estimated Total Acres of Disturbance			38.3
NOTES: ¹ Miles crossed by alternative route reference centerline ² Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures ³ Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations ⁴ Estimated amount of disturbance from existing and new access roads.						

Alternative COUT-B

Alternative COUT-B would cross land administered by the Ashley, Uinta, and Manti-La Sal National Forests. On the Ashley National Forest, this alternative route crosses 12.0 miles along Link U431. It is estimated that Alternative COUT-B would result in approximately 190.6 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 9). Furthermore, it is estimated that 142 acres of clearing of overstory and/or tall vegetation within the transmission line right-of-way would occur along this alternative route on the Ashley National Forest.

**TABLE 9
ASHLEY NATIONAL FOREST LANDTYPE ASSOCIATION
CROSSED BY ALTERNATIVE COUT-B AND ACRES OF DISTURBANCE**

Landtype Association	Link	Mileage ¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres) ⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres) ²	Permanent Disturbance (Acres) ³		
Anthro Plateau – 200	U431	9.3	107.0	2.8	26.9	136.7
Anthro Plateau – 125	U431	0.2	2.3	0.1	1.4	3.8
Avintaquain Canyon – 160	U431	2.5	28.8	0.8	20.5	50.1
Total Miles		12.0	Estimated Total Acres of Disturbance			190.6

NOTES:

¹Miles crossed by alternative route reference centerline

²Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures

³Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations

⁴Estimated amount of disturbance from existing and new access roads

Estimates provided for Alternative COUT-B are similar for the COUT-B variations

On the Uinta National Forest, this alternative route crosses 8.9 total miles split between Links U530 (1.8 miles) and U539 (7.1 miles). It is estimated that Alternative COUT-B would result in approximately 176.6 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 10). Furthermore, it is estimated that 105 acres of clearing of overstory and/or tall vegetation in the transmission line right-of-way would occur along this alternative on the Uinta National Forest.

**TABLE 10
UINTA NATIONAL FOREST LANDTYPE ASSOCIATIONS
CROSSED BY ALTERNATIVE COUT-B AND ACRES OF DISTURBANCE**

Landtype Association	Link	Mileage ¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres) ⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres) ²	Permanent Disturbance (Acres) ³		
Structurally Controlled Landscape-Shale – 4	U530	0.6	6.9	0.2	4.2	11.3
	U539	1.0	11.5	0.3	10.0	21.8
Structurally Controlled Landscape-Shale – 5	U530	1.2	13.8	0.4	8.0	22.2
	U539	1.6	18.4	0.5	17.4	36.3
Stream Canyon Association – 1	U539	0.2	2.3	0.1	1.4	3.8
Stream Canyon Association – 2	U539	0.2	2.3	0.1	1.3	3.7
Stream Canyon Association – 4	U539	0.7	8.1	0.2	4.9	13.2
Stream Canyon Association – 10	U539	0.3	3.5	0.1	2.0	5.6
Stream Canyon Association – 11	U539	0.4	4.6	0.1	2.9	7.6
Stream Canyon Association – 12	U539	0.3	3.5	0.1	2.2	5.8

TABLE 10 UINTA NATIONAL FOREST LANDTYPE ASSOCIATIONS CROSSED BY ALTERNATIVE COUT-B AND ACRES OF DISTURBANCE						
Landtype Association	Link	Mileage¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres)⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres)²	Permanent Disturbance (Acres)³		
Tectonic Mountain Association – 5	U539	0.1	1.2	0.0	0.7	1.9
Tectonic Mountain Association – 9	U539	2.3	26.5	0.7	16.2	43.4
Total Miles		8.9	Estimated Total Acres of Disturbance			176.6
NOTES: ¹ Miles crossed by alternative route reference centerline ² Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures ³ Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations ⁴ Estimated amount of disturbance from existing and new access roads Estimates for Alternative COUT-B are similar for the COUT-B route variations						

On the Manti-La Sal National Forest, this alternative route crosses 1.7 total miles along Link U621. It is estimated that Alternative COUT-B would result in approximately 38 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 11). Furthermore, it is estimated that 20 acres of clearing of overstory and/or tall vegetation in the transmission line right-of-way would occur along this alternative route on the Manti-La Sal National Forest.

TABLE 11 MANTI-LA SAL NATIONAL FOREST LANDTYPE ASSOCIATIONS CROSSED BY ALTERNATIVE COUT-B AND ACRES OF DISTURBANCE						
Landtype Association	Link	Mileage¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres)⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres)²	Permanent Disturbance (Acres)³		
Spanish Fork Mountain Ridgeland- Thistle Highlands	U621	0.7	8.1	0.2	10.9	19.2
Spanish Fork Mountain Ridgeland- Indianola-Thistle Valleys	U621	1.0	11.5	0.3	7.3	19.1
Total Miles		1.7	Estimated Total Acres of Disturbance			38.3
NOTES: ¹ Miles crossed by reference centerline ² Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures ³ Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations ⁴ Estimated amount of disturbance from existing and new access roads. Estimates for Alternative COUT-B are similar for the COUT-B route variations						

Alternative COUT-C

Alternative COUT-C would cross land administered by both the Uinta and Manti-La Sal National Forests. On the Uinta National Forest, this alternative route crosses 8.9 total miles split between Links U530 (1.8 miles) and U539 (7.1 miles). It is estimated that Alternative COUT-C would result in approximately 177 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 12). Furthermore, it is estimated that 105 acres of clearing of overstory and/or tall vegetation in the transmission line right-of-way would occur along this alternative route on the Uinta National Forest.

TABLE 12 UINTA-WASATCH-CACHE NATIONAL FOREST LANDTYPE ASSOCIATIONS CROSSED BY ALTERNATIVE COUT-C AND ACRES OF DISTURBANCE						
Landtype Association	Link	Mileage¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres)⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres)²	Permanent Disturbance (Acres)³		
Structurally Controlled Landscape-Shale – 4	U530	0.6	6.9	0.2	4.2	11.3
	U539	1.0	11.5	0.3	10.0	21.8
Structurally Controlled Landscape-Shale – 5	U530	1.2	13.8	0.4	8.0	22.2
	U539	1.6	18.4	0.5	17.4	36.3
Stream Canyon Association – 1	U539	0.2	2.3	0.1	1.4	3.8
Stream Canyon Association – 2	U539	0.2	2.3	0.1	1.3	3.7
Stream Canyon Association – 4	U539	0.7	8.1	0.2	4.9	13.2
Stream Canyon Association – 10	U539	0.3	3.5	0.1	2.0	5.6
Stream Canyon Association – 11	U539	0.4	4.6	0.1	2.9	7.6
Stream Canyon Association – 12	U539	0.3	3.5	0.1	2.2	5.8
Tectonic Mountain Association – 5	U539	0.1	1.2	0.0	0.7	1.9
Tectonic Mountain Association – 9	U539	2.3	26.5	0.7	16.2	43.4
Total Miles		8.9	Estimated Total Acres of Disturbance			176.6
NOTES:						
¹ Miles crossed by alternative route reference centerline						
² Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures						
³ Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations						
⁴ Estimated amount of disturbance from existing and new access roads.						
Estimates for Alternative COUT-C are similar for the COUT-C route variations						

On the Manti-La Sal National Forest, this alternative route crosses 1.7 total miles along Link U621. It is estimated that Alternative COUT-C would result in approximately 38 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 13). Furthermore, it is estimated that 20 acres of clearing of overstory and/or tall

vegetation in the transmission line right-of-way would occur along this alternative route on the Manti-La Sal National Forest.

TABLE 13 MANTI-LA SAL NATIONAL FOREST LANDTYPE ASSOCIATIONS CROSSED BY ALTERNATIVE COUT-C AND ACRES OF DISTURBANCE						
Landtype Association	Link	Mileage ¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres) ⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres) ²	Permanent Disturbance (Acres) ³		
Spanish Fork Mountain Ridgелands-Thistle Highlands	U621	0.7	8.1	0.2	10.9	19.2
Spanish Fork Mountain Ridgелands-Indianola-Thistle Valleys	U621	1.0	11.5	0.3	7.3	19.1
Total Miles		1.7	Estimated Total Acres of Disturbance			38.3
NOTES: ¹ Miles crossed by alternative route reference centerline ² Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures ³ Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations ⁴ Estimated amount of disturbance from existing and new access roads. Estimates for Alternative COUT-C are similar for the COUT-C route variations						

Alternative COUT-H

Alternative COUT-H crosses land administered by the Manti-La Sal National Forest. This alternative route would cross 11.3 total miles along Link U600. It is estimated that Alternative COUT-H would result in approximately 224 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 14). Furthermore, it is estimated that 133 acres of clearing of overstory and/or tall vegetation in the transmission line right-of-way would occur along this alternative route on the Manti-La Sal National Forest.

**TABLE 14
MANTI-LA SAL NATIONAL FOREST LANDTYPE ASSOCIATIONS
CROSSED BY ALTERNATIVE COUT-H AND ACRES OF DISTURBANCE**

Landtype Association	Link	Mileage ¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres) ⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres) ²	Permanent Disturbance (Acres) ³		
Wasatch Plateau-Eastern horsts derived from the Black Hawk Formation	U600	1.8	20.7	0.5	20.3	41.5
Wasatch Plateau-Eastern horsts derived from Mesa Verde Group	U600	3.9	44.9	1.2	37.3	83.4
Wasatch Plateau-Central grabens and glacial outwash valleys (764)	U600	2.8	32.2	0.8	12.6	45.6
Wasatch Plateau-Northern canyons derived from North Horn Formation	U600	2.8	32.2	0.8	20.2	53.2
Total Miles		11.3	Estimated Total Acres of Disturbance			223.7
<p>NOTES:</p> <p>¹Miles crossed by alternative route reference centerline</p> <p>²Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures</p> <p>³Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations</p> <p>⁴Estimated amount of disturbance from existing and new access roads</p>						

Alternative COUT-I

Alternative COUT-I crosses land administered by the Manti-La Sal National Forest. This alternative route crosses 22.4 total miles split among Links U539 (2.3), U629 (11.6 miles), and U630 (8.5 miles). It is estimated that Alternative COUT-I would result in approximately 374 acres of disturbance due to temporary and permanent disturbance from Project components and access road improvements and/or construction (Table 15). Furthermore, it is estimated that 237 acres of clearing of overstory and/or tall vegetation in the transmission line right-of-way would occur along this alternative route on the Manti-La Sal National Forest.

TABLE 15 MANTI-LA SAL NATIONAL FOREST LANDTYPE ASSOCIATIONS CROSSED BY ALTERNATIVE COUT-I AND ACRES OF DISTURBANCE						
Landtype Association	Link	Mileage¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres)⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres)²	Permanent Disturbance (Acres)³		
Wasatch Plateau-Central grabens and glacial outwash valleys (747)	U630	3.5	40.3	1.1	7.5	48.9
	U629	0.7	8.1	0.2	2.9	11.2
Wasatch Plateau-Western horsts and glaciated ridges and canyons derived from North Horn Formation	U630	2.5	28.8	0.8	16.2	45.8
Wasatch Plateau-Western horsts, eastern slopes, and glaciated valleys	U630	0.6	6.9	0.2	17.0	24.1
Wasatch Monocline-Northern canyons derived from North Horn Formation	U630	1.9	21.9	0.6	6.7	29.2
Mancos Shale Lowlands-Castle Valley pediments	U629	0.4	4.6	0.1	6.8	11.5
Wasatch Plateau-Eastern escarpment derived from Mesa Verde Group	U629	3.8	43.7	1.1	14.6	59.4
Wasatch Plateau-Eastern horsts derived from North Horn Formation	U629	2.0	23.0	0.6	7.2	30.8
Wasatch Plateau-Eastern horsts derived from Flagstaff Limestone	U629	1.7	19.6	0.5	4.4	24.5

**TABLE 15
MANTI-LA SAL NATIONAL FOREST LANDTYPE ASSOCIATIONS
CROSSED BY ALTERNATIVE COUT-I AND ACRES OF DISTURBANCE**

Landtype Association	Link	Mileage ¹	Estimated Disturbance from Project Components		Estimated Disturbance from Access Roads (Acres) ⁴	Total Estimated Amount of Disturbance for Landtype
			Temporary Disturbance (Acres) ²	Permanent Disturbance (Acres) ³		
Wasatch Plateau-Eastern horsts derived from Mesa Verde Group	U629	3.0	34.5	0.9	10.1	45.5
Tectonic Mountain Association – 9	U539	2.3	26.5	0.7	16.2	43.4
Total Miles		22.4	Estimated Total Acres of Disturbance			374.3
NOTES: ¹ Miles crossed by alternative route reference centerline ² Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures ³ Estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations ⁴ Estimated amount of disturbance from existing and new access roads						

Cumulative Effects

Cumulative effects on soil resources can result from alterations to the natural environment and land surface that could increase the rate of soil erosion by water or wind. The implementation of appropriate selective mitigation measures would minimize short-term impacts, such as disturbance of surface soils and other alterations to the natural environment stemming from construction of the Project, other present and past projects, and RFFAs, such that the local soil resources would be stabilized or returned to a state close to their pre-construction state. Long-term impacts on soil resources would be associated with increased public access via new access roads to previously undisturbed areas crossed by the Project.

Mitigation Planning

Design features of the Proposed Action for environmental protection are measures identified as part of the Project description and would be implemented as part of construction. Selective mitigation measures were developed in collaboration with the BLM and USFS and include measures or techniques recommended or required by the agencies after initial impacts were assessed. Once an alternative route is selected, the Applicant would coordinate with USFS, as appropriate, to refine the implementation of mitigation at specific locations or areas. The detailed mitigation would be incorporated into the Plan of Development (POD) prior to Project construction. A number of plans would be included in the POD, including a Stormwater Pollution Prevention Plan; Erosion, Dust Control, and Air Quality Plan; and Reclamation, Revegetation, Transportation and Access Plan, and Monitoring Plan. These plans in the POD would provide site-specific direction for implementing erosion control measure, revegetation, and closure and/or rehabilitation of Project disturbance not necessary for Project maintenance or repair.

Design Features of the Proposed Action for Environmental Protection

Several design features presented in the Applicant’s Project description (Design Features 1, 2, 16, 17, 18, 23, 24, 26, 27, 29, and 30; refer to Table 2-8 in the Draft EIS) would be applied where applicable and

feasible based on the Project description to reduce the effects of surface-disturbing activities on soil resources.

- **Design Feature 1** – In construction areas where recontouring is not required, vegetation would be left in place wherever possible, and original contour would be maintained to avoid excessive root damage and allow for resprouting in accordance with the reclamation plan. Vegetation not consistent with minimum clearance distances between trees and transmission lines must be removed to ensure line safety and reliability (required by National Electric Reliability Council Transmission Vegetation management Program).
- **Design Feature 2** – In construction areas (e.g., marshaling yards, structure work areas, and spur roads from existing access roads) where there is ground disturbance or where recontouring is required, surface reclamation would occur as required by the landowner or land-management agency. The method of reclamation normally would consist of, but is not limited to, returning disturbed areas back to their natural contour, reseeded, installing cross drains for erosion control, placing water bards in the road, and filling ditches.

All areas on land administered by the BLM or USFS disturbed as a part of the construction and/or maintenance of the proposed power line would be seeded with a seed mixture appropriate for those areas. The BLM or USFS would approve a seed mixture suitable for each range type. Seeding methods typically would include drill seeding, where practicable; however, the BLM or USFS may recommend broadcast seeding as an alternative method in some cases.

A Reclamation, Revegetation, and Monitoring Framework Plan identifying reclamation stipulations would be developed and incorporated in the POD, which would be approved by the BLM and USFS prior to the issuance of a right-of-way grant or special-use authorization, respectively.

- **Design Feature 16** – During and after construction of the transmission line, the right-of-way would be free of non-biodegradable debris. Slash would be left in place or disposed of in accordance with requirements of the land-management agency or landowner.
- **Design Feature 17** – In newly disturbed temporary work areas, the soil would be salvaged and distributed and contoured evenly over the surface of the disturbed area after construction completion. The soil surface would be left rough to help reduce potential wind erosion.
- **Design Feature 18** – Grading would be minimized by driving overland in areas approved in advance by the land-management agency within pre-designated work areas wherever possible.
- **Design Feature 23** – In cultivated agricultural areas, soil compacted by construction activities would be de-compacted. Construction activities would occur as practical to minimize impacts on agricultural operations.
- **Design Feature 24** – Where work would occur on hazardous and contaminated sites, the Applicant must seek approval from the U.S. Environmental Protection Agency. Work on contaminated sites must avoid remedial structures (e.g., capped areas, treatment, monitoring wells, etc.) and workers must use adequate worker protection measures for working in contaminated areas.
- **Design Feature 26** – All construction-vehicle movement outside the right-of-way would be restricted to pre-designated access, contractor-acquired access, public roads, or overland travel

approved in advance by the applicable land-management agency, unless authorized by the construction inspection contractor.

- **Design Feature 27** – The spatial limits of construction activities including vehicle movement would be predetermined, with activity restricted to and confined within those limits. No paint or permanent discoloring agents indicating survey or construction limits would be applied to rocks, vegetation structures, fences, etc.
- **Design Feature 29** – All requirements of those entities having jurisdiction over air-quality matters would be adhered to. Any necessary dust-control plans would be developed and permits for construction activities would be obtained. Open burning of construction trash would not be allowed, unless permitted by appropriate authorities.
- **Design Feature 30** – Hazardous material would not be drained onto the ground or into streams or drainage areas. Totally enclosed containment would be provided for all trash. All construction waste, including trash and litter, garbage, other solid waste, petroleum products and other potentially hazardous materials would be removed to a disposal facility authorized to accept such materials within 1 week of Project completion.

Selective Mitigation Measures

Selective mitigation measures 1, 2, 3, 4, 5, 7, 10, 13, and 16 (refer to Table 2-13 in the Draft EIS) would be applied where recommended after initial impacts (i.e., impacts anticipated after application of design features of the Proposed Action for environmental protection) were identified and assessed.

- **Selective Mitigation Measure 1** – Disturbance to Sensitive Soils and Vegetation – Existing access roads and/or trails would not be widened or otherwise upgraded for construction and maintenance in areas, where soils and vegetation are particularly sensitive to disturbance, except in areas where repairs are necessary to make existing roads/trails passable and safe determined by the land-management agency. Avoiding unnecessary access road upgrades within 300 feet of outstanding water, impaired water, perennial streams, and intermittent streams would limit the amount of surface disturbance. Limiting ground disturbance in proximity to lotic water would reduce the potential for direct and indirect effects such as soil compaction and/or decompaction, loss of soil stabilizing vegetation, and increase potential for erosion and sediment transport.
- **Selective Mitigation Measure 2** – Sensitive Resources Avoidance – There will be no blading of new access roads in certain areas of sensitive resources (e.g., perennial streams, riparian areas, wetlands, historic trails) during construction (or maintenance). In these particular areas, existing crossings will be used at perennial streams, national recreation trails, and irrigation channels and existing or overland access routes are to be used for construction and maintenance in these select areas. Every crossing must be identified and a crossing plan developed. To minimize ground disturbance, overland routes must be flagged with easily seen markers, and the route must be approved in advance. Avoiding blading in areas with sensitive resources would reduce ground disturbance in these area reducing the potential for increased sedimentation into water bodies or loss of soil resources. Use of well-defined overland routes would reduce removal of surface vegetation maintaining soil and land surface stability.
- **Selective Mitigation Measure 3** – Minimize Slope Cut and Fill – The alignment of any new access roads or cross-country routes in designated areas would follow the landform contours where practicable to minimize ground disturbance and/or reduce scarring (visual contrast) of the landscape, providing that such alignment does not impact other resource values. In addition to reducing ground disturbance associated with the construction of new access roads, modification

to the size and/or configuration of the permanent structure pads facilitated by minor structure design adjustments would allow cut and fill slopes to be minimized and contoured to blend with existing topography to the extent practicable. Following the existing land contours and terrain, particularly in steep terrain, minimizes the cutting and filling of slopes where soil resources are particularly sensitive to surface disturbance.

- **Selective Mitigation Measure 4 – Minimize Tree Clearing** – Clearing of trees in and adjacent to the right-of-way would be minimized to limit disturbance to timber resources, reduce visual contrast, and protect raptor nesting habitat, to the extent practicable to satisfy conductor-clearance requirement (i.e., PacifiCorp Vegetation Management Standards). Trees and other vegetation would be removed selectively (e.g., edge feathering) to blend the edge of the right-of-way into adjacent vegetation patterns, as practicable and appropriate. To protect biological resources, only trees over 12 feet tall would be selectively removed in riparian habitats. Prior to construction, the route would be driven and historic nesting trees would be marked with a global positioning system and flagged to be saved, if possible. Minimizing tree clearing would reduce impacts on surface vegetation which would reduce the potential for accelerated erosion and other impacts on soil resources that result from surface-disturbing activities.
- **Selective Mitigation Measure 5 – Minimize New or Improved Accessibility** – To limit new or improved access into the Project area, as well as earthwork associated with the construction of structure pads in extremely steep terrain, all new or improved access (e.g., blading, widening existing access) and structure pads that would not be required for maintenance would be closed or rehabilitated using the most effective and least environmentally damaging methods, appropriate to that area and developed through consultation with the landowner or land-management agency. Methods for road closure or management include installing and locking gates, obstructing the path (e.g., earthen berms, boulders, redistribution of woody debris), revegetating and mulching the surface of the roadbed to make it less apparent, restoring the road to its natural contour and vegetation, or constructing waterbars to ensure proper drainage. Structure pads would be contoured to match existing grade and revegetate to the extent practicable to reduce their visual dominance in extremely steep terrain. Closure of access roads that are not needed for Project maintenance or repairs would allow these access roads to be fully rehabilitated reducing long-term effects on sensitive resources. Beyond returning the road to as close to its natural state as possible, road closure would remove the road from the transportation system and unauthorized use by public including off-highway vehicles. Restricting access would reduce the potential for unauthorized travel on the road that potentially would result in impacts on soil resources such as accelerated erosion.
- **Selective Mitigation Measure 7 – Span and/or Avoid Sensitive Features** – Within the limits of standard structure design and in conformance with engineering and Applicant requirements, structures would be located to allow conductors to clearly span identified sensitive features. Structures would be placed so as to avoid sensitive features, including, but not limited to, wetlands, riparian areas, water courses, hazardous substance remediation, and cultural sites. Avoidance measures may include selective structure placement, spanning sensitive features, or realigning access routes. Spanning and/or avoiding sensitive features would allow very specific alterations to the standard transmission line structure placements, either varying the distance between structure sites or moving the individual structure sites laterally relative to the general centerline to reduce or avoid impacting localized areas of sensitive resources.
- **Selective Mitigation Measure 10 – Helicopter Construction** – Helicopter placement of transmission line structures during construction and helicopter patrol and maintenance may be used where practicable to reduce surface impacts in environmental constraint areas or steep

terrain locations (e.g., Baxter Pass). Helicopter placement of transmission line structures would eliminate the necessity of access roads to structure sites, namely those in very steep terrain where impacts associated with access roads would be extensive and difficult to mitigate.

- **Selective Mitigation Measure 13** – Overland Access – The Construction Contractor would use overland access to the greatest extent possible in areas where no grading would be needed to access work areas. Overland access would consist of drive-an-crush and/or clear-and-cut travel. Drive-and-crush is vehicular travel to access a site without significantly modifying the landscape. Vegetation is crushed but not cropped. Soil is compacted, but no surface soil is removed. Clear-and-cut is considered as brushing off (removal) of all vegetation to improve or provide suitable access for equipment. All vegetation is removed using above-ground cutting methods that leave the root crown intact. Prior to work beginning, overland access routes would be staked to minimum width of 14 feet and would be specified in the POD. The appropriate use of overland access routes would be restricted based on dry or frozen soil conditions, seasonal weather conditions, and relatively flat terrain. Use of overland access would reduce blading of new access roads, which would significantly reduce ground disturbance and its associated impacts on soil resources. Reducing impacts on soil resources would reduce the need for selective mitigation measures.

- **Selective Mitigation Measure 16** – Blend Road Cuts or Grading – Soil amendments, mineral emulsions, or asphalt emulsion (i.e., Permeon™ or approved equal) would be applied, or grading techniques such as slope rounding and slope scarification would be used to blend road and pad cuts into the landscape in areas of steep terrain where grading is necessary, in rocky areas, or where soil color would create strong landscape contrasts.

Blending road cuts or transmission line structure sites with the natural topography would reduce the potential for slope failure by reducing the angle of cut slopes.

Summary of Effects

The principle potential impact on soil resources associated with the Project would be surface-disturbing activities during construction. The amount of disturbance resulting from the Project is strongly correlated with the length of the alternative route as the shortest alternative routes on USFS-administered land, COUT-C, COUT-H, and COUT BAX-E would result in the least disturbance (Table 16) Some variation in this correlation results from the access model based on presence of existing access and the slope of the local topography. This is demonstrated in Alternatives COUT-A, COUT-I, COUT BAX-B, and COUT BAX-C crossing the similar distances of USFS-administered land but the acreage disturbed calculations vary.

Alternative	Mileage ¹	Total Estimated Amount of Disturbance (Acres) ²	Average Acres of Disturbance per mile	Estimated Amount of Overstory/Tall Vegetation Clearing (Acres)
COUT BAX-B	22.4	374.3	16.7	237.0
COUT BAX-C	22.4	374.3	16.7	237.0
COUT BAX-E	11.3	223.7	19.8	133.0
COUT-A	20.1	451.0	22.4	237.0
COUT-A-1	19.7	444.3	22.6	232.0
COUT-B ³	22.6	405.5	17.9	267.0

TABLE 16 SUMMARY OF ESTIMATED GROUND DISTURBANCE AND VEGETATION CLEARING				
Alternative	Mileage¹	Total Estimated Amount of Disturbance (Acres)²	Average Acres of Disturbance per mile	Estimated Amount of Overstory/Tall Vegetation Clearing (Acres)
COUT-C ⁴	10.6	214.9	20.3	125.0
COUT-H	11.3	223.7	19.8	133.0
COUT-I	22.4	374.3	16.7	237.0

NOTES:
¹Miles crossed by alternative route reference centerline
²Estimated amount of disturbance of 11.5 acres per mile, associated with structure work areas, wire tensioning and pulling sites, wire-splicing sites, multipurpose construction yards, helicopter fly yards, and guard structures; combined with estimated amount of disturbance of 0.3 acre per mile, associated with area occupied by structure and communication regeneration stations; combined with estimated amount of disturbance from existing and new access roads
³Estimates provided for Alternatives COUT-B are similar for COUT-B variations
⁴Estimates provided for Alternatives COUT-C are similar for COUT-C route variations

Monitoring Recommendations

Site-specific monitoring recommendations would be determined when a route is selected for construction, geotechnical investigations are completed, and the Project POD including the Stormwater Pollution Prevention Plan; Erosion, Dust Control, and Air Quality Plan; and Reclamation, Revegetation, and Monitoring Plan are developed.

References

- Bureau of Land Management (BLM). 2014. Draft Environmental Impact Statement and Land-use Plan Amendments for the Energy Gateway South Transmission Project. Case File WYM-174597. February.
- Grace III, J.M., and B.D. Clinton. 2007. Protecting Soil and Water in Forest Road Management. U.S. Department of Agriculture, U.S. Forest Service USFS National Agroforestry Center/UNL Faculty Publications. Paper 58.
- Hintze, L.F., G.C. Willis, D.Y.M. Laes, D.A. Sprinkel, and K.D. Brown. 2000. Geologic Map of Utah. Utah Geological Survey.
- Lopez, C.F. 1980. Nebo Basin Soil Survey. Spanish Fork Ranger District. Uinta-Wasatch-Cache National Forest.
- Luce, C.H., and T.A. Black. 2001. Spatial and Temporal Patterns in Erosion from Forest Roads. In *Influence of Urban and Forest Uses on the Hydrologic-Geomorphic Responses of Watersheds*. Edited by M.S. Wigmosta and S.J. Burges. Water Resources Monographs, American Geophysical Union, Washington, D.C. pp. 165-178.
- U.S. Department of Agricultural. Soil Conservation Service. 1977. Soil Erodibility and Soils Loss Factors for Utah Soils.
- U.S. Fish and Wildlife Service. 2012a. National Wetlands Inventory. Available at: <http://www.fws.gov/wetlands/>, accessed August 22, 2013.
- U.S. Forest Service (USFS). 1976. Hobble Creek, Diamond Fork, White River Soil Survey. Spanish Fork Ranger District, Uinta-Wasatch-Cache National Forest.
- _____. 1986a. Ashley National Forest Land and Resource Management Plan. U.S. Department of Agriculture.
- _____. 1986b. Manti-La Sal National Forest Land and Resource Management Plan. U.S. Department of Agriculture.
- _____. 2003. Uinta National Forest Land and Resource Management Plan. U.S. Department of Agriculture.
- _____. 2009. Ashley National Forest Ecosystem Diversity Evaluation Report. U.S. Department of Agriculture.
- _____. 2011. Soils and Geologic Hazards. Uinta National Forest Oil and Leasing Draft Environmental Impact Statement. Chapter 3: Affected Environment. 32 pp.