ESTES TO FLATIRON TRANSMISSION LINES REBUILD PROJECT
LARIMER COUNTY, COLORADO

Draft Environmental Impact Statement (DOE/EIS-0483)
September 2014

Western
AREA POWER
ADMINISTRATION

Mission Statement

Western is a Federal agency under the Department of Energy that markets and transmits wholesale electrical power through an integrated 17,000-circuit mile, high-voltage transmission system across 15 western states. Western’s mission: Market and deliver clean, renewable, reliable, cost-based Federal hydroelectric power and related services.

Department of Energy
Western Area Power Administration
Rocky Mountain Customer Service Region
P.O. Box 3700
Loveland, CO 80539-3003

AUG 2 8 2014

Dear Interested Party:

Enclosed for your review is the Draft Environmental Impact Statement (EIS) for Western Area Power Administration (Western) Estes-Flatiron Transmission Lines Rebuild Project. The Draft EIS informs the public and interested parties of potential environmental impacts associated with implementing each route alternative. Western is seeking comments to determine the adequacy of the document and to receive input on the selection of a Preferred Alternative to inform the Final EIS. This Draft EIS has been prepared by Western following the National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. §§ 4321-4347); the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 CFR parts 1500-1508); and the U.S. Department of Energy (DOE) and United States Forest Service (USFS) NEPA procedures (10 CFR parts 1021 and 1022 and 36 CFR part 220).

This Draft EIS analyzes the environmental consequences of four possible route alternatives with three routing variations to rebuild and upgrade the existing 115-kilovolt (kV) transmission lines, and a no action alternative, which would keep the existing lines in place and continue established maintenance activities. The proposed route alternatives would improve access to the transmission lines; widen the rights-of-way (ROWs) where existing ROWs are inadequate for public and line crew safety and reliable power delivery; and implement an integrated vegetation management approach within the ROWs to reduce the risk of trees and other vegetation damaging or interfering with the transmission line and power delivery to Estes Park, Loveland and nearby Front Range communities. Western is the lead Federal agency for the Draft EIS. The USFS, a cooperating agency for the Draft EIS, has jurisdiction over National Forest System lands crossed by the transmission lines and will be making its own decision based on this Draft EIS.

Copies of the Estes-Flatiron Transmission Line Rebuild Project Draft EIS are available on the Web site at http://ww2.wapa.gov/sites/western/transmission/infrastruct/Pages/Estes-Flatiron.aspx. Locations of hard copies will be listed on the project Web site.

How to provide input and comments

Comments will be accepted for 45 days following the publication of the Environmental Protection Agency notice of availability in the *Federal Register*. All comments will be considered by Western in determining the Agency Preferred Alternative in the Final EIS. All substantive comments and information submitted will be summarized and addressed in the Final EIS. Substantive comments are those that reasonably question the accuracy of, methodology for, or assumptions used in the environmental analysis; present new information relevant to the analysis; present alternatives other than those analyzed and result in changes or revisions in one or more alternatives; or identifies evidence for why an alternative is preferable. Western can best use your comments and information if received within the public review period.

Those individuals wishing to submit comments are asked to do so in writing and submit them by any of the following methods:

E-mail: RMR_estesflatironeis@wapa.gov;
Fax: (720) 962-7269; or
Mail: Mark Wieringa
Western Area Power Administration, A7400
P.O. Box 281213
Lakewood, CO 80228-8213

Please include "Estes-Flatiron Transmission Lines Rebuild Project Draft EIS" in the subject line of your e-mail message. Please be aware that your entire comment, including personal identifying information such as address, phone number, or e-mail address, may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so. You can limit the personal information delivered with your comment.

Public outreach opportunities
Western will host public hearings in Loveland and Estes Park, Colorado, to provide an overview of the proposed project and to take public comments on the Draft EIS. The public hearings will be announced at least 15 days in advance through public notices, news releases to the local media, e-mail and mailings. Public hearing dates and locations will also be posted on the project Web site at http://ww2.wapa.gov/sites/western/transmission/infrastruct/Pages/Estes-Flatiron.aspx.

Project background
Western currently owns, operates, and maintains two 115-kV single-circuit transmission lines, dating from 1938 and 1953, that connect Estes Park to the Flatiron Substation in Larimer County, Colorado. The proposed project would remove both existing 115-kV single-circuit transmission lines and wood structures between Flatiron Substation and the intersection of Mall Road and U.S. Highway 36 in Estes Park and replace them with: (1) one double-circuit 115-kV transmission line on steel monopoles within a single ROW, (2) a new double-circuit 115-kV transmission line on steel monopoles within a single ROW with the western portion buried in concrete cable trenches for about 2.6 miles, (3) rebuild of both lines as single-circuit transmission lines on wood-pole H-frame structures on separate ROWs, or (4) the no action alternative, which would keep the existing lines in place and continue established maintenance activities.

The proposed project extends between Lake Estes on the east side of Estes Park and Western's Flatiron Substation. The project area analyzed in the Draft EIS encompasses lands east of the community of Estes Park and west of the Town of Loveland, and includes both private lands in Larimer County and public lands administered by the U.S. Department of Interior, USFS, the Colorado State Land Board, Northern Colorado Water Conservancy District, and Larimer County. Major transportation corridors are U.S. Highways 34 and 36.

Thank you for your continued interest in the Estes-Flatiron Transmission Line Rebuild Project. We appreciate the information and suggestions you have contributed to this process. Should you have any questions, please contact Mark Wieringa, Western Area Power Administration, NEPA Document Manager, at (720) 962-7448.

Sincerely,

Bradley S Warren

Bradley S. Warren
Regional Manager

Enclosure

Estes to Flatiron Transmission Lines Rebuild Project, Larimer County, Colorado, DOE/EIS-0483

Draft Environmental Impact Statement

Responsible Agencies

Lead Federal Agency:
U.S. Department of Energy, Western Area Power Administration

Cooperating Federal Agencies:
U.S. Department of Agriculture, Forest Service

Abstract

The Western Area Power Administration (Western) currently owns, operates, and maintains two 115-kilovolt (kV) single-circuit transmission lines that connect Estes Park to the Flatiron Substation in Larimer County, Colorado. Western is proposing to rebuild the existing 115-kV system between Flatiron Substation and the intersection of Mall Road and U.S. Highway 36 in Estes Park. The proposed project would remove the existing 115-kV single-circuit transmission lines and wood structures and replace them with: 1) a new double-circuit 115-kV transmission line on steel monopoles within a single right-of-way (ROW), 2) a new double-circuit 115-kV transmission line on steel monopoles within a single ROW with the western portion buried in concrete cable trenches for about 2.6 miles, or 3) rebuild both lines as single-circuit transmission lines on wood-pole H-frame structures on separate ROWs. The proposed project would improve access to the transmission lines, widen the ROWs where existing ROW is inadequate, and implement an integrated vegetation management approach within the ROWs to ensure electrical clearance requirements are met and maintained for the life of the proposed project. Western is the lead Federal agency for the Environmental Impact Statement (EIS). The U.S. Forest Service has jurisdiction over National Forest System lands crossed by the transmission lines, and is a cooperating agency for the EIS.

Deadline for Draft EIS Comments

Comments on the Draft EIS must be received at the address provided below no later than November 3, 2014.

For additional information or to comment on the Draft EIS, contact:

Mark Wieringa
Western Area Power Administration, A7400
P.O. Box 281213
Lakewood, CO 80228-8213
email: RMR_estesflatironeis@wapa.gov
fax: 720-962-7269

For additional information on DOE NEPA activities, contact:

Ms. Carol M. Borgstrom, Director
Office of NEPA Policy and Compliance, GC-54
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585
phone: 800-472-2756 or visit the DOE NEPA Web site at http://energy.gov/nepa/office-nepa-policy-and-compliance

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Summary

Introduction

Western Area Power Administration (Western), is proposing to rebuild and upgrade two 115-kilovolt (kV) single-circuit transmission lines between Flatiron Substation and the intersection of Mall Road and United States (U.S.) Highway 36 in Estes Park, Larimer County, Colorado. The proposed project is subject to the environmental review process mandated under the National Environmental Policy Act (NEPA) of 1969.

This Environmental Impact Statement (EIS) analyzes the environmental consequences of four alternatives with three routing variations to rebuild and upgrade the existing 115-kV transmission lines, and the no-action alternative. Western is the lead Federal agency for the NEPA document. The U.S. Forest Service (USFS) has jurisdiction over National Forest System lands crossed by the transmission lines, is a cooperating agency for the EIS, and will be providing its own decision on this EIS.

The EIS has been prepared in accordance with the NEPA of 1969, as amended (42 United States Code [U.S.C.] Section 4321et seq*.)*, the Council on Environmental Quality regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and U.S. Department of Energy (DOE) and USFS NEPA procedures (10 CFR Part 1021 and 1022 and 36 CFR Part 220).

Project Location

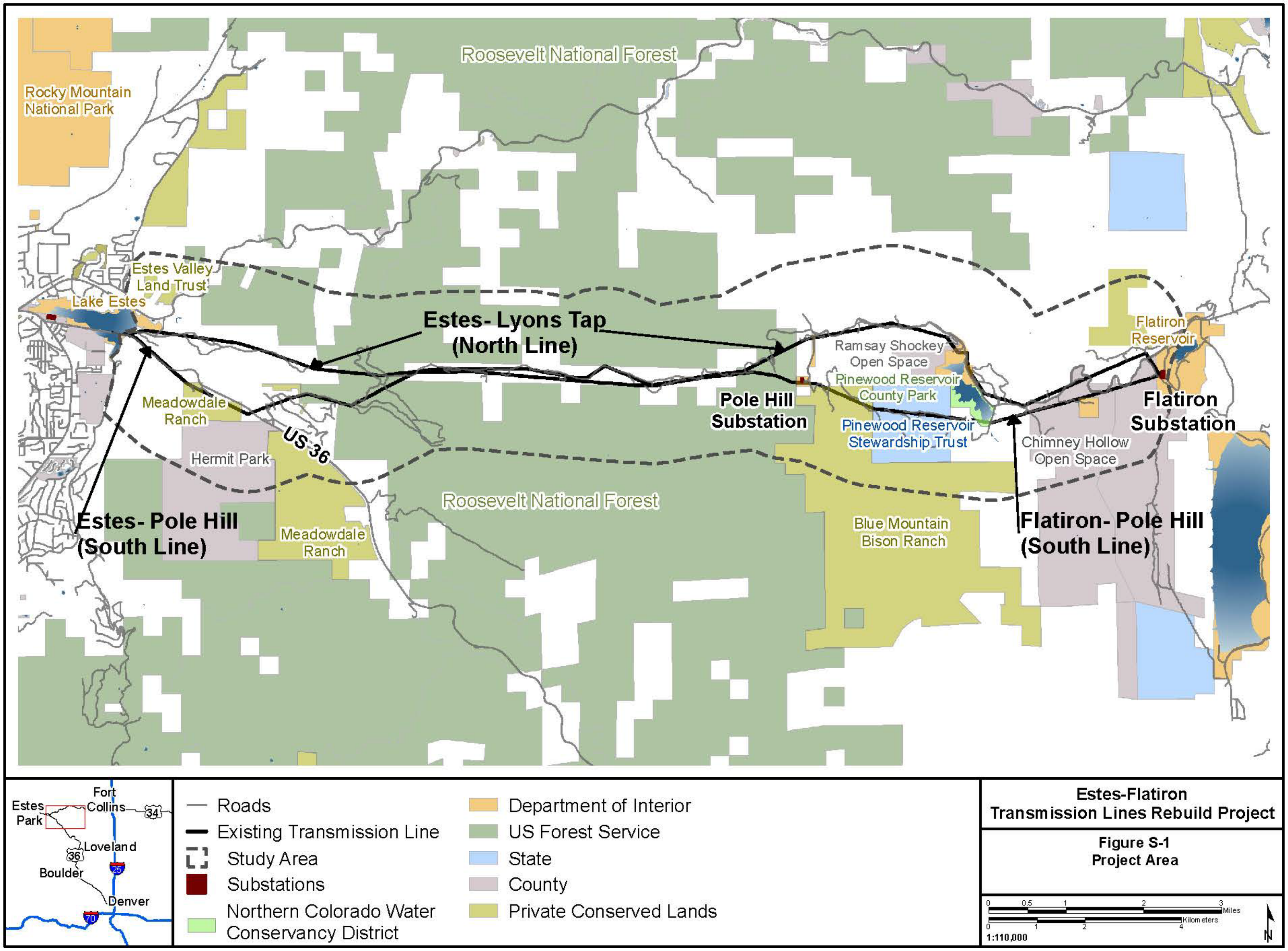
The proposed project is located in Larimer County, Colorado and extends between Lake Estes on the east side of Estes Park and Western's Flatiron Substation. The project area is situated east of the community of Estes Park and west of the Town of Loveland. Major transportation corridors are U.S. Highways 36 and 34. The project area includes private lands in Larimer County, and public lands administered by the U.S. Department of the Interior (DOI), USFS, the Colorado State Land Board (SLB), Northern Colorado Water Conservancy District (NCWCD) and Larimer County. **Figure S-1** shows the general location of the proposed project.

Background

Western's mission is to market and deliver reliable, renewable, cost-based hydroelectric power and related services. Western owns, operates, and maintains two single-circuit transmission lines between the Estes Park and Flatiron Substations. The lines were constructed to transmit electricity from hydropower generation sources within the Colorado-Big Thompson (CBT) project. After the formation of the DOE and Western in 1977, ownership of the transmission lines transferred from the Bureau of Reclamation to Western.

The Estes-Lyons Tap is the more northern of the two lines and will be referred to in the remainder of this document as the North Line. The second, more southerly line consists of the Estes-Pole Hill (E-PH) and Flatiron-Pole Hill lines that connect the Pole Hill Substation to Estes Park and the Flatiron Substation, respectively (**Figure S-1**). The two south segments will be referred to in this document as the South Line. Both existing transmission lines are 115-kV single-circuit lines constructed on wood pole H-frame structures. The South Line is 14.5 miles in length and the North Line is 14.1 miles long. Western's proposal only encompasses the single-circuit transmission lines from the east side of the Estes causeway and does not involve the portions of the double-circuit transmission lines located on steel lattice structures along the Estes causeway.

Figure S-1 Project Location Map



The North Line was built in 1938 and the South Line in 1953. Most of the wood pole H-frame structures on the two lines are original and date from the time of construction. A single mode fiber optic communication cable used by Bureau of Reclamation (BOR), Western, and the Platte River Power Authority is part of the two lines. Although the majority of the existing rights-of-way (ROWs) are located on privately owned land, portions of both are located on public lands administered by the USFS, SLB, Larimer County Natural Resources Department, and BOR. Both of the existing lines are located within a designated utility corridor as defined in the 1984 Forest Plan for Arapaho and Roosevelt National Forests and Pawnee National Grassland (ARP) and the 1997 Revision.

Proposed Project

Western is proposing to rebuild the existing 115-kV system between Flatiron Substation and the intersection of Mall Road and U.S. Highway 36 in Estes Park. The proposed project would remove the existing 115-kV single-circuit transmission lines and wood structures and replace them with: 1) a new double-circuit 115-kV transmission line on steel monopoles within a single ROW, 2) a new double-circuit 115-kV transmission line on steel monopoles within a single ROW with the western portion buried in concrete cable trenches for about 2.6 miles, or 3) rebuild both lines as single-circuit transmission lines on wood-pole H-frame structures on separate ROWs. The USFS action is to issue an authorization for the portion of the transmission line(s) rebuild that crosses National Forest System lands. The proposed project would improve access to the transmission lines for maintenance and increase the ability to restore outages more quickly, widen the ROWs where existing ROW is inadequate, and implement an integrated vegetation management approach within the ROWs to ensure electrical clearance requirements are met and maintained for the life of the proposed project.

Purpose and Need

Western's Purpose and Need

Transmission systems in the United States are planned, operated and maintained to meet North American Electric Reliability Corporation (NERC) reliability standards and National Electrical Safety Code (NESC) requirements. These organizations establish reliability, safety and other standards for the bulk power system in the United States. To fulfill its statutory mission and meet NERC and NESC standards, Western must ensure its facilities meet current safety standards, are readily accessible for maintenance and emergencies, resistant to wildfire, and are cost effective for its customers. Through field observation and maintenance records, Western has determined that the existing lines need to be upgraded and rebuilt.

Forest Service Purpose and Need

The USFS purpose and need is to determine whether to issue a special use permit for the proposed transmission lines upgrade and rebuild and bring Western's facilities under a current authorization with a defined ROW and an Operation & Maintenance Plan. The USFS requires the EIS to ensure the proposed project complies with the Forest Plan.

Decision to Prepare an EIS

Western initially began preparation of an environmental assessment (EA) for the proposed project. Western's proposal is under a class of actions in the DOE NEPA Implementing Procedures (10 CFR Part 1021) that normally requires the preparation of an EA. Subsequent to the EA determination, Western held public meetings in Estes Park and Loveland, Colorado, on November 29 and 30, 2011. Western received numerous written and oral comments from the public and agencies on the proposal during the scoping period. The public expressed concerns regarding the impacts of the proposal and some of the stakeholders requested evaluation of additional alternatives. In response to input received during the initial EA scoping, Western determined that an EIS would be the more appropriate level of NEPA review.

Public Involvement

Scoping

Potential issues were identified through an expanded public involvement process that included agency discussions, two sets of public scoping meetings, and scoping comments received during two formal scoping periods. The scoping period for the EA extended from November 29 through January 31, 2012. Additional comments were received through May 2012.

A Notice of Intent (NOI) was issued on April 17, 2012 (77 Federal Register 22774). The NOI invited public participation in the EIS scoping process and solicited public comments on the scope of the EIS during a 90-day scoping period initially set to expire on July 16, 2012. An extension of the scoping period to August 31, 2012, was subsequently announced on the project website, through a press release, email notification, and direct mailing of a project newsletter. EIS scoping meetings were held on August 6, 2012, in Loveland, Colorado and August 7, 2012, in Estes Park, Colorado. Both meetings utilized an open house format with exhibits and opportunities for interaction with Western and USFS representatives. In response to public requests to extend the scoping period beyond the August 31, 2012, deadline, Western further extended the scoping period to October 19, 2012.

In total, more than 660 comment letters, forms and emails were received during the two scoping periods for the EA and the EIS. Both the EA and EIS Scoping Summary Reports are available for download from the project website located at: http://go.usa.gov/rvtP.

Alternative Development Workshops

Western implemented an expanded public involvement process for the Estes to Flatiron Transmission Lines Rebuild Project EIS. The expanded public involvement process included three public alternatives workshops held in Estes Park and Loveland during the public scoping period. The purpose of alternatives workshops was to solicit public input on route options and design features to be considered during the alternatives development process for the EIS. Workshops were held on October 2, 2012, in Loveland, and on October 3 and October 4, 2012, in Estes Park.

Alternatives workshops utilized an open house format, and sought to engage meeting attendees in interactive exercises to identify route options. Large-format informational displays provided information about the public involvement process, transmission line siting considerations, and context-sensitive design options. Maps depicting steep slopes, park and open space, parcel boundaries, and viewsheds were on display, as well as large-format composite opportunity and constraint maps, to assist meeting participants with making informed suggestions on potential route options. Map booklets with detailed maps showing existing and proposed ROWs in relation to parcel boundaries also were available. Transmission structure options also were available for public review. A total of 49 meeting attendees signed in at the public alternatives workshops, including 27 at the meeting in Loveland, and 22 at the meetings in Estes Park.

Issue Identification

Issues are defined as concerns about the potential effects of the proposed project. The range of issues was determined through agency, stakeholder, and public scoping, as well as through internal scoping between Western and the USFS. Each potential issue was evaluated to determine its relevance to the proposed project. If the issue was determined to be a substantial concern, Western evaluated whether it should be considered a “key issue” during the alternative development process. Key and other issues identified through scoping for the EIS are described below.

Key Issues

Key issues are issues that were used to drive the development of alternatives and compare the differences between the alternatives analyzed in detail. Key issues identified during scoping that influenced the alternative development include:

- Effects of new ROW acquisition from the proposed project on land uses, property owners, and Western's customers.
- Effects of the proposed project on scenic travel corridors (e.g., U.S. Highway 36), residential, and recreational viewsheds in the vicinity of Estes Park, residential developments, such as Meadowdale Hills and Newell Lake View subdivisions, and on National Forest System lands.
- Effects of new road construction in inaccessible areas with steep topography.
- Effects of the proposed project on recreational uses and experiences in the vicinity of Estes Park and Pinewood Reservoir, and on National Forest System lands accessed by USFS Road 122 (Pole Hill Road).
- Effects of the proposed project on protected areas, including county open space, lands protected by conservation easement, lands within the Stewardship Trust Program, and State Wildlife Areas. No protected areas have been identified on National Forest System lands.
- Effects of ROW expansion or new ROW acquisition on existing infrastructure (e.g., Upper Thompson Sanitation District's treatment plant) and other structures.

Other Issues Selected for Detailed Analysis

Other issues define proposed project effects that should be analyzed in detail in the EIS, but that have not driven alternatives development. Other issues identified for detailed analysis include:

- Effects of the proposed project on property values, as well as sources of revenue from tourism and outdoor recreation that Front Range communities and the regional economy rely upon.
- Effects of the proposed project (ground disturbance for access, pole removal, and new structure installation) on cultural resources.
- Effects of ROW clearing and road construction, road reconstruction, road reconditioning and ongoing maintenance on wetlands, soils, and water quality.
- Effects of electric and magnetic fields from high-voltage power lines on human health.
- Effects of the proposed project on wildlife; plant; fisheries; threatened, endangered and USFS sensitive species; management indicator species; and general species of wildlife, plant (vegetation) and fish species.

Issues Considered but Not Analyzed Further

The following issues were considered but not analyzed further:

- Comments that Western should replace the lattice structures along the causeway of Lake Estes as part of this proposed project. The lattice structures are already double-circuit and are not in need of replacement.
- Comments that the E-PH transmission line are not within the USFS designated utility corridor as outlined in the ARP Forest Plan, and that consolidating the two lines on the southern alignment would not be in compliance with the ARP Forest Plan. The USFS has stated that the designated utility corridor includes both the transmission line ROWs (USFS 2012a).
- Comments that the proposed project is a “waste of taxpayer funds” were determined to be outside the scope of the EIS.
- A request that Western complete a socio-economic analysis of tourist and recreation based economies in Denver, Fort Collins, Boulder, and other Front Range cities supported by the Roosevelt National Forest. This issue is analyzed in the EIS; however, because socio-economic effects of rebuilding the transmission would not extend beyond the immediate project vicinity, the analysis area is limited to the Town of Estes Park and Loveland.

- A request that Western expand notification during scoping and publish notices in papers in Denver, Boulder, and Longmont. Newspaper notices are targeted for those communities where there is the greatest interest and potential for effects. Residents of Estes Park and Loveland would experience the greatest effects, and represent approximately 50 percent of the mailing addresses in the project mailing list. Therefore, newspaper notices have been published in the Estes Park Trail-Gazette and Loveland Reporter-Herald. The USFS publishes notices in their Newspaper of Record, which is the Fort Collins Coloradoan. Direct mailings, press releases, and website updates are the primary means to communicate project updates to individuals that have shown an interest in the project and reside outside Estes Park and Loveland.

Comments expressing general support for or opposition to the proposed project without supporting rationale were determined to be expression of opinion, non-substantive, or outside the scope of the EIS.

Decisions Framework

Western and the USFS prepared the EIS as the lead and cooperating Federal agencies, respectively. The results of the analysis are presented in this EIS and will form the basis for decisions regarding the proposed project.

Following the Draft EIS review and comment period, Western and the USFS will consider comments submitted by the public, interested organizations, and government agencies, and will respond to all substantive comments. Based on the Draft EIS and public input, Western and the USFS will designate their preferred alternative in the Final EIS. Western will issue a Record of Decision (ROD) no sooner than 30 days following the issuance of the Final EIS. Western may combine elements of alternatives considered in the EIS in the ROD.

As a cooperating agency, the USFS will prepare its own ROD in accordance with their respective policies and guidelines. The USFS is required to comply with all laws (National Forest Management Act, NEPA, Section 7 of the Endangered Species Act [ESA], National Historic Preservation Act, etc.), regulations, and policies for the portion of the proposed project on lands under its jurisdiction.

Instrumental to the decisions will be the consideration of measureable indicators that have been defined to measure the effects of the different alternatives with regard to key and other issues. The measurable indicators used to compare the alternatives are presented in Chapter 2.0, **Table 2.8-1**. The USFS decision will be subject to a pre-decisional objection process. In order to have standing to object to the USFS decision, a person(s) or organization must submit specific written comments during the 45-day (at a minimum) public comment period on this Draft EIS. These comments will be addressed in the Final EIS. The Final EIS and USFS draft ROD will be made available to the public. The 45-day Objection Period will begin with publication of a legal notice in the USFS newspaper of record, the Fort Collins Coloradoan. This objection process was provided by the Consolidated Appropriations Act of 2012.

Alternatives Considered in Detail

A range of reasonable alternatives for the proposed project was identified by evaluating routing opportunities and constraints, engineering design standards, public comments, and environmental resources that occur within the project area. The objective was to identify alternatives that address public, environmental, and social concerns, and meet the project purpose and need and engineering criteria for the transmission line rebuild.

Ultimately, four alternatives with three routing variations to rebuild and upgrade the existing 115-kV transmission lines, and the No Action Alternative were identified for detailed analysis in the EIS. These are described briefly below. In this EIS “variants” refer to routing variations off the main alternative, whereas “reroutes” are any section of the alignment that is off existing ROW. The alignments of alternatives and routing variations using overhead construction methods are shown on **Figure S-2**. The alignments of routing variations using underground construction methods are shown on **Figure S-3**.

- **No Action Alternative** – Keep the existing transmission lines in service through continuing structure replacement and maintenance. The existing ROWs would be expanded, as needed, and minor adjustments made to the alignments where necessary in order to comply with NERC and NESC requirements.
- **Alternative A** – Rebuild and consolidate the transmission lines primarily on the existing North transmission line ROW. This alternative includes a reroute to the north and northeast of Newell Lake View subdivision and along Mall Road in Estes Park (**Figure S-2**).
    - **Variant A1** – Variant A1 is identical to Alternative A for all but the westernmost segment (**Figure S-2**). At a point in the valley between Mount Olympus and Mount Pisgah, this routing variation would depart from the alignment of the existing North Line and traverse along the base of Mount Pisgah before turning to the northwest and generally following an alignment parallel to U.S. Highway 36 for the remaining distance to the existing steel lattice double-circuit structure at the intersection of U.S. Highway 36 and Mall Road.
    - **Variant A2** – Variant A2 follows an alignment similar to Variant A1; however, the westernmost 2.7 miles of the transmission line would be constructed underground (**Figure S-3**).
- **Alternative B** – Rebuild and consolidate the transmission line, primarily on the existing South transmission line ROW. This alternative includes a 0.25-mile reroute along Pole Hill Road on National Forest System lands, and a 0.75-mile reroute to the North Line on new ROW in the vicinity of Pole Hill Substation (**Figure S-2**).
- **Alternative C** – Rebuild and consolidate the transmission lines along an alignment that utilizes a combination of the existing North and South transmission line ROWs. This alternative includes reroutes off existing transmission line ROW east of Pinewood Reservoir, along Pole Hill Road on National Forest System lands, and on privately held land on the west end of the project area (**Figure S-2**).
    - **Variant C1** – Rebuild and consolidate the transmission lines along an alignment that utilizes a combination of the existing North and South transmission line ROWs. This alternative follows an alignment similar to Alternative C; however, the westernmost 2.7 miles of the transmission line would be constructed underground (**Figure S-3**).
- **Alternative D** – Rebuild the two existing transmission lines in-kind as single-circuit lines located on separate ROWs. This alternative would utilize structures very similar to those currently in use, although structure height may increase by 5 to 10 feet. The existing ROWs would be expanded as needed and minor adjustments made to the alignments where necessary to comply with NERC and NESC requirements. This alignment includes a reroute to Pole Hill Road where there is inadequate ROW through Newell Lake View subdivision and relocation of one structure on the north side of the Upper Thompson Sanitation District parcel in Estes Park, to accommodate expansion of their facility (**Figure S-2**).

Figure S-2 Alternatives for Overhead Construction

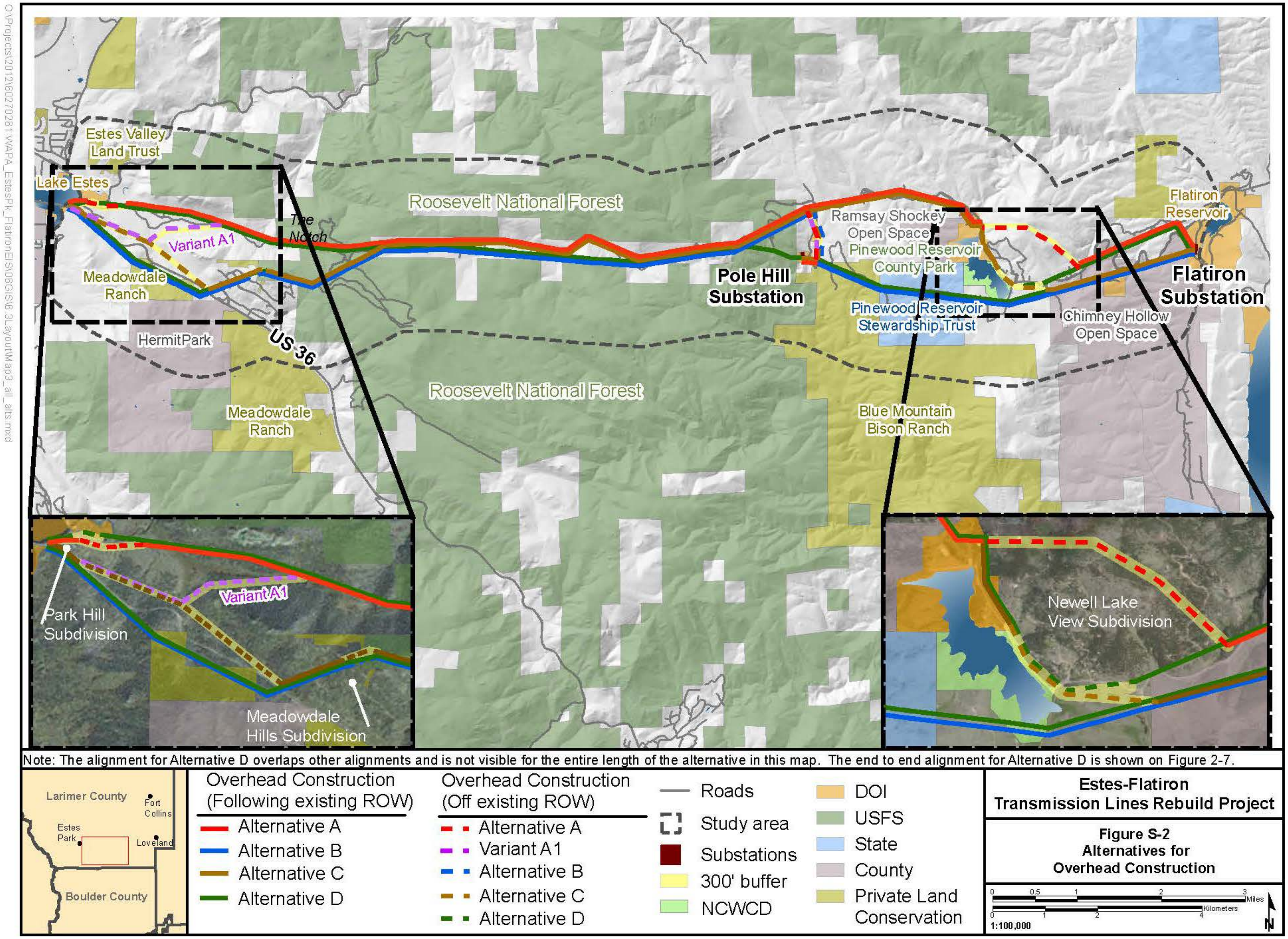
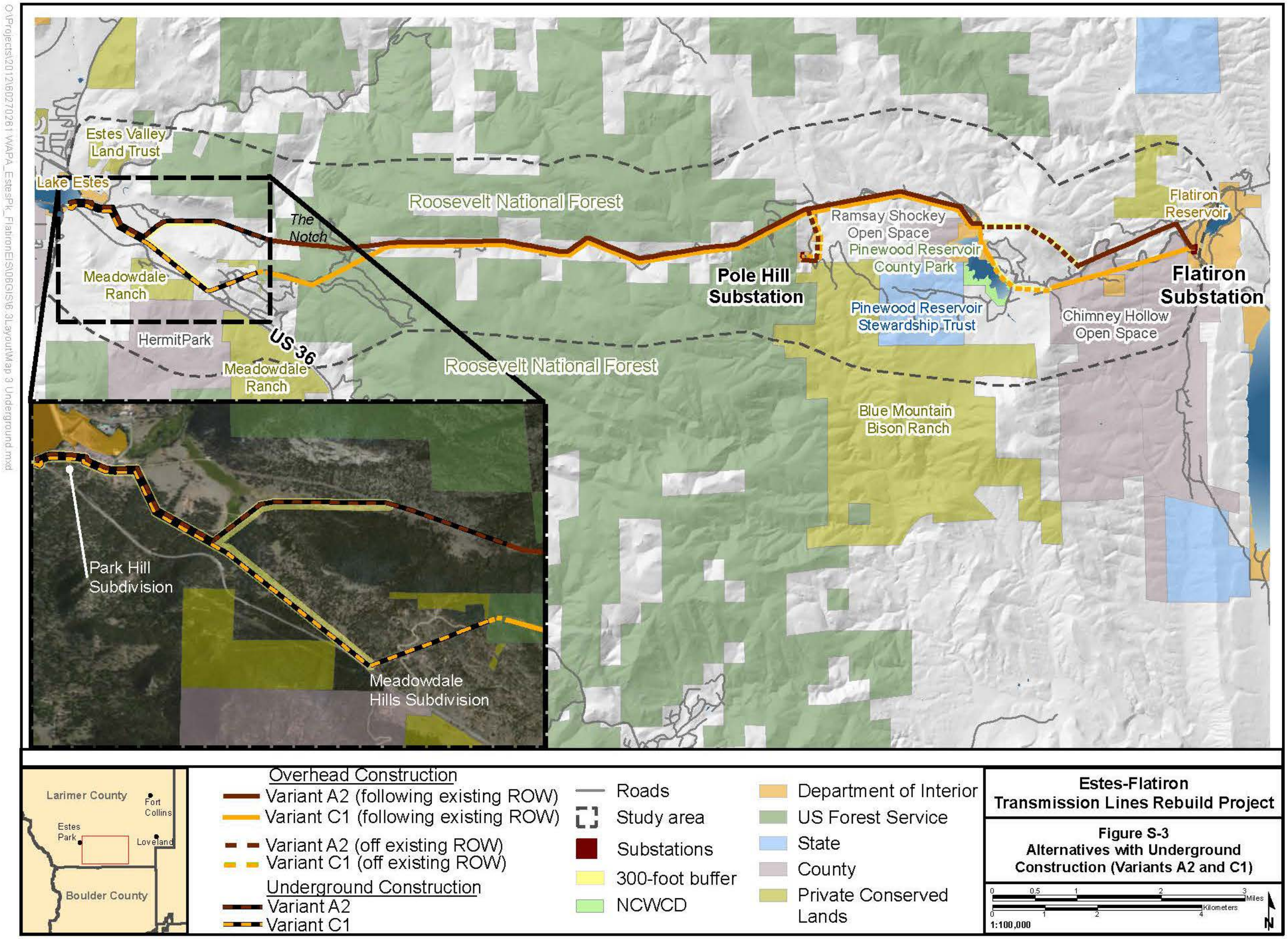


Figure S-3 Underground Construction Options (Variants A2 and C1)



Key Differences between Alternatives

The key differences between the alternatives are route alignment (North or South of Mount Pisgah and North or South of Pinewood Lake), ROW type (new or existing), transmission line type (single-circuit or double-circuit), transmission structure type (steel monopole or wood H-frame), and transmission line construction method (overhead or underground).

Alternatives A, B, and C and routing Variants A1, A2, and C1 would all consolidate a rebuilt double-circuit transmission line onto a single ROW. The transmission line would be constructed overhead on steel monopoles for the entire length of the line under Alternatives A, B, and C and Variant A1; Variants A2 and C1 would construct the westernmost 2.7 miles of the double-circuit line underground on different alignments. Alternative D proposes to rebuild both existing transmission lines as single-circuit lines on primarily existing ROW using wood H-frame structures.

Access requirements also are a key difference between the alternatives. Alternative A and Variants A1 and A2 traverse steep terrain with poor access on National Forest System lands in the vicinity of The Notch (**Figure S-2** and **S-3**). Other areas with steep terrain and poor access include the alignment for Alternative B on existing ROW south of U.S. Highway 36, and the alignment for Alternative D on existing ROW west of Pole Hill Substation.

An estimate of short-term disturbance areas associated with transmission line construction are provided in **Table S-1** below. Long-term disturbance for structure bases would be less than 0.1 acre for any alternative.

Table S-1 Summary of Short-Term Disturbance for Transmission Line Construction by Alternative

Project Component	Disturbance Area	Short-term Disturbance by Alternative (acres)					
		A/A1	A2	B	C	C1	D
Structure installation	11,350 square feet per structure	18 - 24	15 - 20	20 - 26	19 - 25	15 - 21	56 - 65
Conductor stringing sites	0.25 acre per site	1 - 3	1 - 2	1 - 3	1 - 3	1 - 2	2 - 5
Staging areas	2-3 sites; 5 acres per site	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15
Removal of existing H-frame structures	9,500 square feet per structure	45	44	45	45	44	41
Pulling sites for line removal	0.25 acre per site	1 - 3	1 - 2	1 - 3	1 - 3	1 - 2	2 - 5
Underground construction	9 acres per mile	NA	24	NA	NA	25	NA
Total		75 - 90	95 - 108	77 - 92	75 - 90	96 - 108	112 -132

A comparison of rough order magnitude life-cycle costs for the seven end-to-end alternatives is provided in **Table S-2** below.

Table S-2 Preliminary Transmission Line Cost Estimates by Alternative

	Alternative ($ millions)						
	A	**A1**	**A2**	**B**	**C**	**C1**	**D**
80-year construction cost	19.7	19.2	37.9	23.1	19.1	39.6	22.7
80-year maintenance cost	1.3	1.3	1.2	1.4	1.3	1.1	1.1
80-year vegetation management cost	1.6	1.6	1.4	1.8	1.7	1.4	3.2
Total 80-year life cycle cost	22.6	22.1	39.5	26.3	22.1	42.2	27.0
Easement acquisition cost	1.6	1.3	1.3	0.4	0.8	1.0	1.8
Total	24.2	23.4	40.8	26.7	22.9	43.1	28.8

Alternatives Considered but Eliminated

Alternative Alignments

In addition to the alignments carried forward for detailed analysis in the Draft EIS, several additional routing alternatives were identified. Some of these alternatives emerged through a series of public workshops held in October 2012 that were intended to review the constraint/opportunity criteria and to solicit public comment on potential alternative alignments. Through this process, a wide range of potential routing alternatives, some of which were carried forward for detailed analysis, while others were eliminated following an initial consideration of their feasibility. Alternative alignments considered but eliminated, including the reasons for their elimination, are summarized in **Table S-3** below.

Table S-3 Alternative Alignments Dismissed from Detailed Analysis

Potential Reroute	Reason for Dismissal
U.S. Highway 34 and U.S. Highway 36 reroutes	Proposals to reroute the transmission line along Highways 34 and 36 would not use existing transmission line ROWs and would instead follow existing transportation ROWs. These proposals were not carried forward because they do not address the issues raised during scoping, but simply displace impacts to new landowners. Locating the lines along these routes also adds flooding as another possible major catastrophic future event that may affect the transmission lines reliability.
Reroute west of Meadowdale Hills subdivision, on the east slope of Mount Pisgah	This potential route crosses steep slopes without any existing access roads, and would be difficult and costly to construct resulting in substantial erosion risks and related increased maintenance costs. Road construction across this topography would require excessive cut and fill and increase visual impacts.
Reroute to the south side of the northern alignment, below The Notch	This potential route is located in an area with steep slopes and poor access; also it follows a riparian corridor. Western's standard construction practice (SCPs) direct that structure sites, access ways, and other disturbance areas will be located at least 100 feet, where practical, from rivers and streams (including ephemeral streams). Because this route follows a riparian corridor it is not suitable for siting the transmission line.

Potential Reroute	Reason for Dismissal
Reroutes far to the south of the South Line in the vicinity of Pinewood Reservoir Stewardship Trust and Blue Mountain Bison Ranch	This routing strategy was suggested during workshops to reduce effects to recreational and residential viewsheds at Pinewood Lake. These reroutes were dismissed because they crossed protected lands, did not fully address the visual resource issue, and displaced impacts to new landowners. To more effectively respond to concerns regarding viewshed effects, a reroute around the north side of Newell Lake View subdivision was identified and carried forward for detailed analysis (Alternative A).
A reroute that followed a gas pipeline between the northern and southern alignment on the east end of the project area, between the access road to the Bald Mountain radio facility and the intersection of Pole Hill Road and Chimney Hollow Road	This reroute was suggested as a means to co-locate linear infrastructure. However, the reroute fails to effectively address other scoping issues related to visual impacts and would require new ROW acquisition. There also may be additional mitigation required by the gas utility, if Western were to site a transmission line parallel to an existing gas line.
Reroute following Flatiron Penstocks (CBT project)	In an effort to further consolidate linear facilities, consideration was given to an alignment that paralleled the penstocks that descend Bald Mountain to Flatiron Reservoir. The penstocks emerge aboveground well below the summit of Bald Mountain and follow an alignment that is prominent in the viewshed from Flatiron Reservoir, one that doesn't take advantage of the opportunities for concealment provided by the surrounding terrain. Further, the penstocks are iconic facilities that date to the 1940s and have historic significance.
Reroute along Cottonwood Creek	This reroute would extend from the vicinity of Flatiron Reservoir and follow an alignment to the northwest generally along Cottonwood Creek, rejoining the ROW of the existing North Line near Pinewood Lake Dam. This alternative would require several miles of construction through steep terrain with poor access. It was dropped in favor of Alternative A that accomplishes an avoidance of the Pinewood Lake viewshed and the adjacent subdivision in a more direct and effective manner.

Alternative Structure Types

In addition to routing options, alternative project designs were considered and presented during the public workshops held in October 2012. Other structure types considered included a lattice structure and double-circuit H-frame. Neither the lattice nor double-circuit H-frame designs were supported by public comments, and were not carried forward for further analysis.

Other Alternatives

Other alternatives also were considered, as discussed below.

Use of Olympus Tunnel

The Olympus tunnel begins below Lake Estes and extends to the east through Mount Olympus, eventually meeting up with the Pole Hill Tunnel and other CBT project facilities that extend all the way to Flatiron Reservoir. The possibility of placing an underground cable system within the Olympus Tunnel and other below ground facilities was identified as a potential opportunity, one that would reduce or eliminate visual impacts and other identified concerns. Although such systems have been installed in other water conveyance tunnels, including the Adams Tunnel through Rocky Mountain

National Park, it is only feasible when the facility was specifically designed to accommodate the cables and splices at the time of its initial construction. Placing a cable within a tunnel not designed and constructed to accommodate one would diminish the capacity of the facility to deliver water and function as designed and also create considerable operational, scheduling, and maintenance challenges. For these reasons, this alternative is infeasible and it was dropped from further consideration.

Underground Construction near Pinewood Lake

Due to the sensitivity of the viewshed south of Pinewood Lake, underground construction was considered for a segment of the project through this area, following the alignment of Alternative B. Underground construction presents a number of challenges, including greatly higher costs than conventional aboveground construction. Several alternatives, specifically Alternatives A and C, avoid the viewshed south of Pinewood Lake, providing an alternative that eliminates these impacts at a much lower cost. For this reason, underground construction at this location was dropped from further consideration.

Underground Construction on National Forest System Land

Variant C1 rebuilds the transmission line underground to the Forest boundary near the north end of the Meadowdale Hills subdivision. Western considered extending Variant C1 further east onto National Forest System lands, but dismissed it based on the following technical reasons.

- Extending Variant C1 further east along the proposed alignment for Alternative C would involve trenching within a rough section of Pole Hill Road that is noted for its recreational value to four-wheel drive users. Restoring Pole Hill Road to previous conditions following installation of cable trenches would not be possible, unless the cable trenches were buried deeper. Continued use of Pole Hill Road would impact the integrity of cable trenches.
- Terminating the underground section on National Forest System land would require an underground service vault. This vault could not be located on Pole Hill Road and would require that the vault be located off the road. The installation of the vault would require the clearing of a large forested area to accommodate the vault installation and future access.
- Extending Alternative C1 along the existing Estes-Pole Hill transmission line route (the route for Alternative D) would require extensive clearing within a mixed coniferous forest. The width of the clearing would need to accommodate the trench, a spoil pile, and a service road to accommodate the installation of the cable trench and service vault.

Impact Comparison

Table S-4 compares the alternatives with regard to key and other issues identified in Section 1.6.3, using selected measurable indicators. **Table S-5** provides a summary comparison of environmental effects by resource and alternative. Additional information regarding the specific effects of each alternative to each resource can be found in Chapter 4.0.

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Table S-4 Measurement Indicators for Key and Other Issues

Measurement Indicators for Issues	Alternative A	Variant A1	Variant A2	Alternative B	Alternative C	Variant C1	Alternative D	No Action
Issue: ROW acquisition								
Acres of new ROW acquisition	153	157	152	42	117	110	177	122
Acres of new ROW acquisition (USFS lands)	23	23	23	31	31	31	55	0
Acres of ROW to be decommissioned	143	151	150	42	139	143	4	2
Miles of land ownership crossed	Private - 12.0 USFS - 1.7 DOI - 0.6 SLB - 0.0 NCWCD - 0.0 County - 0.8	Private - 12.0 USFS - 1.7 DOI - 0.6 SLB - 0.0 NCWCD - 0.0 County - 0.6	Private - 12.1 USFS - 1.7 DOI - 0.6 SLB - 0.0 NCWCD - 0.0 County - 0.6	Private - 9.4 USFS - 2.2 DOI - 0.4 SLB - 1.0 NCWCD - 0.2 County - 1.6	Private - 10.6 USFS - 2.2 DOI - 1.0 SLB - 0.0 NCWCD - 0.1 County - 1.8	Private - 10.6 USFS - 2.2 DOI - 1.0 SLB - 0.0 NCWCD - 0.1 County - 1.8	Private - 20.0 USFS - 3.8 DOI - 1.0 SLB - 1.0 NCWCD - 0.2 County - 2.5	Private - 20.0 USFS - 3.8 DOI - 1.0 SLB - 1.0 NCWCD - 0.2 County - 2.5
Issue: effects on visual resources								
Existing Scenic Integrity Objective (SIO) (NFS lands)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Resulting SIO (NFS lands)	Very Low[1]	Very Low[1]	Very Low[1]	Very Low[1]	Very Low[1]	Very Low[1]	Moderate	Moderate
Issue: Forest road construction/reconstruction								
Miles of new administrative road on NFS land for permanent access	0.9	0.9	0.9	0.6	0.6	0.6	1.9	0
Reconstruction of existing ML2 system road on NFS lands (miles)	0	0	0	0	3.4	3.4	0	0
Limited reconditioning of existing ML2 system road post-construction (miles)	2.2	2.2	2.2	3.2	0.2	0.2	3.2	0
Miles of permanent access on NFS lands in areas with difficult constructability	0.6	0.6	0.6	0.0	0.0	0.0	1.0	0
Issue: recreational uses & experiences								
Long-term changes in recreation opportunities on NFS lands	NA	NA	NA	NA	Diminished off-highway vehicle (OHV) opportunities	Diminished OHV opportunities	NA	NA
Issue: protected lands								
No. protected lands crossed	4	4	4	5	4	4	7	7
Issue: effects on infrastructure								
Conflicts with Upper Thompson Sanitation District	No	No	No	No	No	No	No	Limits facility expansion
Issue: property values & economic effects								
No. of landowners affected by ROW acquisition	46	48	42	19	36	36	40	40
New ROW	8	10	7	4	9	9	5	5
Expanded ROW	38	38	35	15	27	27	35	35
Subdivisions affected by ROW acquisition (new or expanded ROW)	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill Newell Lake
No. of landowners with ROW to be decommissioned	36	36	36	51	33	33	7	7
Businesses directly affected	NA	NA	NA	NA	OHV tour operator	OHV tour operator	NA	NA
Issue: cultural resources								
Number of National Register of Historic Place-eligible historic sites potentially impacted	6	6	6	3	5	5	8	7
Issue: water resources, floodplains, and wetlands[2]								
Waterbodies Crossed	43	41	41	49	47	47	80	80
Wetlands Present	13	11	12	6	11	9	15	16
Waters of the U.S.	20	17	18	14	22	18	28	28

Measurement Indicators for Issues	Alternative A	Variant A1	Variant A2	Alternative B	Alternative C	Variant C1	Alternative D	No Action
Issue: ROW clearing & maintenance								
Soil types in Analysis Area								
Low revegetation potential (acres)	32	32	13	44	21	14	60	60
Compaction prone (acres)	58	57	56	26	71	70	90	90
Water erodible (acres)	82	76	63	57	52	50	115	115
Vegetation types in ROW								
Ponderosa pine woodland (acres)	139	139	136	116	130	134	207	207
Mixed conifer forest (acres)	13	13	9	38	16	9	42	42
Mountain shrub mosaic (acres)	24	24	27	30	31	26	62	62
Upland meadow, or upland meadow/wetland mosaic (acres)	24	24	31	37	30	30	70	70
Issue: electric and magnetic fields								
Electric fields at the ROW edge (kilovolt per meter)	0.12	0.12	0	0.12	0.12	0	0.34	0.34
Magnetic fields at each ROW edge (milligauss)	5.2/1.8	5.2/1.8	0.05	5.2/1.8	5.2/1.8	0.05	5.2/5.3	5.2/5.3
Issue: effects on plants, wildlife, & fish								
Special Status Plants								
Threatened and endangered	LP	LP	LP	LP	LP	LP	LP	LP
Sensitive species	MAII	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Species of local concern	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Issue: effects on plants, wildlife, & fish								
Elk and Mule Deer Winter Range (acres)	112	104	104	97	106	124	142	142
Moose Winter Range (acres)	49	45	45	44	47	55	61	61
Special Status Wildlife								
Threatened and endangered	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Sensitive species	MAII	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Management indicator species	NC	NC	NC	NC	NC	NC	NC	NC

[1] Would require lowering of SIO and documentation of change of SIO in MA 8.3 - Utility Corridor for this project area, in accordance with Forest Plan Standard 154 and also documentation in the USFS ROD.

[2] Wetlands and waterbodies were determined from desktop analysis and augmented with survey data where available. Ground surveys were completed early in the NEPA process during initial EA alternative development. Therefore, survey data was not collected for the full site of alternatives. A full delineation of water resources will be performed on the Preferred Alternative route after the Preferred Alternative is selected.

NA = not applicable.

LP = low probability of species presence.

MAII = may adversely impact individuals, but not likely to result in a loss of viability on the Planning area, or cause a trend to federal listing.

NLAA = may affect, not likely to adversely affect.

NC = no change in population trend.

Table S-5 Comparison of Alternative Effects

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Soils	Potential impacts to soils include compaction, rutting, erosion, and contamination. Compaction and erosion impacts would be minimized through SCPs.	Potential impacts would be the same as Alternative A. Acres of impacted soil types would be the same as Alternative A.	Potential impacts would be the same as Alternative A. Fewer acres would be affected than Alternative A. More soil disturbance would result from trenching, possibly reducing soil productivity.	Potential impacts would be the same as Alternative A. Acres of impacted soil types would be the same as Alternative A2.	Potential impacts would be similar to Alternative A. More acres of bedrock would be affected. Reconstruction of Pole Hill Road and USFS Road 247.D would reduce erosion associated with these ML2 roads in the long term and have long-term beneficial effects for soils on National Forest System lands.	Potential impacts would be the same as Alternative A. Soil disturbance acreages would be similar to Alternative C. More soil disturbance would result from trenching, possibly reducing soil productivity. Reconstruction of USFS Roads 122 and 247.D would reduce erosion associated with these ML2 roads in the long term and have long-term beneficial effects for soils on National Forest System lands.	Potential impacts would be the same as Alternative A. The most acres of soils and bedrock would be affected.	Natural and anthropogenic actions would continue to impact soil resources at current levels. Impacts associated with relocation of the line would be similar to Alternative A.
Water Resources and Floodplains	Impacts to surface water or groundwater quantity and quality would be minor to negligible through implementation of SCPs and compliance with permit provisions. Measurable effects would be avoided within the Federal Emergency Management Agency (FEMA)-designated floodplain.	Additional potential for changes in runoff, erosion, and sedimentation would occur in areas of new access roads and ROW construction. Impacts to surface water or groundwater quantity and quality would be minor to negligible through implementation of SCPs and compliance with permit provisions. Measurable effects would be avoided within the FEMA-designated floodplain	Variant A2 would have impacts similar to Variant A1. In addition, construction for the underground portion of the ROW may encounter groundwater; if this occurred, it would be addressed in compliance with state permit approvals.	Potential impacts would generally be of the same type as Alternative A. Additional potential for impacts to existing runoff conditions, erosion, and sedimentation would occur in the steep terrain near Meadowdale Ranch and Ravencrest areas. Potential impacts would be minor to negligible, and would be addressed similar to Alternative A. The FEMA-designated floodplain would be avoided.	Potential impacts would generally be the same as Alternative B. An area that may have shallow groundwater and domestic occurs along Alternative C at the east side of Pinewood Reservoir. Impacts to surface water or groundwater quantity and quality would be minor to negligible through implementation of SCPs and compliance with permit provisions.	Potential impacts would be the same as for Alternative C. Shallow groundwater also may be encountered where deeper excavation would occur for underground construction along the western 2.7 miles of the ROW.	The potential for impacts from ROW use and construction would be similar to Alternatives A and B. The re-route in the vicinity of Pinewood Reservoir would have the potential for shallow groundwater impacts similar to Alternative C. Implementation of SCPs and compliance with permit provisions would reduce impacts to minor or negligible levels.	Potential impacts to surface or groundwater quantity and quality would be similar to Alternative D, but would be spread out in space and time. Implementation of SCPs and compliance with permit provisions would limit impacts to minor or negligible levels. Negligible impacts to floodplains would occur.
Wetlands and Waters of the U.S.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Fewer potential impacts would be anticipated because of decreased construction disturbance.
Vegetation	Ponderosa pine, mixed conifer forest, mountain shrub mosaic, and upland meadows would be impacted by project disturbance.	Potential impacts to vegetation types would be the same as Alternative A.	Potential impacts to vegetation types would be similar to Alternative A.	Potential impacts to vegetation types would be similar to Alternative A, although slightly less ponderosa pine woodlands would be affected and more mixed conifer forest, mountain shrub mosaic, and upland meadows would be affected.	Potential impacts to vegetation types would be similar to Alternative A, although slightly less ponderosa pine woodlands would be affected and more mixed conifer forest, mountain shrub mosaic, and upland meadows would be affected.	Potential impacts to vegetation types would be similar to Alternative A, although slightly less ponderosa pine woodlands and mixed conifer forest would be affected and more mountain shrub mosaic and upland meadows would be affected.	Potential impacts to vegetation types would be greater than Alternative A. A greater amount of ponderosa pine, mixed conifer forest, mountain shrub mosaic, and upland meadows would be affected.	Disturbance acreage of vegetation communities within the ROW would be 147 acres. Potential impacts to all vegetation types would be similar to Alternative D.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Special Status and Sensitive Plant Species	No federally listed species are found along Alternative A. Due to limited distribution of federally listed species and low quality of habitat, no impacts to these species would be expected. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Due to limited distribution of federally listed species and low quality of habitat, no impacts to these species would be expected. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Due to limited distribution of federally listed species and low quality of habitat, no impacts to these species would be expected. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.	Due to low quality of habitat and reduced surface disturbance, no impacts to federally listed species would be anticipated. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.
Wildlife Habitat	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative. Impacts due to surface disturbance would be greater where the transmission line would be constructed underground.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative. Impacts due to surface disturbance would be greater where the transmission line would be constructed underground.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Acres of big-game habitat impacted would be similar to Alternative D.
Raptors and Other Birds	Implementation of proposed mitigation measures, as well as seasonal restrictions to prevent impacts to raptors and migratory birds potentially would minimize direct impacts. Remaining impacts (e.g., loss of habitat) are anticipated to be minor.	Potential impacts would be the same as Alternative A. There would be reduced risk of raptor collisions where the transmission line would be constructed underground.	Potential impacts would be the same as Alternative A. There would be reduced risk of raptor collisions where the transmission line would be constructed underground.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A. There would be reduced risk of raptor collisions where the transmission line would be constructed underground.	Potential impacts would be the same as Alternative A.	Displacement of upland game birds, raptors, and other birds as a result of increased human activity during maintenance activities would be short-term and minor. Relocation of the line would result in potential impacts similar to Alternative A.
Special Status and Sensitive Wildlife Species Habitat Disturbance	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected (200 acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at the same level as Alternative A	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at approximately the same level as Alternative A (203 acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at a greater level than Alternative A (221 acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at approximately the same level as Alternative A (207 acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at approximately the same level as Alternative A (199 acres).	The most vegetation communities in the ROW that support special status and sensitive wildlife species would be affected than any other alternative (381 acres).	Fewer acres (147 acres) of vegetation communities in the ROW that support special status and sensitive wildlife species would be affected than any action alternative.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Land Use and Recreation Land Use	Long-term adverse impacts to land use from the acquisition of new or expanded ROW (153 acres) would range from negligible to moderate depending on the location and ownership of the acquired ROW. Beneficial effects where existing ROW would be decommissioned.	Impacts are similar to A; however, Variant A1 would require 157 acres of new ROW.	Impacts are similar to A; however, Variant A2 would require 152 acres of new ROW.	Impacts are similar to A; however, Alternative B requires the fewest acres of ROW acquisition (42 acres).	Impacts are similar to A; however, Variant A1 would require 110 acres of new ROW.	Impacts are similar to A; however, Variant C1 would require 110 acres of new ROW.	Impacts are similar to A; however, Alternative D would maintain two ROWs and therefore requires the most ROW acquisition (177 acres). The beneficial effects of ROW consolidation would not be realized under this alternative.	Existing ROWs would be expanded to a minimum width of 75 feet. New ROW would be acquired to relocate the line from Newell Lake View subdivision (through which there is inadequate ROW). The beneficial effects of ROW consolidation would not be realized.
Recreation	Potential short and long-term impacts to recreation from access roads, staging areas, and construction and maintenance activities would range from negligible to moderate depending on the location and timing of activities. The long-term recreational experience would be enhanced in areas where existing transmission line would be decommissioned.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Short-term recreation opportunities on the Besant Point Trail could be affected depending on the timing of construction. Long-term impacts would include effects to the recreational setting on Pole Hill Road. Other potential impacts to recreation would be similar to Alternative A.	Moderate short and long-term impact to the recreation setting and recreation facilities along the eastern side of Pinewood Reservoir County Park. Other potential impacts to recreation would be similar to Alternative A. Four-wheel drive recreation opportunities would be significantly adversely impacted on sections of USFS Road 122 and USFS Road 247.D that would be reconstructed.	Moderate short and long-term impact to the recreation setting and recreation facilities along the eastern side of Pinewood Reservoir County Park. Other potential impacts to recreation would be similar to Alternative A. Four-wheel drive recreation opportunities would be significantly adversely impacted on sections of USFS Road 122 and USFS Road 247.D that would be reconstructed.	Moderate short and long-term impact to the recreation setting along the eastern side of Pinewood Reservoir County Park. Other potential impacts to recreation would be similar to Alternative A. The beneficial effects of ROW consolidation would not be realized under this alternative.	Moderate short and long-term impact to recreation setting along the eastern side of Pinewood Reservoir County Park. Negligible to minor adverse effects to recreation setting where additional ROW would need to be acquired. The beneficial effects of ROW consolidation would not be realized under this alternative.
Visual Resources	New, taller structures and associated disturbance would result in short- and long-term adverse effects ranging from minor to moderate with localized strong visual changes. Long-term beneficial effects would occur where the South Line would be removed. Moderate adverse effects would occur from new access roads and vegetation management	Potential impacts would be the same as Alternative A, except for along 0.5 mile of U.S. Highway 36 where the adverse effect would be greater.	Potential impacts would be the same as Alternative A, except for the underground segment near Estes Park which would be less visible than an overhead transmission line.	Adverse effects would occur to Chimney Hollow Open Space, Pinewood Lake, Meadowdale Hills and Ravencrest subdivisions, and U.S. Highway 36. Beneficial effects would occur to the valley between Mount Pisgah and Mount Olympus as seen from the Estes Valley. Other potential impacts to scenic resources would be similar to Alternative A.	Adverse effects would occur to Chimney Hollow Open Space, and Meadowdale Hills and Ravencrest subdivisions, and along 0.75 mile of U.S. Highway 36. Beneficial effects would occur to the valley between Mount Pisgah and Mount Olympus as seen from the Estes Valley. Other potential impacts to scenic resources would be similar to Alternative A.	Potential impacts would be the same as Alternative C, except for the underground segment near Estes Park which would be less visible than an overhead transmission line.	Potential long-term impacts would be the similar as the No Action Alternative. Beneficial changes would result within the Newell Lake View subdivision. Moderate adverse effects would occur from new access roads and vegetation management similar to Alternative A.	Minor adverse to moderate impacts from visible portions of the two existing transmission lines and ongoing structure replacement and vegetation maintenance activities would continue similar to existing conditions. Beneficial changes would result within the Newell Lake View subdivision.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Socioeconomics and Community Resources	Beneficial effects associated with job opportunities and to the economic base would be temporary and minor. Minor decreases in property values as a result of taller structures, and conversely minor increases in property values where structures would be removed. No environmental justice concerns were identified.	Potential impacts would be the same as Alternative A.	Cost of construction would increase 80 percent relative to Alternative A. Residences near the underground portion of the variant may experience a minor increase in property values, except near the transition structure.	Potential impacts would be the same as Alternative A.	Potential impacts would be similar to Alternative A. Reconstruction of Pole Hill Road would result in moderate long-term effects to a USFS permit holder that leads OHV tours in the Pole Hill area.	Cost of construction would increase 80 percent relative to Alternative A. Residences near the underground portion of the variant may experience a minor increase in property values, except near the transition structure. Reconstruction of Pole Hill Road would result in moderate long-term effects to a USFS permit holder that leads OHV tours in the Pole Hill area.	Beneficial effects associated with job opportunities and to the economic base would be temporary and minor. Minor decreases in property values as a result of taller structures. Alternative D would maintain two ROWs and the beneficial effects to property values from ROW decommissioning would not be realized, except where the line would be relocated from Newell Lake View subdivision to Pole Hill Road.	Potential impacts include increased maintenance costs as existing lines age and require more maintenance. The No Action alternative would maintain two ROWs and the beneficial effects to property values from ROW decommissioning would not be realized, except where the line would be relocated from Newell Lake View subdivision to Pole Hill Road.
Electrical Effects and Human Health	Effects associated with noise, radio and television interference, and induced current and voltage, as well as effects to cardiac pacemakers would be negligible; SCPs would further minimize noise and induced current and voltage. EMF levels would be less than the existing transmission lines. Health effects would be similar to or less than existing lines.	Potential effects would be the same as Alternative A.	Potential effects would be the same as Alternative A, except that electrical fields would be blocked by the soil where the transmission line is constructed underground and wouldn't be a concern.	Potential effects would be the same as Alternative A.	Potential effects would be the same as Alternative A.	Potential effects would be the same as Alternative A, except that electrical fields would be blocked by the soil where the transmission line is constructed underground and wouldn't be a concern.	Potential effects would be the same as Alternative A.	Electric fields at the ROW edge, and magnetic fields within the ROW, would be higher than for action alternatives. Potential effects would be the same as Alternative A.
Cultural Resources	A total of 6 historic properties, 2 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Unavoidable adverse effects would be minimized or mitigated through a treatment plan, and through implementation of SCPs.	A total of 6 historic properties, 2 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 6 historic properties, 2 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 8 historic properties and 2 contributing elements of the CBT project Historic District have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 9 historic properties and 2 contributing elements of the CBT project Historic District have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 9 historic properties and 2 contributing elements of the CBT project Historic District have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 12 historic properties, 4 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 12 historic properties, 4 contributing elements of the CBT project Historic District, and 1 unevaluated site have been documented along this alternative. At this time, no inventories have been conducted along the line that would be relocated.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Transportation	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.3 miles of temporary access and 1.3 miles of permanent access on National Forest System land, of which 0.6 mile would be constructed in inaccessible areas with difficult constructability.	Potential impacts would be similar to Alternative A.	Potential impacts would be similar to Alternative A.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.7 miles of temporary access and 0.8 mile of permanent access on National Forest System land, none of which would be constructed in inaccessible areas with difficult constructability.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.7 miles of temporary access and 0.8 mile of permanent access on National Forest System land, none of which would be constructed in inaccessible areas with difficult constructability. Increased traffic on USFS Road 122 may result from this alternative as the road would be improved.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.7 miles of temporary access and 0.8 mile of permanent access on National Forest System land, none of which would be constructed in inaccessible areas with difficult constructability. Increased traffic on USFS Road 122 may result from this alternative as the road would be improved.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 2.5 miles of permanent access on National Forest System land, 1.0 mile of which would be constructed in inaccessible areas with difficult constructability.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. There would be no new temporary or permanent access authorized on National Forest System lands.

Note: Impacts in this table described in Chapter 2.0 were determined after implementation of design criteria, SCPs, and mitigation measures described in Chapter 4.0.

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Acronyms and Abbreviations

°F	degree Fahrenheit
µg/m^3	microgram per cubic meter
AAQS	Ambient Air Quality Standards
ACSR	Aluminum Conductor Steel-Reinforced
Alpine	Alpine Archaeological Consultants, Inc.
AM	amplitude modulated
amsl	above mean sea level
ANSI	American National Standard Institute
APCD	Air Pollution Control Division
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
ARP	Arapaho and Roosevelt National Forests and Pawnee National Grassland
ATV	all-terrain vehicle
BCC	Birds of Conservation Concern
BOR	Bureau of Reclamation
CAA	Clean Air Act
CBT	Colorado-Big Thompson
CDA	Colorado Department of Agriculture
CDPHE	Colorado Department of Public Health and Environment
CDWR	Colorado Division of Water Resources
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CNHP	Colorado Natural Heritage Program
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
CPW	Colorado Parks and Wildlife
CWA	Clean Water Act
DAU	Data Analysis Unit
dBA	decibel (A-weighted)
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
EA	environmental assessment
EIS	environmental impact statement
E-LS	Estes-Lyons
EMF	electric and magnetic fields
EO	Executive Order
EPA	U.S. Environmental Protection Agency
E-PH	Estes-Pole Hill
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FM	frequency modulated
F-PH	Flatiron-Pole Hill
FR	Federal Register

FRCC	Fire Regime Condition Class
FSH	Forest Service Handbook
FSM	Forest Service Manual
GHG	greenhouse gas
GPS	Global Positioning System
HUC	hydrologic unit code
kcmil	thousand circular mil
KOP	key observation point
kV	kilovolt
MBTA	Migratory Bird Treaty Act
mG	milligauss
MIS	Management Indicator Species (Forest Service)
ML2	maintenance level 2
NAAQS	National Ambient Air Quality Standards
NCWCD	Northern Colorado Water Conservancy District
NDIS	Natural Diversity Information Source
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NFMA	National Forest Management Act
NHPA	National Historic Preservation Act
NO_2	nitrogen dioxide
NOI	Notice of Intent
NO_X	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
OHV	off-highway vehicle
OHWM	ordinary high water mark
OSHA	Occupational Safety and Health Administration
Pb	lead
PM	particulate matter
PM_{10}	particulate matter aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter aerodynamic diameter of 2.5 microns or less
ppb	parts per billion
ppm	parts per million
PSD	Prevention of Significant Deterioration
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
ROW	right-of-way
SCP	standard construction practice
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Office
SIO	Scenic Integrity Objective

SIP	State Implementation Plan
SLB	State Land Board (Colorado)
SMS	Scenery Management System
SO_2	sulfur dioxide
SWReGAP	Southwest Regional Gap Analysis Project
TCP	traditional cultural properties
tpy	tons per year
U.S.	United States
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound
Western	Western Area Power Administration

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1.0 Introduction

Western Area Power Administration (Western), a power marketing administration within the United States (U.S.) Department of Energy (DOE), is proposing to rebuild and upgrade two 115-kilovolt (kV) single-circuit transmission lines between Flatiron Substation and the intersection of Mall Road and U.S. Highway 36 in Estes Park, Larimer County, Colorado. The proposed project is subject to the environmental review process mandated under the National Environmental Policy Act (NEPA) of 1969.

This Environmental Impact Statement (EIS) analyzes the environmental consequences of four alternatives with three routing variations to rebuild and upgrade the existing 115-kV transmission lines, and the no-action alternative. Western is the lead Federal agency for the NEPA document. The U.S. Forest Service (USFS) has jurisdiction over National Forest System lands crossed by the transmission lines, is a cooperating agency for the EIS, and will be basing its own decision on this EIS.

This EIS has been prepared in accordance with the NEPA of 1969, as amended (42 United States Code [U.S.C.] Section 4321et seq*.)*, the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 Code of Federal Regulations [CFR] Parts 1500-1508), and DOE and USFS NEPA procedures (10 CFR Part 1021 and 1022 and 36 CFR Part 220).

1.1 Project Location

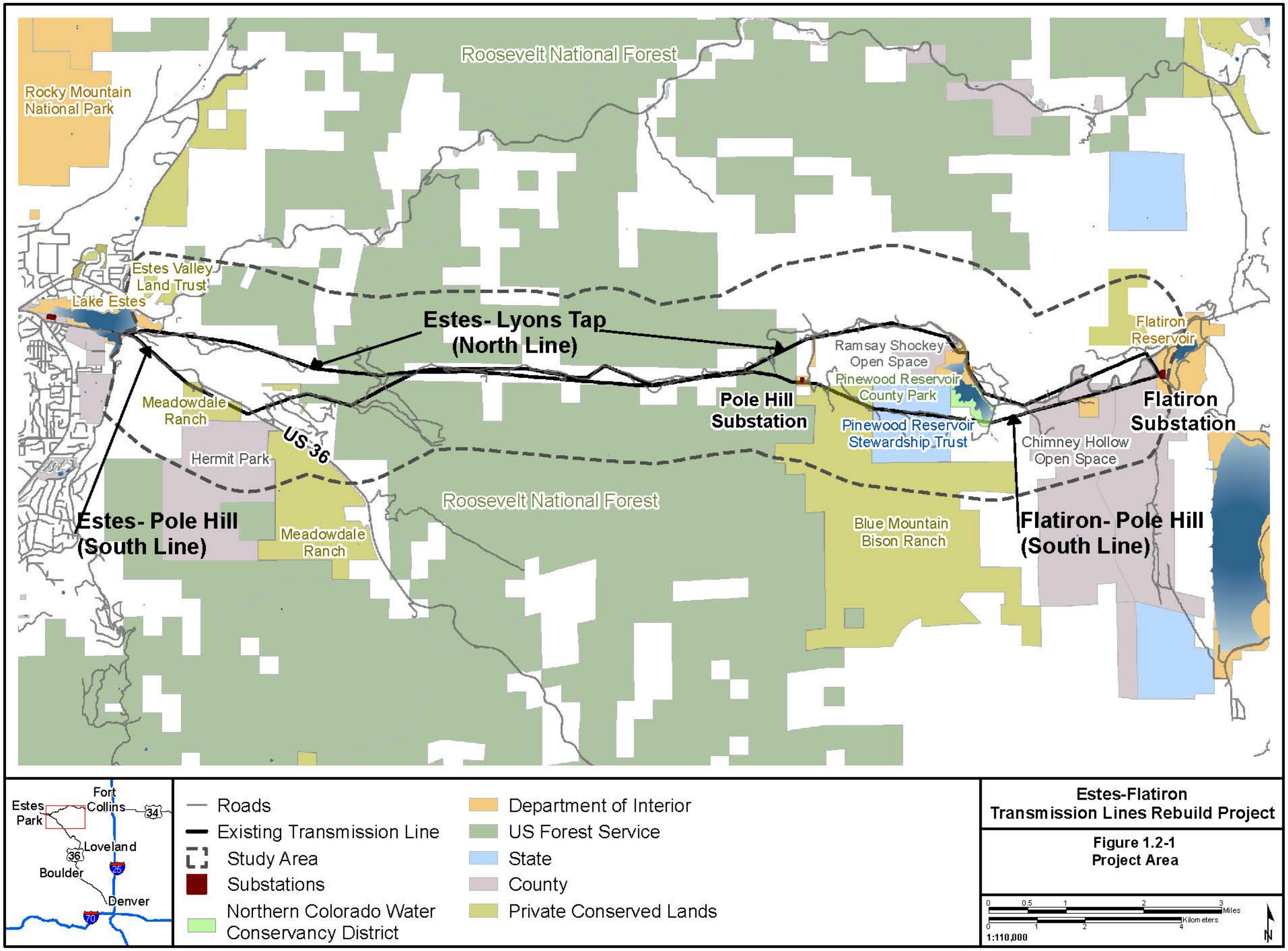
The proposed project is located in Larimer County, Colorado, and extends between Lake Estes on the east side of Estes Park and Western's Flatiron Substation. The project area is situated east of the community of Estes Park and west of the Town of Loveland. Major transportation corridors are U.S. Highways 36 and 34, which provide access between Front Range communities to the east and Rocky Mountain National Park to the west of the project area. The project area includes private lands in Larimer County, and public lands administered by the U.S. Department of the Interior (DOI), USFS, the Colorado State Land Board, Northern Colorado Water Conservancy District (NCWCD) and Larimer County. **Figure 1.2-1** shows the general location of the proposed project.

1.2 Background

Western's mission is to market and deliver reliable, renewable, cost-based hydroelectric power and related services. Western undertakes a variety of construction projects, either on its own or in partnerships with other utilities or power customers. Western owns, operates, and maintains two single-circuit transmission lines between the Estes Park and Flatiron Substations. Prior to the formation of the DOE, the DOI's Bureau of Reclamation (BOR) constructed and maintained the two existing transmission lines as part of the Colorado-Big Thompson (CBT) project. The lines were constructed to transmit electricity from hydropower generation sources within the CBT project. After the formation of the DOE and Western in 1977, ownership of the transmission lines transferred from the BOR to Western.

The Estes-Lyons Tap (E-LS) is the more northern of the two lines and will be referred to in the remainder of this document as the North Line. The second, more southerly line consists of the Estes-Pole Hill (E-PH) and Flatiron-Pole Hill lines (F-PH) that connect the Pole Hill Substation to Estes Park and the Flatiron Substation, respectively (**Figure 1.2-1**). The two south segments will be referred to in this document as the South Line. Both existing transmission lines are 115-kV single-circuit lines constructed on wood pole H-frame structures. The South Line is 14.5 miles in length and the North Line is 14.1 miles long. Western's proposal only encompasses the single-circuit transmission lines from the east side of the Estes causeway and does not involve the portions of the double-circuit transmission lines located on steel lattice structures along the Estes causeway.

Figure 1.2-1 Project Location Map



The North Line was built in 1938 and the South Line in 1953. Most of the wood pole H-frame structures on the two lines are original and date from the time of construction. A single mode fiber optic communication cable used by BOR, Western, and the Platte River Power Authority is part of the two lines. Although the majority of the existing rights-of-way (ROWs) are located on privately owned land, portions of both are located on public lands administered by the USFS, State Land Board, Larimer County Natural Resources Department, and BOR. Both of the existing lines are located within a designated utility corridor as defined in the 1984 Forest Plan for Arapaho and Roosevelt National Forests and Pawnee National Grassland (ARP) and the 1997 Revision.

1.3 Proposed Project

Western is proposing to rebuild the existing 115-kV system between Flatiron Substation and the intersection of Mall Road and U.S. Highway 36 in Estes Park. The proposed project would remove the existing 115-kV single-circuit transmission lines and wood structures and replace them with: 1) a new double-circuit 115-kV transmission line on steel monopoles within a single ROW, 2) a new double circuit 115-kV transmission line on steel monopoles within a single ROW with the western portion buried in concrete cable trenches for about 2.6 miles, or 3) rebuild both lines as single-circuit transmission lines on wood-pole H-frame structures on separate ROWs. The USFS action is to issue an authorization for the portion of the transmission line(s) rebuild that crosses National Forest System lands. The proposed project would improve access to the transmission lines for maintenance and increase the ability to restore outages more quickly, widen the ROWs where existing ROW is inadequate, and implement an integrated vegetation management approach within the ROWs to ensure electrical clearance requirements are met and maintained for the life of the project. A detailed description of the alternatives under consideration is provided in Chapter 2.0.

1.4 Purpose and Need

1.4.1 Western's Purpose and Need

Transmission systems in the U.S. are planned, operated and maintained to meet North American Electric Reliability Corporation (NERC) reliability standards and National Electrical Safety Code (NESC) requirements. These organizations establish reliability, safety and other standards for the bulk power system in the U.S. To fulfill its statutory mission, meet NERC and NESC standards, and comply with relevant legal requirements. Western must ensure its facilities meet current safety standards, are readily accessible for maintenance and emergencies, resistant to wildfire, and are cost effective for its customers. Through field observation and maintenance records, Western has determined that the existing lines need to be upgraded and rebuilt.

1.4.1.1 Existing Structure Conditions

The existing wood structures are in poor condition and continue to deteriorate due to both age and the type of material with which they were constructed. Many of the existing structures on both lines suffer from core rot and cracking, and are reaching the end of their anticipated facility life. The majority of wood structures will need replacing in the near future to maintain them to meet the strength requirements found in NESC standards.

1.4.1.2 Existing Access Conditions

The transmission structures along the existing ROWs had access to them at one time for construction and maintenance. However, in the 60 to 75 years since the transmission lines were built, access has deteriorated at many locations. Portions of the existing lines are marginally accessible, if at all, for routine maintenance and structure replacement. Inaccessible areas include sections of the existing transmission lines that span canyons, are located on steep cliff or rocky slopes, or require crossing the Pole Hill penstock.

1.4.1.3 Existing ROW Conditions

Portions of the existing transmission lines run parallel to each other in relatively close proximity. Each line has a separate ROW. The North Line has a ROW width of only 20 to 30 feet at most locations, which is inadequate to meet safety standards. The South Line has ROW widths that range from 75 feet to 130 feet for most of its length. Western would need to widen those portions of the ROW on both lines that have an easement width of less than 110 feet. The area crossed by the transmission lines is susceptible to mountain pine beetle infestation and has heavy fuel loads. Where ROWs have insufficient width and heavy fuel loading, they are more vulnerable to a large wildfire event. This level of risk does not meet applicable standards or Western's commitment to its customers to provide reliable and safe power.

In many cases, ROW maintenance has been limited to removal of hazard trees. This practice typically does not address the encroaching vegetation until it becomes a threat that requires immediate attention to ensure no adverse effect to the transmission line or to avoid a fire caused by a transmission line. This reactive approach to hazardous vegetation maintenance is not conducive to ensuring the level of operating reliability that is required by today's NERC standards, nor is it efficient or cost effective. Today's stricter maintenance standards require a more aggressive, proactive approach to vegetation management, with the goal of ensuring that there will be no tree-caused transmission line outages and minimizing the risk for wildfires. See Chapter 2.0 for further discussion of NERC standards and proposed vegetation management procedures.

1.4.2 Forest Service Purpose and Need

The USFS purpose and need is to determine whether to issue a special use permit for the proposed the proposed transmission lines upgrade and rebuild and bring Western's facilities under a current authorization with a defined ROW and an Operation & Maintenance Plan. The USFS will require the EIS to ensure the proposed project complies with the Forest Plan.

1.5 Decision to Prepare an EIS

Western initially began preparation of an environmental assessment (EA) for the proposed project. Western's proposal is under a class of actions in the DOE NEPA Implementing Procedures (10 CFR Part 1021) that normally requires the preparation of an EA. Subsequent to the EA determination, Western held public meetings and received numerous written and oral comments from the public and agencies on the proposal during the scoping period. The public expressed concerns regarding the impacts of the proposal and some of the stakeholders requested evaluation of additional alternatives. In response to input received during the initial EA scoping, Western determined that an EIS would be the more appropriate level of NEPA review.

1.6 Public Involvement

1.6.1 Scoping

Potential issues were identified through an expanded public involvement process that included agency discussions, two sets of public scoping meetings, and scoping comments received during two formal scoping periods. The first round of public meetings was held in Estes Park and Loveland, Colorado, on November 29 and 30, 2011. At that time, Western anticipated preparing an EA for the proposed project. The scoping period for the EA extended from November 29 through January 31, 2012. Additional comments were received through May 2012.

Subsequent to the initial EA scoping period, Western determined that an EIS was the appropriate level of analysis for this proposed project. A Notice of Intent (NOI) was issued on April 17, 2012 (77 Federal Register [FR] 22774; Appendix A). The NOI invited public participation in the EIS scoping process and solicited public comments on the scope of the EIS during a 90-day scoping period initially set to expire on July 16, 2012. An extension of the scoping period to August 31, 2012, was subsequently announced on the project website, through a press release, email notification, and direct mailing of a project newsletter. EIS scoping meetings were held on August 6, 2012, in Loveland, Colorado, and August 7, 2012, in Estes Park, Colorado. Both meetings utilized an open house format with exhibits and opportunities for interaction with Western and USFS representatives. In response to public requests to extend the scoping period beyond the August 31, 2012, deadline, Western further extended the scoping period to October 19, 2012.

In total, more than 660 comment letters, forms and emails were received during the two scoping periods for the EA and the EIS. Both the EA and EIS Scoping Summary Reports are available for download from the project website located at: http://go.usa.gov/rvtP.

1.6.2 Alternative Development Workshops

Western implemented an expanded public involvement process for the Estes to Flatiron Transmission Lines Rebuild Project EIS. The expanded public involvement process included three public alternatives workshops held in Estes Park and Loveland during the public scoping period. The purpose of alternatives workshops was to solicit public input on route options and design features to be considered during the alternatives development process for the EIS. Workshops were held on October 2, 2012, in Loveland, and on October 3 and October 4, 2012, in Estes Park.

Alternatives workshops utilized an open house format, and sought to engage meeting attendees in interactive exercises to identify route options. Large-format informational displays provided information about the public involvement process, transmission line siting considerations, and context-sensitive design options. Maps depicting steep slopes, park and open space parcel boundaries, and viewsheds were on display, as well as large-format composite opportunity and constraint maps, to assist meeting participants with making informed suggestions on potential route options. Map booklets with detailed maps showing existing and proposed ROW in relation to parcel boundaries. Transmission structure options also were available for public review. A total of 49 meeting attendees signed in at the public alternatives workshops, including 27 at the meeting in Loveland, and 22 at the meetings in Estes Park.

1.6.3 Areas of Controversy

Rebuilding the transmission line on either the North Line or the South Line is controversial with the public. Neighborhood groups in proximity to the South Line expressed a strong preference for rebuilding the transmission line on the North ROW while neighborhood groups and residential uses in proximity to the North Line expressed a strong preference for rebuilding the transmission line on the South ROW. It should be noted that both of the existing transmission line ROWs were in place prior to these neighborhood developments; the homes were built with the existing transmission lines in place. Homes within the oldest subdivision along the west portion of the North Line were built starting in 1938 and into the 1940s. Homes adjacent to the South Line were first constructed in the early 1960s. A primary goal of alternatives development was to develop alternatives that responded to this conflicting input received from the public during scoping and the alternatives development workshops.

1.6.4 Issue Identification

Issues are defined as concerns about the potential effects of the proposed project. The range of issues was determined through agency, stakeholder, and public scoping, as well as through internal scoping between Western and the USFS. Each potential issue was evaluated to determine its relevance to the proposed project. If the issue was determined to be a substantial concern, Western evaluated whether it should be considered a “key issue” during the alternative development process. Key and other issues identified through scoping for the EIS are described in Sections 1.6.4.1 and 1.6.4.2 below.

1.6.4.1 Key Issues

Key issues are issues that were used to drive the development of alternatives and compare the differences between the alternatives analyzed in detail. Key issues identified during scoping that influenced the alternative development include:

- Effects of new ROW acquisition on land uses, property owners, and Western's customers.
- Effects of the proposed project on scenic travel corridors (e.g., U.S. Highway 36), residential, and recreational viewsheds in the vicinity of Estes Park, residential developments, such as Meadowdale Hills and Newell Lake View subdivisions, and on National Forest System lands.
- Effects of new road construction in inaccessible areas with steep topography.
- Effects of the proposed project on recreational uses and experiences in the vicinity of Estes Park and Pinewood Reservoir, and on National Forest System lands accessed by USFS Road 122 (Pole Hill Road).
- Effects of the proposed project on protected areas, including county open space, lands protected by conservation easement, lands within the Stewardship Trust Program, and State Wildlife Areas. No protected areas have been identified on National Forest System lands.
- Effects of ROW expansion or new ROW acquisition on existing infrastructure (e.g., Upper Thompson Sanitation District’s treatment plant) and other structures.

1.6.4.2 Other Issues Selected for Detailed Analysis

Other issues define project effects that should be analyzed in detail in the EIS, but that have not driven alternatives development. Other issues identified for detailed analysis include:

- Effects of the proposed project on property values, as well as sources of revenue from tourism and outdoor recreation that Front Range communities and the regional economy rely upon.
- Effects of the proposed project (ground disturbance for access, pole removal, and new structure installation) on cultural resources.
- Effects of ROW clearing and road construction, road reconstruction, road reconditioning and ongoing maintenance on wetlands, soils, and water quality.
- Potential effects of electric and magnetic fields (EMF) from high-voltage power lines on human health.
- Effects of the proposed project on wildlife; plant; fisheries; threatened, endangered and USFS sensitive species; management indicator species; and general species of wildlife, plant (vegetation) and fish species.

1.6.4.3 Issues Considered but Not Analyzed Further

The following issues were considered but not analyzed further:

- Comments that Western should replace the lattice structures along the causeway of Lake Estes as part of this proposed project. The lattice structures are already double-circuit and are not in need of replacement.
- Comments that the E-PH transmission line is not within the USFS designated utility corridor as outlined in the ARP Forest Plan, and that consolidating the two lines on the southern alignment would not be in compliance with the ARP Forest Plan. The USFS has stated that the designated utility corridor includes both the transmission line ROWs (USFS 2012a).
- Comments that the proposed project is a “waste of taxpayer funds” were determined to be outside the scope of the EIS.

- A request that Western complete a socio-economic analysis of tourist and recreation based economies in Denver, Fort Collins, Boulder, and other Front Range cities supported by the Roosevelt National Forest. This issue is analyzed in the EIS; however, because socio-economic effects of rebuilding the transmission would not extend beyond the immediate project vicinity, the analysis area is limited to the Town of Estes Park and Loveland.
- A request that Western expand notification during scoping and publish notices in papers in Denver, Boulder, and Longmont. Newspaper notices are targeted for those communities where there is the greatest interest and potential for effects. Residents of Estes Park and Loveland would experience the greatest effects, and represent approximately 50 percent of the mailing addresses in the project mailing list. Therefore, newspaper notices have been published in the Estes Park Trail-Gazette and Loveland Reporter-Herald. The USFS publishes notices in their Newspaper of Record, which is the Fort Collins Coloradoan. Direct mailings, press releases, and website updates are the primary means to communicate project updates to individuals that have shown an interest in the project, and reside outside Estes Park and Loveland.
- Comments expressing general support for or opposition to the proposed project without supporting rationale were determined to be outside the scope of the EIS.

1.7 Decisions Framework

Western and the USFS prepared the EIS as the lead and cooperating Federal agencies, respectively. The results of the analysis are presented in this EIS and will form the basis for decisions regarding the proposed project.

Following the Draft EIS review and comment period, Western and the USFS will consider comments submitted by the public, interested organizations, and government agencies, and will respond to all substantive comments. Based on the Draft EIS and public input, Western and the USFS will designate their preferred alternative in the Final EIS. Western will issue a Record of Decision (ROD) no sooner than 30 days following the issuance of the Final EIS. Western may combine elements of alternatives considered in the EIS in the ROD.

As a cooperating agency, the USFS will prepare its own ROD in accordance with their respective policies and guidelines. The USFS is required to comply with all laws (National Forest Management Act [NFMA], NEPA, Section 7 of the Endangered Species Act [ESA], National Historic Preservation Act [NHPA], etc.), regulations, and policies for the portion of the proposed project on lands under its jurisdiction.

Instrumental to the decisions will be the consideration of measureable indicators that have been defined to measure the effects of the different alternatives with regard to key and other issues. The measurable indicators used to compare the alternatives are presented in **Table 2.8-1**. The USFS decision will be subject to a pre-decisional objection process. In order to have standing to object to the USFS decision, a person(s) or organization must submit specific written comments during the 45-day (at a minimum) public comment period on this Draft EIS. These comments will be addressed in the Final EIS. The Final EIS and USFS draft ROD will be made available to the public. The 45-day Objection Period will begin with publication of a legal notice in the USFS newspaper of record, the Fort Collins Coloradoan. This objection process was provided by the Consolidated Appropriations Act of 2012.

1.8 Regulatory Framework

The proposed project would need to comply with applicable regulatory requirements, including statutes, regulations, executive orders, DOE orders and guidance and permit requirements. Applicable requirements may include, but are not limited to, those listed below.

1.8.1 Statutes

- Antiquities Act of 1906 (16 U.S.C. §§ 432, 433)
- Archaeological and Historic Preservation Act of 1960 (16 U.S.C. §§ 469-469c-2), as amended
- Archaeological Resources Protection Act of 1979 (16 U.S.C. §§ 470aa-mm), as amended
- Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668-668d), as amended
- Clean Air Act (CAA) of 1970 (42 U.S.C. §§ 7401 et seq.), as amended
- ESA of 1973 (7 U.S.C. § 136; 16 U.S.C. §§ 1531 et seq.), as amended
- Farmland Protection Policy Act of 1981 (7 U.S.C. §§ 4201-4209)
- Federal Water Pollution Control Act (Clean Water Act [CWA]) of 1972 (33 U.S.C. §§ 1251 et seq.), as amended
- Federal Noxious Weed Act of 1974, as amended (7 U.S.C. §§ 2814 et seq.)
- Historic Sites Act of 1935 (16 U.S.C. § 461)
- Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. §§ 703-712), as amended
- NEPA of 1969 (42 U.S.C. §§ 4321 et seq.)
- NFMA of 1976 (16 U.S.C. §§ 1600-1614)
- NHPA 1966 (16 U.S.C. §§ 470 et seq.)
- Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001 et seq.)
- Occupational Safety and Health Act of 1970 (29 U.S.C. § 1A651), as amended

1.8.2 Regulations

- CEQ Regulations for Implementing NEPA, 40 CFR Parts 1500-1508
- Determining Conformity of General Federal Actions to State or Federal Implementation Plans, 40 CFR Part 93, Subpart B
- Interagency Cooperation, ESA of 1973, as amended, 50 CFR Part 402
- U.S. Environmental Protection Agency (EPA) Administered Permit Programs: the National Pollutant Discharge Elimination System (NPDES), 40 CFR Part 122
- Federal Hazardous Materials Transportation Regulations, 49 CFR Parts 171–180
- Hazardous Waste Management Regulations, 40 CFR Parts 260–270
- National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 61
- National Register of Historic Places (NRHP), 36 CFR Part 60
- Occupational Safety and Health Standards and Regulations, 29 CFR Parts 1910 and 1926
- Protection of Historic Properties, 36 CFR Part 800
- U.S. Army Corps of Engineers (USACE) Regulatory Program Regulations, 33 CFR Parts 320-331.

- U.S. DOE NEPA Implementing Procedures, 10 CFR Part 1021
- U.S. DOE Compliance with Floodplain/Wetlands Environmental Review Requirements, 10 CFR Part 1022
- USFS NEPA Implementing Regulations, 36 CFR Part 220

1.8.3 Executive Orders

- Executive Order (EO) 11593, Protection and Enhancement of the Cultural Environment, May 13, 1971
- 11988, *Floodplain Management*, May 24, 1977
- EO 11990, *Protection of Wetlands*, May 24, 1977
- EO 12875, Enhancing the Intergovernmental Partnership, October 26, 1983
- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, February 11, 1994
- EO 13084, Consultation and Coordination with Indian Tribal Governments, May 14, 1998
- EO 13112, Invasive Species, February 3, 1999
- EO 13175, Consultation and Coordination with Indian Tribal Governments, November 6, 2000
- EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001
- EO 28357, Actions to Expedite Energy-Related Projects, May 18, 2001

1.8.4 DOE Orders and Guidance

- DOE Order 450.1, Environmental Protection Program
- DOE Order 451.1B, NEPA Compliance Program
- Office of NEPA Policy and Assistance, *Environmental Impact Statement Checklist*, November 12, 1997
- Office of NEPA Policy and Assistance, *Environmental Impact Statement Summary*, September 29, 1998
- Office of NEPA Policy and Compliance, *The EIS Comment-Response Process*, October 8, 2004
- Office of NEPA Policy and Compliance, Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statement, Second Edition (the Green Book), December 23, 2004
- Office of NEPA Policy and Compliance, *EIS Distribution*, June 15, 2006
- Office of NEPA Policy and Compliance, Need to Consider Intentional Destructive Acts in NEPA Documents, December 1, 2006
- Office of NEPA Policy and Compliance, Procedures for Submitting Documents for Posting on the DOE NEPA Website, August 2008

1.8.5 Forest Service Directives

The USFS Directive System consists of the USFS manual and handbooks, which codify the agency's policy, practice, and procedure. The system serves as the primary basis for the internal management and control of all programs and the primary source of administrative direction to USFS employees. The Forest Service Manual (FSM) contains legal authorities, objectives, policies, responsibilities, instructions, and guidance needed on a continuing basis by USFS line officers and primary staff to plan and execute programs and activities. Forest Service Handbooks (FSH) are the principal source of specialized guidance and instruction for carrying out the direction issued in the FSM. Applicable USFS directives may include, but are not limited to, those listed below.

- FSM 1950, Environmental Policy and Procedures
- FSH 1909.15, Environmental Policy and Procedures Handbook
- FSM 2330, Publicly Managed Recreation Opportunities
- FSM 2520, Watershed Protection and Management
- FSH 2509.25, Watershed Conservation Practices Handbook
- FSM 2550, Soil Management
- FSH 2509.18, Soil Management Handbook
- FSM 2630, Management of Wildlife and Fish Habitat
- FSM 2670, Threatened, Endangered and Sensitive Plants and Animals
- FSH 2609.13, Wildlife and Fisheries Program Management Handbook
- FSM 2710, Special Use Authorizations
- FSH 2709.11, Special Uses Handbook
- FSH 701, Landscape Aesthetics, a Handbook for Scenery Management

1.8.6 State and Local Requirements

Federal agencies are not required to comply with the regulatory requirements of state or local land use regulations. Nevertheless, Western would plan, design, construct and operate the proposed project in accordance with the substantive requirements of state and local plans and policies, whenever practicable.

1.9 Permits and Approvals

Permits and approvals that may be required for project implementation are summarized in **Table 1.9-1**.

Table 1.9-1 Permits and Approvals

Permit or Approval	Description	Statute or Regulation	Administrative Authority
Special-Use Authorization	A special-use authorization is a legal document such as a permit, term permit, lease, or easement, which allows occupancy, use, rights or privileges on National Forest System lands. The authorization is granted for a specific use of land for a specific period of time.	36 CFR Part 251	USFS
CWA § 401 WQC	§ 401 of the CWA requires that federally permitted actions be reviewed for compliance with state water quality standards, if those actions may result in the discharge of pollutants to waters of the U.S within the state. State approval is granted via the § 401 water quality certification.	§ 401 of CWA (33 U.S.C. §§1251 et seq.)	CDPHE
CWA § 402 NPDES Permit(s)	§ 402 of the CWA establishes the NPDES program regulating the discharge of pollutants to waters of the U.S. NPDES permits are required to authorize discharges of storm water associated with construction activities and discharges of construction dewatering effluent.	§ 402 of CWA (33 U.S.C. §§1251 et seq.)	CDPHE
CWA § 404 Department of the Army Permit	§ 404 of the CWA regulates the discharge of dredge and fill material into waters of the U.S. Regulated activities include most earthmoving activities in and along streams below the ordinary high water mark (OHWM), and within jurisdictional wetlands.	§ 404 of CWA (33 U.S.C. §§1251 et seq.)	USACE
ESA Section 7 Consultation	Required for all Federal actions to ensure minimization of adverse impacts to federally listed species.	ESA (16 U.S.C. §§ 1531 et seq.)	USFWS
NHPA Section 106 Consultation	Federal agencies are required to consult with the State Historic Preservation Office to seek ways to avoid, minimize, or mitigate adverse effects of a Federal action on historic properties.	NHPA (16 U.S.C. §§ 470 et seq.); 36 CFR Part 800	Colorado Office of Archaeology and Historic Preservation

CDPHE = Colorado Department of Public Health and Environment; NPDES = National Pollutant Discharge Elimination System; USFWS = U.S. Fish and Wildlife Service; USACE = U.S. Army Corps of Engineers.

1.10 Document Organization

The contents of each chapter of the EIS are as follows:

- Chapter 1.0 provides background information on the proposed project, states the purpose and need for the project, and summarizes public involvement activities conducted in support of the EIS.
- Chapter 2.0 describes all alternatives considered in the EIS. It describes common features of transmission line design, construction, operation, and maintenance; includes a summary comparison of the environmental effects of the alternatives; and discusses measures to prevent or mitigate potential effects.
- Chapter 3.0 describes the affected environment of resources that the proposed alternatives could affect. Resources discussed include air quality; geology and paleontology; soils; water resources and floodplains; wetlands; vegetation; wildlife; special status and sensitive species; fuels and fire; land use and recreation; visual resources; socioeconomics, community resources, and environmental justice; electrical effects and human health; cultural resources; and transportation.
- Chapter 4.0 describes the potential environmental effects of the alternatives. The chapter identifies the direct and indirect, short-term and long-term, beneficial and adverse effects to each resource identified in Chapter 3.0. A discussion of residual impacts, the relationship between short-term uses and long-term productivity, and irreversible and irretrievable commitments of resources is included at the end of the chapter.
- Chapter 5.0 identifies the potential cumulative effects of the alternatives to each resource identified in Chapter 3.0. Cumulative impact is the impact on the environment that results from the incremental impact of the proposal when added to the other past, present, and reasonably foreseeable future actions regardless of who undertakes the other actions.
- Chapter 6.0 provides a list of preparers, a contractor disclosure statement, and the distribution list for the EIS.
- Chapter 7.0 provides a list of references used in the document.
- Chapter 8.0 provides an index for the document.

2.0 Alternatives

2.1 Introduction

This chapter describes the range of alternatives considered to meet the identified Purpose and Need described in Chapter 1.0. The alternatives include rebuilding the two separate transmission lines as a double-circuit line using alternate alignments and designs, including underground construction for selected segments. An additional alternative would rebuild the two lines using structures very similar to those currently in use and generally located along the two existing ROWs. A double-circuit transmission line carries six conductors on a single-pole structure within one ROW, while a single-circuit line carries only three conductors on a single H-frame structure within one ROW. The existing ROWs would be expanded as needed and minor adjustments made to the alignments where necessary to comply with NERC and NESC requirements. The USFS action for each of the action alternatives is to issue an authorization with a defined ROW and an Operation and Maintenance Plan for the portion of the transmission line(s) rebuild that crosses National Forest System lands. The No Action Alternative also is fully considered and described.

As described in Chapter 1.0, Western owns, operates, and maintains two transmission lines between the Flatiron substation and the intersection of Mall Road and U.S. Highway 36 in Estes Park. Both lines begin as two distinct individual single-circuit lines at the Flatiron Substation, near Loveland. The lines combine to a double circuit line at the lattice structure located on Mall Road, near Estes Park. This project ends where the lines become double circuit at the lattice structures. The E-LS line is the more northern of the two lines and will be referred to in the remainder of this document as the North Line. The second, more southerly line, consisting of the E-PH and the F-PH lines will be referred to in this document as the South Line. Both existing transmission lines are 115-kV single-circuit lines constructed on wood H-frame structures.

Western does not have a preferred alternative at this time. The USFS, which is a cooperating agency on this project, also has not identified a preferred alternative. All of the alternatives, and portions thereof described in detail are under consideration as well as No Action. Western will identify a preferred alternative following public review of the Draft EIS. The preferred alternative could be one of the alternatives analyzed in detail in this Draft EIS or some combination of each of the alternatives.

2.2 Alternatives Considered in Detail

The development of a reasonable range of alternatives is an essential element of an EIS. As stated in the CEQ regulations for implementing NEPA, an EIS must rigorously explore and objectively evaluate all reasonable alternatives (40 CFR 1502.14a). NEPA also requires that a no action alternative be evaluated, in addition to the action alternatives, to establish a baseline for analysis and to analyze the consequences of not implementing the proposed project.

Alternatives Development Workshop

A range of reasonable alternatives for the proposed project was identified by evaluating routing opportunities and constraints, engineering design standards, public comments, and environmental resources that occur within the project area. The objective was to identify alternatives that address public, environmental, and social concerns, and meet the project purpose and need and engineering criteria for the transmission lines rebuild.

Ultimately, four alternatives with three routing variations to rebuild and upgrade the existing 115-kV transmission lines, and the No Action Alternative were identified for detailed analysis in the EIS. These are described briefly below, and in greater detail in Sections 2.2.1.1 through 2.2.1.8. In this document "variants" refer to routing variations off the main alternative, whereas "reroutes" are any section of the alignment that is off existing ROW. The alignments of alternatives and routing variations using overhead construction methods are shown on **Figure 2.2-1**. The alignments of routing variations using underground construction methods are shown on **Figure 2.2-2**.

- **No Action Alternative** – Keep the existing transmission lines in service through continuing structure replacement and maintenance. The existing ROWs would be expanded, as needed, and minor adjustments made to the alignments where necessary in order to comply with NERC and NESC requirements.
- **Alternative A** – Rebuild and consolidate the transmission lines primarily on the existing North transmission line ROW. This alternative includes a reroute to the north and northeast of Newell Lake View subdivision and along Mall Road in Estes Park (**Figure 2.2-3**).
    - **Variant A1** – Variant A1 is identical to Alternative A for all but the westernmost segment (**Figure 2.2-4**). At a point in the valley between Mount Olympus and Mount Pisgah, this routing variation would depart from the alignment of the existing North Line and traverse along the base of Mount Pisgah before turning to the northwest and generally following an alignment parallel to U.S. Highway 36 for the remaining distance to the existing steel lattice double-circuit structure at the intersection of U.S. Highway 36 and Mall Road.
    - **Variant A2** – Variant A2 follows an alignment similar to Variant A1; however, the westernmost 2.7 miles of the transmission line would be constructed underground (**Figure 2.2-2**).
- **Alternative B** – Rebuild and consolidate the transmission line, primarily on the existing South transmission line ROW. This alternative includes a 0.25 mile reroute along Pole Hill Road on National Forest System lands, and a 0.75 mile reroute to the North Line on new ROW in the vicinity of Pole Hill Substation (**Figure 2.2-5**).
- **Alternative C** – Rebuild and consolidate the transmission lines along an alignment that utilizes a combination of the existing North and South transmission line ROWs. This alternative includes reroutes off existing transmission line ROW east of Pinewood Reservoir, along Pole Hill Road on National Forest System lands, and on privately held land on the west end of the project area (**Figure 2.2-6**).
    - **Variant C1** – Rebuild and consolidate the transmission lines along an alignment that utilizes a combination of the existing North and South transmission line ROWs. This alternative follows an alignment similar to Alternative C; however, the westernmost 2.7 miles of the transmission line would be constructed underground (**Figure 2.2-2**).
- **Alternative D** – Rebuild the two existing transmission lines in-kind as single-circuit lines located on separate ROWs. This alternative would utilize structures very similar to those currently in use, although structure height may increase by 5 to 10 feet. The existing ROWs would be expanded as needed and minor adjustments made to the alignments where necessary to comply with NERC and NESC requirements. This alignment includes a reroute to Pole Hill Road where there is inadequate ROW through Newell Lake View subdivision and relocation of one structure on the north side of the Upper Thompson Sanitation District parcel in Estes Park, to accommodate expansion of their facility (**Figure 2.2-7**).

Each of these alternatives is described in detail in the remainder of this chapter, starting with a discussion of the alignments that were utilized and the process used to develop those alignments. Other elements of the alternatives are described in subsequent sections, including construction methods, design considerations and other project features. Many of these elements are discussed under the heading Activities Common to All Action Alternatives (Section 2.3).

Figure 2.2-1 Alternatives for Overhead Construction

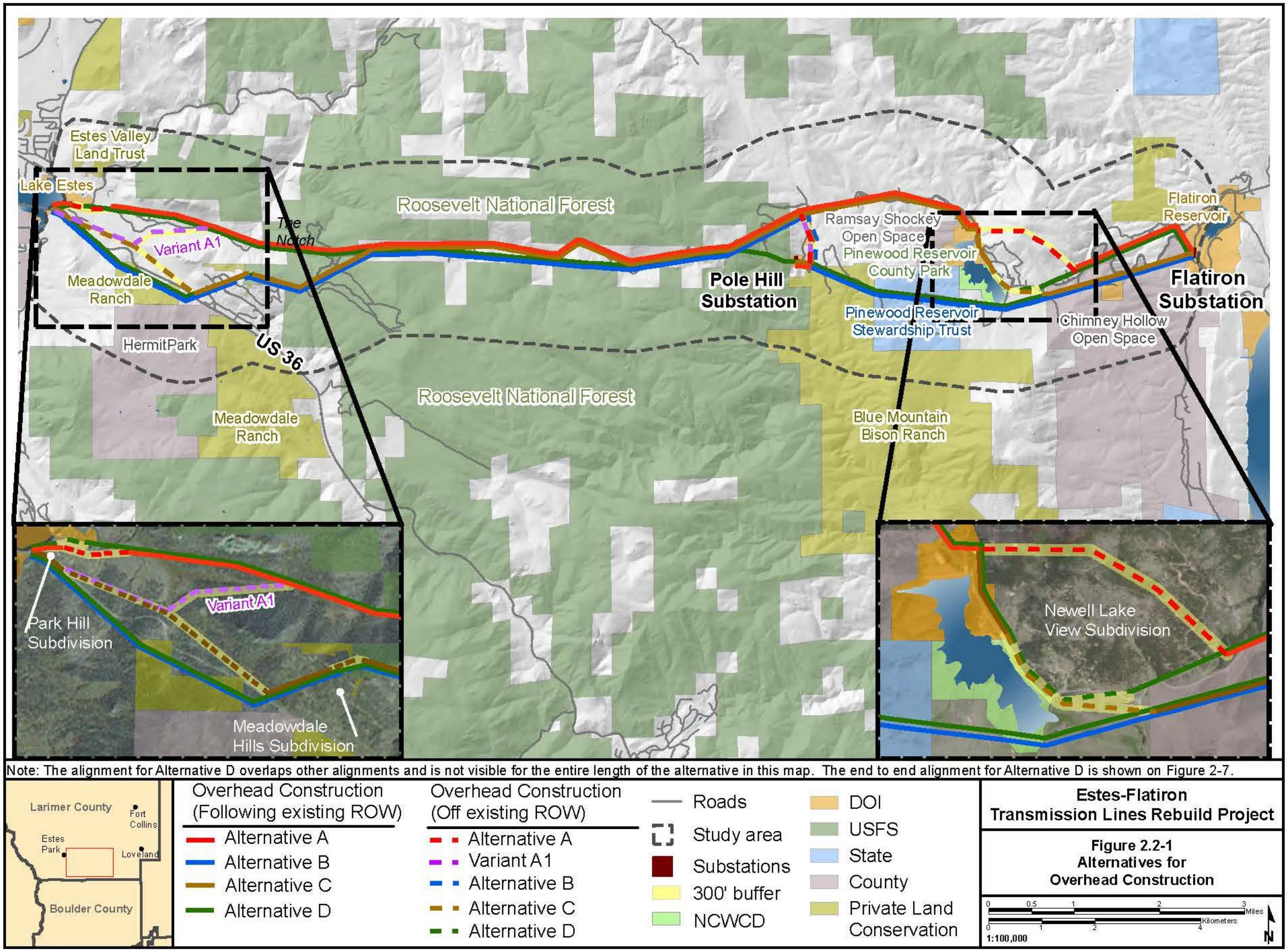
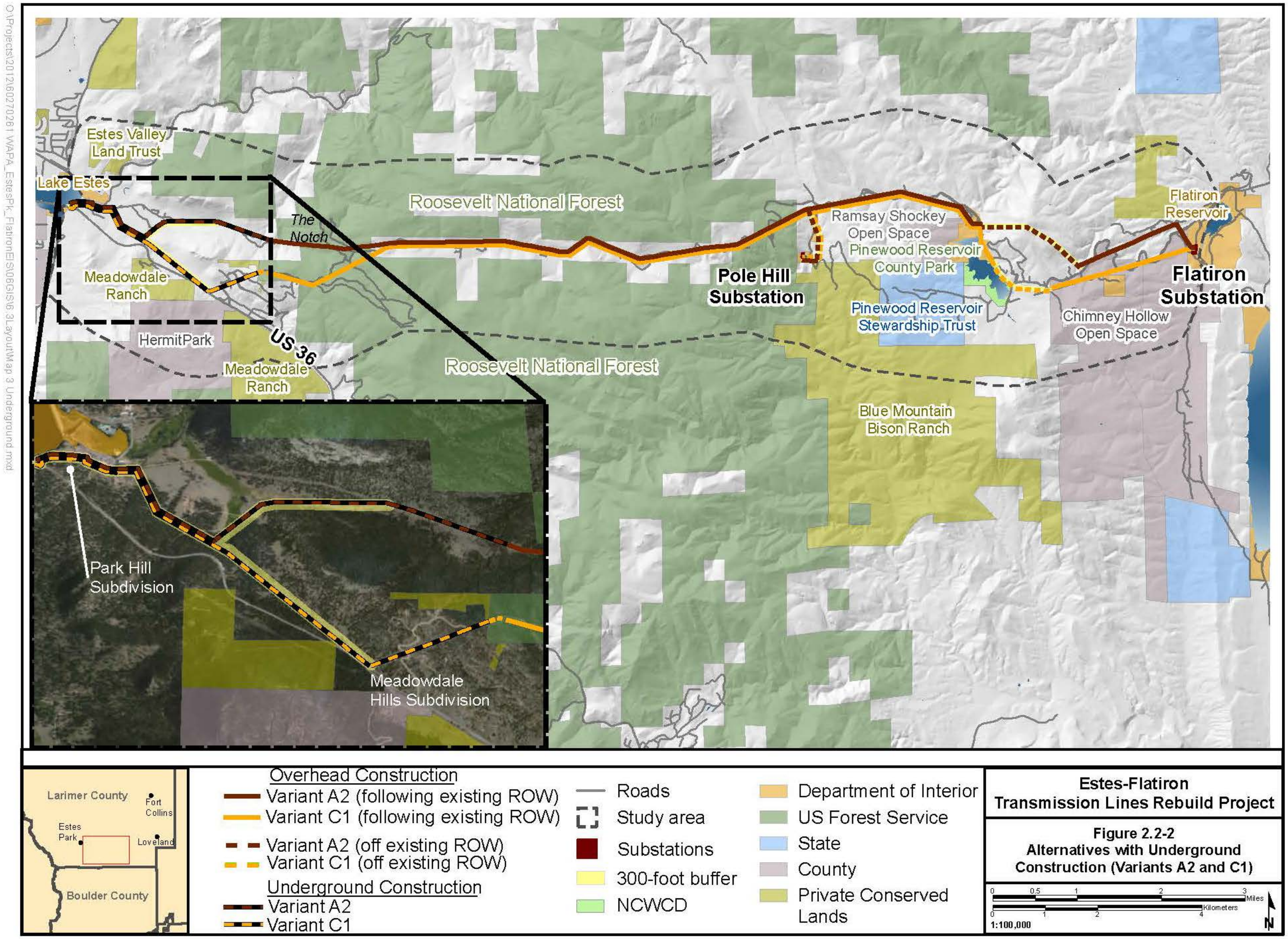


Figure 2.2-2 Alternatives with Underground Construction (Variants A2 and C1)



2.2.1 Development of Alternative Alignments

In order to assure that all reasonable routes were considered, an evaluation of routing constraints and opportunities was completed focusing on an area generally 2 to 3 miles in width and extending between the Flatiron Substation and the project terminus on the east side of Lake Estes. The 2- to 3-mile-wide study area was generated by mapping a 1-mile-wide buffer around all existing ROWs that have been in place for the last 60 to 75 years. This approach reflects Western's need to maximize use of existing ROW in order to reduce ROW acquisition costs, and also to avoid burdening new landowners who bought homes or land with no indication of a utility ROW near them when the property was acquired.

The initial step in this evaluation was to compile resource information within the study area. Using this information, an initial constraint/opportunity analysis was completed. The following constraint and opportunity criteria were incorporated into the analysis to address engineering and construction considerations (particularly access) as well as public scoping comments.

- Steep Slopes, which were defined as areas with slopes 30 percent or greater and no existing access.
- Visual Considerations, including those areas that would be highly visible from residences, recreation areas, and highways.
- Buildings, for which a 55-foot buffer was defined around existing buildings.
- Protected areas, including county open space, lands protected by conservation easement, lands within the Stewardship Trust Program, and State Wildlife Areas.

The results of this analysis were then used to create a composite map by highlighting areas with overlapping constraints. Varying tones were used to depict areas that ranged from no constraints to three overlapping constraints. This information was then used to assist in the identification of alternative alignments, which were subsequently incorporated into a series of overall alternatives.

A key step in the process was a series of alternatives development workshops that were held at the Estes Park Museum and the Bison Visitor Center near Flatiron Reservoir over a 3-day period in early October 2012. Workshop objectives included:

- Present opportunities, constraints, and other considerations that may influence potential transmission line routes.
- Suggest, review, and refine route options and design features.
- Provide a forum for the public to comment on or ask questions about the alternatives screening process.

In preparation for the alternatives workshops, Western compiled map data showing key siting considerations in the project area. Mapped resource data were available for public review and comment and the public was invited to identify route options. Input on transmission line design features, such as structure type and finish, and method of construction also was requested. The workshops were attended by approximately 50 local residents and other interested parties and the input was considered in developing the alternatives described in this chapter.

The resulting alternatives are shown in **Figure 2.2-1** and **Figure 2.2-2**, and described in the remainder of this section. Additional potential alignments also were identified and discussed in Section 2.7, Alternatives Considered but Dismissed. In all cases, the alternatives follow some portion of the existing transmission line alignments and the ROWs they utilize.

2.2.1.1 No Action Alternative

Consideration of the No Action Alternative is a required element of an EIS (40 CFR 1502.14(d)). Under the No Action Alternative, Western would leave in place both existing transmission lines from Mall Road in Estes to Flatiron Substation and replace structures at their current locations as they deteriorated. Maintenance requirements on the existing lines would increase. The lines would become difficult to keep in service in the very near term due to their age and deteriorating condition. Western would need to replace deteriorating structures with an increasing frequency. Approximately 70 to 80 percent of all structures will need replacement in the near future. Replacements of cross arms and other hardware would be required to keep the lines reliable and to ensure public and worker safety. The frequency of repairs would increase as the lines continue to age.

In addition to on-going maintenance activities and structure replacement, the No Action Alternative would involve the acquisition of additional ROW on private lands at locations where an adequate ROW has not been previously acquired. ROW widths along the existing transmission lines range from 20-130 feet. At locations with limited ROW width, it is difficult to maintain appropriate vegetation clearances and compliance with applicable reliability standards per, for example, NERC Standard FAC-003-1, Transmission Vegetation Management Program (NERC 2006). In order to comply with applicable standards and maintain an acceptable level of reliability, Western would acquire additional ROW at all locations on private land where the current ROW width is less than 75 feet, and depending on maintenance requirements, additional ROW may need to be acquired at some locations where the existing ROW width is less than 110 feet. The South Line has a ROW width of 75 feet or more over its entire length. Conversely, the North Line has inadequate ROW width over nearly its entire length, the only exceptions being short segments near Mall Road in Estes and near the Flatiron Substation.

Where there is inadequate ROW on private land, Western would acquire the additional ROW needed to meet applicable standards. For much of the North Line, this would require acquisition of an additional 45 to 55 feet of ROW. At one location, specifically a segment through the Newell Lake View subdivision, the existing line would be relocated to follow Pole Hill Road near Pinewood Reservoir and a new ROW acquired due to the fact that several homes have built immediately adjacent to the existing transmission line ROW. However, the No Action Alternative would require maintaining access to the existing transmission lines in order to maintain the line and replace deteriorated structures. See Section 2.3.2 for a discussion of the type and level of access required.

A basic difference between the action alternatives and No Action is that activities required to access the existing lines to remove and replace deteriorated structures and other access improvements required for maintenance activities would occur incrementally over a longer period of time instead of within a specified construction schedule. Ultimately, the No Action Alternative would be similar to Alternative D in terms of the activities required to maintain the lines in service and the amount of area disturbed also would be similar. Western would coordinate with the USFS regarding pole replacement on National Forest System land, and the USFS would require the appropriate level of NEPA analysis to authorize pole replacements on National Forest System lands. On National Forest System land, Western would not seek authorization to expand its ROW for the South Line. However, additional authorization may be needed for the North Line.

2.2.1.2 Alternative A – Construct a Double-Circuit Line on a Consolidated ROW (North)

Alternative A would construct, operate, and maintain a new double-circuit line along the alignment of the existing North transmission line between the Flatiron Substation and the east shore of Lake Estes at Mall Road and U.S. Highway 36. The existing structures would be removed and replaced with new double-circuit structures. See **Figure 2.2-8** and **Table 2.2-1** for information on structure design and dimensions for a description of the structure design. The new line would require a 110-foot ROW and generally follow the existing alignment except at two locations, off National Forest System land. One of these departures from the existing alignment would occur in the vicinity of Newell Lake View subdivision where existing ROW is inadequate. In order to avoid these impacts, the alignment would depart from the existing ROW at a point approximately one mile east of the subdivision. At this point, the new alignment would turn to the northwest, using topography to reduce visibility where possible and traversing through steep and rugged terrain. The alignment would rejoin the existing transmission line alignment just north of Pinewood Lake Dam and continue along this alignment for most of the remaining distance to the intersection with the existing double-circuit line at Mall Road. The second departure from the alignment of the existing transmission line occurs east of Mall Road. Just east of the Upper Thompson Sanitation District's office and Mall Road, the new alignment would jog to the south along Mall Road in order to avoid a conflict with the Upper Thompson Sanitation District wastewater treatment plant. The reroute is referred as the Mall Road reroute in this document.

Another element of Alternative A is a short line segment (0.75 mile) that would extend south to the Pole Hill Substation. This segment would require new ROW and would be built using the same design as the double-circuit line. **Figure 2.2-3** shows the alignment of Alternative A.

Construction of a double-circuit line along the alignment of Alternative A would allow the existing South transmission line to be removed and the ROW allowed to return to natural vegetation patterns. See Section 2.3.4 for a discussion of the removal process. Under Alternative A, the western end of Pole Hill Road would not be improved, and the road would retain its challenge for four-wheel drive use. See Section 2.3.2.1 for additional information on access requirements under each of the alternatives.

2.2.1.3 Variant A1 – Western Alignment Option

Variant A1 is identical to Alternative A for all but the westernmost segment (**Figure 2.2-4**). At a point in the valley between Mount Olympus and Mount Pisgah, this routing variation would depart from the alignment of the existing North Line and traverse along the base of Mount Pisgah before turning to the northwest and generally following an alignment parallel to U.S. Highway 36 for the remaining distance to the intersection with the existing double-circuit line at Mall Road. This segment would require a new ROW for most of its length. Under Variant A1, the western end of Pole Hill Road would not be improved, and the road would retain its challenge for four-wheel drive use. See Section 2.3.2.1 for additional information on access requirements under each of the alternatives.

2.2.1.4 Variant A2 – Underground Construction Along a Segment of Alternative A

Variant A2 is identical to Alternative A for all but the westernmost segment. The transmission line would be rebuilt aboveground following Alternative A until intersecting the eastern end of Variant A2. Structure type and construction methods along the aboveground portions of this alternative would be same as described for Alternative A. The westernmost portion of this variant would be constructed underground following a new alignment as shown on **Figure 2.2-2**. Underground construction methods applicable to Variant A2 are described in Section 2.2.4. Under Variant A2, the western end of Pole Hill Road would not be improved, and the road would retain its challenge for four-wheel drive use. See Section 2.3.2.1 for additional information on access requirements under each of the alternatives.

Figure 2.2-3 Alternative A – Double-Circuit Line on a Consolidated ROW (North)

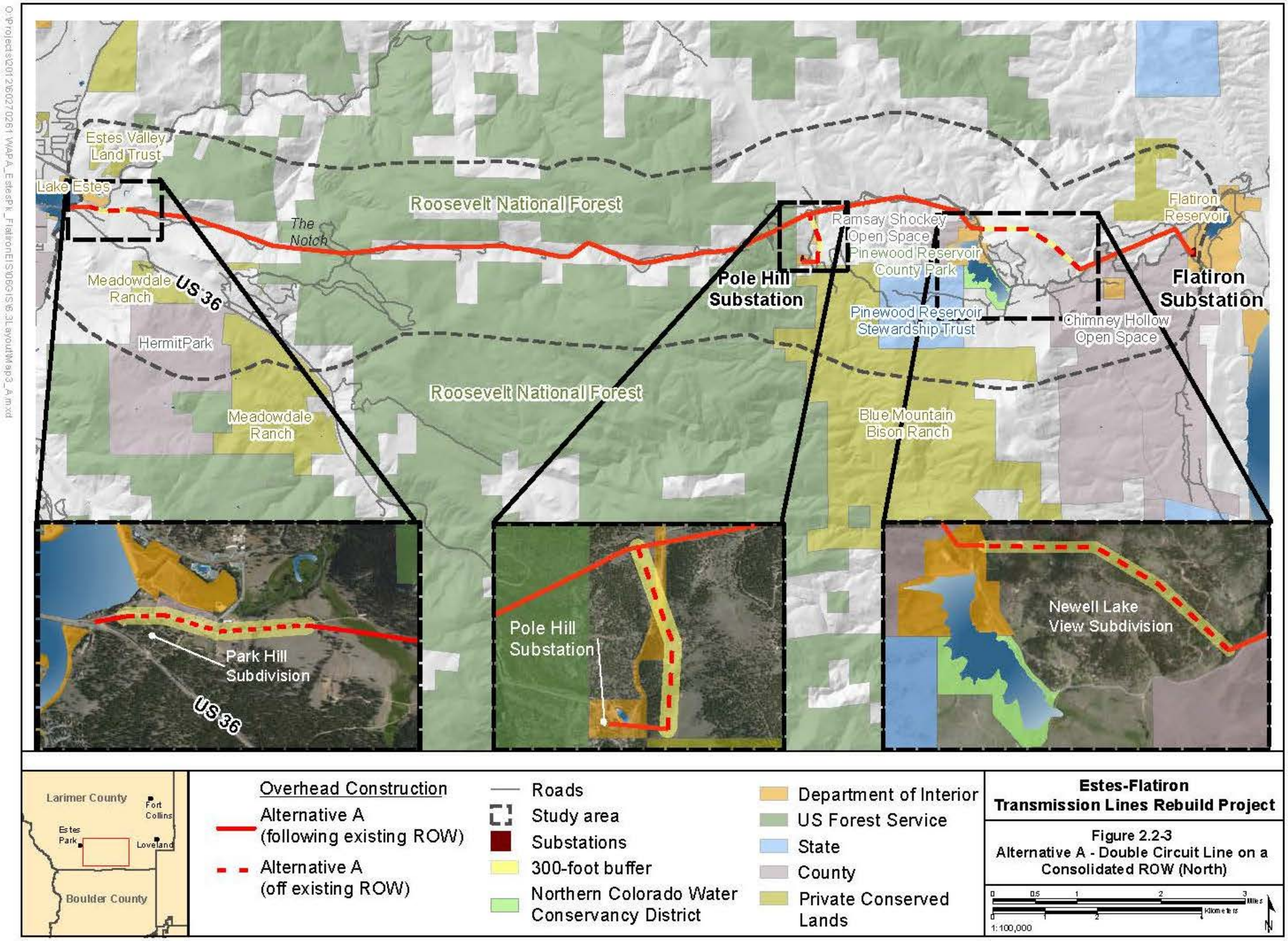
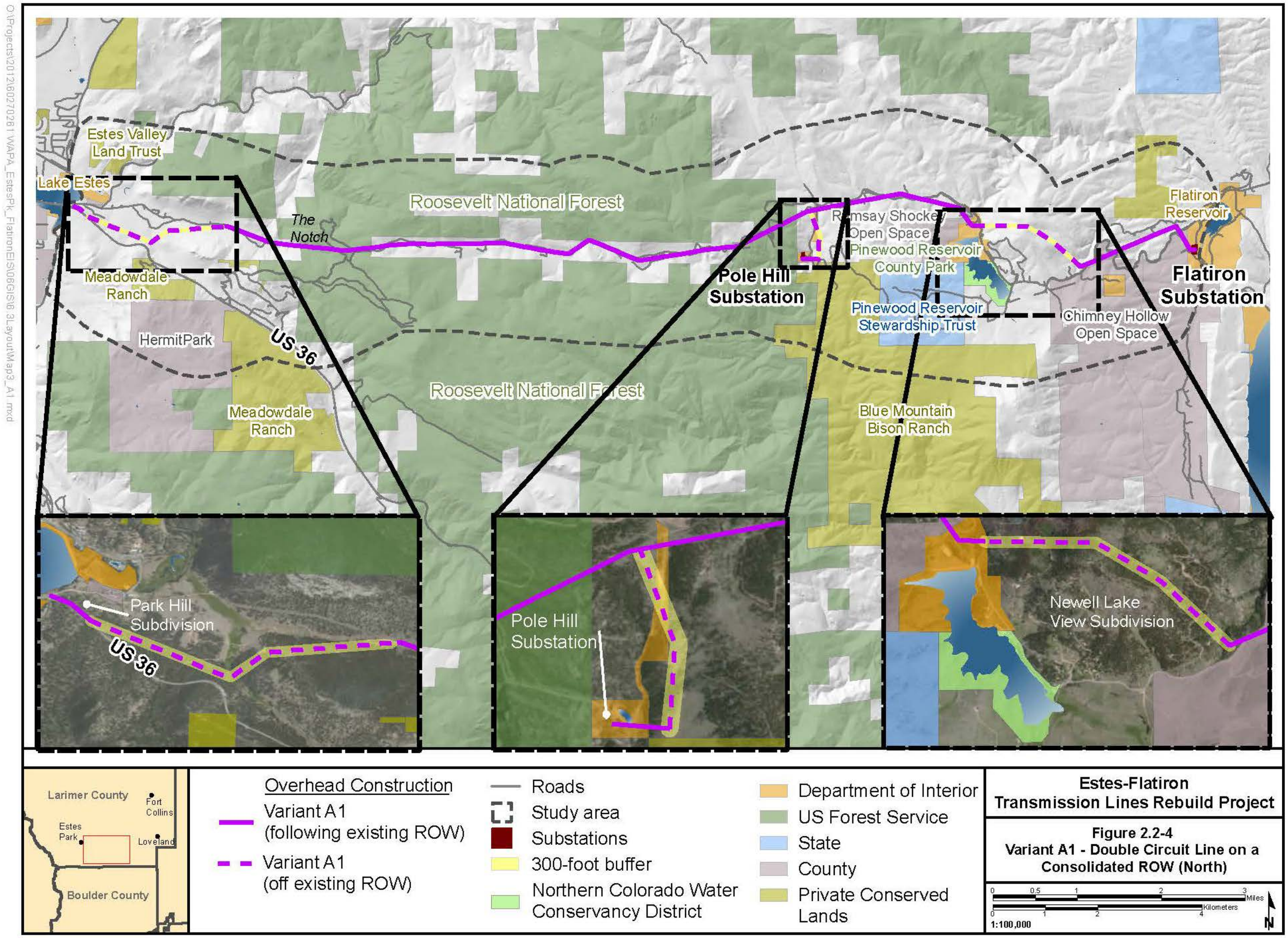


Figure 2.2-4 Variant A1 – Double-Circuit Line on a Consolidated ROW (North)



2.2.1.5 Alternative B – Construct a Double-Circuit Line on a Consolidated ROW (South)

Alternative B would construct, operate, and maintain a new double-circuit line along the alignment of the existing South transmission line for most of the distance between Flatiron Substation and the intersection of Mall Road and U.S. Highway 36. The existing structures would be removed and replaced with new double-circuit structures. See **Figure 2.2-8** and **Table 2.2-1** for information on structure design and dimensions. The new line would require a 110-foot ROW and generally follow the existing alignment except at two locations. Just east of the Pole Hill Substation the alignment of Alternative B would turn north and partially parallel Lone Elk Road for 0.75 mile until intersecting the alignment of the existing North transmission line. A new ROW would be required for this segment. Alternative B diverts to the north at this location in order to avoid: 1) crossing the penstock and 2) crossing the steep and rocky terrain located west of the Pole Hill Substation. Both the penstock and the rough terrain west of Pole Hill Substation would make permanent structure access problematic.

Alternative B would then follow the alignment of the existing North transmission line for approximately one mile to a point where the alignments of the two existing lines converge and parallel each other on separate ROWs. West of this point, Alternative B would follow the alignment of the existing South transmission line. A second 0.25 mile reroute would move the transmission line off the existing ROW to parallel the western end of Pole Hill Road on National Forest System land (see **Figure 2.2-5**).

Because Alternative B turns to the north prior to reaching the Pole Hill Substation, a short (less than 0.25 mile) segment of transmission line would have to be constructed to maintain an electrical connection to the substation.

Construction of a double-circuit line along the alignment of Alternative B would allow the existing North transmission line to be removed and the ROW to return to natural vegetation patterns. See Section 2.3.4 for a discussion of the removal process. However, it would be necessary to leave a portion of the existing structures in place to maintain the existing fiber optic service provided to Pinewood Dam. This would be accomplished by leaving a single pole in place at each existing structure site along the North Line between the dam and the vicinity of the Green Mountain Drive. The remaining single pole at each structure site would be utilized to support the fiber optic line.

Under Alternative B, the western end of Pole Hill Road would not be improved, and the road would retain its challenge for four-wheel drive use. See Section 2.3.2.1 for additional information on access requirements under each of the alternatives.

2.2.1.6 Alternative C – Construct a Double-Circuit Line on a Consolidated ROW Using a Combination of Alignments

Alternative C would build a new double-circuit line between Flatiron Substation and the intersection of Mall Road and U.S. Highway 36 using a combination of alignments, including the alignments of both existing lines as well as new alignments in some locations. See **Figure 2.2-8** and **Table 2.2-1** for information on structure design and dimensions. After leaving the Flatiron Substation, Alternative C would follow the alignment of the existing South Line for a distance of just over 2 miles before turning to the northwest as it approaches Pinewood Lake. Just east of Pinewood Lake, Alternative C would leave the alignment of the existing South Line and follow a new alignment, generally paralleling Pole Hill Road along the south edge of the Newell Lake View subdivision until intersecting with the alignment of the existing North Line near Pinewood Lake Dam. From this point Alternative C would follow the alignment of the existing North Line to the point where the North and South lines diverge just east of The Notch (**Figure 2.2-6**). Alternative C would then cross over to the alignment of the South transmission line at the point where the two existing lines separate and continue on existing

Figure 2.2-5 Alternative B – Double-Circuit Line on a Consolidated ROW (South)

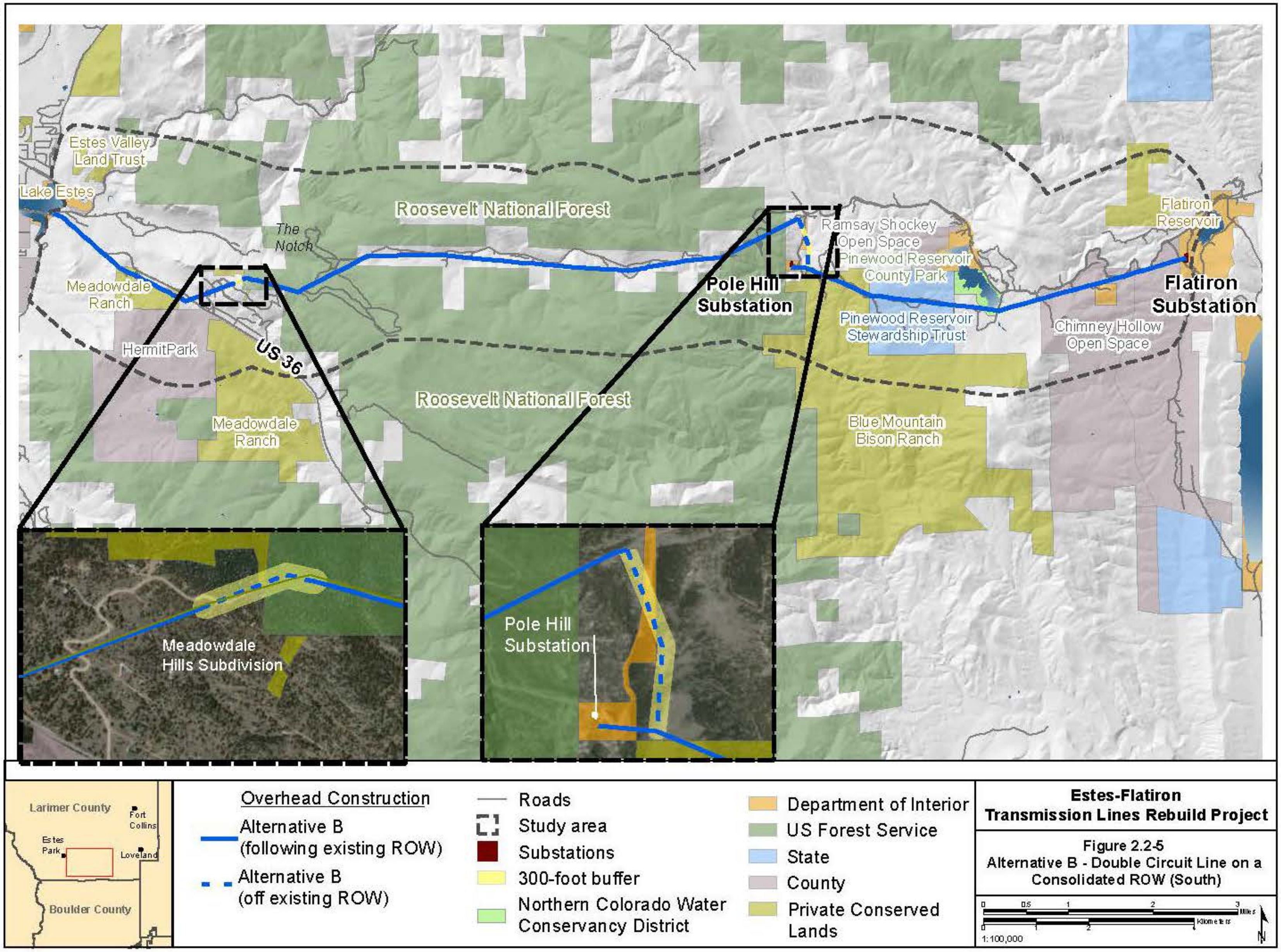
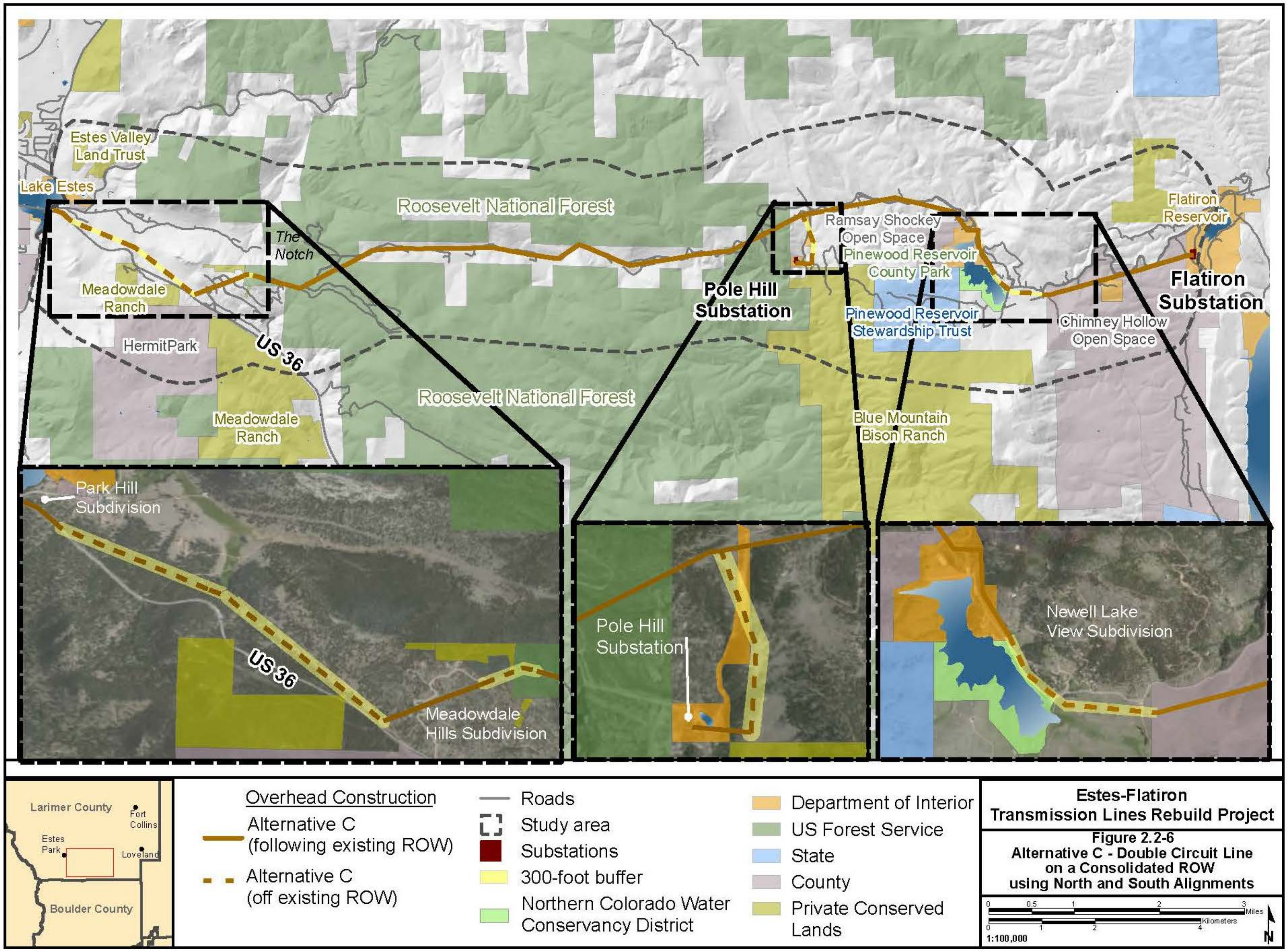


Figure 2.2-6 Alternative C – Double-Circuit Line on a Consolidated ROW Using North and South Alignments



ROW and a 0.25-mile reroute to parallel the western end of Pole Hill Road on National Forest System land. The alignment continues on existing ROW through Meadowdale Hills subdivision to U.S. Highway 36. Instead of crossing the highway at this location, Alternative C would follow a new alignment generally parallel to U.S. Highway 36 for the remaining distance to the intersection of Mall Road and U.S. Highway 36.

New ROW would be required for this segment, which is intended to reduce visibility from U.S. Highway 36. In order to further reduce visibility, special design measures would be considered for this segment and Meadowdale Hills subdivision, including the use of structures with a lower height and shorter span.

Because Alternative C turns to the north prior to reaching the Pole Hill Substation, a short (less than 0.25 mile) segment of double-circuit transmission line would have to be constructed to maintain an electrical connection to the substation.

At locations where the Alternative C alignment follows one of the existing transmission lines the existing structures would be replaced with new double-circuit structures, but the locations would vary depending on final design. At other locations where the new double-circuit line is not using an existing or expanded ROW, the existing structures would be removed and the ROW allowed to return to natural vegetation patterns. See Section 2.3.4 for a discussion of the removal process. Under Alternative C, Pole Hill Road would be reconstructed on National Forest System land to level the grade, removing the challenge for four-wheel drive use. See Section 2.3.2.1 for additional information on access requirements under each of the alternatives.

2.2.1.7 Variant C1 – Underground Construction along a Segment of Alternative C

Variant C1 is identical to Alternative C for all but the westernmost segment. The transmission line would be rebuilt aboveground following Alternative C until intersecting the USFS boundary near Meadowdale Hills subdivision. Structure type and construction methods along the aboveground portions of this alternative would be same as described for Alternative C. The westernmost portion of this alternative, from Mall Road to the USFS boundary adjacent to the Meadowdale Hills subdivision, would be constructed underground following a new alignment as shown on **Figure 2.2-2**. Underground construction methods applicable to Variant C1 are described in Section 2.2.4.

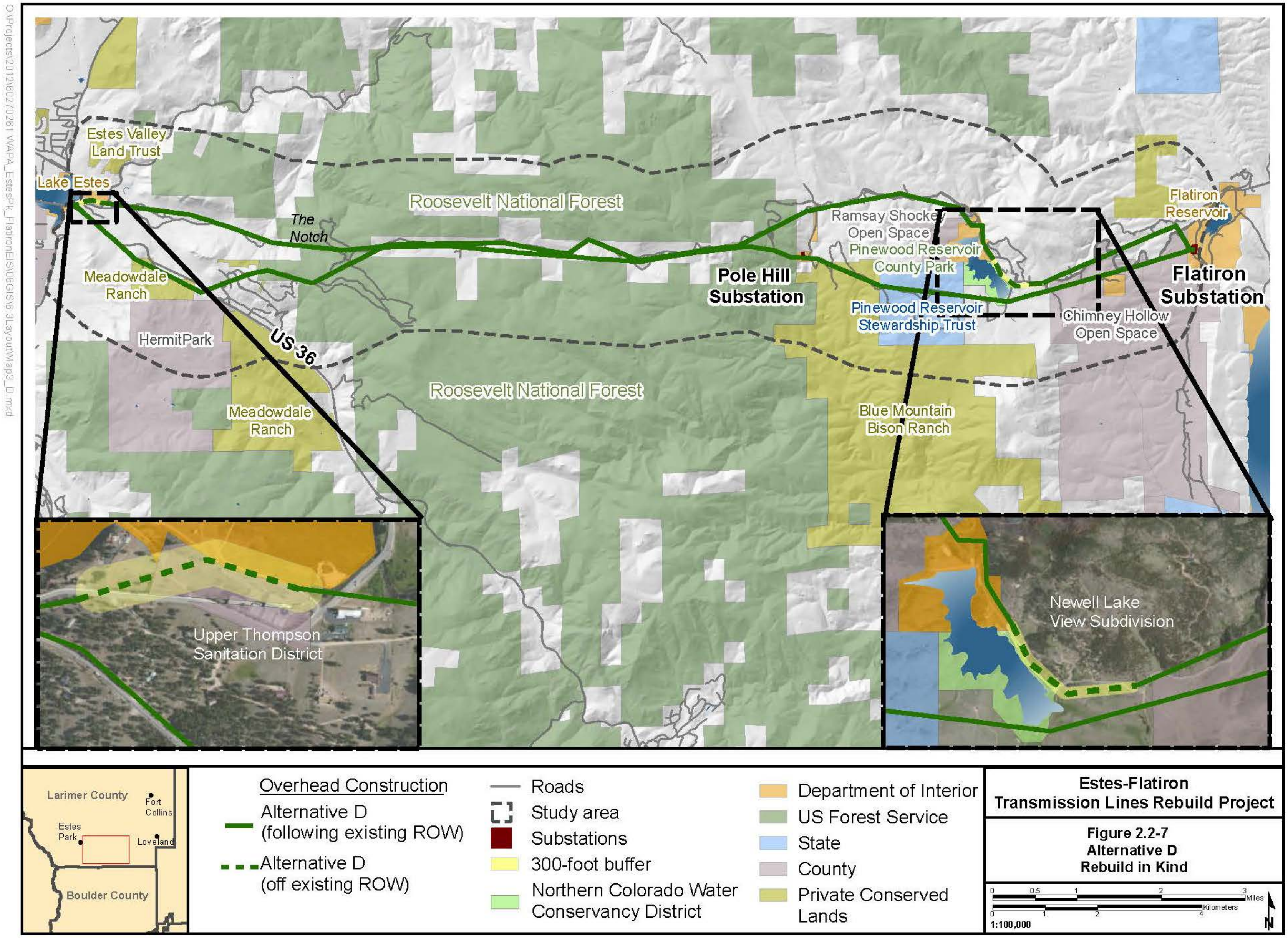
Under Variant C1, Pole Hill Road would be reconstructed on National Forest System land to level the grade, removing the challenge for four-wheel drive use. See Section 2.3.2.1 for additional information on access requirements under each of the alternatives.

2.2.1.8 Alternative D – Rebuild In-Kind

Alternative D would rebuild both the existing North and South transmission lines in-kind as single-circuit lines using structures very similar to those currently in use. See **Figure 2.2-8** and **Table 2.2-1** for information on structure design and dimensions. The existing ROWs would be expanded as needed and minor adjustments would be made to the alignments where necessary for compliance with NERC requirements. An adjustment to the alignment would occur in the vicinity of Newell Lake View subdivision where there is inadequate ROW. In order to avoid these impacts, the alignment would depart from the existing ROW near the eastern boundary of the subdivision and follow an alignment generally along Pole Hill Road, rejoining the existing ROW just north of Pinewood Lake Dam. The location of one structure on the north side of the Upper Thompson Sanitation District parcel in Estes Park also would be adjusted to accommodate expansion of their facility (**Figure 2.2-7**).

Under Alternative D, the western end of Pole Hill Road would not be improved, and the road would retain its challenge for four-wheel drive use. See Section 2.3.2.1 for additional information on access requirements under each of the alternatives.

Figure 2.2-7 Alternative D – Rebuild In-Kind



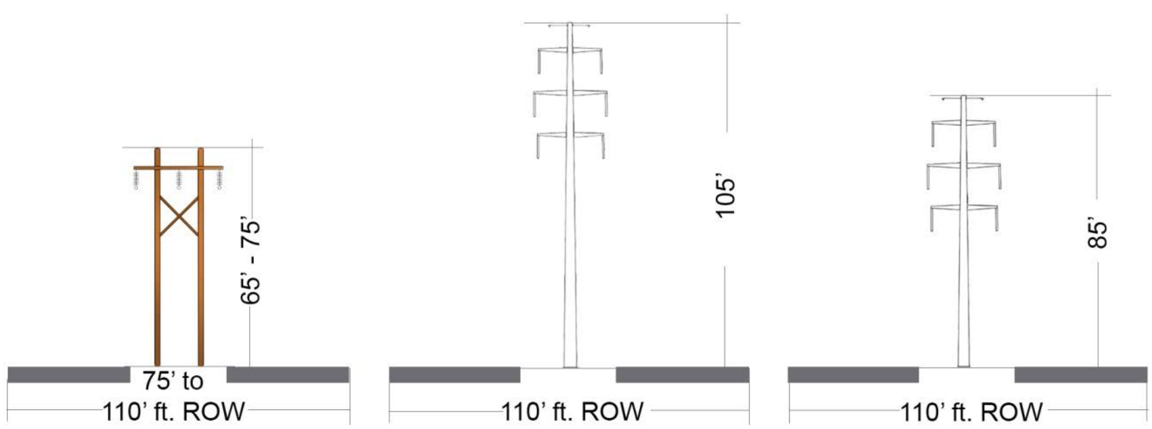
2.2.2 Description of Transmission Facilities

Figure 2.2-8 shows a typical single-circuit 115-kV wood H-frame structure, which is the structure type that is utilized along both the existing North and South Lines, and a 115-kV double-circuit steel structure. The single-pole double-circuit steel structures would replace the existing single-circuit wood structures and would be utilized for all segments of Alternatives A, B, and C; Variant A1; and overhead sections of Variants A2 and C1. The structures would be set in augered holes with an average depth of 18 feet; however, a maximum depth of up to 30 feet may be required at some locations. Structures located at a point where the alignment makes major angles would have a larger diameter and require a concrete foundation to provide additional support.

The steel pole structures would be self-weathering steel or galvanized steel. Conductor size would be increased from 397.5 Aluminum Conductor Steel-Reinforced (ACSR) to 795 ACSR. The new steel structures would average 105 feet tall, approximately 40 feet higher than the existing 65-foot-tall H-frame structures (**Table 2.2-1**). The additional height is required to accommodate the double-circuit and configuration. Structure heights would vary depending on site specific considerations. At locations where visibility from sensitive viewpoints is a major concern, structures with a shorter average height (85-foot) and shorter span length could be utilized. For example, structures with a shorter average height and span would be considered parallel to U.S. Highway 36 or adjacent to residential subdivisions, such as Park Hill, Meadowdale Hills, and/or Newell Lake View subdivisions, and on National Forest System lands. The shorter design would result in roughly twice the number of structures in a given length of ROW in order to meet required conductor clearances.

The wood H-frame structure design that would be utilized for Alternative D would be very similar to the design shown in **Figure 2.2-8**. However, the conductor size would be increased to 795 ACSR on each line, resulting in taller structures (5 to 10 feet) than those currently in use. Two groundwires, including one optical ground wire fiber optic communication line, would be added to the top of the structures to replace the existing system that would be removed by reconstruction of the two existing lines. Under the No Action alternative, the conductor would not be replaced and any poles replaced during routine maintenance of the line would be similar in appearance and dimension to the existing poles.

Figure 2.2-8 Existing 115-kV Single-circuit Wood Pole H-frame Structure and Proposed 115-kV Double-circuit Single-pole Steel Structures



115-kV Single-circuit Wood Pole H-frame Structure Alternatives D and No Action

115-kV Double-circuit Single Pole Standard Steel Structure Alternatives A, A1, A2, B, C, C1

115-kV Double-circuit Single Pole Standard Steel Short Structure Alternatives A, A1, A2, B, C, C1

Table 2.2-1 Typical Transmission Structures

Description	Alternatives A, A1, A2, B, C, and C1 115-kV Double-circuit Single-pole Standard Steel Structures	Alternatives A, A1, A2, B, C, and C1 115-kV Double-circuit Single-pole Shortened Steel Structures[1]	Alternative D 115-kV Single-circuit Wood-pole H-frame Structures
ROW width	110 feet	110 feet	110 feet
Span between structures (average)	850 feet	450 feet	600 to 700 feet
Span between structures (maximum)	1,300 feet	700 feet	1,300 feet
Number of structures (average)	6 per mile	12 per mile	8 per mile
Height of structure (average)	105 feet	85 feet	65 feet
Height of structure (typical range)	100 to 130 feet	80 to 110 feet	50 to 75 feet
Width of structure cross/davit arm	20 feet at davit arm	20 feet at davit arms	25 feet at cross arm
Width of structure at ground level	4 to 8 feet	3 to 7 feet	12 feet
Structure base area	28 square feet per structure	23 square feet per structure	3.5 square feet per pole
Land disturbed by construction at each structure base	11,350 square feet (0.26 acre) on average	11,350 square feet (0.26 acre) on average	9,500 square feet (0.22 acre) on average
Distance between conductor stringing sites	1.5 to 3 miles	1.5 to 3 miles	1.5 to 3 miles
Land disturbed at each stringing site	0.25 acre 105 feet x 105 feet	0.25 acre 105 feet x 105 feet	0.25 acre 105 feet x 105 feet
Conductor type and size	ACSR 795 kcmil	ACSR 795 kcmil	ACSR 795 kcmil
Circuit conductors configuration	Vertical	Vertical	Horizontal
Minimum ground clearance beneath conductors	22 feet	22 feet	22 feet

[1] Structures with a shorter average height and span would be considered parallel to U.S. Highway 36 or adjacent to residential subdivisions.

kcmil = thousand circular mil.

2.2.3 Comparison of ROW Lengths and Land Ownership Crossed

Table 2.2-2 provides a comparison of alternative ROW lengths and land ownership crossed by alternative ROWs.

Table 2.2-2 Comparison of Alternative Elements

Alternative	Total Length (miles)	Within Existing ROW (miles)	Within New ROW (miles)	Land Ownership Crossed (miles)					
				County	SLB	NCWCD	USFS	DOI	Private/ Other
No Action	28.6	27.6	1	2.5	1	0.2	3.8	1.0	20.0
A	15.0	12.6	2.4	0.8	-	-	1.7	0.6	12.0
Variant A1	15.1	11.4	3.7	0.6	-	-	1.7	0.6	12.0
Variant A2	15.3	11.3	4.0	0.6	-	-	1.7	0.6	12.1
B	14.8	13.8	1.0	1.6	1	0.2	2.2	0.4	9.4
C	15.5	12.1	3.4	1.8	-	0.1	2.2	1.0	10.6
Variant C1	15.7	11.7	4.0	1.8	-	0.1	2.2	1.0	10.6
D	28.6	27.6	1	2.5	1	0.2	3.8	1.0	20.0

SLB = State Land Board (Colorado), NCWCD = Northern Colorado Water Conservancy District, DOI = U.S. Department of the Interior.

2.2.4 Underground Construction

Variants A2 and C1 would build a portion of the new line underground. The locations of the underground segments are shown in **Figure 2.2-2**. The length of underground construction for Variant A2 is 2.67 miles and for Variant C1 it would be 2.74 miles.

Solid dielectric cable is the customary cable choice for new underground electric transmission lines operating at 230 kV and below. Cross-linked polyethylene cable is the proposed type for the underground Variants A2 and C1. Each transmission line circuit utilizes three separate cables, just as three bare conductors are required for aboveground transmission lines. The single duct bank required for the proposed double-circuit E-LS and E-PH transmission lines will accommodate six cross-linked polyethylene power cables, two fiber optic communications cables, and two spare conduits. PVC conduits would be set in a concrete duct bank designed to enclose and protect the conduits, and to dissipate the normal heat generated by the power cables. Installing two circuits underground in a common concrete-encased duct bank entails deep excavation using sloped trenches or trench boxes. The duct bank would be approximately 4 feet in height and 6 feet wide, located at the bottom of a 9-foot deep trench. The top of the concrete duct bank is covered with 5 feet native soil backfill (HDR 2013). Photos of typical underground construction methods are provided in **Figure 2.2-9**.

Trench dimensions would be wider and deeper in places where vaults are located. Vaults are large concrete boxes buried at specific intervals along the route centerline to provide permanent access to the conduits, for cable installation, and space for installing and securing polymer pre-molded cable splices. Separate vaults are used for each circuit. The number and spacing of vaults, required for an underground transmission line, is dictated by the length of cable that can be transported on a reel, the cable's allowable pulling tension, elevation changes along the route, and the internal cable sidewall pressure encountered as it is installed through bends in the centerline. A 115-kV cross-linked polyethylene cable requires a splice every 900 to 3,500 feet, depending on topography (Public Service Commission of Wisconsin 2011).

The conceptual design for the proposed underground transmission circuits assumes 11 separate splice vaults would be constructed for each circuit, for a total of 22 splice vaults (HDR 2013). Vault dimensions are approximately 10 by 30 feet and 10 feet high. They have two chimneys constructed with manholes which workers use to access the vault interior for cable pulling, splice installation and periodic inspection. Covers for the manholes are flush with the finished road surface or ground elevation. Vaults may be either prefabricated, and transported to the site in two pieces, or constructed onsite (HDR 2013).

Most commonly, backhoes are used to dig trenches for the duct bank and vaults. Where the transmission lines would be constructed in unpaved areas, all shrubs and trees would be cleared in the area to be trenched, approximately 25 feet each side of centerline. Jack and bore construction may be used in areas where open trench construction is prohibited by major existing features such as railroads, waterways, or other large facilities or utilities. For the route selections studied, no such obstructions are anticipated. When bedrock or subsoils primarily consisting of large boulders are encountered, blasting may be necessary. Small controlled blasts would fracture the rock, with little to no fly rock rising from the site. The blasts would create a short-term boom (less than 0.5 second), resulting in a short-term localized change in noise levels and ground vibrations. Direct impacts on wildlife from blasting could range from minor behavioral responses to change in the use of an area. There would be no measurable long-term effect on population numbers or distribution over a species range of occurrence.

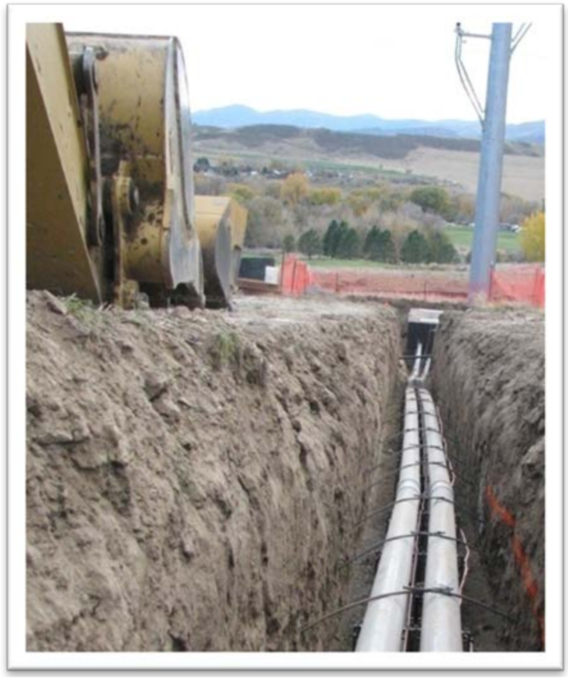
Cable pulling and splicing would occur after the duct banks and vaults are completed. A typical setup is to position the supply reel trailer at the transition structure, or at one vault and position pulling winch equipment at the next vault. Cables would be individually pulled through the duct bank between vaults, or from the transition structure to the nearest vault. Cables are usually pulled in the direction of higher elevation to lower elevation (Public Service Commission of Wisconsin 2011).

The connections between overhead and underground lines require mounting porcelain cable terminations on special single-pole steel structures, also known as transition structures. These structures would be approximately 100 feet tall and 5 feet wide at the base (HDR 2013). They would each accommodate three cable terminations, with relatively wide separations, to meet the electrical code safety requirements of the overhead line. Two transition structures are required at each termination site for the proposed double-circuit transmission line. Alternatively, cable terminations may be located in a small enclosed, secured area, again with two customary single-pole dead-end structures. This approach would reduce the visibility of the cable terminations and yield simpler construction and inspection access.

Site restoration for underground construction is similar to overhead transmission line construction restoration. Disturbed areas would be restored with top soils that were excavated and stockpiled during construction or with new topsoil. Permanent surface monuments would be installed to mark the easement centerline, and to document the presence of the duct bank beneath. Any infrastructure impacted by the construction project such as roadways, driveways, curbs, and private utilities would be restored to their previous function, and yards and pastures vegetated as specified in landowner easements. Post-construction, trees and large shrubs would not be allowed within a 75-foot ROW for underground sections of the line. Some herbaceous vegetation and agricultural crops may be allowed to return to the ROW.

Figure 2.2-9 Examples of Underground Transmission Line Construction

230-kV duct bank under construction, Longmont, Colorado



115-kV duct and termination structure in open space in Jefferson County, Colorado

Exposed sections of conduits, duct bank, and backfill constructed for 230-kV in Longmont

Interior of a vault, before cable installation, for 230-kV transmission line in Denver

2.3 Activities Common to All Action Alternatives

This section describes those activities that would occur with any of the action alternatives, though each alternative would have some differences based on the site specific conditions encountered, e.g., the type of terrain crossed, vegetation types, and availability of existing access roads. Conventional, aboveground construction methods would be used exclusively under Alternatives A, B, C, D, and Variant A1, and would be used in combination with underground construction methods under Variants A2 and C1. Western would take only one line circuit out of service at a time to maintain electrical service during construction and also would keep the fiber optic communications system in service.

The transmission line ROW would be surveyed along its centerline. The survey data would be used during design to determine structure locations and heights needed to meet the transmission line design criteria for conductor clearances.

Standard construction practices (SCPs) would be employed to minimize potential adverse effects during construction activities (see Section 2.5, Standard Construction Practices).

Western's standard construction specification requires the construction contractor to have a Safety and Health Program and to take necessary precautions to protect the safety and health of employees and members of the public, and to prevent damage to public and private property. Prior to the start of construction, the construction contractor would be required to submit its Safety and Health Program to Western for approval. At a minimum, the Safety and Health Program would be required to include designation of an on-site superintendent, safety and health policy statements, provisions for first aid and medical care of any injured employees, provisions for employee training, fire protection, health and sanitation facilities, procedures for specific sequences of work to ensure adequate activity hazard analysis, provisions for use of personal protection equipment, procedures for protecting the public, company policy and procedures for enforcing safety and health regulations, procedures required by Occupational Safety and Health Administration (OSHA) 1926, Subpart D (Occupational Health and Environmental Controls), inspection program, fall protection policy and program, and provisions for line-clearance tree trimming operations per OSHA 1910.269.

The construction contractor would be required to keep roads open without unreasonable delays and to provide and maintain suitable detours. Protection of the public would be provided as required by OSHA 1926, Subpart G, "Signs, Signals, and Barricades," and by the public agency having law enforcement jurisdiction for the roadway.

2.3.1 Acquisition of Land Rights

To access, construct, and maintain the proposed project, Western would need to obtain easements for some segments of the transmission lines or access roads. In order to select specific structure locations, a combination of aerial and land surveys, environmental and engineering field studies, and geologic investigations would be necessary, and Western would request landowner permission prior to entering areas where it does not have an existing easement. Western would select final sites to minimize effects to the properties crossed and to satisfy design criteria, such as maintaining adequate conductor-to-ground clearance. Western would compensate for or repair damage to fences, or other property caused by the surveys and studies.

Western would negotiate and purchase necessary easements from landowners under Federal property acquisition guidelines (the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 and its regulations, located at 42 U.S.C. § 4601 et seq. and 49 CFR Part 24). A qualified real estate appraiser would appraise the easement at fair market value. The appraiser would determine the value of the easement using customary appraisal methods, including analysis of available market data and comparable sales, and by taking into consideration the rights being acquired from the landowner. The appraiser would invite the landowner(s) to accompany him/her during the property inspection. Landowners could then identify any property features and uses believed to be of importance in determining the value of the easement. Western would present landowners with a written offer and a contract to purchase the required easements. Western's realty specialist would explain the contract and discuss the basis for payment. Once the conditions of the agreement are met, the transaction would be processed as efficiently as possible. Western would make full payment for easements to landowners, and would pay for any title insurance and all recording fees.

If Western and a landowner are unable to agree on purchase of an easement, Federal and state laws enable Western to acquire property rights for facilities to be built in the public interest through eminent domain proceedings. During the proceedings, a court would determine the compensation that Western would pay to the landowner.

When construction on a particular ROW is ready to begin, Western would advise the landowner(s) of the construction schedule. Western would make reasonable attempts to take into account the use and condition of the land to minimize any inconvenience. Western would compensate landowners for crop and property damage that occurs as a result of construction or maintenance of the transmission line. If a landowner believes that damage has occurred and has not been recognized, he or she could contact the Western realty specialist.

The landowner would retain title to the land over which Western's easement crosses, and would be able to continue using that land for activities that do not interfere with Western's use of the ROW. These uses may include parking, cultivation, and livestock grazing, among others. Activities typically not permitted in transmission line ROWs are those that reduce ground-to-line clearance, interfere with access to the line for maintenance, or jeopardize the integrity of the support structures. Buildings and structures may not be erected in the ROW because they could impede the safe operation of the transmission line or interfere with access for maintenance. For safety reasons, equipment that can extend higher than 14 feet, such as dump trucks, cranes, derricks, bale wagons, and stack movers, should not be used around transmission towers and lines (per NESC guidelines). Likewise, pumps, wells, and flammables must not be placed in a ROW. Properly grounded and permitted fences are acceptable as long as adequate gates for access have been installed.

2.3.2 Access

Regardless of the alternative selected, Western would need access to each structure site to construct and maintain the new transmission line and/or remove existing line. Western would utilize existing access that was developed during the construction of the existing lines to the extent possible. Where existing access is inadequate for line removal or new construction, Western would need to establish new access from the nearest existing road or spur road to each structure site.

At some locations where there are existing roads, improvements may be needed to provide the necessary degree of access. Western would reconstruct or recondition roads only to the extent that it is necessary to provide access for construction equipment. Native material would be the primary source of road fill needed. Aggregate would be used only when needed to reduce further impacts to the road prism or as called for by specific engineering activities (i.e., for culvert installations).

It should be noted that new structures would not be specifically sited until the transmission line is designed following completion of the EIS and issuance of a ROD. Once new structure sites are identified, Western would consult with landowners and the USFS on the location of new access routes needed for construction and maintenance. Western would conduct cultural and biological surveys along the access routes identified, and document the results in reports. Western would only authorize construction of a new access routes following receipt of appropriate USFS, State Historic Preservation Office (SHPO), and USFWS approvals or concurrences.

In order to minimize road building, Western would consider overland access where topography, soil, and vegetation conditions support overland travel with minimum disturbance and compaction. In most cases, where slopes are less than 15 percent, Western would not need to establish new access roads. Instead, access would be by travel within the ROW from the closest existing access road or spur road, resulting in temporary disturbances. Western would expect vegetation to recover quickly at these locations because it would not be graded or cleared.

For alternatives that propose to consolidate ROWs (Alternatives A, B, and C, and the variants), permanent access would be needed on the ROW where the consolidated double-circuit transmission line would be rebuilt; only temporary access would be required to remove the existing single-circuit line from the ROW that would be abandoned. In areas with steep and rough slopes, temporary access to structures that need to be removed would be accomplished by foot, tracked vehicle, or all-terrain vehicle (ATV). Alternative D would rebuild single-circuit lines on both existing ROWs, and permanent access would be needed to each structure on both the North and South Lines.

Table 2.3-1 provides estimates of the lengths of temporary and permanent access improvements needed for removal of the existing line and new construction under each of the action alternatives.

Table 2.3-1 Temporary and Permanent Access Requirements by Alternative

Access Type*	A	A1	A2	B	C	C1	D
Temporary access for decommissioning the existing line only (miles)	7.1	7.1	7.1	7.1	8.2	8.2	0.1
Permanent access for long-term maintenance of rebuilt line (miles)	5.6	5.7	5.9	6.8	5.5	4.8	11.3

*Estimated mileage is for access spurs from existing state, county, private, or USFS roads.

2.3.2.1 Access Requirements on National Forest System Land

National Forest Service Roads

USFS roads that provide access to Western's existing ROWs are all classified as Maintenance Level 2 (ML2). ML2 is assigned to roads open for use by high clearance vehicles where passenger car use is not considered. No change in classification is proposed for any USFS road. However, under Alternative C and Variant C1, Western proposes to reconstruct sections of USFS Roads 122 and 247.D, to allow for passage of semi-trailer trucks to structure locations. Under this alternative, grinding, chipping, or blasting could be used to level the grade on the west end of Pole Hill Road. Use of imported aggregate would be limited and would be used only when needed to achieve proper grades for haul. Alternatives A, B, and D and Variants A1 and A2 propose either no improvements to USFS roads or limited reconditioning to remove ruts post-construction. Western's SCPs would be applied as appropriate.

The miles of USFS road where road reconstruction or limited road reconditioning is proposed, is summarized by alternative in **Table 2.3-2**.

Table 2.3-2 National Forest Service Road Reconstruction or Reconditioning

Road Category	A, A1, & A2	B	C & C1	D
Unimproved system road (miles)	1.4	0.4	0.0	0.4
Limited reconditioning of existing ML2 system road post-construction (miles)	2.2	3.2	0.2	3.2
Reconstruction of existing ML2 system road for construction (miles)	0	0	3.4	0

Permanent Access

Permanent access between USFS roads and structure sites is needed to access the rebuilt line on either one ROW (Alternatives A, B, C, and variants) or two ROWs (Alternative D). The roads Western currently use for access to the transmission lines would continue to be used to the extent feasible. Where existing access is inadequate, new permanent access roads are proposed. Permanent access roads are proposed to be classified as Maintenance Level 2 and Traffic Service Level “C.” Western would recondition/reconstruct roads only to the extent that it is necessary to provide access for construction and maintenance equipment. The proposed designation is for administrative use only. During the design phase, Western would consult with the USFS on access road alignments and conduct biological and cultural surveys for any new roads not previously surveyed.

Temporary Access

Temporary access for line decommissioning would utilize Western's existing access roads, new temporary access roads, existing non-system two-track, and overland travel, as needed for each of the alternatives. New temporary access roads would have a design width of 8 feet. Western would construct temporary access roads to the extent that it is necessary to provide access for four-wheel drive trucks. Once implementation is complete these temporary access roads would be obliterated and revegetated as needed.

Road Decommissioning

Alternatives A, B, C, and the variants propose to rebuild the transmission line as a double-circuit line on one of two existing ROWs. The other ROW would be decommissioned by removing structures, insulator bundles and crossarms, and conductors, and revegetating the ROW as needed. Once the ROW is decommissioned, Western's existing or temporary access to that ROW on National Forest System land also would be decommissioned. Access decommissioning may consist of providing for proper drainage and allowing the access route to naturally revegetate, or involve more active restoration methods such as scarification and reseeding, depending on local site conditions.

Access by Alternative

The miles of permanent and temporary access on National Forest System lands for line removal and new construction under each of the action alternatives and variants are summarized in **Table 2.3-3** below.

Table 2.3-3 Access on National Forest System Lands by Alternative

Road Category	A, A1, & A2	B	C & C1	D
Permanent Access (Administrative Designation)				
Existing Western access designated for administrative use	0.4	0.2	0.2	0.6
New administrative road for permanent access	0.9	0.6	0.6	1.9
Temporary Access				
New temporary road for line decommissioning	0.4	0.9	0.9	0.0
Temporary access by non-system two-track	0.6	0.5	0.5	0.0
Temporary access by overland travel	0.3	0.3	0.3	0.0
Decommissioning				
Existing Western access to be decommissioned	0.2	0.3	0.3	0.0

2.3.3 Construction Staging Areas

Existing substations and their immediate surroundings would be used to the extent possible for equipment staging, material laydown, and storage facilities. Additionally, Western anticipates that two 62,500–square-foot temporary staging areas (approximately 3 acres, combined) would be necessary to support implementation of any action alternative. The location of staging areas would be determined by the construction contractor during the construction phase; staging areas would be sited in accordance with Western's SCPs (**Table 2.5-1**) and would be located at sites previously disturbed where practical. Existing or portable concrete batch plants would be used to supply poured concrete for foundations for transmission line structures. In accordance with the SCPs, staging areas would be surveyed, as necessary, for cultural and other resources prior to disturbance.

2.3.4 Existing Line Removal

The construction contractor would determine how to remove existing structures. Landowners would be consulted to determine if structures would be cut off below ground level or completely removed. Generally, structures would be lowered to the ground and stripped of hardware, arms, and braces. The conductor would be removed and coiled up prior to "laying" down existing structures or coiled up after the structures have been removed from the ROW. Pulling sites may be needed to pull the conductors. The construction contractor would have the option to remove guy anchors or cut them off 30 inches below ground level. In areas with steep topography or poor access, wood-pole structures may be left in place, removed by dragging with a drag line, or removed by other means. If poles are left in place, they would be flush cut at the ground and left on-site in the ROW in long sections.

Construction waste materials would be collected, hauled away, and recycled or disposed of at approved sites. Often old utility poles are offered to landowners for their use. All disturbed areas not returned to agricultural cultivation would be reseeded to minimize erosion and the invasion of noxious weeds. All disturbance areas would be restored to their original condition as feasible. Damaged roads, gates, fences, or landscaping would be repaired.

The contractor would be required to prepare and implement a safety program in compliance with appropriate Federal, state, and local safety standards and requirements, and as approved by Western.

2.3.5 Clearing and Grading

Crews would remove trees and shrubs from the structure location and along the ROW, as necessary, to provide access for construction equipment and activities. Methods for vegetation clearing and debris disposal are described in detail in **Appendix B**. Vegetation removal for ROW maintenance is described in Section 2.6.1.

2.3.6 Structure and Conductor Installation

Direct embedded single-pole steel structures are proposed for Alternative A, Variant A1, and Alternatives B and C. A truck-mounted or track-mounted auger would be used to excavate holes for the structures. The steel poles would be assembled at the pole sites, or portions of the poles may be assembled at the staging areas and then hauled to the sites. The structures would be lifted into place with cranes or helicopter and held in place while concrete trucks backfill the excavation, filling the hole around the structure.

If site conditions or design requirements indicate a need, single-pole structures that bolt to a foundation would be used. The foundations are constructed by installing rebar cages and anchor bolt cages in the excavated holes. Concrete would then be poured into the formed foundation to secure these cages in place. The fully assembled steel poles would then be bolted to the foundation anchor bolts. Excess soil would be spread evenly around the base of the poles and revegetated or removed from the site.

For Alternative D, which involves wood pole structure replacement, holes would be augered for new structure poles. Approximately 10 percent of the total structure height plus an additional 2 feet of each structure would be placed underground (e.g., a 70-foot-tall structure would have approximately 9 feet underground). Construction crews would assemble new structures within the ROW, and then position the structures into augered holes using cranes. Dirt from the excavations would be used to backfill around the new poles and to fill in the holes from the removed structures. Excess dirt would be spread near the pole and leveled with existing topography.

Assembly of transmission line structures would occur on site where insulators, braces, and other equipment would be attached to the structures while they are still on the ground. Boom trucks and cranes would be used to raise the structures into foundation bore holes for structures.

The proposed project would require level sites approximately every 2 to 3 miles along the transmission line to house reels of transmission cable and to serve as staging areas for wire-pulling. Western would try to avoid locations that require grading or removal of vegetation. The conductor pulling, sagging, and clipping operations would take place once the structures are in place. The conductor would not touch the ground during stringing or tensioning. Pulleys would be attached to the insulators to string the conductors, which then would be pulled to the appropriate tension. Contractors would use either a ground vehicle or helicopter to install the pulling cable. Where necessary, traffic would be slowed or alerted while activities are occurring that could affect public safety.

Conductor pulling is limited by reel size; typically, a conductor of this diameter can be loaded onto reels in 10,000-15,000-foot segments. Most disturbance during this phase of construction would occur within the existing or expanded ROW. However, at some locations (e.g., at pulling and tensioning sites near an angle in the alignment) areas outside the ROW may be disturbed during construction.

2.3.7 Site Cleanup and Restoration

Crews would remove debris and other materials from construction sites following construction and dispose of it in a certified private, public, or construction and demolition landfill, as appropriate. Where appropriate, usually areas with compactive soil types or where compaction would cause a problem, crews would loosen and level disturbed soil areas with harrowing or disking to approximate preconstruction contours. Ruts and scars that would interfere with overland travel would be filled or recontoured. Disturbed areas would be reseeded and mulched, as needed, using an approved mix as soon as practical after construction activities are completed in any given area. On National Forest System lands, an approved seed mix would be used for restoration. In some areas, mulching, netting, or turf reinforcement mats may be necessary to protect seeded areas from erosion. If used, mulching would consist of weed-free hay or other approved material. Periodically, crews would monitor revegetated areas to determine that coverage is adequate. Areas may be reseeded, as necessary, to establish cover.

Drainage structures and other improvements not needed for permanent maintenance of the transmission lines would be removed. Similarly, access roads or trails that are not needed for ongoing maintenance access would be blocked and reclaimed, as negotiated with the public or private land managers.

2.3.8 Workforce

The workforce would be a combination of local labor acquired by contractors, and a mobile labor workforce that specializes in transmission line construction and temporarily relocates to the area where the work necessitates. Construction would be accomplished by two or three crews of five to six persons each.

2.3.9 Construction Sequencing

The transmission line rebuild is expected to take eight to twelve months to construct, depending on which alternative is selected. **Table 2.3-4** lists the typical sequence of construction activities for overhead transmission line and the equipment needed for each task. Photos of typical overhead construction methods are provided in **Figure 2.3-1**. Underground construction methods applicable to Variant A2 and Variant C1 are described in Section 2.2.4.

Table 2.3-4 Construction Activities and Equipment

Task	Equipment
Surveying	Utility vehicles, pickups, ATVs
Access	Graders, caterpillars, dump trucks, water trucks
ROW Clearing	Brush hogs, mowers, chain saws, skidders, bulldozers
Staging	Flatbeds with cranes, delivery trucks, pickups
Excavation	Backhoes, rotary drilling rigs, augers, cement mixers, pickups, ATVs, portable compressors
Structure Assembly	Cranes, material trucks, carryalls, pickups
Structure Placement	Cranes, boom trucks, pickups, semi-trailer trucks, helicopters
Cable Pulling	Boom trucks/man lifts, reel trailers, hydraulic tensioning equipment, pickups, helicopters
Cleanup	Flatbeds, dump trucks, pickups
Restoration	Seeding equipment, hand-seeding equipment, caterpillars, backhoes, flatbeds, pickups

2.3.10 Construction Disturbance and Monitoring

During construction, a construction inspector (Western employee or hired independent contractor) would be present in the field to ensure implementation of SCPs and project-specific design criteria (Section 2.5). An estimate of short-term disturbance areas associated with transmission line construction and access routes are provided in **Tables 2.3-5** and **2.3-6** below. Long-term disturbance for structure bases would be less than 0.1 acre for any alternative.

Table 2.3-5 Summary of Short-Term Disturbance for Transmission Line Construction by Alternative

		Short-term Disturbance by Alternative (acres)					
Project Component	**Disturbance Area**	**A/A1**	**A2**	**B**	**C**	**C1**	**D**
Structure installation	11,350 square feet per structure	18 - 24	15 - 20	20 - 26	19 - 25	15 - 21	56 - 65
Conductor stringing sites	0.25 acre per site	1 - 3	1 - 2	1 - 3	1 - 3	1 - 2	2 - 5
Staging areas	2-3 sites; 5 acres per site	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15	10 - 15
Removal of existing H-frame structures	9,500 square feet per structure	45	44	45	45	44	41
Pulling sites for line removal	0.25 acre per site	1 - 3	1 - 2	1 - 3	1 - 3	1 - 2	2 - 5
Underground construction	9 acres per mile	NA	24	NA	NA	25	NA
Total		75 - 90	95 - 108	77 - 92	75 - 90	96 - 108	112 -132

NA = not applicable.

Table 2.3-6 Summary of Short-Term and Long-Term Surface Disturbance for Access Routes

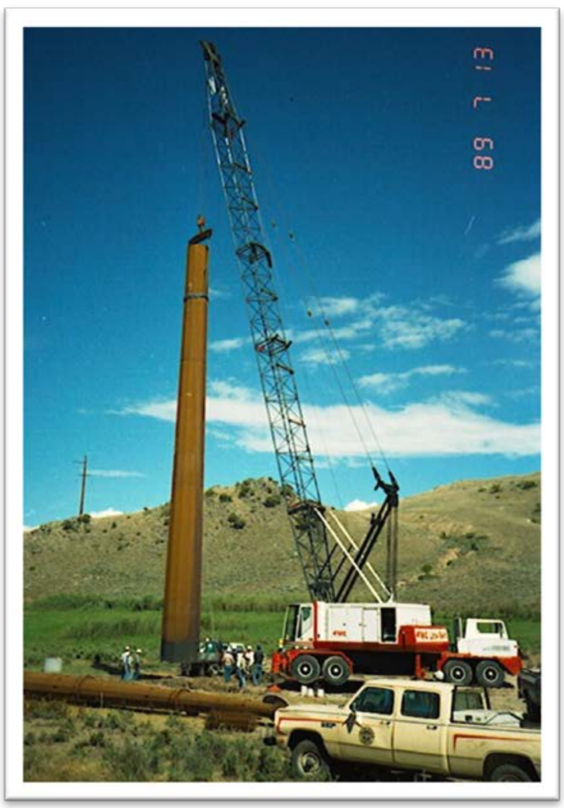
Disturbance Type	A	A1	A2	B	C	C1	D
Short-term disturbance for temporary access (acres)	7	7	7	7	8	8	0
Long-term disturbance for permanent access (acres)	10	10	11	13	10	9	21

* Assumes 8-foot-wide access route for temporary access and 15-foot-wide access route for permanent access.

Figure 2.3-1 Examples of Overhead Transmission Line Construction

Hauling structure on an access road

Auger drilling for structure base



Setting a structure base

Setting the top of a structure

2.4 Comparison of Alternative Costs

A comparison of rough order magnitude life-cycle costs for the seven end-to-end alternatives is provided in **Table 2.4-1** below. Estimated construction costs take into account the terrain, construction difficulty, length of line, and escalation for projected construction date. Estimated construction costs do not include costs for planning, lands and rights, environmental surveys and compliance, geologic investigations, designs and specifications, or construction supervision. The number of acres of land to be acquired for new or expanded ROWs is estimated as follows: Alternative A (153 acres); Variant A1 (157 acres); Variant A2 (152 acres); Alternative B (42 acres); Alternative C (117 acres); Variant C1 (110 acres); and Alternative D (177 acres). Land acquisition costs in **Table 2.4-1** are based on a market analysis completed by Western to determine landowner compensation and land acquisition costs, including: acquisition labor costs, surveys, legal review, title policies, appraisals, and possible condemnations.

Table 2.4-1 Preliminary Transmission Line Cost Estimates by Alternative[1,2]

	Alternative ($ millions)						
	A	**A1**	**A2**	**B**	**C**	**C1**	**D**
80-year construction cost	19.7	19.2	37.9	23.1	19.1	39.6	22.7
80-year maintenance cost	1.3	1.3	1.2	1.4	1.3	1.1	1.1
80-year vegetation management cost	1.6	1.6	1.4	1.8	1.7	1.4	3.2
Total 80-year life cycle cost	22.6	22.1	39.5	26.3	22.1	42.2	27.0
Easement acquisition cost	1.6	1.3	1.3	0.4	0.8	1.0	1.8
Total	24.2	23.4	40.8	26.7	22.9	43.1	28.8

1 Overhead transmission line costs for Alternative D includes replacement costs after 40 years due to use of wood structures.

2 Underground cost estimates include replacement cost of the dielectric cables after 40 years.

2.5 Standard Construction Practices

Western has SCPs, including standard operation and maintenance practices that avoid or minimize impacts to the environment to the greatest extent practicable. Design criteria are actions or measures integrated into the project design to avoid, minimize, reduce, or eliminate adverse effects as a result of implementing the action alternatives. For the Estes-Flatiron transmission lines rebuild, Western's SCPs identified in **Table 2.5-1** would be implemented for the construction of any action alternative. These measures are part of Western's proposed project and are considered in this EIS. Maintenance activities under the no action alternative may be performed by a Western maintenance crew, rather than by a construction contractor; however, SCPs would still apply.

Table 2.5-1 Western's Standard Construction Practices

Ref. #	Standard Construction Practices
SCP 1	The contractor shall limit the movement of its crews and equipment to the ROW, including access routes. The contractor shall limit movement on the ROW to minimize damage to grazing land, crops, or property, and shall avoid unnecessary land disturbance.
SCP 2	When weather and ground conditions permit, the contractor shall obliterate contractor-caused deep ruts that are hazardous to farming operations and to movement of equipment. Such ruts shall be leveled, filled, and graded, or otherwise eliminated in an approved manner. In hay meadows, alfalfa fields, pastures, and cultivated productive lands, ruts, scars, and compacted soils shall have the soil loosened and leveled by scarifying, harrowing, discing, or other approved methods. Damage to ditches, tile drains, terraces, roads, and other features of the land shall be corrected. Before final acceptance of the work in these agricultural areas, ruts shall be obliterated, and trails and areas that are hard-packed as a result of contractor operations shall be loosened, leveled, and reseeded. The land and facilities shall be restored as nearly as practicable to their original conditions.
SCP 3	Water bars or small terraces shall be constructed across ROW and access roads when needed to prevent water erosion and to facilitate natural revegetation.
SCP 4	The contractor shall comply with applicable Federal, state, and local environmental laws, orders, and regulations. Prior to construction, supervisory construction personnel and heavy equipment operators will be instructed on the protection of cultural and ecological resources.
SCP 5	The contractor shall exercise care to preserve the natural landscape, and shall conduct its construction operations to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, construction roads, or excavation operations, trees, native shrubbery, and vegetation shall be preserved and shall be protected from damage by the contractor's construction operations and equipment. To the extent practicable considering the need to protect transmission lines from encroaching vegetation and vegetation hazards (especially trees) edges of clearings and cuts through tree, shrubbery, or other vegetation would be irregularly shaped to soften the visual impact of straight lines within the ROW.
SCP 6	On completion of the work, work areas shall be scarified or left in a condition that would facilitate natural revegetation, provide for proper drainage, and prevent erosion. The contractor would repair damages resulting from the contractor's operations. Newly created access roads will be left to revegetate to height that still allows vehicle passage.
SCP 7	Construction staging areas shall be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent. Staging areas will not be placed within wetlands, including fen wetlands, riparian communities, or in proximity to surface waters. On abandonment, storage and construction buildings, including concrete footings and slabs, and construction materials and debris shall be removed from the site. The area shall be regraded as required so that surfaces drain naturally, blend with the natural terrain, and are left in a condition that will facilitate natural revegetation, provide for proper drainage, and prevent erosion.
SCP 8	Borrow pits shall be excavated so that water will not collect and stand. Before being abandoned, the sides of borrow pits shall be brought to stable slopes, with slope intersections shaped to carry the natural contour of adjacent undisturbed terrain into the pit or borrow area, giving a natural appearance. Waste piles shall be shaped to provide a natural appearance. No waste piles will occur on National Forest System lands.

Ref. #	Standard Construction Practices
SCP 9	Construction activities shall be performed by methods that will prevent entrance, or accidental spillage, of solid matter contaminants, debris, other objectionable pollutants and wastes into streams, flowing or dry watercourses, lakes, and underground water sources. Pollutants and waste include, but are not restricted to refuse, garbage, cement, concrete, sanitary waste, industrial waste, oil and other petroleum products, aggregate processing tailing, mineral salts, and thermal pollution.
SCP 10	Dewatering work for structure foundations or earthwork operations adjacent to, or encroaching on, streams or watercourses, shall be conducted in a manner to prevent muddy water and eroded materials from entering the streams or watercourses by construction of intercepting ditches, bypass channels, barriers, settling ponds, or by other approved means. Dewatering shall comply with applicable state requirements.
SCP 11	Excavated material or other construction materials shall not be stockpiled or deposited near or on stream banks, lake shorelines, or other watercourse perimeters where they can be washed away by high water or storm runoff, or can encroach upon the actual watercourse itself.
SCP 12	Waste waters from construction operations shall not enter streams, watercourses, or other surface waters without the appropriate permits and proper implementation of applicable permit conditions, including but not limited to use of turbidity control methods as settling ponds, gravel-filter entrapment dikes, approved flocculating processes, or other approved methods. Waste waters discharged into surface waters shall be essentially free of settleable material. For the purpose of these practices, settleable material is defined as material that will settle from the water by gravity during a 1-hour quiescent detention period.
SCP 13	The contractor shall use practicable methods and devices that are reasonably available to control, prevent, and otherwise minimize discharges of air contaminants.
SCP 14	The emission of dust into the air will not be permitted during the handling and storage of concrete aggregate, and the contractor shall use methods and equipment as necessary for the collection and disposal, or prevention, of dust. The contractor's methods of storing and handling cement and pozzolans shall include means of controlling air discharges of dust.
SCP 15	Equipment and vehicles that show excessive emissions of exhaust gases due to poor engine adjustments, or inefficient operating conditions, shall not be operated until repairs or adjustments are made.
SCP 16	The contractor shall prevent nuisance to persons or damage to crops, cultivated fields, and dwellings from dust originating from his operations. Oil and other petroleum derivatives shall not be used for dust control. Speed limits shall be enforced, based on road conditions, to reduce dust problems.
SCP 17	To avoid nuisance conditions due to construction noise, internal combustion engines shall be fitted with an approved muffler and spark arrester.
SCP 18	Burning or burying waste materials on the ROW or at the construction site will be permitted if allowed by local regulations. The contractor shall remove all other waste materials from the construction area. All materials resulting from the contractor's clearing operations shall be removed from the ROW. No waste materials can be buried on National Forest System lands.
SCP 19	The contractor shall make necessary provisions in conformance with safety requirements for maintaining the flow of public traffic, and shall conduct its construction operations to offer the least possible obstruction and inconvenience to public traffic.
SCP 20	Western will apply necessary mitigation to eliminate problems of induced currents and voltages onto conductive objects sharing a ROW, to the mutual satisfaction of the parties involved.

Ref. #	Standard Construction Practices
SCP 21	Structures will be carefully located to avoid sensitive vegetative conditions, including wetlands. If roads would cross wetlands, crossings occur at a feasible location for the construction contractor and in an area where the least amount of damage would occur to the wetland community. If necessary, Western would obtain the appropriate permits from the USACE.
SCP 22	No disturbance of vegetation will occur within 100 feet of a stream, except for hazard trees. No fueling, staging or storage areas would be placed within 100 feet of wetlands, streams or riparian areas. Where possible, vehicles should avoid crossing hydric soils.
SCP 25*	Disturbed areas not needed for maintenance access will be reseeded using mixes approved by the land management agency.
SCP 26	Erosion control measures will be implemented on disturbed areas, including areas that must be used for maintenance operations (access ways and areas around structures).
SCP 27	The minimum area will be used for access ways (generally 12 to 16 feet wide, except where roadless construction is used).
SCP 28	Leveling and benching of structure sites will be the minimum necessary to allow structure assembly, erection, and maintenance.
SCP 29	ROW will be located to use the least steep terrain.
SCP 30	Careful structure location will ensure spanning of narrow flood prone areas.
SCP 31	Structures will not be sited on potentially active faults.
SCP 32	Structure sites and other disturbed areas will be located at least 100 feet, where practical, from rivers, streams (including ephemeral streams), ponds, lakes, and reservoirs.
SCP 33	New access ways will be located at least 100 feet, where practical, from rivers, ponds, lakes, and reservoirs.
SCP 34	At crossings of perennial streams by new access ways, culverts of adequate size to accommodate the estimated peak flow of the stream will be installed. Construction areas will minimize disturbance of the stream banks and beds during construction. The mitigation measures listed for soil/vegetation resources will be performed on areas disturbed during culvert construction.
SCP 35	If the banks of ephemeral stream crossings are sufficiently high and steep that breaking them down for a crossing would cause excessive disturbance, culverts will be installed using the same measures as for culverts on perennial streams, and the applicable USACE permits would be obtained.
SCP 37*	Power line structures will be located, where practical, to span small occurrences of sensitive land uses, such as cultivated areas. Where practicable, construction access ways will be located to avoid sensitive conditions.
SCP 38	ROW will be purchased at fair market value and payment will be made of full value for crop damages or other property damage during construction or maintenance.
SCP 39	The power line will be designed to minimize noise and other effects from energized conductors.
SCP 42*	Before construction, Western will perform a Class III (pedestrian) cultural survey on areas to be disturbed, including structure sites and new access ways. These surveys will be coordinated with the appropriate landowner or land management agency, the SHPO and Indian tribe if on tribal lands. The survey reports and recommendations will be reviewed with the SHPOs and other appropriate agencies. Western's Standard Operating Procedure is to avoid all culturally sensitive sites. If not possible, specific mitigation measures necessary for each site or resource will be determined. Mitigation may include careful relocation of access ways, structure sites, and other disturbed areas to avoid cultural sites that should not be disturbed, or data recovery.

Ref. #	Standard Construction Practices
SCP 43	The contractor will be informed of the need to cease work in the location if cultural resource items are discovered.
SCP 44	Construction activities will be monitored or sites flagged to prevent inadvertent destruction of cultural resource for which the agreed mitigation was avoidance.
SCP 45	Construction crews will be monitored to the extent possible to prevent vandalism or unauthorized removal or disturbance of cultural artifacts or materials from sites where the agreed mitigation was avoidance.
SCP 46	If cultural resources that were not discovered during the Class III survey are encountered during construction, ground disturbance activities at that location will be suspended until the provisions of the NHPA have been carried out.
SCP 47	Construction activities will be monitored or significant locations flagged to prevent inadvertent destruction of paleontological resource for which the agreed mitigation was avoidance.
SCP 48	Clearing for the access road will be limited to that necessary to permit the passage of equipment, and the safe construction, operation and maintenance of the line.
SCP 49	The access road will follow the lay of the land rather than a straight line along the ROW where steep topography would result in a higher disturbance.

*Western's SCPs 23, 24, 36, 40, and 41 are not applicable to this project and are not included in this table.

2.5.1 Project-Specific Design Criteria

The design criteria below were developed to minimize or avoid impacts to avian species and minimize visual effects of vegetation management. The following project-specific design criteria apply to all action alternatives:

2.5.1.1 Avian Wildlife

- Western will design and construct the transmission line in conformance with the Suggested Practices for Avian Protection on Power Lines (Avian Power Line Interaction Committee [APLIC] 2006).
- The siting of structure locations and/or timing of construction related activities will adhere to Colorado Parks and Wildlife (CPW) 2008 *Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors*. When distance buffers are not possible because of project proximity, then seasonal restrictions will be implemented.
- Avian nesting surveys will be conducted prior to construction to ensure ground disturbing activities do not result in the "take" of an active nest or migratory bird protected under the MBTA. If construction occurs during the avian breeding season (roughly between March 15 and September 1), surveys will be conducted no earlier than 72 hours prior to any ground disturbing activities to ensure the proposed project complies with the MBTA.

2.5.1.2 Visual Resources

- Clumps or islands of trees will be left in openings created by danger tree removal (where sagging lines and ground clearance are not a concern) to break sight distance and to maintain natural-appearing landscape mosaic pattern.
- Western will limit the use of foliar application of herbicide to reduce creation of large areas of browned vegetation.
- At road crossings, highway or visual overlooks, Western will leave sufficient vegetation, where possible to screen views of the ROW.

- If an area is visually very sensitive, Western will: (1) soften the straight line of ROW edges by cutting some additional trees outside the ROW during initial construction (with landowner permission); and/or (2) if possible, leave some low-growing trees within the ROW; and/or (3) implement a less-aggressive treatment of the ROW and ensure a higher frequency of monitoring vegetation conditions and scheduling re-treatments when needed.
- Western will treat unnatural-appearing soil disturbances by smoothing piles of soil created by machinery or any other soil disturbance from machine piling within 100 feet of areas requiring Partial Retention Visual Quality Objective/Moderate Scenic Integrity Objective or higher, scenic byways, hiking or multi-use trails, camping areas, other areas of moderate to high use recreation, or any other areas of visual significance.
- At locations where visibility from sensitive viewpoints is a major concern, structures with a shorter average height (85-foot) and shorter span length could be utilized. The shorter design would result in roughly twice the number of structures in a given length of ROW in order to meet required conductor clearances.

2.5.1.3 Special Status Wildlife and Plants

- Upon designation of a preferred alternative after issuance of the Draft EIS, and prior to project implementation, Western would conduct pre-construction surveys along portions of its preferred alternative including access roads not previously surveyed to identify sensitive species habitat or populations, and occurrences of noxious weeds. If special status individuals or populations are discovered, Western would develop mitigation to minimize effects in consultation with the USFS and natural resource agencies.

2.6 Operation and Maintenance Activities Common to All Alternatives

Operation and maintenance of the lines would be the responsibility of Western. Throughout the life of the proposed project, Western would conduct the following operation and maintenance activities:

- Routine aerial inspections of the integrity and condition of the transmission lines, and after wind, ice, and lightning events that cause forced outages. Aerial line patrol is recognized as the most efficient and cost effective method to customers for maintaining the electric power grid. Western maintains and operates their helicopters under Federal Aviation Regulations Parts 135, 133, and 91 as is applicable to the mission being flown.
- Ground inspections once per year, and as needed after weather events, to identify any repair or routine maintenance needs. Maintenance activities would include repairing damaged conductors, insulators, or structure components. Western could conduct climbing inspections on transmission line structures if aerial or ground inspections find problems.
- Maintenance of access roads for Western's use, including surfacing, adequate drainage, and removing downed trees and/or branches.
- Removal of trees and brush that create access, safety, or clearance problems for operation of the transmission lines, and noxious weed control as described in Section 2.6.1 below.

2.6.1 Vegetation Management

Vegetation management practices to be implemented under the No Action and rebuild alternatives are described below.

2.6.1.1 No Action Alternative

Under the No Action Alternative, Western would continue its infrastructure, ROW, and access road maintenance practices as they are currently defined under existing authorizations and other agreements. Due to increasingly more stringent NERC standards, Western must pursue ROW acquisition to allow for maintaining vegetation. Some of the existing transmission line ROW's do not allow enough room for adequate vegetation maintenance for more recent NERC compliance standards.

The current management approach to controlling vegetation, ensuring access, and maintaining equipment is largely reactive and responds to maintenance problems when they occur. Methods to control vegetation are manual, mechanical, and chemical (herbicides). As new practices are required due to new regulatory requirements and internal program requirement changes, Western would propose, review and adopt these changes.

Under the No Action Alternative, Western would continue its management approach for ROW and transmission line maintenance. Because Western addresses primarily danger trees, as defined in its authorization, it must review the ROWs at least once a year to ensure that no new danger trees have appeared and remove them. This focus requires annual reentries, and in some areas more frequent reentries, into the ROW to address vegetation problems that were identified during periodic line patrols or when maintenance forces are in the ROW for other activities. Western manages vegetation using the mix of manual, mechanical, and chemical methods to control vegetation in transmission line and access route ROWs. The No Action Alternative also includes the practice of spot application of approved herbicides. Western also performs access route repairs, as needed. Transmission system maintenance activities would consist of regular aerial and ground patrols to find problems, scheduling and performing repairs to correct problems, and preventative maintenance.

2.6.1.2 Proposed Vegetation Management for All Rebuild Alternatives

As part of the Estes-Flatiron Transmission Lines Rebuild, Western proposes to change the way it manages vegetation in the ROWs to a more proactive approach. This applies to each action alternative for the proposed transmission lines rebuild. Western proposes to manage its transmission line ROWs to better ensure the reliability and safety of the transmission lines, ensure adequate access for maintenance, protect the public and ensure worker safety, and manage risk from fire, all while ensuring the protection of environmental resources. For National Forest System lands, Western proposes to acquire new authorization along with the development of a new operation and maintenance plan to include a more proactive approach for managing vegetation along Western ROWs on National Forest System lands using an integrated vegetation management approach. This approach is based on the American National Standard Institute (ANSI) Tree, Shrub and Other Woody Plant Maintenance-Standard Practices (Integrated Vegetation Management, a. Electric Utility ROW (ANSI A300 (Part 7)-2006 IVM). Western would proactively control vegetation growth and fuel conditions that threaten its transmission lines. For private lands, where new easements are needed for the proposed transmission lines rebuild, Western proposes to include provisions in new easements to include a more proactive approach for managing vegetation using an integrated vegetation management approach. Depending on the rebuild alternative and where existing easements are adequate for proposed transmission line rebuild, Western would implement a more proactive approach for managing vegetation within the ROW to the extent allowed by any restrictions included with the existing easements. Western's proposed approach to vegetation management is summarized below. A more detailed description is provided in **Appendix B**.

2.6.1.3 Categories of Right-of-Way Conditions and Vegetation Treatment Methods

The existing transmission lines are in various conditions concerning vegetation management and fuel loading. For example, there are areas that need relatively little treatment, areas that need significant treatment to bring them to a desirable condition that could then be managed efficiently, and areas with mixed conditions. This is the result of a variety of past actions, including the extent of vegetation clearing along the ROWs when transmission lines were constructed and how these areas were subsequently managed over the years; maintenance practices over many years in a variety of vegetation types that could have contributed to excessive fuel loading in the ROWs; past danger-tree cutting; site conditions (e.g., slope, soil types, rainfall, pine beetle and other beetle attacks, and diseases); tree species distribution; topography; and other variables.

Western has identified six broad categories of ROW conditions along the existing transmission lines. **Table 2.6-1** lists the six categories of ROW conditions and proposed treatment methods during initial construction as well as for ongoing maintenance. Photos illustrating typical ROW conditions associated with each category along the existing transmission lines are provided in **Appendix B**.

Table 2.6-1 Categories of Right-of-Way Conditions and Vegetation Treatment Methods

Category	Vegetation	Frequency of Treatment	Treatment Methods
1	ROW vegetation is compatible with the transmission line based on topography and/or presence of natural, stable, low-growing vegetation communities.	None expected, but ROW monitoring would be needed to ensure conditions have not changed.	None expected.
2	Fast-growing incompatible species that are not acceptable; over the long term, the vegetation is likely to include incompatible vegetation types that would require monitoring and treatment.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively frequent (expected 2- to 6-year return intervals).	Accessible sites would favor use of mechanized equipment and removal of salvageable material. Inaccessible sites would favor use of hand felling.
3	Fast growing incompatible species of trees that are in an acceptable condition, but over the long term, Western would need to treat incompatible vegetation.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively frequent (expected 2- to 6-year year return intervals, but this would vary depending on site conditions).	Accessible sites would favor mechanized equipment, with removal of salvageable material. Inaccessible sites would favor use of hand felling.
4	Slow-growing incompatible species of mature vegetation that is not acceptable, and in the long-term incompatible; vegetation treatments would be needed to control re-growth.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively infrequent on sites with incompatible species with slow growth rates, perhaps 5 or more years, depending on site conditions.	On sites with good access, mechanized equipment would be favored and salvageable material would be removed. On sites with poor access, hand felling and other manual methods would typically be used.

Category	Vegetation	Frequency of Treatment	Treatment Methods
5	These sites have slow-growing incompatible species, and the ROW condition is acceptable. However, over the long term, Western would need to monitor and treat the incompatible species.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively infrequent, perhaps 5 years or longer, depending on site conditions.	On sites with good access, mechanized equipment would be favored and salvageable material would be removed. On sites with poor access, hand felling and other manual methods would typically be used.
6	Treatments in these areas of ROW are driven largely by the conditions of the fuel load. Typically, they include areas with low-growing vegetation types characterized by having high fuel loads. Sites are characterized by dense, woody vegetation capable of high-intensity fire, with transmission lines having relatively low conductor-to-ground clearances.	Initial treatment would occur with construction of the line. This could include mechanical removal of vegetation near structures and from areas of the ROW. Maintenance treatments as needed. Need is determined from ROW monitoring.	In areas with good access, mechanized treatment such as mowing would be favored. In areas with poor access, manual treatments would typically be used.

2.6.1.4 Establishing the Desired ROW Vegetation Condition During Construction

Western would assess current conditions in the ROW to identify areas that need initial treatments during construction based on the categories described above. Treatment of ROW vegetation during construction of new line would emphasize the following activities:

- Cut danger trees if any are present;
- Manage slash that has built up in the ROW to reduce fuels density;
- Grind or crush regeneration that has grown in the ROW to reduce the density of live, green fuels; and
- Cut tree species that at mature height would threaten safe, reliable transmission-line operation.

During construction of the transmission line, Western proposes to remove undesirable vegetation (typically trees) that at mature height would interfere with transmission line safety and reliability. The desired condition would be a ROW dominated by grasses, forbs, shrubs, and lower-growth tree species that, at maturity, would not interfere with the transmission line.

2.6.1.5 Maintaining Desired ROW Condition

Western's proposal includes monitoring and retreating ROW areas at appropriate intervals based on the results of reviews of ROW conditions during line patrols. In ROW areas with relatively low conductor-to-ground clearances, Western would typically retain lower-growth native plant species to maintain the desired vegetation condition. Western would do this through active management to remove tall-growth species. Depending on the specific site conditions, desirable native species could include grasses, forbs, and shrubs, through appropriately sized small or lower-growing tree species. Generally, more selective control methods can be used to maintain this condition along the ROW. ROW maintenance activities and treatment intervals would vary in the ROW depending on the success of previous treatments, vegetation type, rates of vegetation re-growth, environmental protection requirements, and risks to the transmission line.

An important component of ROW maintenance is fuels management to mitigate the risk of wildfires. Western would evaluate the risk to transmission line operations and security from wildfire and manage fuels in the ROWs. ROW fuel loads associated with vegetation re-growth or control treatments must be evaluated and controlled as needed. All vegetation (dead or live) can be considered fuel because it can contribute to fire intensity and duration. In addition to reducing the risk of incompatible vegetation in a ROW, Western's proposed ROW reclamation and long-term maintenance strategies would address areas where accumulated fuel poses an unacceptable risk. Western would reduce fuel density in ROWs using mechanical and manual treatment approaches, as described below.

There could be areas along the existing transmission lines that need no or minimal vegetation management – for example, some areas in canyons and drainages or other steep topography in which trees might not grow to heights or densities that would threaten the transmission line that crosses high above (see Category 1). In some of these areas few if any control methods would be needed for years. In other vegetation communities, occasional mowing of vegetation around structures could be needed to ensure access to the structures and to reduce the risk of fire to the transmission line structures (e.g., mowing sagebrush around wooden structures). Regardless, Western would need to monitor all ROWs to continuously evaluate vegetation conditions and ensure they meet the management requirements, and that changed conditions have not resulted in unacceptable threats.

Vegetation Control Methods

Western proposes several general control methods, individually or in combination, to manage vegetation. These methods include a variety of control methods utilities typically use to manage their ROWs. Western would use the techniques to alter the vegetation condition so that it can be maintained more efficiently and effectively. The following paragraphs describe the general vegetation-control methods.

Manual Control Methods

Manual vegetation control includes the use of hand-operated powered tools and non-powered hand tools. Manual techniques—mainly using chainsaws—can be used where equipment access is limited by terrain, soil conditions, or other environmental conditions. One or two trucks carrying equipment and workers drive along the access road to the appropriate site. Crews of two or more with chainsaws then hike along the ROW and cut target vegetation. Crews often use ATVs instead of trucks. Crew sizes for this type of activity usually range from two to four.

Mechanical Control Methods

Mechanical vegetation control uses machine platforms with various interchangeable treatment-head attachments to remove or control target vegetation along transmission line and authorized access route ROWs. Rubber-tired mechanical equipment platforms are generally limited to operating on slopes less than 30 to 35 percent. Specialized tracked equipment platforms, with articulating control cabins, are typically used on slopes up to 60 percent. Both types of specialized equipment platforms can operate with very low ground pressures. However, site-specific obstacles such as rocks or other extreme terrain conditions can reduce their efficiency. Mechanical operations usually involve a crew of two to three.

Herbicides and Growth Regulators

Western would use spot application of herbicides approved for use to treat undesirable, mostly herbaceous vegetation. Western applies herbicides to invasive species. Herbicides are applied directly to the vegetation using a hand or powered sprayer. Herbicides are used on incompatible vegetation that sprouts after initial treatment by cutting or mowing. Herbicide applications typically involve a crew of one to two.

Western uses herbicides that are approved for use in ROW maintenance and by the USFS. Western uses EPA and state-registered herbicides, and appropriately licensed or certified applicators apply the herbicides following the label requirements.

Herbicides can be applied in different ways, depending on the targeted plants, vegetation density, and site circumstances. Western proposes herbicide treatment either by spot application or localized (site-specific) application.

When making decisions about the use of these methods, Western considers the area being treated, the presence of sensitive plants and other environmental resources, the herbicide label requirements, and whether the method is cost effective and efficient.

Site-specific Herbicide Application

Site-specific or localized herbicide application is the treatment of individual or small groupings of plants. Western typically uses this application method only in areas of low to medium target-plant density. The application techniques include, but are not limited to, basal treatment, low-volume foliar treatment, and cut stump treatment.

Debris Disposal

Managing vegetation includes cleanup – the treatment of slash and debris disposal. Methods of disposing of vegetation debris generated when vegetation is cut, include logging, chipping, lopping and scattering, mulching, and pile burning. Each of these methods are described further in **Appendix B**.

Mechanical Fuel Reduction Methods

Western would reduce existing fuel loads through mechanical thinning, mowing, chipping, and debris removal. Western would use site-specific treatments to reduce potential impacts from wildfire on the transmission line ROW by reducing the likely intensity and duration of fires in the ROW. Western would use a range of mechanical and manual methods, depending on site conditions. These include tree removals, mechanical and hand thinning of small-diameter trees to reduce ladder fuels, mechanical mastication (e.g., grinding and chipping), and hand and mechanical piling. The target fuels of these treatments include downed trees, slash, debris from past treatments, green fuels such as regenerated lodgepole pine, and brush such as Gambel oak and sagebrush.

Western would use prescribed burning only under optimum conditions, such as during periods of minimal wind speeds or high moisture content in fuels, to reduce the risk of fire escape and impacts from smoke. Prescribed fire treatments would include mechanical piling and burning and broadcast burns to reduce surface fuels over larger areas. Large pockets of dead and down woody material and slash generated from mechanical treatments would be broadcast burned or piled and burned to further reduce fuel loadings.

2.7 Alternatives Considered but Dismissed

2.7.1 Alternative Alignments

In addition to the alignments carried forward for detailed analysis in the Draft EIS, several additional routing alternatives were identified. Some of these alternatives emerged through a series of public workshops held in October 2012 that were intended to review the constraint/opportunity criteria and to solicit public comment on potential alternative alignments. Through this process, a wide range of potential routing alternatives, some of which were carried forward for detailed analysis while others were eliminated following an initial consideration of their feasibility. Alternative alignments considered but eliminated, including the reasons for their elimination, are summarized in **Table 2.7-1** below.

Table 2.7-1 Alternative Alignments Dismissed from Detailed Analysis

Potential Reroute	Reason for Dismissal
U.S. Highway 34 and U.S. Highway 36 reroutes	Proposals to reroute the transmission line along U.S. Highways 34 and 36 would not use existing transmission line ROWs and would instead follow existing transportation ROWs. These proposals were not carried forward because they do not address the issues raised during scoping, but simply displace impacts to new landowners and may require constructing an additional length of transmission line. Locating the lines along these routes also adds flooding as another possible major catastrophic future event that may affect the transmission lines.
Reroute west of Meadowdale Hills subdivision, on the east slope of Mount Pisgah	This potential route crosses steep slopes without any existing access roads, and would be difficult and costly to construct resulting in substantial erosion risks and related increased maintenance costs. Road construction across this topography would require excessive cut and fill and increase visual impacts.
Reroute to the south side of the northern alignment, below The Notch	This potential route is located in an area with steep slopes and poor access; it also follows a riparian corridor. Western's SCPs direct that structure sites, access ways, and other disturbance areas will be located at least 100 feet, where practical, from rivers and streams (including ephemeral streams). Because this route follows a riparian corridor it is not suitable for siting the transmission line.
Reroutes far to the south of the South Line in the vicinity of Pinewood Reservoir Stewardship Trust and Blue Mountain Bison Ranch	This routing strategy was suggested during workshops to reduce effects to recreational and residential viewsheds at Pinewood Lake. These reroutes were dismissed because they crossed protected lands, did not fully address the visual resource issue, and displaced impacts to new landowners. To more effectively respond to concerns regarding viewshed effects, a reroute around the north side of Newell Lake View subdivision was identified and carried forward for detailed analysis (Alternative A).
A reroute that followed a gas pipeline between the northern and southern alignment on the east end of the project area, between the access road to the Bald Mountain radio facility and the intersection of Pole Hill Road and Chimney Hollow Road	This reroute was suggested as a means to co-locate linear infrastructure. However, the reroute fails to effectively address other scoping issues related to visual impacts and would require new ROW acquisition. There also may be additional mitigation required by the gas utility, if Western were to site a transmission line parallel to an existing gas line.

Potential Reroute	Reason for Dismissal
Reroute following Flatiron Penstocks (CBT project)	In an effort to further consolidate linear facilities, consideration was given to an alignment that paralleled the penstocks that descend Bald Mountain to Flatiron Reservoir. The penstocks emerge aboveground well below the summit of Bald Mountain and follow an alignment that is prominent in the viewshed from Flatiron Reservoir, one that doesn't take advantage of the opportunities for concealment provided by the surrounding terrain. Further, the penstocks are iconic facilities that date to the 1940s and have historic significance.
Reroute along Cottonwood Creek	This reroute would extend from the vicinity of Flatiron Reservoir and follow an alignment to the northwest generally along Cottonwood Creek, rejoining the ROW of the existing North Line near Pinewood Lake Dam. This alternative would require several miles of construction through steep terrain with poor access. It was dropped in favor of Alternative A that accomplish an avoidance of the Pinewood Lake viewshed and the adjacent subdivision in a more direct and effective manner.

2.7.2 Alternative Structure Types

In addition to routing options, alternative project designs were considered and presented during the public workshops held in October 2012. Other structure types considered included a lattice structure and double-circuit H-frame. Neither the lattice nor double-circuit H-frame designs were supported by public comments, and were not carried forward for further analysis.

2.7.3 Other Alternatives

Other alternatives also were considered but dismissed, as discussed below.

2.7.3.1 Use of Olympus Tunnel

The Olympus tunnel begins below Lake Estes and extends to the east through Mount Olympus, eventually meeting up with the Pole Hill Tunnel and other CBT project facilities that extend all the way to Flatiron Reservoir. The possibility of placing an underground cable system within the Olympus Tunnel and other below ground facilities was identified as a potential opportunity, one that would reduce or eliminate visual impacts and other identified concerns. Although such systems have been installed in other water conveyance tunnels, including the Adams Tunnel through Rocky Mountain National Park, it is only feasible when the facility was specifically designed to accommodate the cables and splices at the time of its initial construction. Placing a cable within a tunnel not designed and constructed to accommodate one would diminish the capacity of the facility to deliver water and function as designed and also create considerable operational, scheduling, and maintenance challenges. For these reasons, this alternative is infeasible and it was dropped from further consideration.

2.7.3.2 Underground Construction near Pinewood Lake

Due to the sensitivity of the viewshed south of Pinewood Lake, underground construction was considered for a segment of the project through this area, following the alignment of Alternative B. As discussed in Section 2.2.4, underground construction presents a number of challenges, including greatly higher costs than conventional aboveground construction. Several alternatives, specifically Alternatives A and C, avoid the viewshed south of Pinewood Lake, providing alternatives that eliminate these impacts at a much lower cost. For this reason, underground construction at this location was dropped from further consideration.

2.7.3.3 Underground Construction on National Forest System Lands

Variant C1 rebuilds the transmission line underground to the Roosevelt Forest boundary near the north end of the Meadowdale Hills subdivision. Western considered extending Variant C1 further east onto National Forest System lands, but dismissed it based on the following technical reasons.

- Extending Variant C1 further east along the proposed alignment for Alternative C would involve trenching within a rough section of Pole Hill Road that is noted for its recreational value to four-wheel drive users. Restoring Pole Hill Road to previous conditions following installation of cable trenches would not be possible, unless the cable trenches were buried deeper. Continued use of Pole Hill Road would impact the integrity of cable trenches.
- Terminating the underground section on National Forest System lands would require an underground service vault. This vault could not be located on Pole Hill Road and would require that the vault be located off the road. The installation of the vault would require the clearing of a large forested area to accommodate the vault installation and future access.
- Extending Alternative C1 along the existing E-PH transmission line route (the route for Alternative D) would require extensive clearing within a mixed coniferous forest. The width of the clearing would need to accommodate the trench, a spoil pile, and a service road to accommodate the installation of the cable trench and service vault.

2.8 Comparison of Alternative Effects

Table 2.8-1 compares the alternatives with regard to key and other issues identified in Section 1.6.3, using selected measurable indicators. **Table 2.8-2** provides a summary comparison of environmental effects by resource and alternative. Additional information regarding the specific effects of each alternative to each resource can be found in Chapter 4.0.

Table 2.8-1 Measurement Indicators for Key and Other Issues

Measurement Indicators for Issues	Alternative A	Variant A1	Variant A2	Alternative B	Alternative C	Variant C1	Alternative D	No Action
Issue: ROW acquisition								
Acres of new ROW acquisition	153	157	152	42	117	110	177	122
Acres of new ROW acquisition (National Forest Service [NFS] lands)	23	23	23	31	31	31	55	0
Acres of ROW to be decommissioned	143	151	150	42	139	143	4	2
Miles of land ownership crossed	Private - 12.0 USFS - 1.7 DOI - 0.6 SLB - 0.0 NCWCD - 0.0 County - 0.8	Private - 12.0 USFS - 1.7 DOI - 0.6 SLB - 0.0 NCWCD - 0.0 County - 0.6	Private - 12.1 USFS - 1.7 DOI - 0.6 SLB - 0.0 NCWCD - 0.0 County - 0.6	Private - 9.4 USFS - 2.2 DOI - 0.4 SLB - 1.0 NCWCD - 0.2 County - 1.6	Private - 10.6 USFS - 2.2 DOI - 1.0 SLB - 0.0 NCWCD - 0.1 County - 1.8	Private - 10.6 USFS - 2.2 DOI - 1.0 SLB - 0.0 NCWCD - 0.1 County - 1.8	Private - 20.0 USFS - 3.8 DOI - 1.0 SLB - 1.0 NCWCD - 0.2 County - 2.5	Private - 20.0 USFS - 3.8 DOI - 1.0 SLB - 1.0 NCWCD - 0.2 County - 2.5
Issue: effects on visual resources								
Existing Scenic Integrity Objective (SIO) (NFS lands)	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Resulting SIO (NFS lands)	Very Low[1]	Very Low[1]	Very Low[1]	Very Low[1]	Very Low[1]	Very Low[1]	Moderate	Moderate
Issue: Forest road construction/reconstruction								
Miles of new administrative road on NFS land for permanent access	0.9	0.9	0.9	0.6	0.6	0.6	1.9	0
Reconstruction of existing ML2 system road on NFS lands (miles)	0	0	0	0	3.4	3.4	0	0
Limited reconditioning of existing ML2 system road post-construction (miles)	2.2	2.2	2.2	3.2	0.2	0.2	3.2	0
Miles of permanent access on NFS lands in areas with difficult constructability	0.6	0.6	0.6	0.0	0.0	0.0	1.0	0
Issue: recreational uses & experiences								
Long-term changes in recreation opportunities on NFS lands	NA	NA	NA	NA	Unquantifiable Diminished off-highway vehicle (OHV) opportunities	Unquantifiable Diminished OHV opportunities	NA	NA
Issue: protected lands								
No. protected lands crossed	4	4	4	5	4	4	7	7
Issue: effects on infrastructure								
Conflicts with Upper Thompson Sanitation District	No	No	No	No	No	No	No	Limits facility expansion
Issue: property values & economic effects								
No. of landowners affected by ROW acquisition	46	48	42	19	36	36	40	40
New ROW	8	10	7	4	9	9	5	5
Expanded ROW	38	38	35	15	27	27	35	35
Subdivisions affected by ROW acquisition (new or expanded ROW)	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill Newell Lake	Park Hill Newell Lake
No. of landowners with ROW to be decommissioned	36	36	36	51	33	33	7	7
Businesses directly affected	NA	NA	NA	NA	OHV tour operator	OHV tour operator	NA	NA
Issue: cultural resources								
Number of NRHP-eligible historic sites potentially impacted	6	6	6	3	5	5	8	7
Issue: water resources, floodplains, and wetlands[2]								
Waterbodies Crossed	43	41	41	49	47	47	80	80
Wetlands Present	13	11	12	6	11	9	15	16
Waters of the U.S.	20	17	18	14	22	18	28	28

Measurement Indicators for Issues	Alternative A	Variant A1	Variant A2	Alternative B	Alternative C	Variant C1	Alternative D	No Action
Issue: ROW clearing & maintenance								
Soil types in Analysis Area								
Low revegetation potential (acres)	32	32	13	44	21	14	60	60
Compaction prone (acres)	58	57	56	26	71	70	90	90
Water erodible (acres)	82	76	63	57	52	50	115	115
Vegetation types in ROW								
Ponderosa pine woodland (acres)	139	139	136	116	130	134	207	207
Mixed conifer forest (acres)	13	13	9	38	16	9	42	42
Mountain shrub mosaic (acres)	24	24	27	30	31	26	62	62
Upland meadow, or upland meadow/wetland mosaic (acres)	24	24	31	37	30	30	70	70
Issue: electric and magnetic fields								
Electric fields at the ROW edge (kilovolt per meter [kV/m])	0.12	0.12	0	0.12	0.12	0	0.34	0.34
Magnetic fields at each ROW edge (milligauss [mG])	5.2/1.8	5.2/1.8	0.05	5.2/1.8	5.2/1.8	0.05	5.2/5.3	5.2/5.3
Issue: effects on plants, wildlife, & fish								
Special Status Plants								
Threatened and endangered	LP	LP	LP	LP	LP	LP	LP	LP
Sensitive species	MAII	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Species of local concern	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Issue: effects on plants, wildlife, & fish								
Elk and Mule Deer Winter Range (acres)	112	104	104	97	106	124	142	142
Moose Winter Range (acres)	49	45	45	44	47	55	61	61
Special Status Wildlife								
Threatened and endangered	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA	NLAA
Sensitive species	MAII	MAII	MAII	MAII	MAII	MAII	MAII	MAII
Management indicator species	NC	NC	NC	NC	NC	NC	NC	NC

[1] Would require lowering of SIO and documentation of change of SIO in MA 8.3 - Utility Corridor for this project area, in accordance with Forest Plan Standard 154 and also documentation in the USFS ROD.

[2] Wetlands and waterbodies were determined from desktop analysis and augmented with survey data where available. Ground surveys were completed early in the NEPA process during initial EA alternative development. Therefore, survey data was not collected for the full site of alternatives. A full delineation of water resources will be performed on the Preferred Alternative route after the Preferred Alternative is selected.

NA = not applicable.

LP = low probability of species presence.

MAII = may adversely impact individuals, but not likely to result in a loss of viability on the Planning area, or cause a trend to federal listing.

NLAA = may affect, not likely to adversely affect.

NC = no change in population trend.

Table 2.8-2 Comparison of Alternative Effects

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Soils	Potential impacts to soils include compaction, rutting, erosion, and contamination. Compaction and erosion impacts would be minimized through SCPs.	Potential impacts would be the same as Alternative A. Acres of impacted soil types would be the same as Alternative A.	Potential impacts would be the same as Alternative A. Fewer acres would be affected than Alternative A. More soil disturbance would result from trenching, possibly reducing soil productivity.	Potential impacts would be the same as Alternative A. Acres of impacted soil types would be the same as Alternative A2.	Potential impacts would be similar to Alternative A. More acres of bedrock would be affected. Reconstruction of Pole Hill Road and USFS Road 247.D would reduce erosion associated with these ML2 roads in the long-term and have long-term beneficial effects for soils on National Forest System lands.	Potential impacts would be the same as Alternative A. Soil disturbance acreages would be similar to Alternative C. More soil disturbance would result from trenching, possibly reducing soil productivity. Reconstruction of USFS Roads 122 and 247.D would reduce erosion associated with these ML2 roads in the long-term and have long-term beneficial effects for soils on National Forest System lands.	Potential impacts would be the same as Alternative A. The most acres of soils and bedrock would be affected..	Natural and anthropogenic actions would continue to impact soil resources at current levels. Impacts associated with relocation of the line would be similar to Alternative A.
Water Resources and Floodplains	Impacts to surface water or groundwater quantity and quality would be minor to negligible through implementation of SCPs and compliance with permit provisions. Measurable effects would be avoided within the Federal Emergency Management Agency (FEMA)-designated floodplain.	Additional potential for changes in runoff, erosion, and sedimentation would occur in areas of new access roads and ROW construction. Impacts to surface water or groundwater quantity and quality would be minor to negligible through implementation of SCPs and compliance with permit provisions. Measurable effects would be avoided within the FEMA-designated floodplain	Variant A2 would have impacts similar to Variant A1. In addition, construction for the underground portion of the ROW may encounter groundwater; if this occurred, it would be addressed in compliance with state permit approvals.	Potential impacts would generally be of the same type as Alternative A. Additional potential for impacts to existing runoff conditions, erosion, and sedimentation would occur in the steep terrain near Meadowdale Ranch and Ravencrest areas. Potential impacts would be minor to negligible, and would be addressed similar to Alternative A. The FEMA-designated floodplain would be avoided.	Potential impacts would generally be the same as Alternative B. An area that may have shallow groundwater and domestic occurs along Alternative C at the east side of Pinewood Reservoir. Impacts to surface water or groundwater quantity and quality would be minor to negligible through implementation of SCPs and compliance with permit provisions.	Potential impacts would be the same as for Alternative C. Shallow groundwater also may be encountered where deeper excavation would occur for underground construction along the western 2.7 miles of the ROW.	The potential for impacts from ROW use and construction would be similar to Alternatives A and B. The re-route in the vicinity of Pinewood Reservoir would have the potential for shallow groundwater impacts similar to Alternative C. Implementation of SCPs and compliance with permit provisions would reduce impacts to minor or negligible levels.	Potential impacts to surface or groundwater quantity and quality would be similar to Alternative D, but would be spread out in space and time. Implementation of SCPs and compliance with permit provisions would limit impacts to minor or negligible levels. Negligible impacts to floodplains would occur.
Wetlands and Waters of the U.S.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Erosion and sedimentation impacts would be minimized or mitigated through implementation of SCPs and proposed mitigation measures.	Fewer potential impacts would be anticipated because of decreased construction disturbance.
Vegetation	Ponderosa pine, mixed conifer forest, mountain shrub mosaic, and upland meadows would be impacted by project disturbance.	Potential impacts to vegetation types would be the same as Alternative A.	Potential impacts to vegetation types would be similar to Alternative A.	Potential impacts to vegetation types would be similar to Alternative A, although slightly less ponderosa pine woodlands would be affected and more mixed conifer forest, mountain shrub mosaic, and upland meadows would be affected.	Potential impacts to vegetation types would be similar to Alternative A, although slightly less ponderosa pine woodlands would be affected and more mixed conifer forest, mountain shrub mosaic, and upland meadows would be affected.	Potential impacts to vegetation types would be similar to Alternative A, although slightly less ponderosa pine woodlands and mixed conifer forest would be affected and more mountain shrub mosaic and upland meadows would be affected.	Potential impacts to vegetation types would be greater than Alternative A. A greater amount of ponderosa pine, mixed conifer forest, mountain shrub mosaic, and upland meadows would be affected.	Disturbance acreage of vegetation communities within the ROW would be 147 acres. Potential impacts to all vegetation types would be similar to Alternative D.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Special Status and Sensitive Plant Species	No federally listed species are found along Alternative A. Due to limited distribution of federally listed species and low quality of habitat, no impacts to these species would be expected. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Due to limited distribution of federally listed species and low quality of habitat, no impacts to these species would be expected. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Due to limited distribution of federally listed species and low quality of habitat, no impacts to these species would be expected. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.	Due to low quality of habitat and reduced surface disturbance, no impacts to federally listed species would be anticipated. Potential impacts to sensitive plant species and species of concern would be minor and short-term due to limited surface disturbance in the ROW, and reclamation of disturbed areas.
Wildlife Habitat	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative. Impacts due to surface disturbance would be greater where the transmission line would be constructed underground.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative. Impacts due to surface disturbance would be greater where the transmission line would be constructed underground.	Elk and mule deer winter range, and moose winter range habitat would be affected by this alternative.	Acres of big-game habitat impacted would be similar to Alternative D.
Raptors and Other Birds	Implementation of proposed mitigation measures, as well as seasonal restrictions to prevent impacts to raptors and migratory birds potentially would minimize direct impacts. Remaining impacts (e.g., loss of habitat) are anticipated to be minor.	Potential impacts would be the same as Alternative A. There would be reduced risk of raptor collisions where the transmission line would be constructed underground.	Potential impacts would be the same as Alternative A. There would be reduced risk of raptor collisions where the transmission line would be constructed underground.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A. There would be reduced risk of raptor collisions where the transmission line would be constructed underground.	Potential impacts would be the same as Alternative A.	Displacement of upland game birds, raptors, and other birds as a result of increased human activity during maintenance activities would be short-term and minor. Relocation of the line would result in potential impacts similar to Alternative A.
Special Status and Sensitive Wildlife Species Habitat Disturbance	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected (200 acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at the same level as Alternative A	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at approximately the same level as Alternative A (203 acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at a greater level than Alternative A (221acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at approximately the same level as Alternative A (207acres).	Vegetation communities in the ROW that support special status and sensitive wildlife species would be affected at approximately the same level as Alternative A (199 acres).	The most vegetation communities in the ROW that support special status and sensitive wildlife species would be affected than any other alternative (381acres).	Fewer acres (147 acres) of vegetation communities in the ROW that support special status and sensitive wildlife species would be affected than any action alternative.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Land Use and Recreation Land Use	Long-term adverse impacts to land use from the acquisition of new or expanded ROW (153 acres) would range from negligible to moderate depending on the location and ownership of the acquired ROW. Beneficial effects where existing ROW would be decommissioned.	Impacts are similar to A; however, Variant A1 would require 157 acres of new ROW.	Impacts are similar to A; however, Variant A2 would require 152 acres of new ROW.	Impacts are similar to A; however, Alternative B requires the fewest acres of ROW acquisition (42 acres).	Impacts are similar to A; however, Variant A1 would require 110 acres of new ROW.	Impacts are similar to A; however, Variant C1 would require 110 acres of new ROW.	Impacts are similar to A; however, Alternative D would maintain two ROWs and therefore requires the most ROW acquisition (177 acres). The beneficial effects of ROW consolidation would not be realized under this alternative.	Existing ROWs would be expanded to a minimum width of 75 feet. New ROW would be acquired to relocate the line from Newell Lake View subdivision (through which there is inadequate ROW). The beneficial effects of ROW consolidation would not be realized.
Recreation	Potential short and long-term impacts to recreation from access roads, staging areas, and construction and maintenance activities would range from negligible to moderate depending on the location and timing of activities. The long-term recreational experience would be enhanced in areas where existing transmission line would be decommissioned.	Potential impacts would be the same as Alternative A.	Potential impacts would be the same as Alternative A.	Short-term recreation opportunities on the Besant Point Trail could be affected depending on the timing of construction. Long-term impacts would include effects to the recreational setting on Pole Hill Road. Other potential impacts to recreation would be similar to Alternative A.	Moderate short and long-term impact to the recreation setting and recreation facilities along the eastern side of Pinewood Reservoir County Park. Other potential impacts to recreation would be similar to Alternative A. Four-wheel drive recreation opportunities would be significantly adversely impacted on sections of USFS Road 122 and USFS Road 247.D that would be reconstructed.	Moderate short and long-term impact to the recreation setting and recreation facilities along the eastern side of Pinewood Reservoir County Park. Other potential impacts to recreation would be similar to Alternative A. Four-wheel drive recreation opportunities would be significantly adversely impacted on sections of USFS Road 122 and USFS Road 247.D that would be reconstructed.	Moderate short and long-term impact to the recreation setting along the eastern side of Pinewood Reservoir County Park. Other potential impacts to recreation would be similar to Alternative A. The beneficial effects of ROW consolidation would not be realized under this alternative.	Moderate short and long-term impact to recreation setting along the eastern side of Pinewood Reservoir County Park. Negligible to minor adverse effects to recreation setting where additional ROW would need to be acquired. The beneficial effects of ROW consolidation would not be realized under this alternative.
Visual Resources	New, taller structures and associated disturbance would result in short- and long-term adverse effects ranging from minor to moderate with localized strong visual changes. Long-term beneficial effects would occur where the South Line would be removed. Moderate adverse effects would occur from new access roads and vegetation management	Potential impacts would be the same as Alternative A, except for along 0.5 mile of U.S. Highway 36 where the adverse effect would be greater.	Potential impacts would be the same as Alternative A, except for the underground segment near Estes Park which would be less visible than an overhead transmission line.	Adverse effects would occur to Chimney Hollow Open Space, Pinewood Lake, Meadowdale Hills and Ravencrest subdivisions, and U.S. Highway 36. Beneficial effects would occur to the valley between Mount Pisgah and Mount Olympus as seen from the Estes Valley. Other potential impacts to scenic resources would be similar to Alternative A.	Adverse effects would occur to Chimney Hollow Open Space, and Meadowdale Hills and Ravencrest subdivisions, and along 0.75 mile of U.S. Highway 36. Beneficial effects would occur to the valley between Mount Pisgah and Mount Olympus as seen from the Estes Valley. Other potential impacts to scenic resources would be similar to Alternative A.	Potential impacts would be the same as Alternative C, except for the underground segment near Estes Park which would be less visible than an overhead transmission line.	Potential long-term impacts would be the similar as the No Action Alternative. Beneficial changes would result within the Newell Lake View subdivision. Moderate adverse effects would occur from new access roads and vegetation management similar to Alternative A.	Minor adverse to moderate impacts from visible portions of the two existing transmission lines and ongoing structure replacement and vegetation maintenance activities would continue similar to existing conditions. Beneficial changes would result within the Newell Lake View subdivision.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Socioeconomics and Community Resources	Beneficial effects associated with job opportunities and to the economic base would be temporary and minor. Minor decreases in property values as a result of taller structures, and conversely minor increases in property values where structures would be removed. No environmental justice concerns were identified.	Potential impacts would be the same as Alternative A.	Cost of construction would increase 80 percent relative to Alternative A. Residences near the underground portion of the variant may experience a minor increase in property values, except near the transition structure.	Potential impacts would be the same as Alternative A.	Potential impacts would be similar to Alternative A. Reconstruction of Pole Hill Road would result in moderate long-term effects to a USFS permit holder that leads OHV tours in the Pole Hill area.	Cost of construction would increase 80 percent relative to Alternative A. Residences near the underground portion of the variant may experience a minor increase in property values, except near the transition structure. Reconstruction of Pole Hill Road would result in moderate long-term effects to a USFS permit holder that leads OHV tours in the Pole Hill area.	Beneficial effects associated with job opportunities and to the economic base would be temporary and minor. Minor decreases in property values as a result of taller structures. Alternative D would maintain two ROWs and the beneficial effects to property values from ROW decommissioning would not be realized, except where the line would be relocated from Newell Lake View subdivision to Pole Hill Road.	Potential impacts include increased maintenance costs as existing lines age and require more maintenance. The No Action alternative would maintain two ROWs and the beneficial effects to property values from ROW decommissioning would not be realized, except where the line would be relocated from Newell Lake View subdivision to Pole Hill Road.
Electrical Effects and Human Health	Effects associated with noise, radio and television interference, and induced current and voltage, as well as effects to cardiac pacemakers would be negligible; SCPs would further minimize noise and induced current and voltage. EMF levels would be less than the existing transmission lines. Health effects would be similar to or less than existing lines.	Potential effects would be the same as Alternative A.	Potential effects would be the same as Alternative A, except that electrical fields would be blocked by the soil where the transmission line is constructed underground and wouldn't be a concern.	Potential effects would be the same as Alternative A.	Potential effects would be the same as Alternative A.	Potential effects would be the same as Alternative A, except that electrical fields would be blocked by the soil where the transmission line is constructed underground and wouldn't be a concern.	Potential effects would be the same as Alternative A.	Electric fields at the ROW edge, and magnetic fields within the ROW, would be higher than for action alternatives. Potential effects would be the same as Alternative A.
Cultural Resources	A total of 6 historic properties, 2 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Unavoidable adverse effects would be minimized or mitigated through a treatment plan, and through implementation of SCPs.	A total of 6 historic properties, 2 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 6 historic properties, 2 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 8 historic properties and 2 contributing elements of the CBT project Historic District have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 9 historic properties and 2 contributing elements of the CBT project Historic District have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 9 historic properties and 2 contributing elements of the CBT project Historic District have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 12 historic properties, 4 contributing elements of the CBT project Historic District, and 2 unevaluated sites have been documented along this alternative. Mitigation of adverse effects would be the same as Alternative A.	A total of 12 historic properties, 4 contributing elements of the CBT project Historic District, and 1 unevaluated site have been documented along this alternative. At this time, no inventories have been conducted along the line that would be relocated.

Resource	Alternative A	Alternative A1	Alternative A2	Alternative B	Alternative C	Alternative C1	Alternative D	No Action Alternative
Transportation	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.3 miles of temporary access and 1.3 miles of permanent access on National Forest System land, of which 0.6 mile would be constructed in inaccessible areas with difficult constructability.	Potential impacts would be similar to Alternative A.	Potential impacts would be similar to Alternative A.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.7 miles of temporary access and 0.8 mile of permanent access on National Forest System land, none of which would be constructed in inaccessible areas with difficult constructability.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.7 miles of temporary access and 0.8 mile of permanent access on National Forest System land, none of which would be constructed in inaccessible areas with difficult constructability. Increased traffic on USFS Road 122 may result from this alternative as the road would be improved.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 1.7 miles of temporary access and 0.8 mile of permanent access on National Forest System land, none of which would be constructed in inaccessible areas with difficult constructability. Increased traffic on USFS Road 122 may result from this alternative as the road would be improved.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. This alternative requires 2.5 miles of permanent access on National Forest System land, 1.0 mile of which would be constructed in inaccessible areas with difficult constructability.	Potential direct and indirect impacts would be less than significant due to low levels of project-generated traffic. There would be no new temporary or permanent access authorized on National Forest System lands.

Note: Impacts in this table described in Chapter 2.0 were determined after implementation of design criteria, SCPs, and mitigation measures described in Chapter 4.0.

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3.0 Affected Environment

3.1 Introduction

As described in Section 2.2.1, Development of Alternative Alignments, upon completion, the action alternatives would have an operating ROW of 110 feet for aboveground alignments, and 75 feet for underground alignments. The ROW area needed for construction would be larger. Because some resources can be impacted outside of the ROW (e.g., air, water or human resources) the project area for affected environment varies by resource and is defined at the beginning of each resource section.

Chapter 3.0 provides descriptions of the existing environmental conditions for physical, biological, and human resources in the project vicinity that may be impacted by constructing and/or operating the proposed project. Physical resources described include air quality, water resources, geology and paleontology, and soil resources. Biological resources described include wetlands and waters of the U.S., vegetation, special status plant species, wildlife, and special status wildlife species. Human resources include socioeconomics and community resources (including environmental justice), visual resources, cultural resources, transportation, recreation, land use, electrical effects and human health, and accidents and intentional destructive acts. Federal, state and local regulations that apply to managing these resources also are discussed in context to the existing environment. Specific impacts from constructing and operating the proposed project are discussed in Chapter 4.0.

3.2 Air Quality

This section describes the climate and existing air quality resource of the region and the applicable air regulations that would apply to the proposed alternatives. The study area for direct air quality impacts is the area within 3.1 miles of the project area.

3.2.1 Climate

The climate in the eastern portion of the area is characterized as arid, with cold winters and warm summers. The climate in the western segments, including Estes Park, is greatly affected by the mountain ranges, both elevation and aspect. Annual precipitation (rainfall and snowfall) in the project area ranges from 12 inches to well over 25 inches and is highly dependent on elevation and aspect of the terrain.

Annual total recorded precipitation (rainfall) in the Estes Park area from February 1, 1896 to May 31, 1994 averaged 16 inches; total annual recorded snowfall averages for the same period are approximately 70 inches. Average maximum temperatures range from 37.7 degrees Fahrenheit (°F) in January to 78.2°F in July. Waterdale, Colorado, located about 4.5 miles northeast of the Flatiron Substation at an elevation of 5,200 feet above mean sea level (amsl), recorded an annual total precipitation (rainfall) of approximately 16 inches; total annual recorded snowfall averages for the same period are 44 inches (period or record January 1, 1902 to September 30, 2012). During that same period, average maximum temperatures ranged from a low in January of approximately 43°F to a high in July of approximately 87°F.

3.2.2 Applicable Laws and Regulations

Federal actions must conform to the CAA. The EPA has primary Federal responsibility for implementing the CAA. In Colorado, the CDPHE Air Pollution Control Division (APCD) administers CAA requirements. To comply with the requirements of the CAA, the State of Colorado has developed a State Implementation Plan (SIP). The SIP describes how Colorado ensures compliance with the CAA.

Regional air basins are classified by the CDPHE-APCD. The project is located within the Denver Metro/North Front Range Region (CDPHE-APCD 2011). This region encompasses Larimer County, including Rocky Mountain National Park. Standards for six criteria pollutants have been identified by the

EPA: particulate matter (PM), ozone (O_3), carbon monoxide (CO), sulfur oxides, nitrogen oxides (NO_X), and lead (Pb).

PM_{10} consists of particulate matter equal to or smaller than 10 microns is size that is suspended in the atmosphere. PM_{10} is generated from sources such as windblown dust and soil from roads, fields and construction sites. $PM_{2.5}$ particles consist of solid or volatile particles up to 2.5 micron size. Sources of $PM_{2.5}$ include combustion products emitted from forest fires or engines, and also can form when gases from power plants, industries, and automobiles react in the air. The area in the vicinity of the proposed project currently meets the Federal standards for PM_{10} and $PM_{2.5}$.

Under the Federal CAA and Amendments, proposed new stationary sources of air pollutants are required to obtain construction and then operating permits for the sources in question. Larger sources that are required to obtain permits must address Prevention of Significant Deterioration (PSD), New Source Performance Standards, visibility protection, and the general conformity provisions of the CAA and Amendments as part of their permitting effort.

Since the area is nonattainment, the project will be required to demonstrate compliance with the general conformity provisions of the CAA and Amendments. With respect to compliance with the General Conformity provisions, development of a SIP was required, to present measures that would result in compliance with the National Ambient Air Quality Standards (NAAQS) for O_3. Such a plan was submitted to EPA, approved and addresses reductions of emissions of the photochemically active precursors of ozone formation - specifically nitrogen dioxide (NO_2) and volatile organic compounds (VOCs), primarily as emitted from internal combustion processes and most commonly as vehicular emissions. All such sources of emissions operated in support of execution of the project must be compliant with the conformity plan.

3.2.3 Air Pollutants of Potential Concern

Of the air pollutants listed above, those of potential concern are particulate matter from disturbed soils, particulates from combustion of fuel, NO_X, and CO. The sources of these pollutants include construction, dust and particulate emissions from roads, tailpipe emissions, and off-road vehicle traffic.

Particulates would occur primarily from short-term construction-related activities or short-term maintenance activities that may generate fugitive dust; and to a lesser degree, from tailpipe emissions, such as diesel exhaust from construction or maintenance vehicles.

3.2.4 Photochemical Oxidants

When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place, producing small amounts of ozone and other oxidants. Approximately 90 percent of oxidants are ozone and the remainder mainly nitrogen oxides.

The NAAQS for photochemical oxidants, of which ozone is the principal component, is 235 micrograms per cubic meter ($\mu g/m^3$) or 120 parts per billion.

3.2.5 National Ambient Air Quality Standards

The criteria for potential air quality impacts include NAAQS requirements for CO, PM_{10}, $PM_{2.5}$, sulfur dioxide (SO_2), and NO_2/NO_X. Applicable Federal and state criteria are presented in **Table 3.2-1**. Primary Standards are established to protect human health and secondary standards to protect the environment. Units of measure for the standards are parts per million by volume, parts per billion by volume, and $\mu g/m^3$. The current NAAQS for PM are:

- 24-hour average PM_{10} concentration is not to exceed 150 µg/m^3 more than once per year;
- 3-year average of the 98th-percentile 24-hour average $PM_{2.5}$ concentration is not to exceed 35 µg/m^3 more than once per year; and
- 3-year average of the annual mean $PM_{2.5}$ concentration is not to exceed 15 µg/m^3.

Table 3.2-1 National and State Ambient Air Quality Standards

Pollutant [final rule cite]		Primary/ Secondary	Averaging Time	Level	Form
Carbon monoxide [76 FR 54294, Aug. 31, 2011]		Primary	8-hour	9 ppm	Not to be exceeded more than once per year
			1-hour	35 ppm	
Lead [73 FR 66964, Nov. 12, 2008]		Primary and secondary	Rolling 3-month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen dioxide [75 FR 6474, Feb. 9, 2010] [61 FR 52852, Oct. 8, 1996]		Primary	1-hour	100 ppb	98th percentile, averaged over 3 years
		Primary and secondary	Annual	53 ppb (2)	Annual Mean
Ozone [73 FR 16436, Mar. 27, 2008]		Primary and secondary	8-hour	0.075 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle pollution Dec. 14, 2012	$PM_{2.5}$	Primary	Annual	12 µg/m^3	98th percentile, averaged over 3 years
		Secondary	Annual	15 µg/m^3	Annual mean, averaged over 3 years
		Primary and secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year
Sulfur dioxide [75 FR 35520, June 22, 2010] [38 FR 25678, Sept. 14, 1973]		Primary	1-hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		Secondary	3-hour	0.5 ppm	Not to be exceeded more than once per year

[1] Final rule signed October 15, 2008. The 1978 lead standard (1.5 µg/m^3 as a quarterly average) remains in effect until one year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[2] The official level of the annual nitrogen dioxide standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

[3] Final rule signed March 12, 2008. The 1997 O_3 standard (0.08 ppm, annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years) and related implementation rules remain in place. In 1997, EPA revoked the 1-hour ozone standard (0.12 ppm, not to be exceeded more than once per year) in all areas, although some areas have continued obligations under that standard (“anti-backsliding”). The 1-hour O_3 standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is less than or equal to 1.

[4] Final rule signed June 2, 2010. The 1971 annual and 24-hour SO_2 standards were revoked in that same rulemaking. However, these standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

µg/m^3 = micrograms per cubic meter, ppb = part per billion, ppm = part per million, $PM_{2.5}$ = particulate matter 2.5 microns or less, PM_{10} = particulate matter 10 microns or less.

Source: EPA 2012.

3.2.5.1 Ozone

In 2007, the Denver Metro/North Front Range region exceeded the Federal ozone standard and its status was changed to nonattainment. Ozone is not typically emitted directly from an individual source, but instead forms as a result of other precursors that are transformed by photo-chemical reactions in the atmosphere. Emissions from motor vehicles, industry, and even vegetation contribute to ozone formation.

Breathing air containing ozone can reduce lung function and increase respiratory symptoms, thereby aggravating asthma or other respiratory conditions. Ozone exposure may contribute to premature death, especially in people with heart and lung disease. High ozone levels also can harm sensitive vegetation and forested ecosystems (EPA 2012). Recent 2012 monitoring results for ozone near the project area would indicate that ozone continues to exceed the NAAQS. **Table 3.2-2** shows the Ozone Monitored Values in Larimer County during 2012.

Table 3.2-2 Larimer County Ozone Monitored Values 2012

First Max (ppm)	Second Max (ppm)	Third Max (ppm)	Fourth Max (ppm)	Number of Exceedences	Location
0.090	0.087	0.081	0.081	15	Rocky Mountain National Park
0.093	0.086	0.086	0.08	13	Fort Collins
0.094	0.080	0.075	0.074	2	Fort Collins
0.086	0.084	0.079	0.077	5	Estes Park

ppm = part per million.

3.2.6 Particulate Matter

Natural sources of PM are dust generated by wind erosion of disturbed soil surfaces and wild land fire. Areas cleared of vegetation are particularly susceptible to dust generation and recent (2012) wildfires in Larimer County caused elevated levels of PM_{10} and $PM_{2.5}$ in the vicinity of the proposed project. Wildfires generally are considered exceptional events and do not cause an area to be declared nonattainment.

The size of PM is important from a human health perspective. There are three common size classifications of PM: the largest size classification is Total Suspended Particulate; the second largest classification is PM_{10}; and the third size classification is designated $PM_{2.5}$.

3.2.7 Prevention of Significant Deterioration

In addition to the designations relative to attainment of conformance with the NAAQS, the CAA requires the EPA to place selected areas within the U.S. into one of three categories, which are designed to limit the deterioration of air quality when it is better than the NAAQS. Class I is the most restrictive air quality category. It was created by Congress to prevent further deterioration of air quality in national parks and wilderness areas of a given size, which were in existence prior to 1977, or those additional areas that have since been designated Class I under Federal regulations (40 CFR 52.21). The closest Class I area to the project area is Rocky Mountain National Park (2 miles to the west of the westernmost part of the project). Areas outside of the designated Class I boundaries are designated as Class II areas, which are allowed a relatively greater deterioration of air quality, although it must still be maintained below NAAQS. No Class III areas have been designated in the U.S.

3.3 Geology and Paleontology

3.3.1 Geology

The proposed project is mainly located in the Rolling Upland of the Southern Rocky Mountain physiographic province (Cole and Braddock 2009; Fenneman 1928). The extreme eastern portion of the project area is in the Foothills Hogbacks of the Colorado Piedmont province. Elevations along the project area range from 5,500 feet above sea level at Flatirons Reservoir up to around 8,600 feet above sea level where the ROW crosses the Rolling Upland. The major drainages, such as the Big Thompson and Saint Vrain Rivers, drain west to east.

The existing transmission lines primarily cross very old Precambrian intrusive and metamorphic rocks (**Figures 3.3-1a** through **3.3-1d**). Much younger sedimentary rocks occur at the southern end of Pinewood Reservoir and at the project's Flatiron Reservoir terminus (Cole and Braddock 2009). **Table 3.3-1** includes a summary of geologic age and map symbols used for geologic formations crossed by the proposed project.

Younger Precambrian intrusive rocks crossed by the existing transmission lines include the Longs Peak granite (YgLP) and associated pegmatite (YXp). A pegmatite is composed of coarse-grained granitic crystalline rock that may contain higher concentrations of elements not found in typical granites. Longs Peak granite was intruded around 1,420 million years ago, plus-or-minus 25 million years. The age of the pegmatite is uncertain and may be similar to the Longs Peak granite or older (Cole and Braddock 2009).

Older Precambrian intrusive rocks traversed by the existing transmission lines include granodiorite (Xgd) and Thompson Canyon trondhjemite (XjT). The granodiorite (an intrusive igneous rock with large amounts of the minerals biotite and horneblend) was emplaced in separate bodies around 1,714 million years ago, plus-or-minus 5 million years (Cole and Braddock 2009). The Thompson Canyon trondhjemite (light-colored igneous intrusive rock with abundant amounts of plagioclase and quartz) was intruded about 1,726 million years ago, plus-or-minus 15 million years.

The Precambrian metamorphic rocks traversed by the transmission lines include knotted mica schist (Xbk) and quartzofeldspathic mica schist (Xbq). The age of metamorphism is 1,713 million years ago, plus-or-minus 30 million years (Cole and Braddock 2009).

The Pennsylvanian-aged Fountain Formation (PlPf) unconformably overlies the Precambrian rocks. Along the Front Range, the Fountain Formation forms flatiron outcrops that dip steeply to the east. The Fountain Formation accumulated in alluvial fans and coastal-plain environments about 260 to 250 million years ago during Middle Pennsylvanian to Late Pennsylvanian/Lower Permian time (Cole and Braddock 2009). This sedimentary deposit, originated as sediments eroded from the Ancestral Rocky Mountains and includes reddish-brown to purplish-gray feldspar-rich conglomerates, trough cross bedded medium- to coarse-grained feldsparrich sandstone, dark reddish-brown siltstone and shale, and thin localized limestone beds (Cole and Braddock 2009).

Deposits of much younger Late Pleistocene and modern colluvium (Qc) present in the area consist of materials that range in size from silt to boulders. These deposits were produced by a variety of interacting mass-wasting processes: chemical weathering, erosion, frost action, and slope angle. Deposited along the valley floor, these deposits may have accumulated piecemeal over long spans of time or episodically as the result of one or more landslides or avalanches. As mapped by Cole and Braddock (2009), this geological mapping unit includes small-area deposits.

Figure 3.3-1a Geology in the Project Area

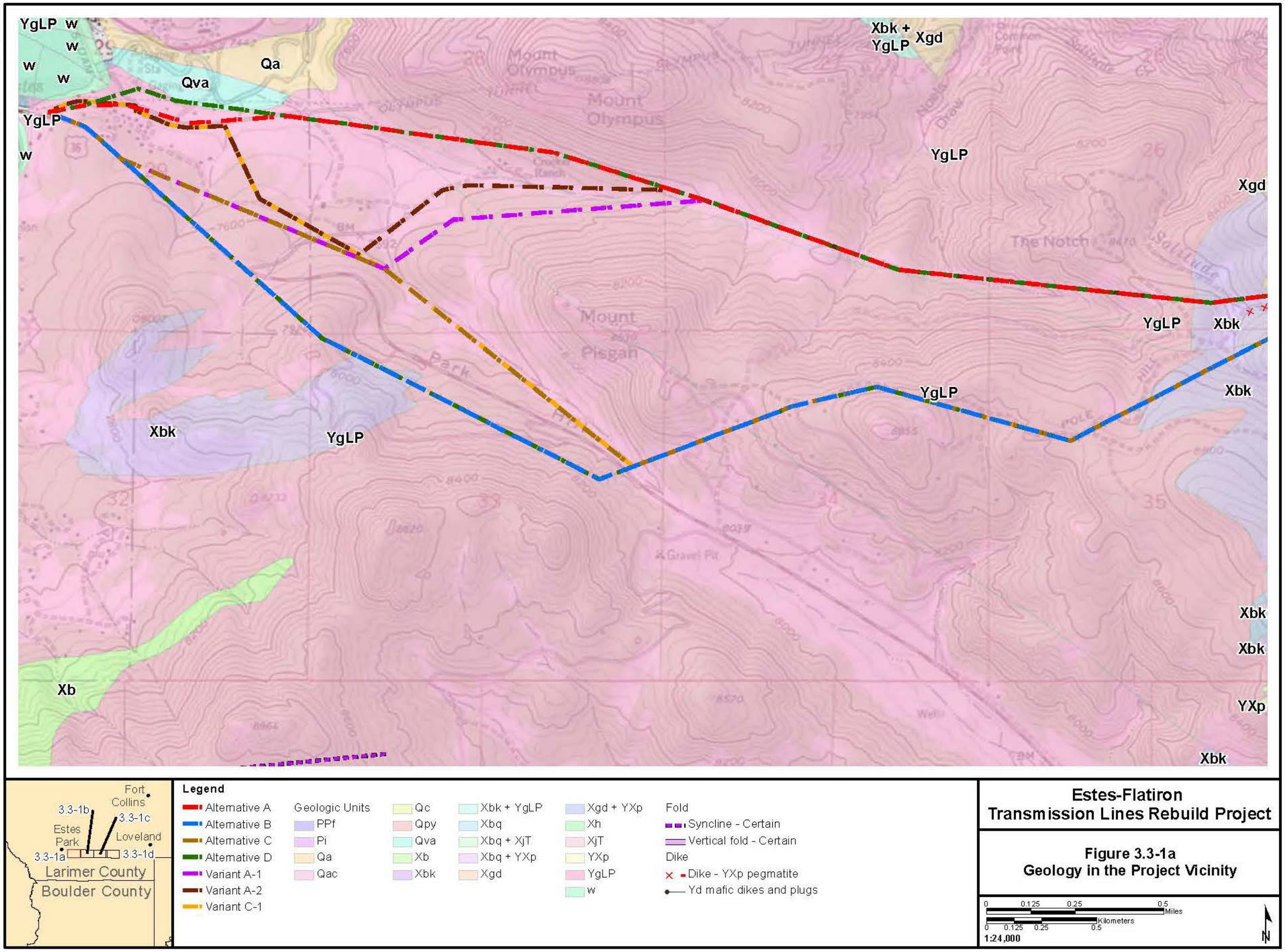


Figure 3.3-1b Geology in the Project Area

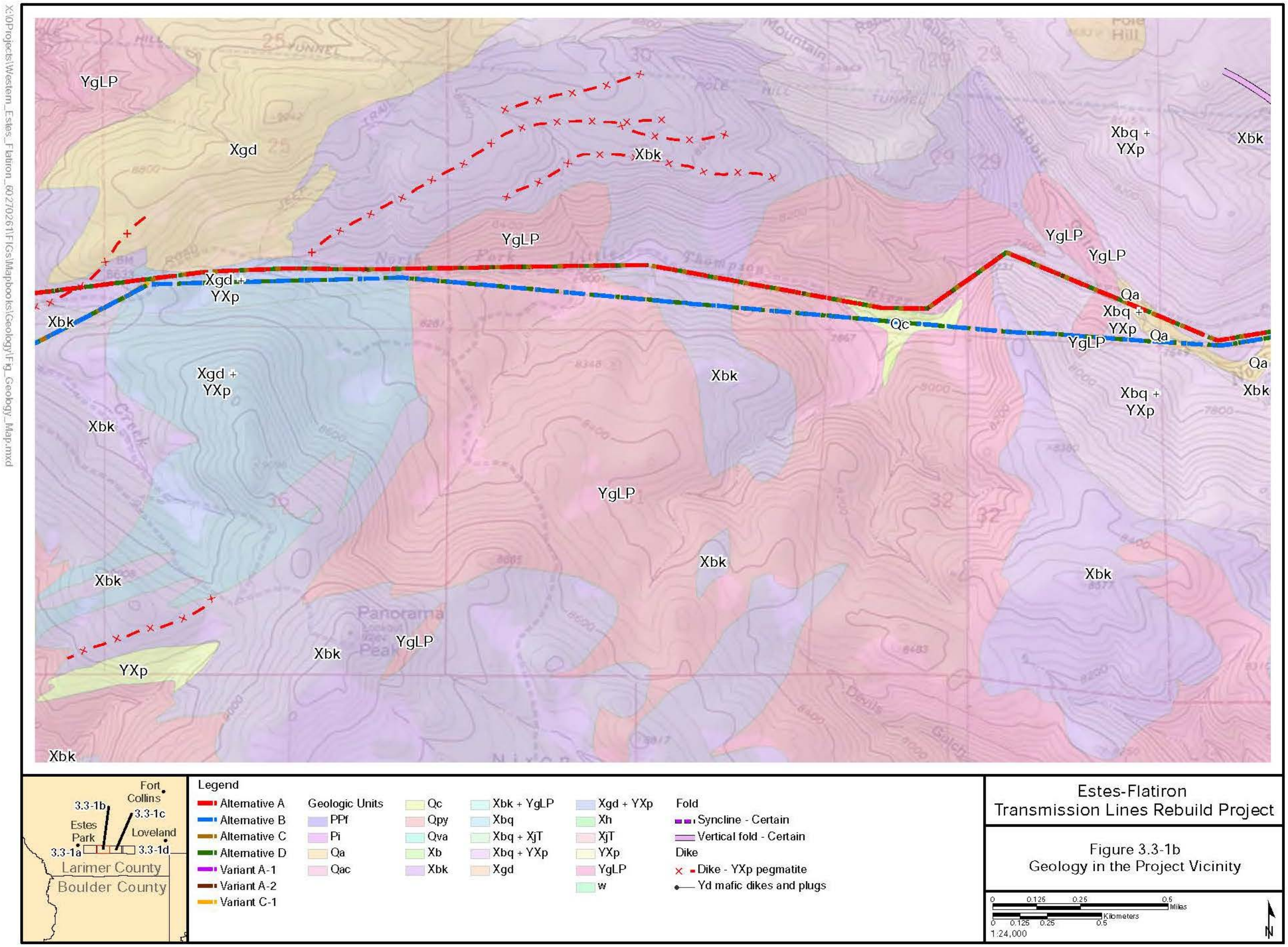


Figure 3.3-1c Geology in the Project Area

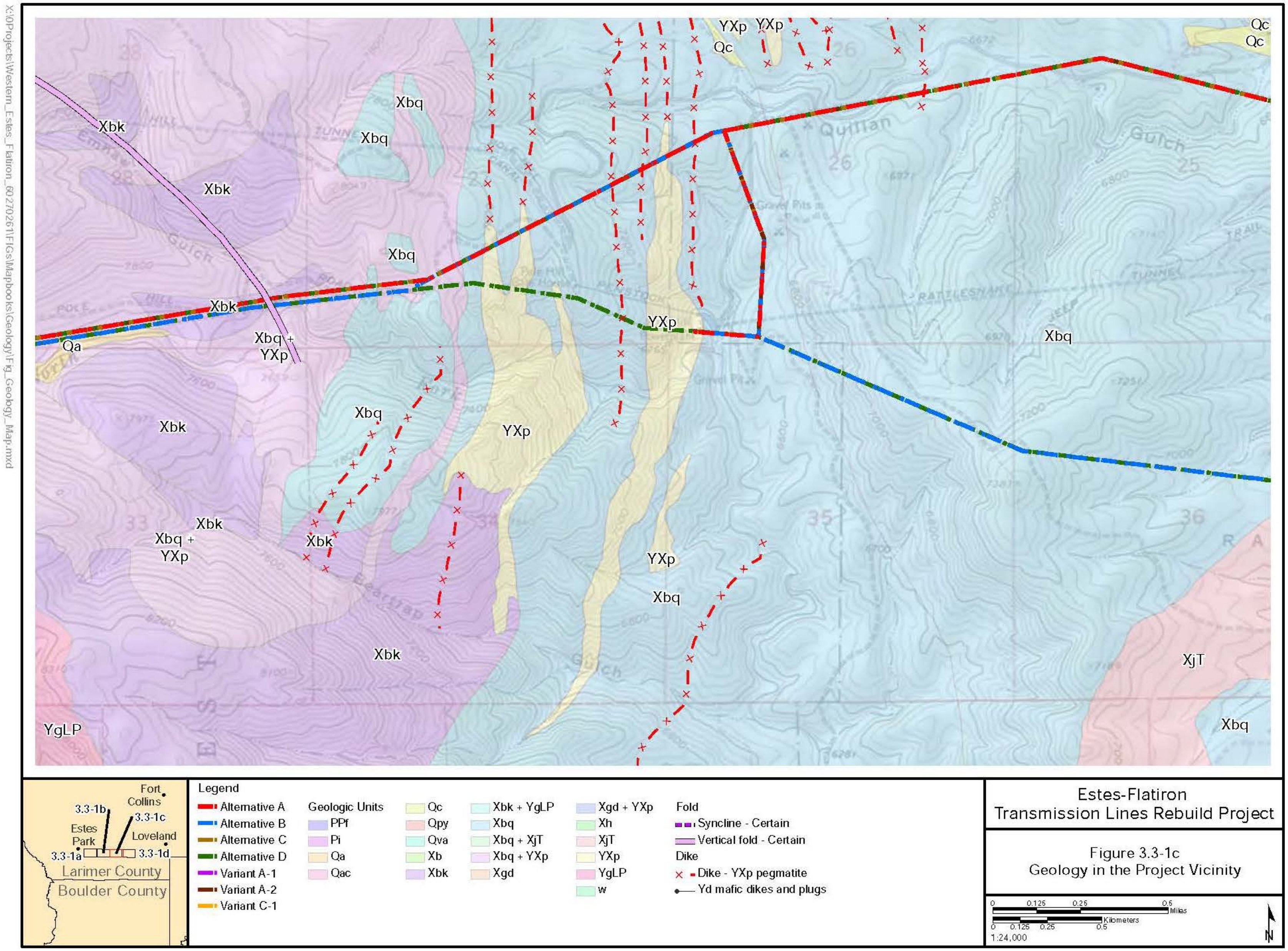


Figure 3.3-1d Geology in the Project Area

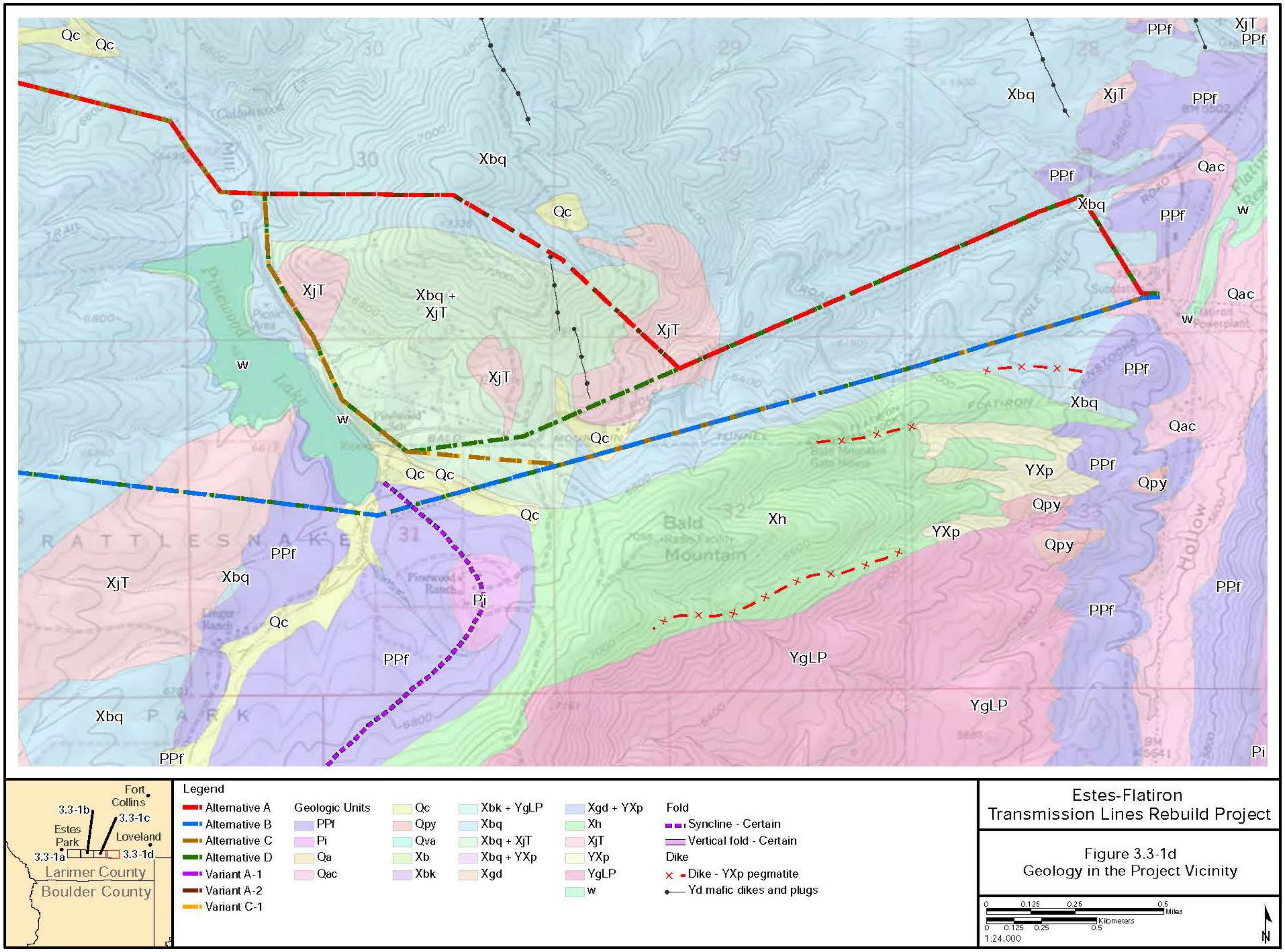


Table 3.3-1 Stratigraphic Chart, Project Vicinity

Era	Eon/Period	Series	Age (Ma[a])	Formation*/Map Symbol
Cenozoic	Quaternary	Holocene	< .015	Alluvium (Qa) Alluvium and colluvium (Qac) Colluvium (Qc) Mountain valley alluvium (Qva)
		Pleistocene	0.1-<0.015	Alluvium (Qa) Alluvium and colluvium (Qac) Colluvium (Qc) Mountain valley alluvium (Qva) Younger piedmont-slope Alluvium (Qpy)
Paleozoic	Permian	All	250-280	Ingleside Formation (Pi) Fountain Formation (PPf)
	Carboniferous	Pennsylvanian	280-320	Fountain Formation (PPf)
		Mississippian	320-360	Not present in project vicinity
	Devonian	All	360-410	Not present in project vicinity
	Silurian	All	410-440	Not present in project vicinity
	Cambrian	All	500-540	Not present in project vicinity
Precambrian	Proterozoic	Neoproterozoic	540-1,000	Not present in project vicinity
		Mesoproterozoic	1,000-1,600	Knotted mica schist and Granite of Longs Peak Batholith (undivided) (Xbq + YgLP) Quartzofeldspathic mica schist and pegmatite (Xbq + YXp) Granodiorite and pegmatite (Xgd + YXp) Granite of Longs Peak batholith (YgLP) Pegmatite (YXp)
		Paleoproterozoic	1,600-2,500	Biotite schist and gneiss (Xb) Knotted Mica Schist (Xbk) Knotted mica schist and Granite of Longs Peak Batholith (undivided) (Xbq + YgLP) Quartzofeldspathic mica schist (Xbq) Quartzofeldspathic mica schist and Trondhjemite of Thompson Canyon, undivided (Xbq + XjT) Quartzofeldspathic mica schist and pegmatite (Xbq + YXp) Granodiorite (Xgd) Granodiorite and pegmatite (Xgd + YXp) Hornblende gneiss and amphibolite (Xh) Trondhjemite of Thompson Canyon (XjT) Pegmatite (YXp)

[a] Ma = Million years ago.

3.3.2 Paleontology

The igneous rocks and metamorphic rocks that form bedrock in the area would not have preserved fossils and would be ranked as 1 (low potential for fossils under the Potential Fossil Yield Classification System (Bureau of Land Management 2007). In addition, these rocks may have preceded the presence of life on earth, precluding the potential presence of fossils. Exposures of these widespread igneous and metamorphic rocks would be expected to be devoid of fossils. Colluvium deposits (Qc), preserved in places within the area, have a nominally higher potential for fossil preservation (Potential Fossil Yield Classification rank 2).

The Fountain Formation is found in bedrock exposures at the southern end of Pinewood Reservoir and has the best potential of yielding fossils (Potential Fossil Yield Classification rank 3). Plant fossils from non-arkosic beds preserved in the Glen Eyrie Shale Member at the base of the Fountain Formation were originally noted by Finlay (1907, 1916). Jennings (1980) identified 15 species of tree-sized fern impressions found just above the Glen Eyrie Member at two localities just north of Canyon City on the western flank of the modern Rocky Mountain uplift. In addition, Ellis (1966) reported silicified Morrowan Age invertebrates from the Glen Eyrie Member weathering out of a 20-foot-thick calcareous interval 250 feet above the base of the Fountain Formation at Perry Park, about 35 miles south of Denver. The invertebrate fauna from this isolated Front Range locality includes bryozoans, brachiopods, crinoids, echinoids, and gastropods.

Only two Fountain Formation fossil localities have been identified in the foothill hogback belt to the east of the project area. Toepelman and Rodeck (1936) described and named an amphibian fossil-footprint track-way found north of Denver in a Fountain Formation quarry on Flagstaff Mountain west of Boulder, Colorado.

3.3.3 Mineral Resources

In the Rolling Uplands, pegmatites have been explored for gem quality minerals and rare earths. In addition, the metamorphic rock terrains may contain high-quality mica crystals.

3.3.4 Geologic Hazards

Geologic hazards that could affect the area include landslides, floods, earthquakes and abandoned mines. The most likely hazards in the project area are mass movements on steep slopes that would be triggered by heavy precipitation (melting snow or rainfall) that saturates and lubricates unconsolidated materials. The potential for landslides is widespread in the project area, based on hazard maps available from the Colorado Geological Survey (2012) (**Figures 3.3-2a** through **3.3-2d**). Flash flooding may be a hazard in narrow canyons. These areas are limited in the project area.

There are no known faults underlying the area that show Quaternary movement (U.S. Geological Survey [USGS] and Colorado Geological Survey 2006). The USGS seismic hazard map (Petersen 2008) indicates that ground movement in the project area that could be triggered by a maximum credible earthquake is expected to be low; having a peak ground acceleration of less than 10 percent of the acceleration of gravity with a 10 percent probability of exceeding that peak ground acceleration in 50 years. No abandoned mine workings have been identified on National Forest System lands in the project area (Sares 1993).

Figure 3.3-2a Landslides and Potentially Unstable Slopes

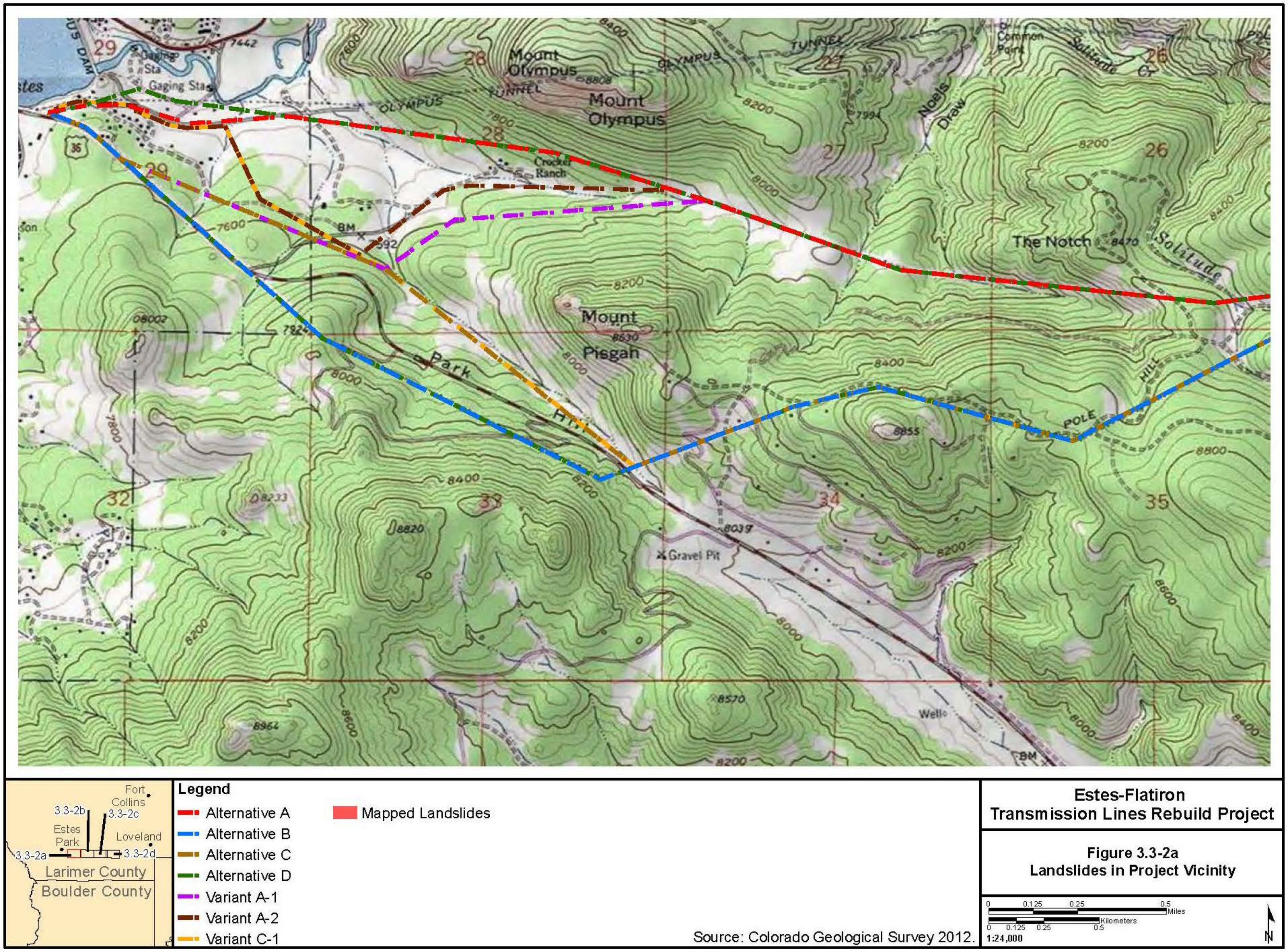


Figure 3.3-2b Landslides and Potentially Unstable Slopes

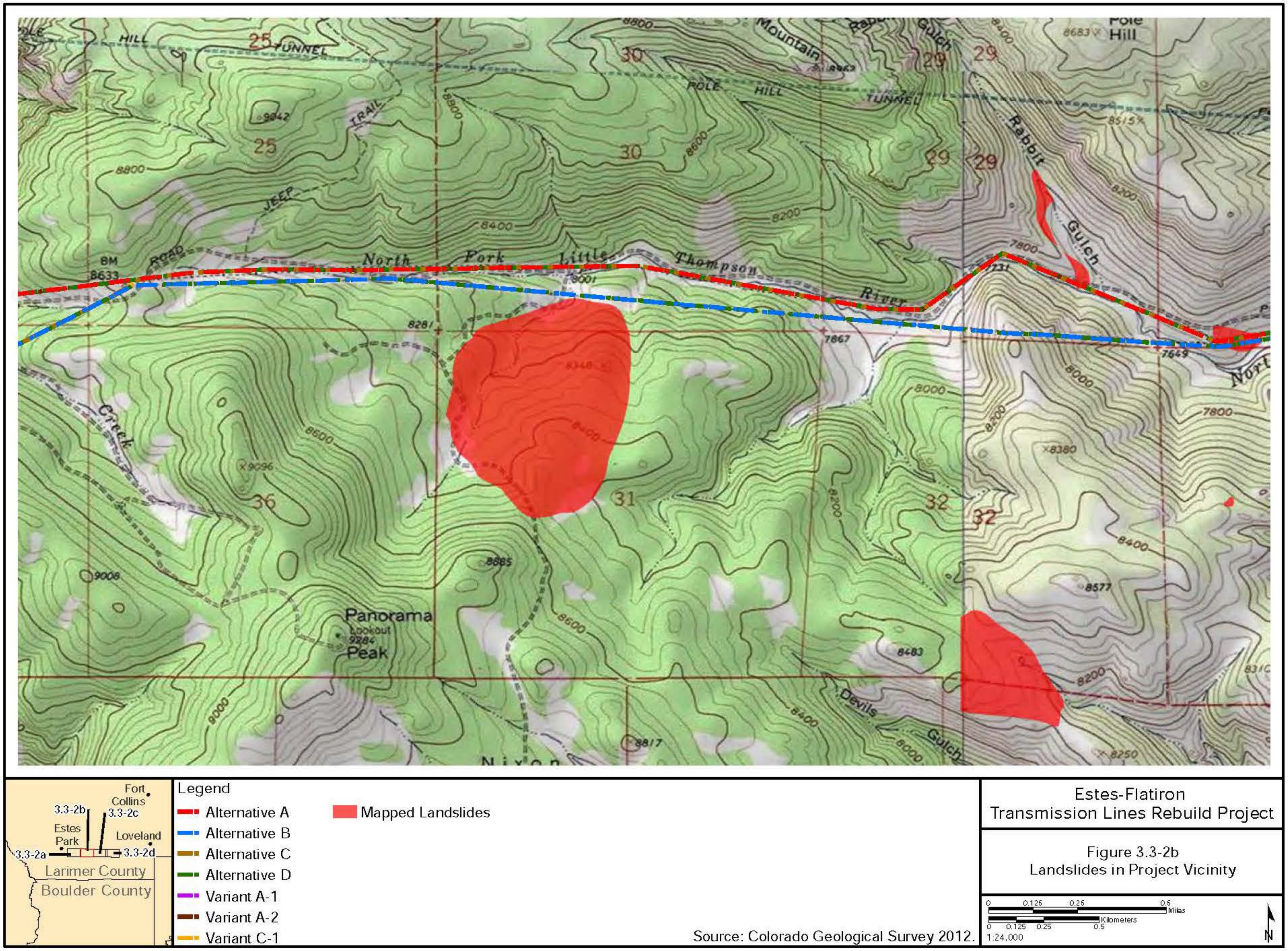


Figure 3.3-2c Landslides and Potentially Unstable Slopes

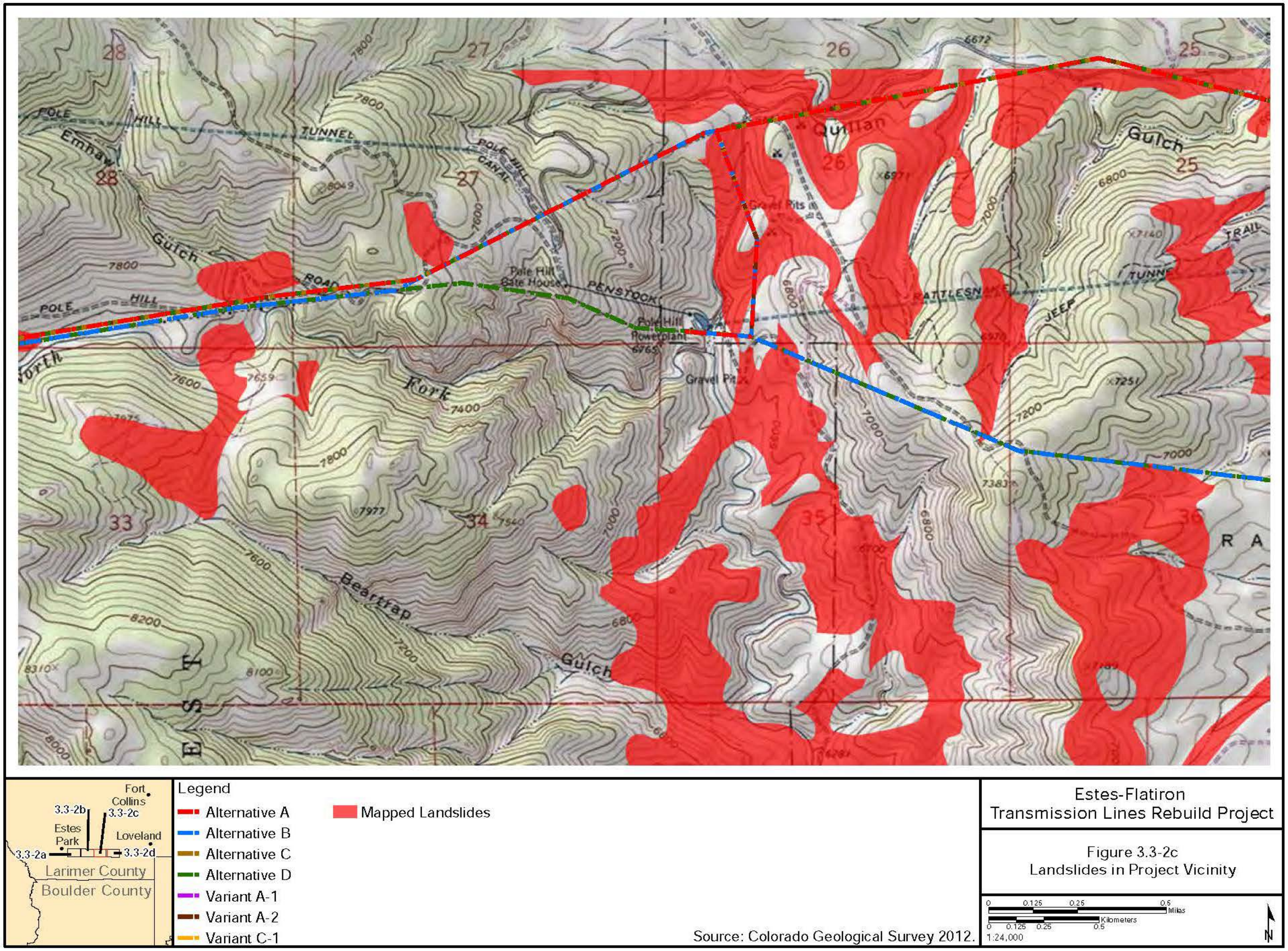
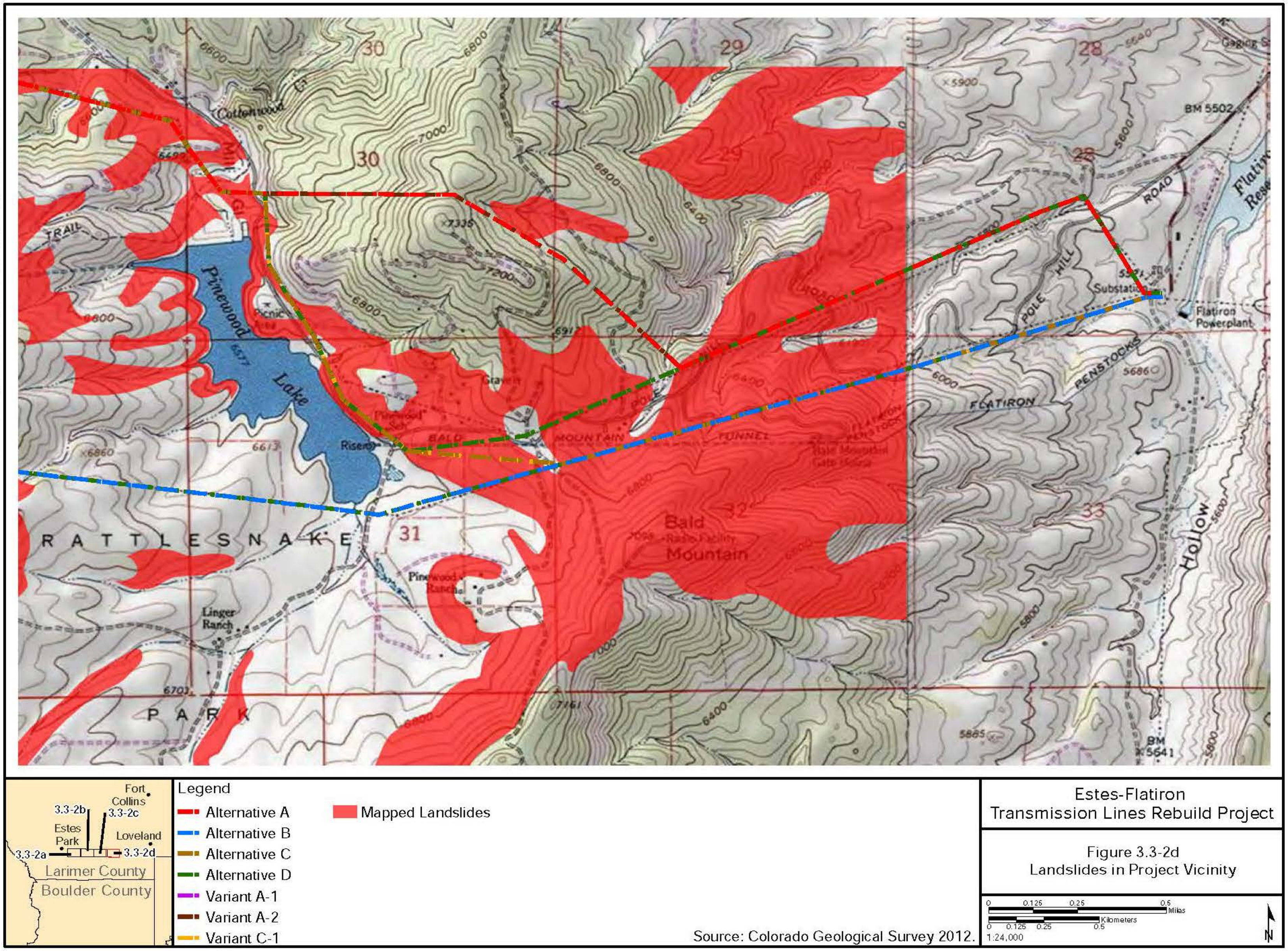


Figure 3.3-2d Landslides and Potentially Unstable Slopes



3.4 Soils

Information regarding soil characteristics was obtained from Natural Resources Conservation Service (NRCS) literature or databases, including the Land Resource Regions and Major Land Resource Areas of the U.S., the Caribbean, and the Pacific Basin, U.S. Department of Agriculture (USDA) Handbook 296 (USDA-NRCS 2006) and the Soil Survey Geographic Database. Soil baseline characterization for the project area is based on Soil Survey Geographic Database review and analyses. The Soil Survey Geographic Database is the most detailed level of soil mapping completed by the USDA-NRCS. The Soil Survey Geographic Database for Larimer County and the Roosevelt National Forest, Colorado (NRCS 2012a) are the source for the soils data in this section. **Table 3.4-1** provides a summary of the soil characteristics within the project vicinity generated from the Soil Survey Geographic Database (NRCS 2012a). The various soil map units within the project vicinity were combined into generalized groups of soils to evaluate potential impacts and to determine effective erosion control measures, reclamation, and revegetation potential in the area.

3.4.1 Regional Overview

The project area is located entirely within Major Land Resource Areas 48A, the Southern Rocky Mountains Province of the Rocky Mountain System (USDA-NRCS 2006). This Major Land Resource Areas consists primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. Elevation ranges from 6,500 to 14,400 feet amsl. Many of the highest mountain ranges were reshaped by glaciation. Alluvial fans at the base of the mountains are recharge zones for local basin and valley fill aquifers.

The soils in Major Land Resource Area 48A primarily formed in slope alluvium and colluvium on mountain slopes or residuum on mountain peaks derived from igneous, metamorphic, and sedimentary parent materials. Younger igneous parent materials, primarily basalt and andesitic lava flows, tuffs, breccias, and conglomerates, are located throughout this area. The dominant soil orders in this Major Land Resource Areas are Mollisols, Alfisols, Inceptisols, and Entisols. Mollisols are fertile soils with high organic matter and a nutrient-enriched, thick surface. Alfisols generally are well developed soils that show extensive profile development, with distinct argillic (clay) accumulations in the subsoil. Alfisols have at least 35 percent base saturation, meaning calcium, magnesium, and potassium are relatively abundant. In contrast, Inceptisols are weakly developed soils that have altered horizons that have lost bases or iron and aluminum but retain some weatherable minerals. Entisols are considered recent soils that lack soil development because erosion or deposition rates occur faster than the rate of soil development.

3.4.2 Project Vicinity Soil Characteristics

Soil characteristics such as susceptibility to erosion and the potential for revegetation are important to consider when planning for construction activities and stabilization of disturbed areas. These limitations are a function of the soils physical and chemical properties as affected by climate and vegetation changes. **Table 3.4-1** summarizes the properties that establish the rate of soil susceptibility due to surface disturbing activities. Explanations of the meanings of each column follow the table.

Water erosion is the detachment and movement of soil by water. Natural erosion rates depend on inherent soil properties, slope, soil cover, and climate. Approximately 11 miles of the soils crossed by the existing transmission lines are highly erodible to water. Wind erosion is the physical wearing of the earth’s surface by wind. Wind erosion removes and redistributes soil. Wind erodible soils are not common within the project vicinity. Highly erodible soils typically require aggressive erosion control measures to minimize soil loss and offsite deposition if they are disturbed.

Table 3.4-1 Soil Characteristics within the Project Vicinity (miles crossed by existing lines)

Map Unit Symbol	Map Unit Name	Miles Crossed	Wind Erodible	Water Erodible	LRP	Compaction Prone	Shallow Bedrock	Droughty	Risk of Corrosion to Steel
112	Trag-Moen complex, 5 to 30 percent slopes	9	0	0	0	4	4	0	0
117	Wetmore-Boyle-Rock outcrop complex, 5 to 60 percent slopes	4	0	1	0	0	1	0	0
30	Elbeth-Moen loams, 5 to 30 percent slopes	4	0	2	0	3	1	0	0
58	Kirtley-Purner complex, 5 to 20 percent slopes	2	0	0	0	0	0	0	2
85	Purner fine sandy loam, 1 to 9 percent slopes	1	0	0	0	0	0	0	1
87	Ratake-Rock outcrop complex, 25 to 55 percent slopes	8	0	2	0	0	2	0	0
2101B	Pachic Argiustolls, 5 to 25 percent slopes	2	0	0	0	0	0	0	0
2703B	Cypher-Ratake families complex, 5 to 40 percent slopes	1	0	0	0	0	7	0	0
2705D	Ratake-Cathedral families-Rock outcrop complex, 40 to 150 percent slopes	2	0	1	<1	0	<1	0	0
2706D	Cypher family-Rock outcrop complex, 40 to 150 percent slopes	1	0	1	0	0	1	0	0
2717B	Cypher-Wetmore-Ratake families complex, 5 to 40 percent slopes	5	0	0	1	0	3	0	0
4703D	Bullwark-Catamount families-Rock outcrop complex, 40 to 150 percent slopes	4	0	4	3	0	4	1	0
4704B	Bullwark-Catamount families-Rubble land complex, 5 to 40 percent slopes	1	0	0	1	0	1	<1	0
5101A	Pachic Argiustolls-Aquic Argiudolls complex, 0 to 15 percent slopes	1	0	0	0	3	0	0	3

Note: Discrepancies in total number of miles crossed may exist. Data represents all alternatives.

LRP = limited revegetation potential

Source: NRCS 2012a.

Soil compaction occurs when soil particles are pressed together and the pore spaces between them are reduced and bulk density is increased. Moist, fine textured soils are most susceptible to severe compaction. Compaction-prone soils are often high in clay content, which can be a limiting factor to vegetation growth. Approximately 10 miles of the soils crossed by the existing line ROW are compaction prone.

Soils with limited revegetation potential have chemical characteristics such as high salts, sodium, or very high or low pH that may limit plant growth. Saline soils affect plant uptake of water and sodic soils often have drainage limitations. In addition, the success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical and chemical characteristics of the soils. Approximately 5.9 miles of the soils crossed have low revegetation potential, and where disturbed, revegetation may be difficult. However, it is likely that not all 5.9 miles would be disturbed by construction of the transmission line. Many of these areas may be spanned.

In areas with a shallow depth to lithic bedrock (relative to the tower foundation excavation depth), excavation may result in rock fragments remaining on the surface at levels that will limit the success of restoration efforts. Where the proposed routes cross soils with lithic bedrock specialized drilling equipment may be required for tower foundations. Approximately 24 miles of soils crossed have lithic bedrock less than 60 inches in depth.

Corrosion potential pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. For uncoated steel, the risk of corrosion is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract. For concrete, the risk of corrosion is based on soil texture, acidity, and amount of sulfates in the saturation extract (NRCS 2012a). No soils that are corrosive to concrete are found within the project vicinity. Approximately 6 miles of soils crossed are corrosive to uncoated steel.

Soils that are droughty have physical characteristics that may limit plant growth due to low water holding capacity. In addition, the success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical characteristics of the soils. Approximately 1 mile of the soils crossed is considered droughty.

Hydric soils are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part that is hydric. These soils are commonly associated with floodplains, lake plains, basin plains, riparian areas, wetlands, springs, and seeps. Based on the soil survey mapping, no hydric soils are crossed by the project; however, small areas of hydric soils may not be documented due to the scale of mapping. Alteration of hydric, saturated, or hummocky soils should be avoided.

Prime farmland is land that has the best combination of physical and chemical characteristics for producing crops and is available for these uses. These soils have the capability to be prime farmland, even if they have not yet been developed for agricultural uses. The Farmland Protection Policy Act states that Federal programs that contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses will be minimized and shall be administered in a manner that, as practicable, are compatible with state and local government and private programs and policies to protect farmland. No prime farmland is within the project area (NRCS 2012a)

3.5 Water Resources and Floodplains

Federal regulations that ensure the protection of water resources include the Safe Drinking Water Act and the CWA. The Safe Drinking Water Act protects drinking water resources and requires strategies to prevent pollution. The CWA regulates pollutant discharge into streams, rivers and wetlands. The EPA has established primary and secondary standards to guarantee quality drinking water. The CDPHE implements the standards set by the EPA and regulates the discharge of pollutants into surface and ground water and enforces the Primary Drinking Water Regulations.

Section 402 of the CWA authorizes discharges of storm water under the NPDES. The State of Colorado is delegated the NPDES program under the CWA and has adopted their own state Pollutant Discharge Elimination System programs. Western would prepare a Storm Water Pollution Prevention Plan as part of the proposed project. This Plan would include stabilization practices, structural practices, storm water management, and other controls.

Floodplains are land areas adjacent to rivers and streams that are subject to recurring flooding. Floodplains typically help moderate flood flow, recharge groundwater, spread silt to replenish soils, and provide habitat for a number of plant and animal species. EO 11988, Floodplain Management, requires Federal agencies to ensure their actions minimize the impacts of floods on human health and safety, and restore the natural and beneficial values of floodplains. DOE regulations in 10 CFR parts 1021 and 1022 require public notification of floodplain involvement (DOE 2003). Western sent a notification of proposed floodplain action for the proposed alternatives to affected landowners, FEMA, and other agencies with its NOI that was distributed as part of the EIS scoping.

3.5.1 Surface Water

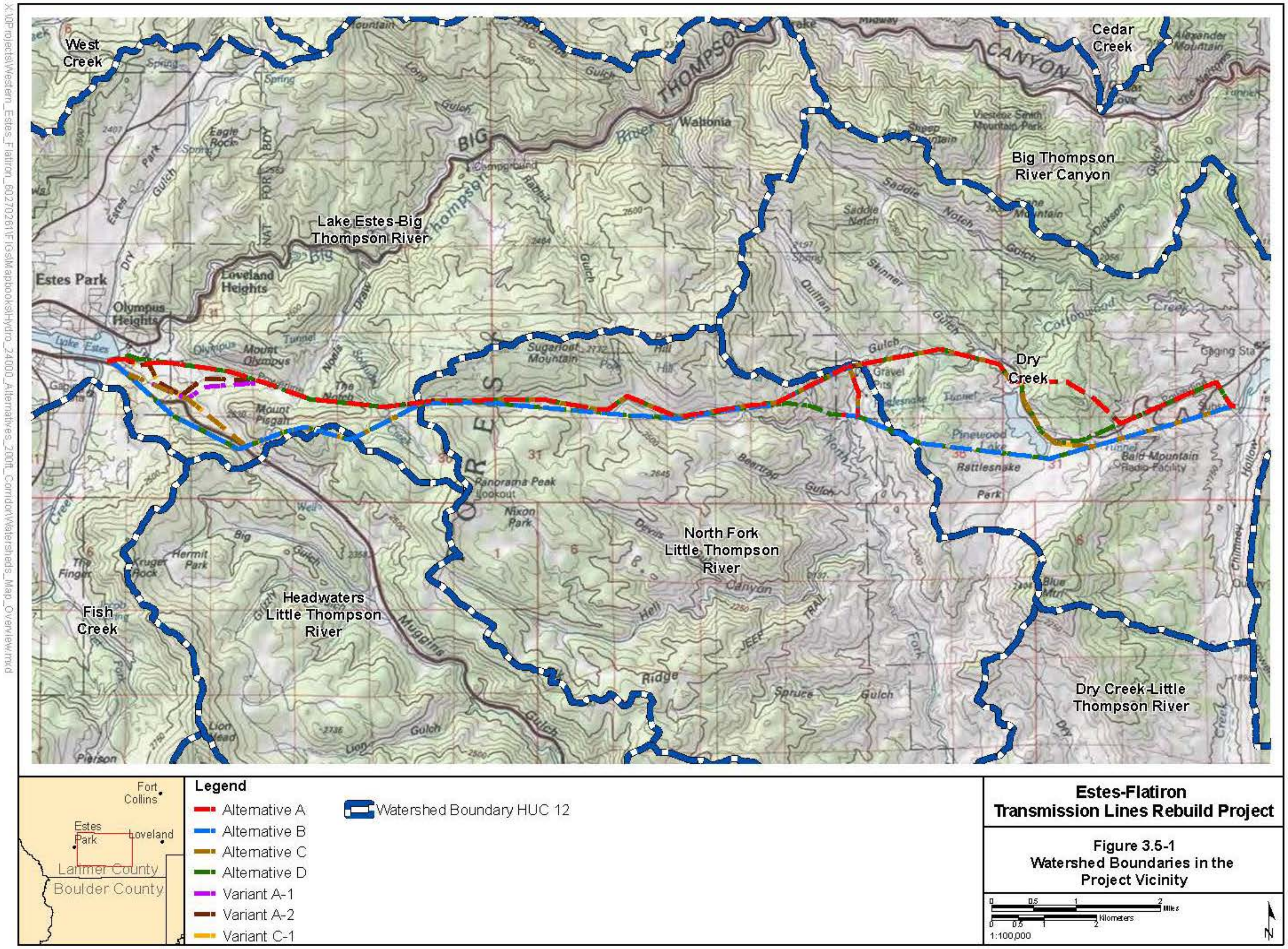
The project area is located within the Big Thompson River watershed in Larimer County, Colorado and includes streams and floodplains crossed by the existing transmission lines, the proposed alternatives, and access roads. Watersheds in the U.S. were delineated by the USGS using a national standard hierarchical system based on surface hydrologic features. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to twelve digits. There are four 12-digit HUC watersheds located on or near the proposed alternatives (NRCS 2012b):

- Lake Estes/Big Thompson (101900060207);
- Headwaters Little Thompson River (101900060402);
- North Fork Little Thompson River (101900060403); and
- Dry Creek - OBTR (101900060602).

These watershed boundaries are shown on **Figure 3.5-1.**

Water quality classifications and standards adopted by the Colorado Water Quality Control Commission implement the Water Quality Control Act in Colorado. Water quality in streams along the existing transmission lines is classified by the CDPHE for current or reasonably expected uses, and uses for which the waters would become more suitable when a water quality goal is attained (CDPHE 2012a,b). All existing and classified uses are to be protected. The classifications are to be for the highest water quality attainable through the use of effluent limitations for point sources and implementation of cost-effective and reasonable best management practices for non-point sources (CDPHE 2012a).Western's SCPs (similar to best management practices) are presented in Section 2.5 Standard Construction Practices.

Figure 3.5-1 Watershed Boundary Map



Section 303(d) of the Federal CWA requires that states list waters that do not fully support existing or designated uses and require development of a Total Maximum Daily Load. Colorado's Monitoring and Evaluation List identifies water bodies where there is reason to suspect water quality problems, but where there is uncertainty regarding one or more factors, such as the representative nature of the data. Also placed on the Monitoring and Evaluation List are water bodies that are impaired but it is unclear whether the cause of impairment is attributable to specific pollutants or general pollution. This list is a state-only document that is not subject to EPA approval (CDPHE 2012c). **Table 3.5-1** shows the stream reaches within the project area that are currently on the state of Colorado's 303(d) impaired water list.

Field reconnaissance was conducted in July and September, 2011. A comprehensive drainage and wetland crossing table was developed that shows all drainages and canals that are spanned by the existing transmission lines or crossed by existing access roads. **Table 3.5-2** shows the number of stream crossings for the alternatives. Approximately 30 small culverts are located along the existing transmission lines.

The North Fork Little Thompson River is the only perennial stream spanned by transmission lines or crossed by access roads within the project area. The remaining 53 ephemeral stream crossings span several tributaries to the Big Thompson River, North Fork Noels Draw, South Fork Noels Draw, Solitude Creek, Quillan Gulch, Mill Gulch, Emhaw Gulch, and unnamed tributaries to these drainages, as well as tributaries to Pinewood Reservoir and Flatiron Reservoir. The ephemeral channels typically flow only during snow melt or local precipitation events.

Existing access roads cross drainages approximately 37 times. Approximately 30 of these crossings have culvert(s) crossings.

3.5.2 Floodplains, Wild and Scenic Rivers

FEMA Flood Insurance Rate Maps are available for the entire project area. These maps, published in December 2006, show Special Flood Hazard Areas (SFHAs), also known as floodplains, that are subject to inundation from a 100-year flood event. The E-LS transmission line runs along the Big Thompson River SFHA. Several wood H-frame structures are located within the delineated floodplain. The existing transmission line spans the SFHA for approximately 550 feet. Mall Road, U.S. Highway 36, and U.S. Highway 34 are roads that cross the SFHA of the Big Thompson River (see **Figure 3.5-2**).

The remainder of the E-LS, E-PH, and F-PH transmission lines and associated access roads in the project area are not located in SFHAs. The proposed reroute sections on the E-PH and E-LS segments are not located in SFHAs.

No Wild & Scenic Rivers occur along the alternative alignments or along any of the existing transmission lines. The Big Thompson River was studied for inclusion in the National Wild & Scenic Rivers System in the late 1970s. Designation was not recommended to Congress at that time (National Wild and Scenic Rivers System 2013).

3.5.3 Groundwater

In addition to the surface water resources previously discussed, the SDWA also applies to groundwater resources.

Table 3.5-1 Colorado Designated Beneficial Uses for Streams, 303(d) List and Colorado's Monitoring and Evaluation Parameters for the Project Area

Hydrologic Unit Code Watershed (HUC-12)	Stream Segment	Beneficial Use Classifications	CWA 303(d) List of Impaired Waters (CDPHE 2012a)	Colorado's Monitoring and Evaluation Parameters
Lake Estes/ Big Thompson	Big Thompson River Segment 2	Aquatic Life Cold 1 Recreation E Water Supply Agriculture	Copper, Cadmium, Zinc, Temperature	Sulfide
Headwaters Little Thompson River	Big Thompson River Segment 8	Aquatic Life Cold 1 Recreation E Water Supply Agriculture	Temperature, Dissolved Oxygen	None
North Fork Little Thompson River	Big Thompson River Segment 8	Aquatic Life Cold 1 Recreation E Water Supply Agriculture	None	None
Dry Creek	Big Thompson River Segment 6	Aquatic Life Warm 2 Recreation E Agriculture (Use Protected)	Copper	E. coli

Beneficial use classifications have the following definitions:

Aquatic Life Cold 1: These are waters that: 1) currently are capable of sustaining a wide variety of cold water biota, including sensitive species; or 2) could sustain such biota but for correctable water quality conditions. Waters shall be considered capable of sustaining such biota where physical habitat, water flows or levels, and water quality conditions result in no substantial impairment of the abundance and diversity of species.

Aquatic Life Warm 2: These are waters that are not capable of sustaining a wide variety of cold or warm water biota, including sensitive species, due to physical habitat, water flows or levels, or uncorrectable water quality conditions that result in substantial impairment of the abundance and diversity of species.

Recreation E: These surface waters are used for primary contact recreation or have been used for such activities since November 28, 1975.

Water Supply: These surface waters are suitable or intended to become suitable for potable water supplies. After receiving standard treatment (defined as coagulation, flocculation, sedimentation, filtration, and disinfection with chlorine or its equivalent) these waters will meet Colorado drinking water regulations and any revisions, amendments, or supplements thereto.

Agriculture: These surface waters are suitable or intended to become suitable for irrigation of crops usually grown in Colorado and which are not hazardous as drinking water for livestock.

Use Protected: These are waters that the Commission has determined do not warrant the special protection provided by the outstanding waters designation or the anti-degradation review process (CDPHE 2012a).

Table 3.5-2 Summary of Drainage Crossings

Transmission Line Alternatives	Number of Perennial Stream Crossings	Number of Intermittent Stream Crossings	Number of Ephemeral Stream Crossings	Number of Canal Crossings	Total Number of Stream Crossings
Alternative A	4	27	11	1	43
Variant A1	4	26	10	1	41
Variant A2	4	26	10	1	41
Alternative B	1	21	26	1	49
Alternative C	4	24	18	1	47
Variant C1	4	24	18	1	47
Alternative D	5	37	37	1	80

In the project area, much of the drinking water used for household supply consists of groundwater pumped from individual wells. For example, approximately 150 water wells have been permitted and/or constructed in the Ravencrest area (Section 34, Township 5 North, Range 72 West). Roughly 75 to 100 wells occur elsewhere near the proposed alternatives (Colorado Division of Water Resources [CDWR] 2013). These individual wells generally are concentrated at the east and west ends of the project area. Correspondingly, numerous individual sanitation systems (septic tanks and filter fields) also occur within the project area.

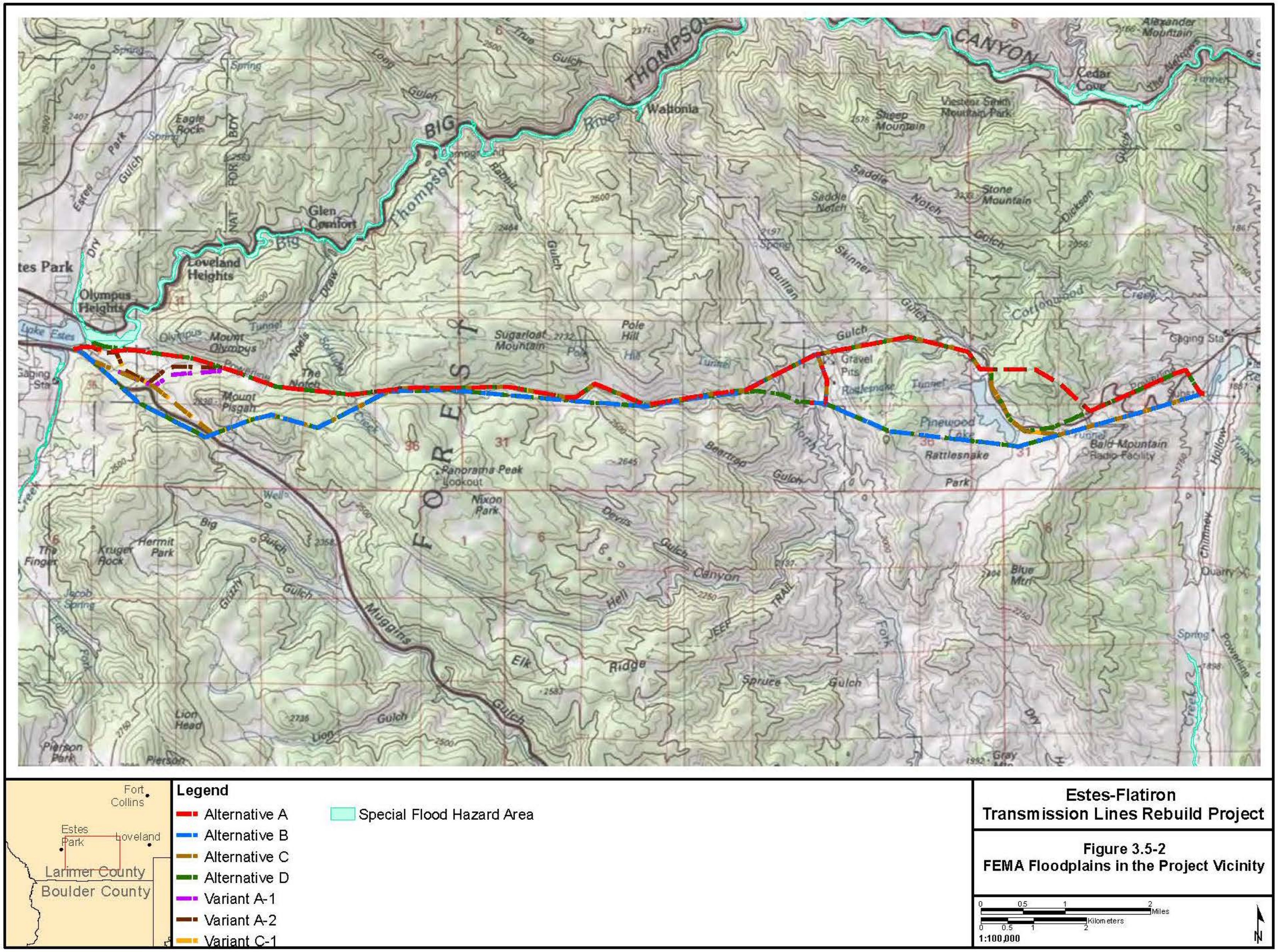
In the mountains on the western half of the project area, depths to groundwater recorded in well logs range from approximately 50 to over 650 feet below the ground surface (CDWR 2013). In the eastern portion of the project area, depths range from approximately 100 to over 300 feet below the ground surface (CDWR 2013). On gentler topography nearer to Pinewood Lake, depths to groundwater vary from approximately 20 to 80 feet below the ground surface (CDWR 2013). Depths to groundwater rapidly increase to the east toward Flatiron Reservoir. Groundwater levels are likely to be nearer the ground surface along toe slopes and low topography along canyons and streams. In addition, depths to water generally are shallowest after snowmelt in the spring and early summer.

3.6 Wetlands and Waters of the U.S.

The following section presents the affected environment for wetlands, waters of the U.S., and riparian areas within the project vicinity.

Riparian and wetland areas comprise a small percentage of the lands in the Western U.S., but their importance to the surrounding ecosystems and associated species is disproportionately great. Most wildlife species use riparian areas at some point in their life cycles (e.g., many migratory birds during breeding and migration seasons), and some depend almost entirely on these systems (e.g., amphibians). Wetlands and riparian areas are often rich in vegetation diversity and structure, providing food, water, shade, and cover to wildlife and livestock, in addition to acting as water purifiers, supplying groundwater recharge, and aiding in flood control.

Figure 3.5-1 Federal Emergency Management Agency Floodplain Map



3.6.1 Applicable Laws and Regulations

Waters of the U.S. are defined in 33 CFR Part 328, Section 3 as all non-tidal waters that are currently, or were used in the past, or may be susceptible to use in interstate commerce; all interstate waters including wetlands; all other waters such as interstate lakes, rivers, streams (including intermittent streams), mud flats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, of which the use, degradation, or destruction could affect interstate commerce; and all impoundments of waters otherwise defined as waters of the U.S. under this definition. In addition, tributaries of the above listed waters, including arroyos and other intermittent drainages, and wetlands adjacent to the above waters also are considered to be waters of the U.S.

Criteria used by the USACE to determine whether a drainage constitutes a waters of the U.S. include presence of a defined bed, banks, or evidence of an OHWM. Wetlands adjacent to other Waters of the U.S., such as streams, also are considered to be waters of the U.S. In addition, and as used herein, the term “wetlands” has a regulatory definition as defined in 33 CFR 328.7(b) as “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Note that the frequency and duration of saturation may vary by geographical region, and is largely dependent upon local climatic conditions.

According to the USACEs 1987 Wetland Delineation Manual, a “three-parameter” approach is required for delineating USACE-defined wetlands (USACE 1987), where areas are identified as wetlands if they exhibit hydrophytic vegetation, hydric soils, and wetland hydrology.

3.6.2 Affected Environment

Within the project vicinity, in 2011, Western conducted field surveys for wetlands and potential waters of the U.S. within a 110-foot ROW centered along the existing transmission lines and access roads. Field surveys consisted of a reconnaissance level sample point approach based on guidelines developed by the USACE. A total of 66 sample points were selected and evaluated representing the majority of these features. Survey results for wetlands are discussed in the text below. Southwest Regional Gap Analysis Project (SWReGAP) data were used to identify wetlands in the project vicinity that were not part of the surveyed areas. Descriptions of the wetlands identified using SWReGAP and acres in the project vicinity are presented in Section 3.7, Vegetation.

Drainages identified during field surveys within the 110-foot ROW included one perennial stream and multiple ephemeral channels. Even though field surveys focused on the 110-foot ROW along the existing transmission lines, field survey results for drainages are sufficient to cover the majority of the project vicinity. According to the field surveys, these stream crossings are all potentially waters of the U.S. **Table 3.6-1** describes the survey results, including the drainage name, flow frequency, its potential jurisdictional status, if an existing access road crosses a waters of the U.S. or wetland, and a description of the drainage or wetland crossing.

3.6.2.1 Wetlands

Wetlands are located adjacent and abutting the North Fork Little Thompson River and within 22 drainage features in the project vicinity. Wetlands along the North Fork Little Thompson River include lowland meadows, wet meadow/drainage complexes, and river terraces. Widths of associated vegetated wetlands ranged from 4.5 to 30 plus feet with lesser widths most common. Vegetation communities established along the river are highly variable with dense herbaceous understories common. Highly developed shrub and tree community components are most notable where the river channel is incised or confined with moderately steep to steeply sloping banks. These wetlands occur across nearly level to less than 5 percent slopes and vary in size from an approximate width of 15 feet to greater than 30 feet. Soils were typically saturated to the surface or near surface. These wetlands support a diverse, productive, herbaceous understory of hydric species with occasional stands of trees and shrubs. Some portions of two of the wetlands appeared to be near-to or potential fens (Sample Point E65 – **Figure 3-5b**).

Wetlands within the ephemeral drainage features in the project vicinity are found at nearly level to less than 10 percent slopes in the study area and support diverse plant communities. The more narrow drainages and swales typically support communities of grass, grass-likes (sedges, rushes, etc.), forbs, shrubs, and tree species. The broader drainages and swales are characterized by plant communities more herbaceous in nature exhibiting a variety of grass, grass-like, and forb species.

Lowland meadows, depressions, and similar topographic elements support 12 wetlands. These wetlands have formed across nearly level topographies to slopes of less than 10 percent. Soils overlying these wetlands are typically saturated to the surface or near surface. Several of the wetlands exhibited hydrologic features including watercourses, drainages, seeps, or springs. Four of these wetlands are considered to be “isolated” while the remainder are tributary to waters of the U.S. The wetlands at sample points E11, E22, E32, E35, and E49 exhibit the essential surficial characteristics of, and are considered to be, potential fens (**Figure 3.6-1a** through **Figure 3.6-1d**). These wetlands are typically highly productive and comparatively diverse, vegetatively, though they typically lack a shrub or tree component to any extent. **Figure 3.6-1a** through **3.6-1d** show the field wetland sample points, field identified drainages, and SWReGAP wetlands crossed by the project alternatives.

3.6.2.2 Waters of the U.S.

Waters of the U.S. in the project vicinity include the North Fork Little Thompson River, its tributaries and ephemeral upland drainages that drain into North Big Thompson River, North Fork Noels Draw, South Fork Noels Draw, Solitude Creek, Quillan Gulch, Mill Gulch, Emhaw Gulch, Pinewood Reservoir, and Flatiron Reservoir.

The only perennial stream in the study area is the North Fork Little Thompson River. The river was flowing at the time of the field surveys. Channel slopes are typically less than 5 percent and are stable. Defined beds and banks are the norm with channel widths at the OHWM, typically ranging from 3.0 to 5.0 feet wide. Four upland ephemeral drainages are tributary to the North Fork Little Thompson River. Channel widths ranged from 2.0 to 4.0 feet. Slopes ranged from 5 to 10 percent. These drainages were typically stable though bank cutting was observed in one area. Vegetation communities along these drainages were dominated by upland-classed plant species. These drainages were not flowing at the time of the survey.

Sixteen upland drainages that drain into North Big Thompson River were identified in the project vicinity during field surveys. They include North Fork Noels Draw, South Fork Noels Draw, Solitude Creek, Quillan Gulch, Mill Gulch, Emhaw Gulch, Pinewood Reservoir and Flatiron Reservoir. Fifteen of these drainages were classed as ephemeral while one, a constructed cement feature known as the Pole Hill Canal, is perennial. three of the ephemeral drainages evaluated were flowing at the time of the field surveys (**Table 3.6-1**). The ephemeral upland drainages are typically characterized by the lack of a defined bed and bank and a channel width ranging from 2.0 to 8.0 feet, though wider drainages up to 15 or 20 feet were observed. Slopes ranged from less than 5 percent to approximately 40 percent overall. Vegetation communities supported by these drainages typically have an upland herbaceous understory with a variable shrub component and are relatively diverse.

Table 3.6-1 Drainage and Wetland Crossings in the Project Vicinity[1]

Sample Points (see Fig 3-5)	Drainage Name	Perennial/ Ephemeral	Potential Waters of the U.S.	Wetland	Existing Road Crosses Drainage with Waters of the U.S. or Wetlands?	Description	Applicable Alternatives
E34	Tributary to Big Thompson	Ephemeral	Y	N	Y	Width channel 6 feet. No wetland. Vegetation: Upland mix, *Pentaphyloides floribunda.*	A,D
E35	Tributary to Big Thompson	Ephemeral	Y	Y	Y	Width OHWM 1 foot. Flowing; wetland mapped. Potential fen. Vegetation: *Juncus balticus*, *Carex aquatilis, Carex nebrascensis.*	A,D
E40	North Fork Noels Draw	Ephemeral	Y	Y	Yes, but no defined channel at road crossing. Only swale.	Width OHWM 2.5 feet. Vegetation: *Alnus incana*, *Betula occidentalis*, *Equisetum arvensis, Calamagrostis inexpansa.*	A, A1, A2, D
E41	Tributary to South Fork Noels Draw	Ephemeral	Y	Y	Y	Width OHWM 2 feet. Flowing intermittent sections. Wetland width 6 to 20 feet. Vegetation: *Lonicera involucrata, Calamagrostis inexpansa, Mertensia ciliata, Carex aquatilis.*	A,A1, A2,D
E48	Solitude Creek	Ephemeral	Y	Y	OHWM 1 foot. Wetlands width 3 - 4 feet.	Width OHWM 1 foot. Flowing. Wetland width 6.5 feet at line crossing. Wetland mapped. Vegetation: *Juncus balticus, Carex utriculata, Mertensia ciliate.*	A, A1, A2,D
E63	Tributary to North Fork Little Thompson	Ephemeral	Y	N	Y	Drainage channel width 4 feet. Vegetation: Upland vegetation.	A, A1, A2,C,C1, D
E62	Tributary to North Fork Little Thompson	Ephemeral	Y	N	Y	Upland drainage. Drainage width 4 feet. Vegetation: Upland vegetation.	A, A1, A2,C,C1,D
E51	North Fork Little Thompson	Perennial	Y	Y	N	Width OHWM 3 feet. Width wetlands 20 feet. Vegetation: *Alopercurus pratensis, Alnus incana* subspp*. Tenuifolia, Carex nebrascensis.*	A, A1, A2,C,C1, D
E51	Tributary to North Fork Little Thompson	Ephemeral	Y	Y	Y	Width OHWM 3 feet. Width wetlands 20 feet. Vegetation: *Alopercurus pratensis, Alnus incana* subspp*. Tenuifolia, Carex nebrascensis.*	A, A1, A2,C,C1,D
E54	Rabbit Gulch	Ephemeral	Y	N	Yes, West County Road 18E, culvert under road.	Drainage width 2 feet. Vegetation: Upland mix.	A, A1, A2,C,C1,D

Sample Points (see Fig 3-5)	Drainage Name	Perennial/ Ephemeral	Potential Waters of the U.S.	Wetland	Existing Road Crosses Drainage with Waters of the U.S. or Wetlands?	Description	Applicable Alternatives
E55	North Fork Little Thompson	Perennial/ Intermittent	Y	Y	Y	Width of OHWM 5 feet. Wetland width 9 to 10 feet. Vegetation: *Carex aquatilis, Carex utriculata, Alopercurus pratensis, Epilobium cilatum* ssp. *Glandulosum.*	A, A1, A2,C,C1,D
E25	Emhaw Gulch	Ephemeral	Y	Y	West County Road 18E, culvert under road.	Width of OHWM 4 to 7 feet. Wetland width 8 feet wide (when present) Vegetation: *Mertensia ciliata, Acer glabrum, Jamesia americana, Salix* spp.	A, A1, A2,B,C, C1,D
E24	Tributary to North Fork Little Thompson	Ephemeral	Y	Y	West County Road 18E, culvert under road.	Channel width 4 feet. Vegetation: Upland mix.	A, A1, A2,B,C,C1,D
E28	Polehill Penstock	Open Canal	Y	N	Y	Concrete canal vegetation.	A, A1, A2, B,C,C1,D
E15	Quillan Gulch	Ephemeral	Y	Y	West County Road 18E, culvert under road.	Width of OHWM 2 to 4 feet. Wetland width mapped. Vegetation: *Salix exigua, Juncus balticus.*	A, A1, A2,C,C1,D
E14	Tributary to Quillan Gulch	Ephemeral	Y	Y	West County Road 18E, culvert under road.	No bed and bank. All vegetated. Drainage width between 3 and 12 feet. Wetlands width between 3 and 12 feet. Vegetation: *Calamagrostis inexpansa, Carex microptera, Carex aquatilis.*	A, A1, A2,C, C1,D
E9	Tributary to Pinewood Lake	Ephemeral	Y	N	Pole Hill Road has culvert at this crossing	No bed and bank. Vegetation: *Bromopsis inermis.*	C,D
E8	Tributary to Flatiron Reservoir	Ephemeral	Y	Y	Pole Hill Road has culvert at this crossing	Width of OHWM 3 feet. Total width of vegetated wetlands 2 to 8 feet. Slight flow in channel. Vegetation: *Salix exigua, Toxicodendron rydbergii, Poa* spp.	A,D
NSP	Tributary to Big Thompson	Ephemeral	Y	N	Culvert under U.S. Highway 36.	No bed and bank. Culvert empties to open area. No sample point taken. Vegetation: Upland mix.	None
E45	Tributary to Big Thompson	Ephemeral	Y	N	Culvert under U.S. Highway 36.	No bed and bank. Drainage width 4 to 6 feet. No flow. Vegetation: Upland mix.	B,D
E47	Tributary to Big Thompson	Ephemeral	Y	Y	Culvert under U.S. Highway 36.	No bed and bank. No flow, wet. Wetland mapped. Vegetation: *Alopercurus pratensis.*	B,C,C1,D
E2	North Fork Little Thompson	Perennial	Y	Y	Y	Width OHWM 2.5 feet. Wetland width 9 feet. Vegetation: *Alnus incana* subspp. Tenuifolia, *Equisetum arvensis, Carex* spp.	B,C,D

Sample Points (see Fig 3-5)	Drainage Name	Perennial/ Ephemeral	Potential Waters of the U.S.	Wetland	Existing Road Crosses Drainage with Waters of the U.S. or Wetlands?	Description	Applicable Alternatives
E25	Emhaw Gulch	Ephemeral	Y	Y	W County Road 18E, culvert under road. (same culvert as 8-6 - 8-7 on E-L Line)	Width of OHWM 4 to 7 feet. Wetland width 8 feet wide (when present) Vegetation: *Mertensia ciliata*, *Acer glabrum, Jamesia americana, Salix* spp.	A, A1, A2,B,C,C1,D
E24	Tributary to North Fork Little Thompson	Ephemeral	Y	N	W County Road 18E, culvert under road. (same culvert as 8-6 - 8-7 on E-L Line)	Channel width 4 feet. Vegetation: Upland mix.	A, A1, A2,B,C,C1,D
E1, E2	Tributary to Flatiron Reservoir	Ephemeral	N	N	N	Upland vegetated drainage. 10 feet wide, no defined bed and bank. Vegetation: Upland mix.	B,C,C1,D
E5	Tributary to Flatiron Reservoir	Ephemeral	Y	N	Pole Hill Road crosses drainage.	Width of OHWM is 2 feet. No wetland. Steep ephemeral drainage. Vegetation: Upland shrubs.	B,C,C1,D
NSP	Tributary to Flatiron Reservoir	Ephemeral	Y	N	Pole Hill Road crosses drainage.	Vegetation: Upland shrubs.	D
E7	Tributary to Flatiron Reservoir	Ephemeral	Y	N	Road crosses drainage	Drainage 3 feet wide. Vegetation: Upland shrubs.	B,C,C1,D
E6	Tributary to Flatiron Reservoir	Ephemeral	Y	N	Road crosses drainage	Drainage 1 to 3 feet. Vegetation: Upland shrubs.	B,C,C1, D
E20	Tributary to Pinewood Lake. Access road crossing only.	Ephemeral	Y	Y	Access road crosses drainage at high spot.	No bed and bank. No channel at crossing. Swale width 12 to 24 feet. Vegetation: High spot across swale (no wetland). Wetlands on upstream and downstream side. Mapped for avoidance.	B, D
E21	Tributary to Chickenhouse Gulch	Ephemeral	Y	N	Curve on access road at this point. Unstable bank on upstream side. May need access road work in this location.	No bed and bank. Channel width 6 feet. Vegetation: Upland vegetation.	A, A1, A2, B, C, C1

Sample Points (see Fig 3-5)	Drainage Name	Perennial/ Ephemeral	Potential Waters of the U.S.	Wetland	Existing Road Crosses Drainage with Waters of the U.S. or Wetlands?	Description	Applicable Alternatives
NSP	North Fork Little Thompson River	Ephemeral	Y	Y	Access road to BOR facility.	Channel width 2 to 3 feet. Wetland width 6 feet. Access road locked - no sample point. Vegetation: *Calamagrostis inexpansa, Thermopsis montanus, Carex* spp.	NONE
E43	Tributary to Big Thompson	Ephemeral	Y	Y	Y	No defined bed and bank. Further south flow concentrates, wet but not flowing. Vegetation: *Juncus balticus, Carex* spp.	A2, C
E44	Tributary to Big Thompson	Ephemeral	Y	N	Y	Channel width 4 to 6 feet. Vegetation: Upland mix.	B, C, D

[1] Not all wetland sample points are included in the Drainage table. Only those with additional attribute information related to waters of the U.S. provided by the Cedar Creek are listed in the table.

OHWM = ordinary high water mark.

Figure 3.6-2a SWRegap Wetlands and NHD Streams

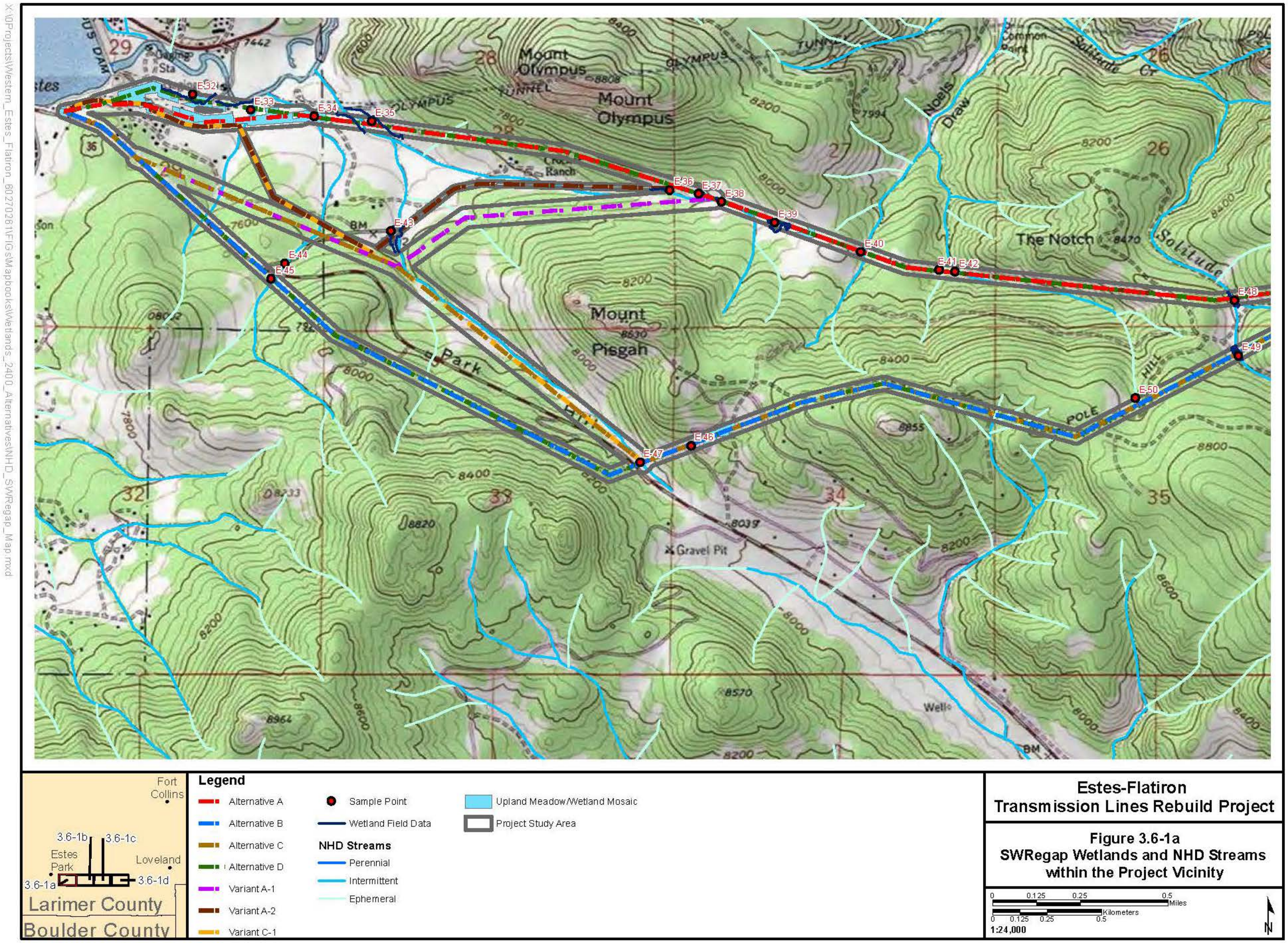


Figure 3.6-1b SWRegap Wetlands and NHD Streams

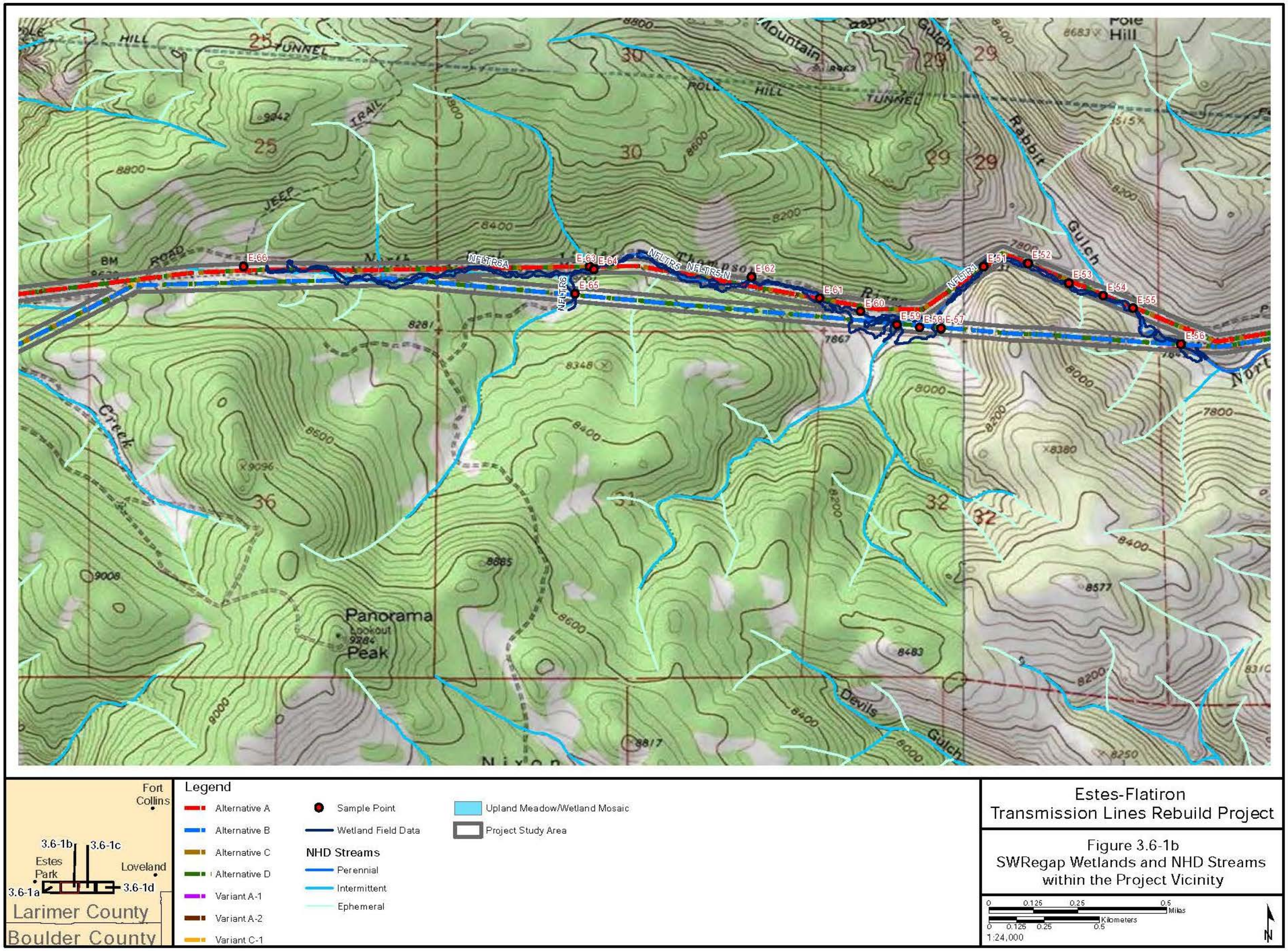


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Figure 3.6-1c SWRegap Wetlands and NHD Streams

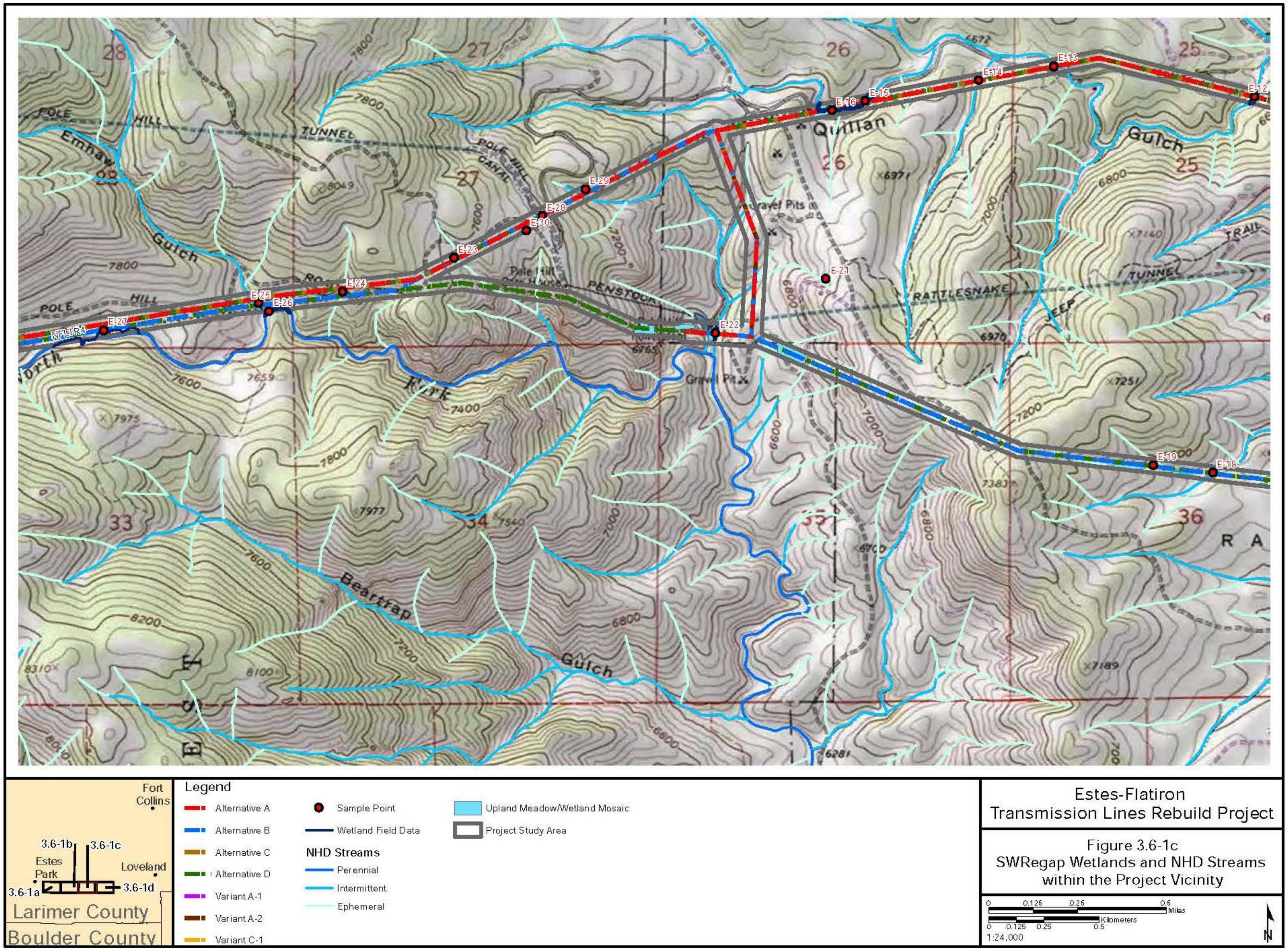
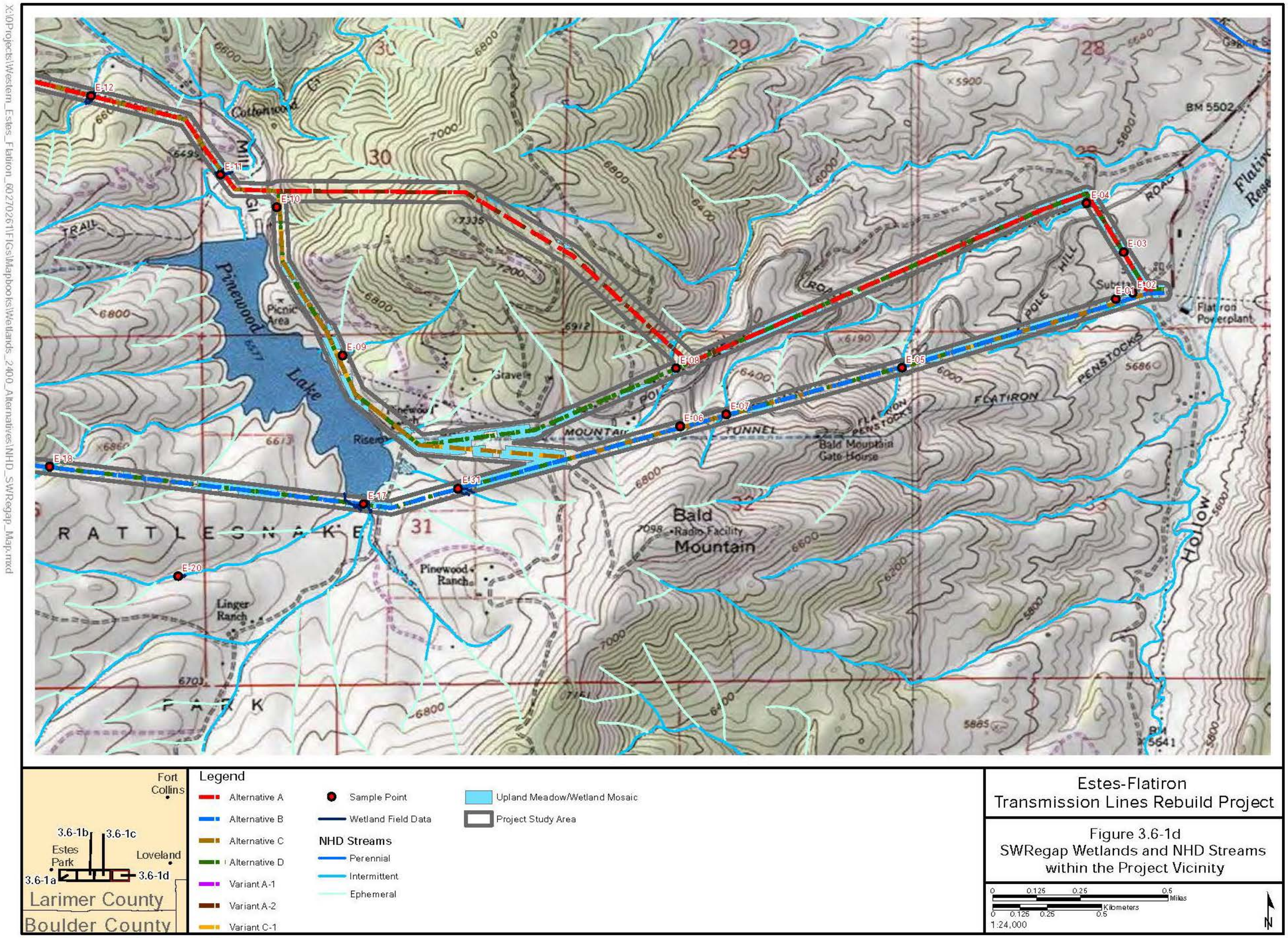


Figure 3.6-1d SWRegap Wetlands and NHD Streams



3.7 Vegetation

The project vicinity for vegetation resources, including general vegetation, noxious weeds and invasive species, wetlands, and special status plant species resources includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants, Potential impacts to vegetation would be limited to these areas. The following section presents the affected environment for general vegetation resources, noxious weeds and invasive species, wetlands, and special status plant species within the project vicinity.

3.7.1 General Vegetation

The project vicinity is predominantly located in the Crystalline Mid-Elevation Forests EPA Level IV ecoregion, with the eastern portion of the line in the Foothill Shrublands ecoregion. Vegetation communities within the project vicinity were surveyed in the summer and early fall of 2011 (Cedar Creek Associates 2012). Observations recorded during initial field evaluation of the project vicinity included vegetation communities and dominant vegetation associated with each vegetation community. The field-identified vegetation communities were incorporated with the available SWReGAP data to create a vegetation layer that characterizes the project vicinity.

The project vicinity is characterized as mountainous, with ponderosa pine dominant throughout the project vicinity. There is an increasing amount of dead woody vegetation (fuel) from mountain pine beetle infestation. See Section 3.7.3, Fuels and Fire Management, for more detail on wildfire and fuel loads in the project vicinity. There are five vegetation communities within the project vicinity including ponderosa pine woodland, mountain shrub, mixed conifer forest, and upland meadow. Intermixed within the vegetation communities are areas of rock outcrops, especially on the eastern portion of the project vicinity. **Table 3.7-1** provides a summary of the acreages for each vegetation cover type within the project vicinity. Wetland communities are included in this table but discussed in greater detail in Section 3.6. **Figures 3.7-1a** through **3.7-1d** illustrates the vegetation cover types present within the project vicinity.

Table 3.7-1 Vegetation Communities in the Project Vicinity

Vegetation Communities	Acres	% of Project Vicinity
Ponderosa pine woodland	508	58
Mountain shrub mosaic	124	14
Mixed conifer forest	93	11
Upland meadow/wetland mosaic	99	11
Upland meadow	48	5
Total	871	100

Descriptions of the plant communities for each vegetation cover type are provided below. Community characterizations were compiled based on the field survey vegetation community descriptions (Cedar Creek Associates 2012). Species nomenclature is consistent with the NRCS Plants Database (NRCS 2013).

Figure 3.7-1a Vegetation Cover Types Present within the Project Vicinity

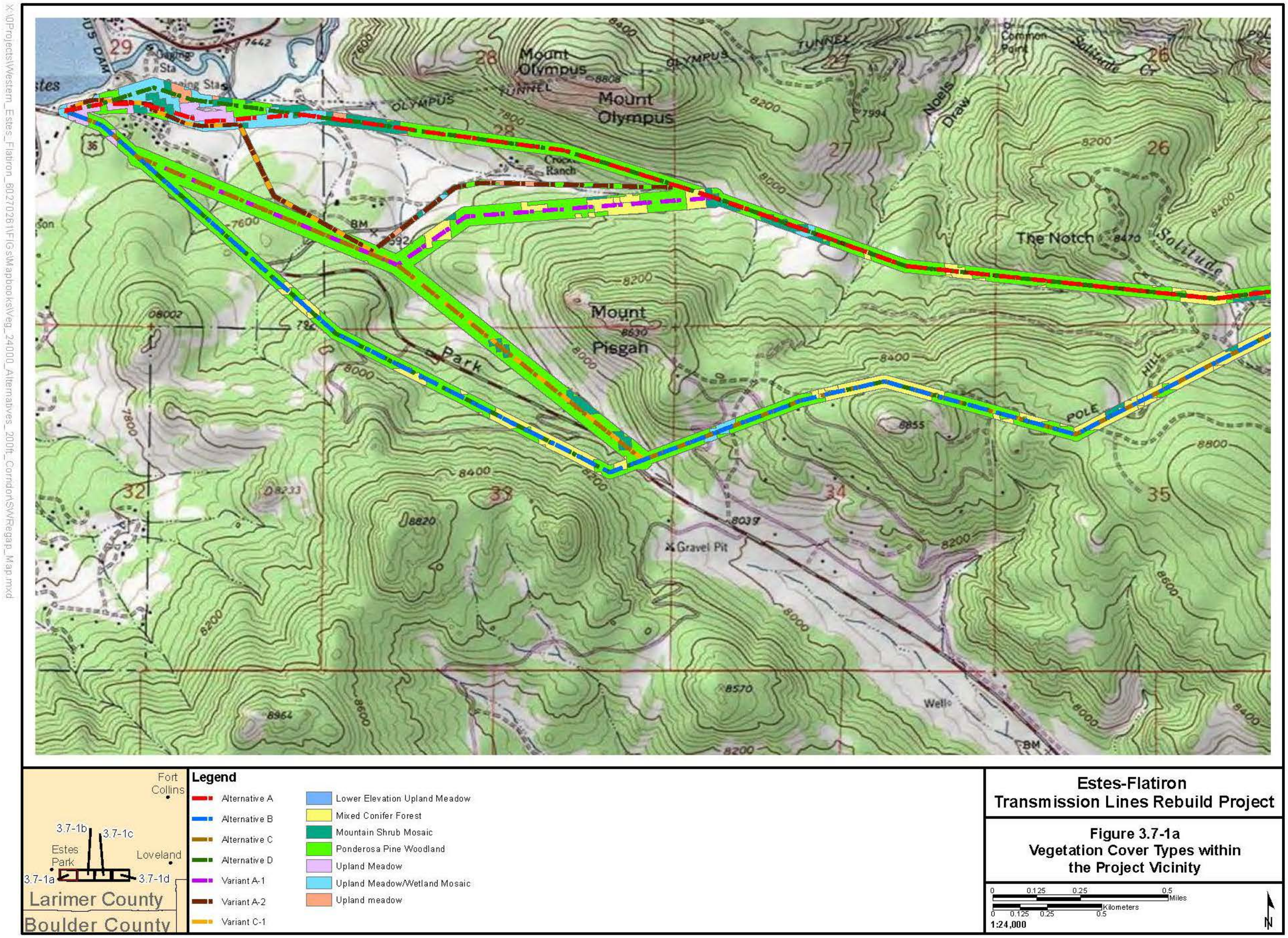


Figure 3.7-1b SWReGAP Data within the Analysis Area

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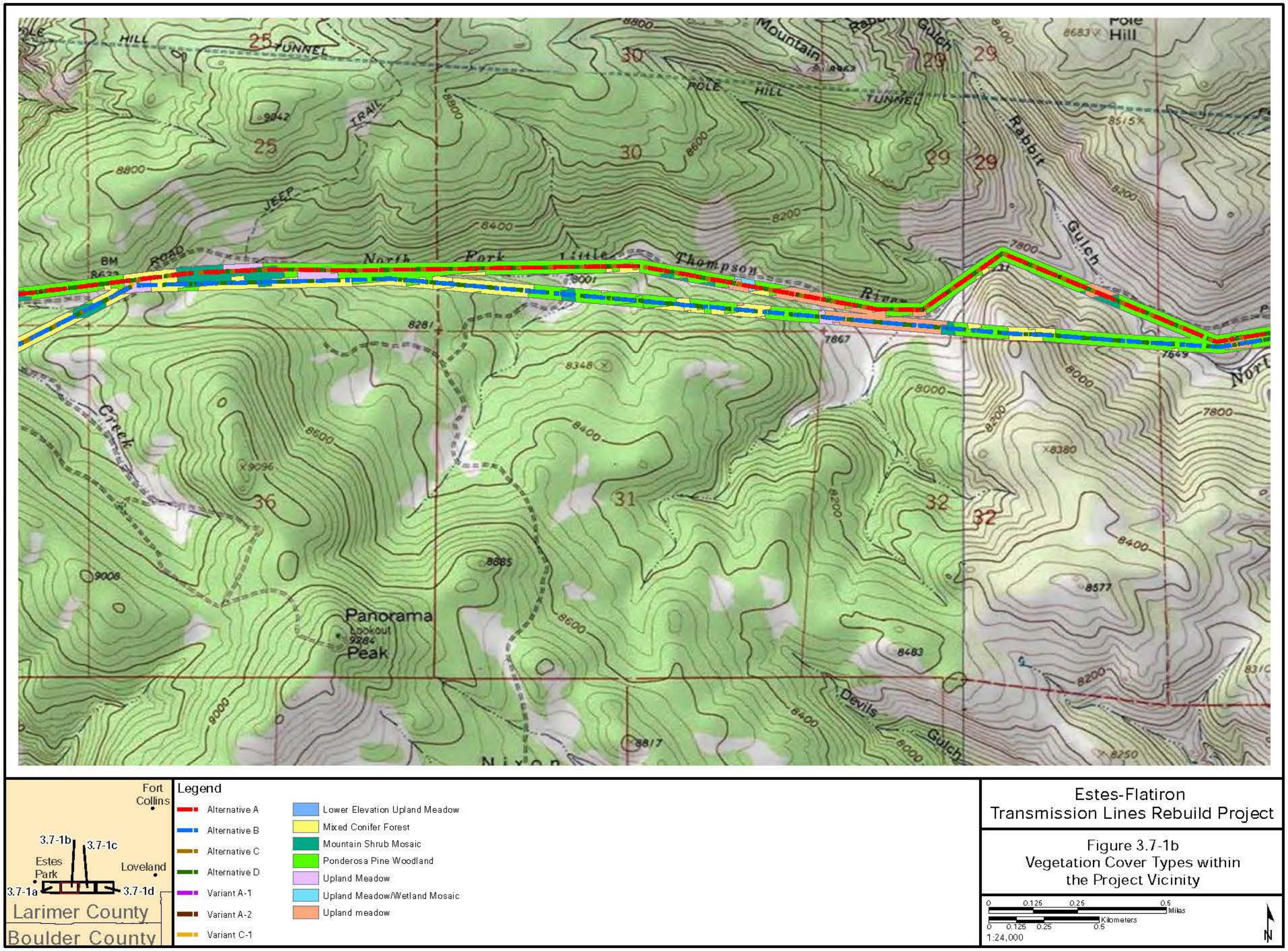


Figure 3.7-1c SWReGAP Data within the Analysis Area

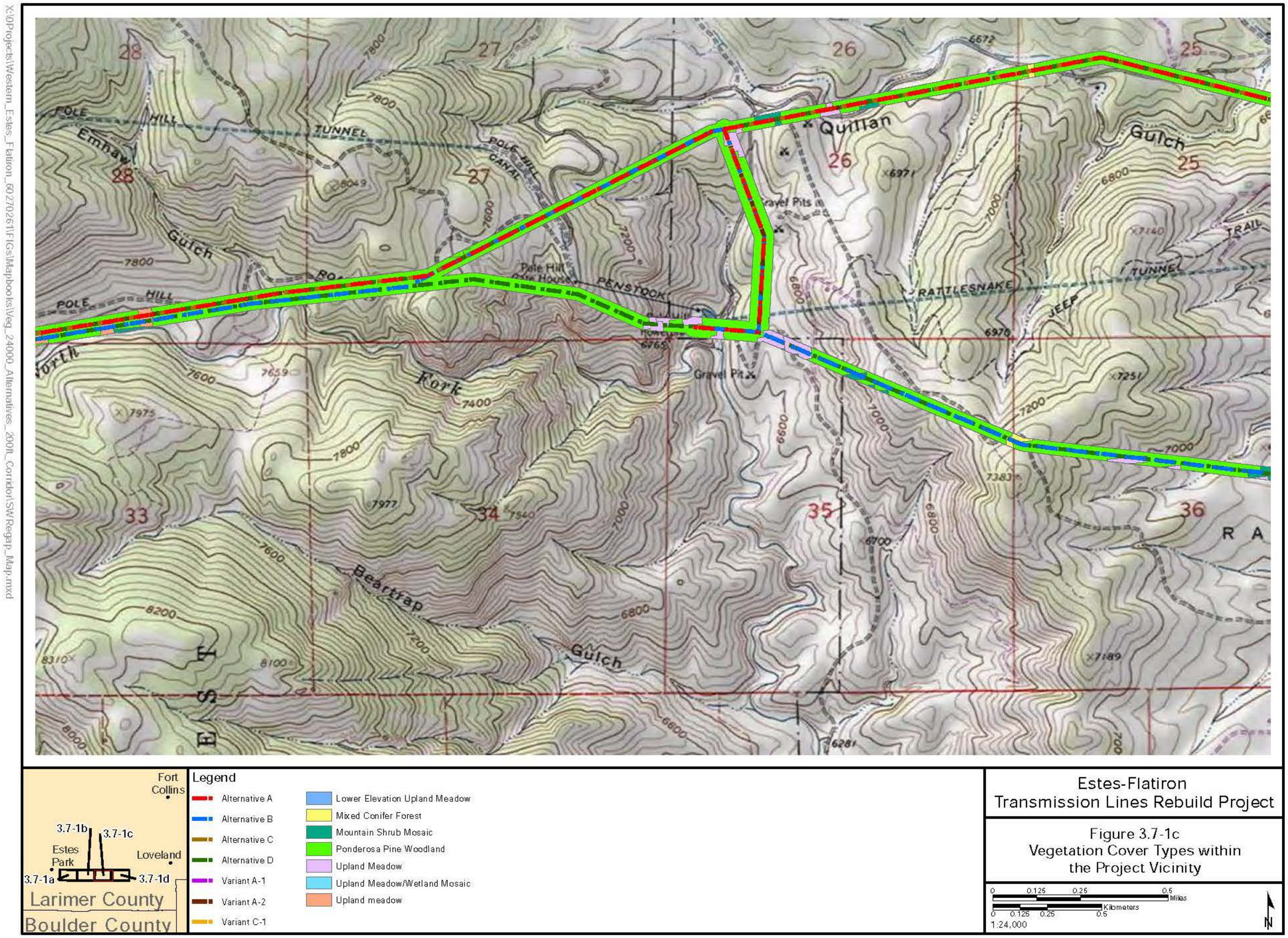
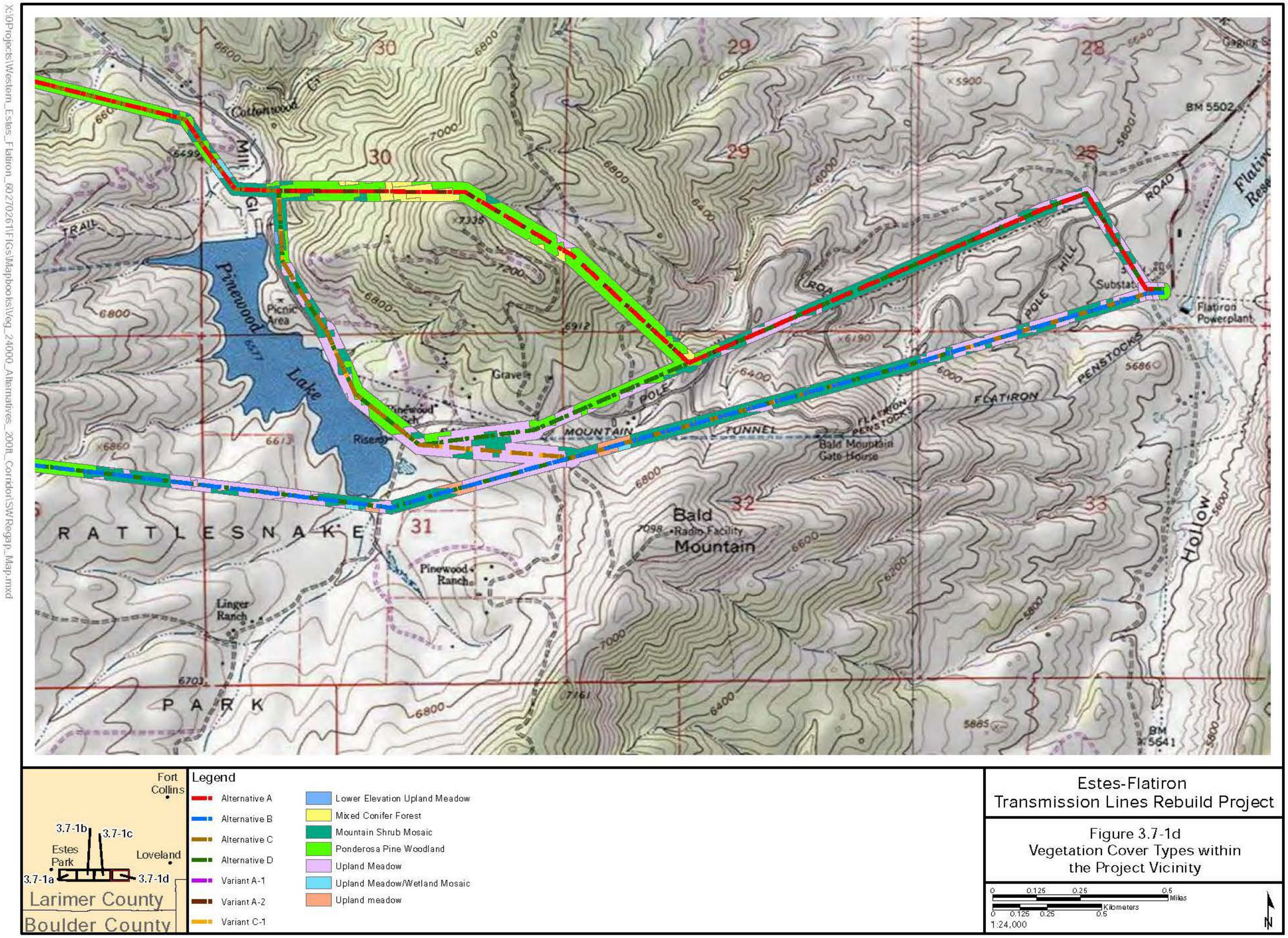


Figure 3.7-1d SWReGAP Data within the Analysis Area



3.7.1.1 Ponderosa Pine Woodland

Ponderosa pine woodlands are the dominant vegetation community within the project vicinity covering 57 percent of the project vicinity. These communities are found throughout the entire project vicinity. The dominant overstory species in this community is ponderosa pine (*Pinus ponderosa*). Understory species consist of shrubs and herbaceous species with dominant species including mountain ninebark (*Physocarpus monogynus*), alderleaf mountain mahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentate*), common juniper (*Juniperus communis*), smooth brome (*Bromopsis inermis*), Rocky Mountain fescue (*Festuca saximontanus*), pine dropseed (*Blepharoneuron tricholepis*), silvery lupine (*Lupinus argenteus*), mountain goldenbanner (*Thermopsis Montana*), hairy false goldenaster (*Heterotheca villosa*), and Mt. Albert goldenrod (*Solidago simplex*) (Cedar Creek Associates 2012).

3.7.1.2 Mountain Shrub Mosaic

Often in association with the Ponderosa Pine woodland vegetation community, the mountain shrub mosaic is scattered throughout the project vicinity. It covers 15 percent of the project vicinity. Dominant vegetation are shrubs, including alderleaf mountain mahogany, fivepetal cliffbush (*Jamesia Americana*), common juniper, chokecherry (*Padus virginiana*), kinnikinnick (*Arctostaphylos uva-ursi*), and Woods' rose (*Rosa woodsii*). Dominant trees include Ponderosa pine, and Douglas-fir (*Pseudotsuga menziesii*), with limited cover. The dominant herbaceous species in this vegetation community is smooth brome (Cedar Creek Associates 2012).

3.7.1.3 Mixed Conifer Forest

The mixed conifer forest (11 percent of the project vicinity) is found predominantly in the southern portions of the project vicinity. The canopy cover varies in this vegetation community, with some areas having a more open canopy. Dominant species are coniferous species including Ponderosa pine, Douglas-fir, lodgepole pine (*Pinus contorta*), and limber pine (*Pinus flexilis*). Ponderosa pine and Douglas-fir are more dominant in the areas with the open canopy cover. In the areas with a closed canopy, the understory includes common juniper, fivepetal cliffbush, and kinnikinnick. Open canopy understory species include Geyer's sedge (*Carex geyeri*), Rocky Mountain fescue, common juniper, kinnikinnick, and mountain ninebark (Cedar Creek Associates 2012).

3.7.1.4 Upland Meadow/Wetland Mosaic

The upland meadow/wetland mosaic is found in association with the upland meadow at the eastern and western ends of the project vicinity. It covers 11 percent of the project vicinity. Dominant vegetation in this vegetation community includes a mix of upland and wetland species. Upland species include grass species such as bluegrass species (*Poa* sp.), smooth brome, Rocky Mountain fescue, needle-and-thread (*Hesperostipa comate*), blue grama (*Bouteloua gracilis*), prairie Junegrass (*Koeleria macrantha*), cheatgrass (*Bromus tectorum*), and forbs including small-leaf pussytoes (*Antennaria parviflora*), prairie sagewort (*Artemisia frigida*), hairy false goldenaster, silverleaf Indian breadroot (*Pediomelum argophyllum*), purple prairie clover (*Dalea purpurea*), silvery lupine, white sagebrush (*Artemisia ludoviciana*), sulphur-flower buckwheat (*Eriogonum umbellatum*), western yarrow (*Achillea millefolium* var. *occidentalis*), Gunnison's mariposa lily (*Calochortus gunnisonii*), and biennial wormwood (*Artemisia biennis*).

Wetland species include meadow foxtail (*Alopecurus pratensis*), Nebraska sedge (*Carex nebrascensis*), thinleaf alder (*Alnus incana* ssp. *tenuifolia*), Northwest Territory sedge (*Carex utriculata*), narrowleaf willow (*Salix exigua*), wild mint (*Mentha arvensis*), mountain rush (*Juncus arcticus* ssp. *littoralis*), and swordleaf rush (*Juncus ensifolius*). Drainages are located in this vegetation community in the eastern portion of the project vicinity. Within these drainages, dominant shrubs include chokecherry, skunkbush sumac (*Rhus trilobata*), and American plum (*Prunus americana*) (Cedar Creek Associates 2012).

3.7.1.5 Upland Meadow

The upland meadow community comprises 6 percent of the project vicinity, and is found at the eastern and western ends of the project vicinity in association with the upland meadow/meadow mosaic vegetation community. Herbaceous species are dominant and include smooth brome, Rocky Mountain fescue, pine dropseed, silvery lupine, mountain goldenbanner, hairy false goldenaster, Mt. Albert goldenrod. At lower elevations in the project vicinity, there is increased diversity of herbaceous species in the upland meadow vegetation community including cheatgrass, needle-and-thread, sulphur-flower buckwheat, prairie sagewort, white sagebrush, blue grama, prairie Junegrass, Gunnison's mariposa lily, silverleaf Indian breadroot, and purple prairie clover. Geyer’s sedge and small-leaf pussytoes were observed in the higher elevation upland meadows. Tree and shrub species in this vegetation community include Ponderosa pine, mountain ninebark, alderleaf mountain mahogany, antelope bitterbrush, and common juniper (Cedar Creek Associates 2012).

3.7.2 Noxious Weeds

The Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974) and EO 13112 of February 3, 1999, require cooperation with state, local, and other Federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. Noxious weeds in Colorado are non-native plant species that have been designated by the Colorado Department of Agriculture (CDA) due to their invasiveness, aggressiveness, or the rate at which they spread and adversely affect desired native plants or agricultural crops and rangelands. The Colorado Noxious Weed Act (CDA 2012) states that noxious weed management is the responsibility of local governing agencies, including incorporated municipalities, counties, and state and Federal agencies. Western would be responsible for controlling all noxious weeds identified in the Colorado Noxious Weed Act whether present now or in the future along and within its ROW.

The CDA manages and regulates noxious and invasive species through the Colorado Noxious Weed Act, which classifies noxious weeds into three lists, A, B, and C (§ 35 5.5-101 through 119, CRS [2003]). Each list has specific control requirements, with the most stringent requirements for those species found on List A. List A species are designated for eradication. List B includes species for which state noxious weed management plans would be developed to stop the continued spread of these species. List C includes species for which state noxious weed management plans would be developed to support the efforts of local governing bodies to facilitate more effective integrated weed management on private and public lands (CDA No Date 1). In addition, the Act states that each county in the state shall adopt a noxious weed management plan for all the unincorporated lands within the county. The Larimer County Noxious Weed Management Plan was approved by the Board of County Commissioners on March 6, 2008.

Field surveys for noxious weeds were conducted along the 2011 proposed alignment during the vegetation surveys by Cedar Creek in 2011. During field surveys state and county listed noxious weeds observed during the field survey were recorded by species, approximate size of weed patch, and location. New proposed and alternative routes added to the proposed project after the initial field surveys have not been surveyed for noxious weeds. Surveys would be conducted prior to project implementation.

Three noxious weeds were observed during field surveys in a total of 49 noxious weed patches within the project vicinity. All three noxious weed species identified in the analysis area are designated by Colorado and Larimer County as List B Species. The three species observed are Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), and Dalmatian toadflax (*Linaria dalmatica*). The majority of the observed noxious weeds were found in drainage bottoms and edges, on wetland edges, or in disturbed areas near road edges. Canada thistle was the dominant weed recorded, being found in 45 of the 49 weed patches. Musk thistle was recorded in 10 weed patches, of which seven populations were found in combination with Canada thistle. Dalmatian toadflax was found at two locations, one in combination with Canada thistle and musk thistle (Cedar Creek Associates 2012).

3.7.3 Fuels and Fire Management

Within each vegetative community type found in the project vicinity, there is a characteristic fire regime. A fire regime is a general description of the role fire would play across a landscape in the absence of modern human mechanical intervention, but includes the influence of aboriginal burning (Agee 1993; Brown 1995). Historical fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation. Generally, fire frequency is inversely related to fire intensity. For example, due to higher precipitation levels and cooler mean temperatures (which foster plant growth), there are higher fuel loads in pinyon-juniper woodlands and upper montane forest vegetation types as compared to lowland shrublands and grasslands. In addition, higher precipitation amounts and cooler temperatures provide greater resistance to fire for longer periods. This combination of factors leads to infrequent, high-intensity fires in montane and subalpine forests, for example. The reverse is true in grasslands where fine fuel types lead to fires at a high frequency that burn rapidly with low intensity. **Table 3.7-2** details historical fire regimes by alternative.

Other factors that determine fire behavior include site topography, weather and climatic conditions, time of year, type of plant community, health of the ecosystem, fuel moisture levels, depth and duration of heat penetration, fire frequency and site productivity. The highest potential rates of fire spread occur in areas with flashy fuels such as cured-out annual bromes, and steep brushy mountain slopes (County of San Diego 2013; NPS 2013a; SDSU 2004).

Table 3.7-2 Acres of Fire Regime Classification by Alternatives

Fire Regime	Alternative A	Variant A1	Variant A2	Alternative B	Alternative C	Variant C1	Alternative D
200+ years; Stand Replacement	17.4	12.0	3.5	11.0	10.0	3.5	18.5
35-100+ years; Mixed Severity	25.8	15.7	5.9	4.2	10.5	5.6	19.6
35-100+ years; Mixed Severity	53.6	53.6	47.3	50.3	50.4	45.7	101.1
0-35 years; Low Severity	280.8	300.2	266.5	267.3	278.2	277.2	473.7

Source: Landfire 2010.

Wildland fire risk tends to be high in disturbed grasslands and forblands dominated by non-native noxious and invasive species, especially those dominated by annual brome species.

Fire Regime Condition Class (FRCC) is a discrete metric that describes how similar a landscape's fire regime is to its natural or historical state. FRCC quantifies the amount that current vegetation has departed from the simulated historical vegetation reference conditions (Hann and Bunnell 2001; Hardy et al. 2001; Barrett et al. 2010; Holsinger et al. 2006). The three condition classes describe low departure (FRCC 1), moderate departure (FRCC 2), and high departure (FRCC 3). Landscapes determined to fall within the category of FRCC 1 contain vegetation, fuel, and disturbances characteristic of the natural regime; FRCC 2 landscapes are those that are moderately departed from the natural regime; and FRCC 3 landscapes reflect vegetation, fuel, and disturbances that are uncharacteristic of the natural regime.

The project vicinity contains a diverse mix of vegetation communities and land cover types, each having a distinct fire regime. All three categories of FRCC are found within the project vicinity. The percentage of the project vicinity defined by each Condition Class is summarized in **Table 3.7-3**, and shown on

Figures 3.7-2a through **3.7-2d**. Fire Regime's within the 200-foot-wide project vicinity are shown on **Figures 3.7-3a** through **3.7-3d**.

Table 3.7-3 Acres of Lands Classified as Fire Regime Condition Class 1, 2, 3, Urban, or Agriculture by Alternative

	Alternative/Variant						
FERC	**A**	**A1**	**A2**	**B**	**C**	**C1**	**D**
Condition Class 1	17.4	12.0	3.5	11.0	10.0	3.5	18.4
Condition Class 2	329.1	338.8	290.4	268.3	297.5	286.7	511.5
Condition Class 3	30.7	30.7	29.2	24.9	25.0	25.0	52. 8
Urban/Development/Agriculture	0	0	0	27.1	27.1	15.8	28.5
Agriculture	33.3	33.3	33.3	28.5	28.5	28.5	60.5

Source: Landfire 2008.

3.7.3.1 Mountain Pine Beetle

Bark beetles, including mountain pine beetles, are endemic to all coniferous forests of North America. The forests of the Rocky Mountains have seen a dramatic increase in bark beetle infestations followed by conifer mortality. The four species that are major hosts of mountain pine beetle infestation are lodgepole pine (*Pinus contorta*), ponderosa pine, sugar pine, and white pine. The lodgepole pine has suffered the greatest losses in this current bark beetle infestation. Lodgepole stands are vulnerable due to several factors including: 1) several years of drought; 2) existing stand conditions of old, overstocked and large diameter; 3) earlier melt in smaller drought impacted snow-packs; 4) and higher average temperatures allowing greater expansion on bark beetle lifecycles, movement and survival into higher elevations. The bark beetle wide scale outbreaks are the result of a variety of circumstances including large areas of suitable hosts, temperature thresholds, and precipitation patterns (Bentz 2008). The life cycle of the bark beetle is temperature dependent, and increased temperatures, especially in the winter can speed up reproductive cycles, and reduce cold-induced mortality (Bentz 2008). Bark beetle populations also are dependent on winter freezing periods, as the species is freeze-intolerant (Bentz et al. 2010).

Annual aerial surveys conducted for each of the national forests document the rate of spread for the current beetle epidemic. Surveys in the late 1990s indicated only few, scattered and otherwise endemic beetle infestations less than 10 acres each. Between 2007 and 2008, lodgepole stands from north to south along the Rocky Mountains were heavily infested with bark beetles.

At the rate of expansion of this current beetle infestation, it is believed that more than 80 percent of all lodgepole pines greater than 5 inches in diameter will be dead within the next 3 years along the Rocky Mountains (**Table 3.7-4**).

Table 3.7-4 Acres of Mountain Pine Beetle Infestation for Each by Alternative

Forest Type	Alternative A	Alternative Variant A1	Alternative Variant A2	Alternative B	Alternative C	Alternative Variant C1	Alternative D
Mixed conifer forest	0	30.1	20.0	70.7	41.4	32.0	70.7

It is important to note that many areas have been infested by bark beetles and the results of infestations are high levels of mortality among coniferous tree species. Though these areas generally exhibit large numbers of dead trees, they may not necessarily pose a hazard to the power lines themselves. As such, individual areas that contain large numbers of dead trees may not be affected by the proposed project, whereas some other areas that contain similar numbers of dead trees may be affected. Determinations of the hazards posed by the dead trees would be made on a site-by-site basis through coordinated efforts by the USFS and Western. Bark beetle infestations leave behind potentially heavy fuel loads as the insects spread across the landscape. Fuel loads, fuel types and inherent fire hazard levels change over time. In the first very obvious stage, the red needle stage, needles persist on the tree providing the means for a surface fire to transition into the forest canopy. Low moisture content in the dead needles allows the fire to move through the crowns more easily than would normal live green crown conditions. After dead needles fall, crown fire potential is significantly decreased, although forest floor fuel loads are substantially increased by the fallen needles. As needles and other fine fuels transition to the forest floor, the potential for high intensity surface fire increases and the potential for crown fire diminishes. .

Five to 20 years following the initial beetle attacks, the dead trees begin to fall to the forest floor and become a substantial portion of the 1- to 10,000-hour surface fuel load. At approximately this same interval, regenerated lodgepole pine stands are 2 to12 feet tall, creating a fine fuel/heavy fuel load. At this point in time, the potential fuel loads are the highest and most hazardous point due to the regeneration stands growing up through the dead fuels. Mixed large diameter dead fuels and pine regeneration stands create the potential for very severe surface fires along with increased difficulty for firefighting operations.

3.7.3.2 Hazards

Defining the fire hazard allows the identification of the availability of fuels to sustain a fire in any given vegetation complex. Risk is associated with the method of fire start (ignition), whether human (accidental or intentional) or natural through lightning strikes.

Private lands bordering National Forest System lands in the project area may be at risk from the hazard fuels build-up from mountain pine beetle mortality if an ignition occurs. Fuel treatment projects in and near private lands are performed to modify hazardous fuel conditions to lessen fire behavior during ignitions, thus decreasing resistance to control. Treatments also lower ease of ignition (risk). Further, treatment goals are to achieve some combination of: (a) reducing flammability, (b) reducing fire intensity, (c) reducing the potential initiation and spread of crown fires, and (d) increasing firefighter safety and effectiveness. As mountain pine beetle mortality and fuels accumulations increase, the human risk factor for ignitions may become a larger issue. Natural ignitions caused by lightning would continue to be a seasonal risk.

The Canyon Lakes Ranger District implemented the Thompson River Fuel Reduction Project on National Forest System lands in and around the project area (Bureau of Land Management 2007). Treatments used to reduce fuel loads included thinning small diameter conifer trees, and the either piling and burning, or chipping and masticated this material. This has reduced the fuel load on portions of the forested areas that would be crossed by the project.

Figure 3.7-2a Fire Regime Condition Classes

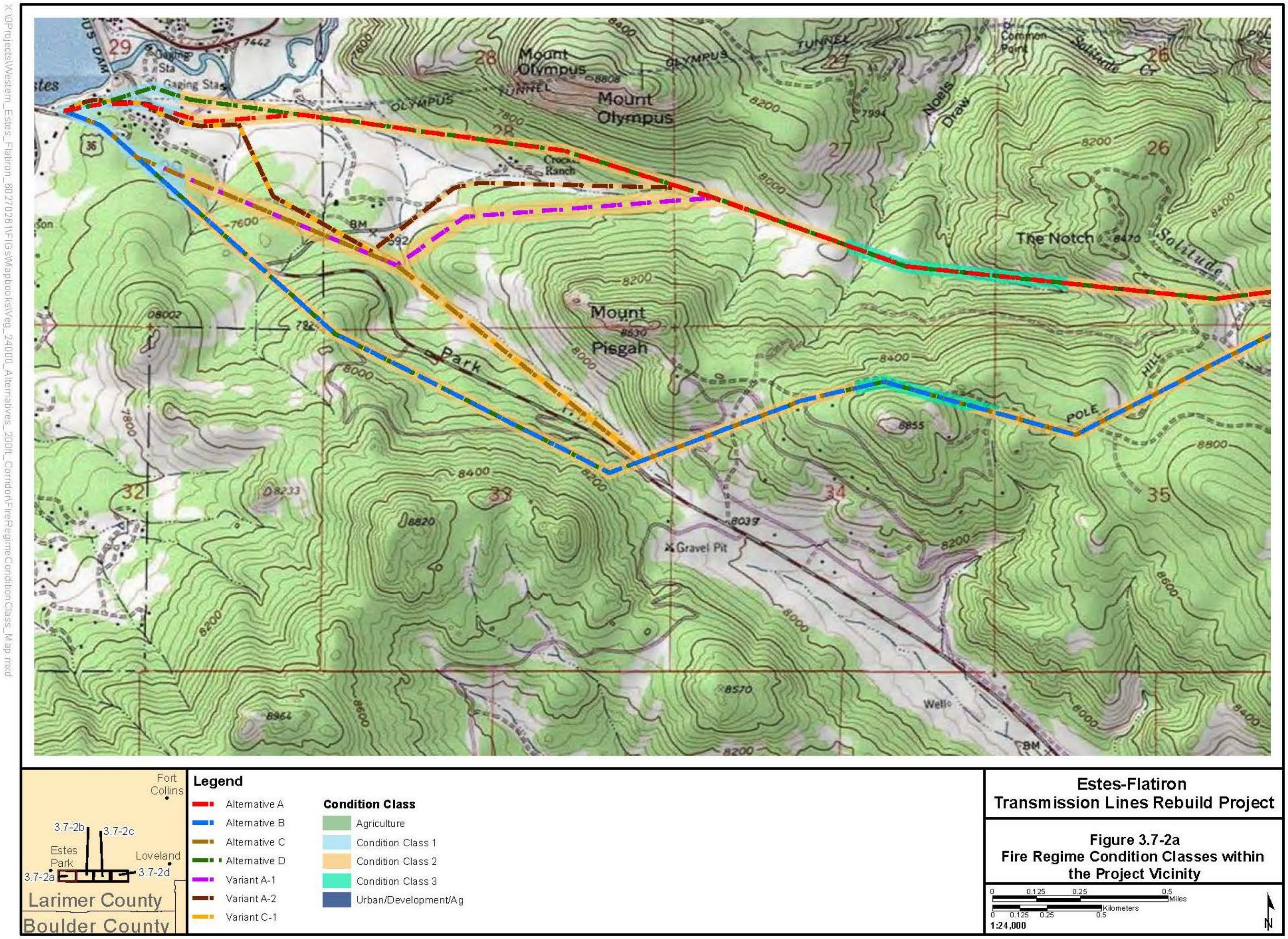


Figure 3.7-2b Fire Regime Condition Classes

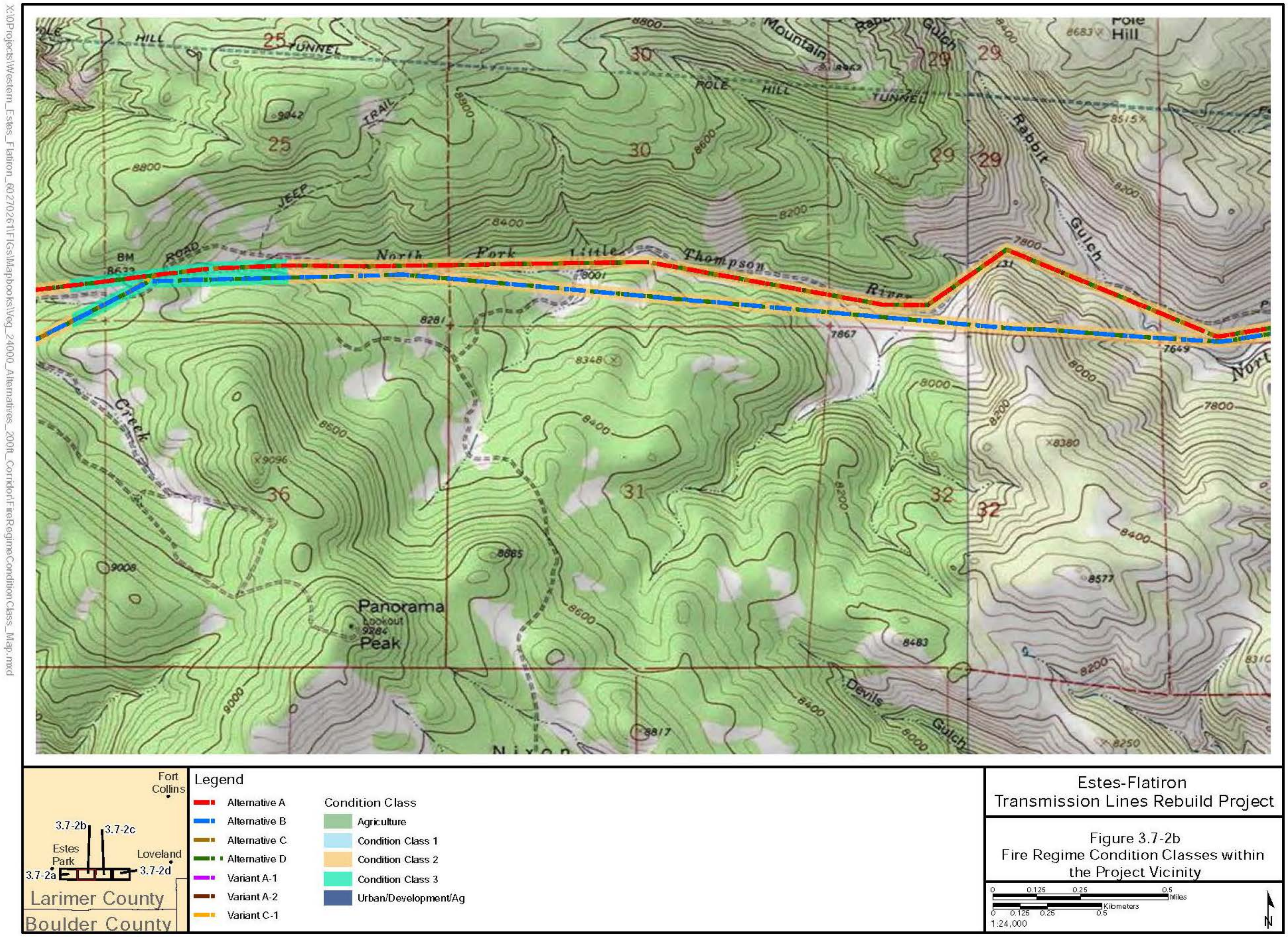


Figure 3.7-2c Fire Regime Condition Classes

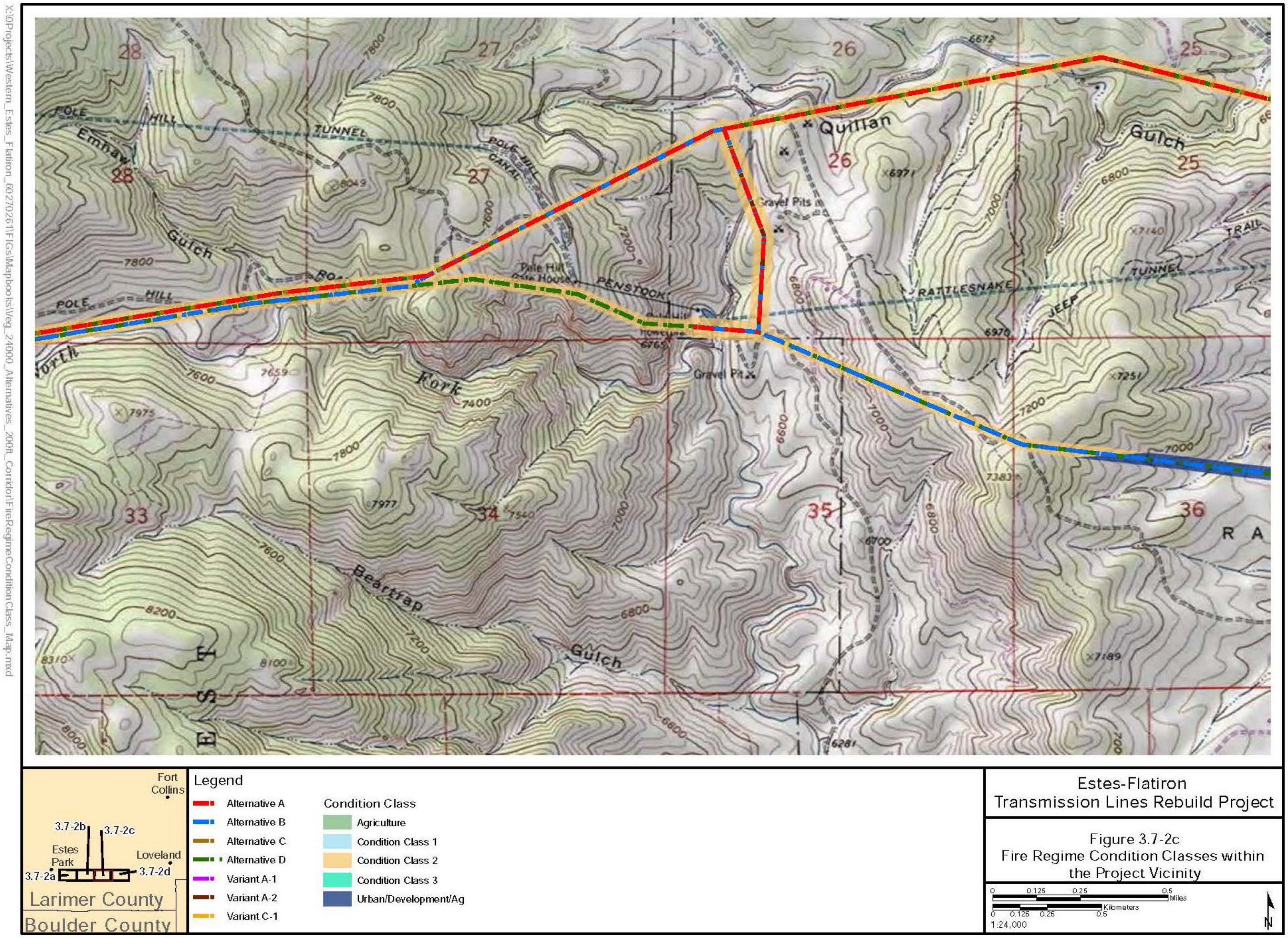


Figure 3.7-2d Fire Regime Condition Classes

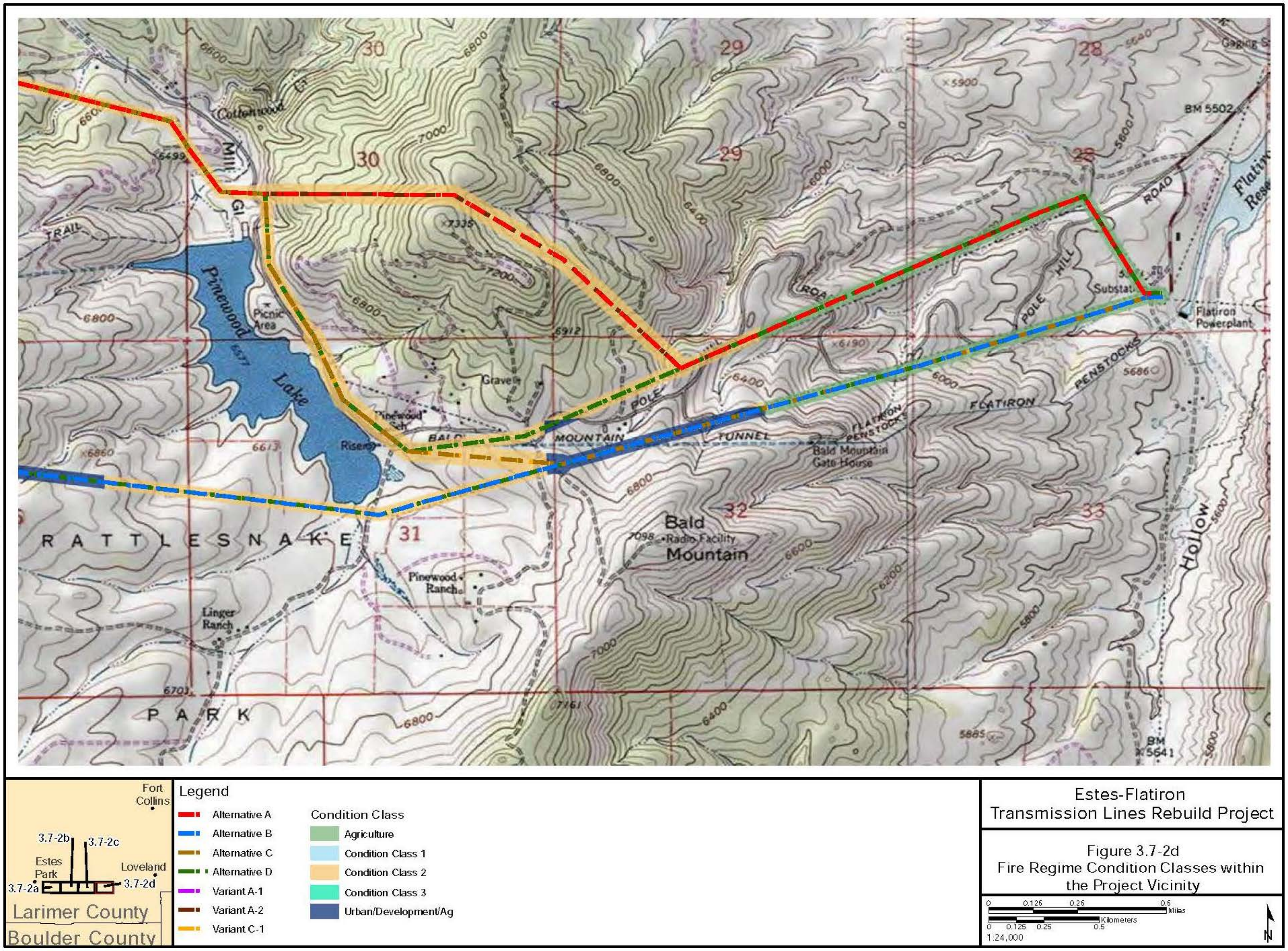


Figure 3.7-3a Fire Regime Data within a 200-Foot-Wide Corridor

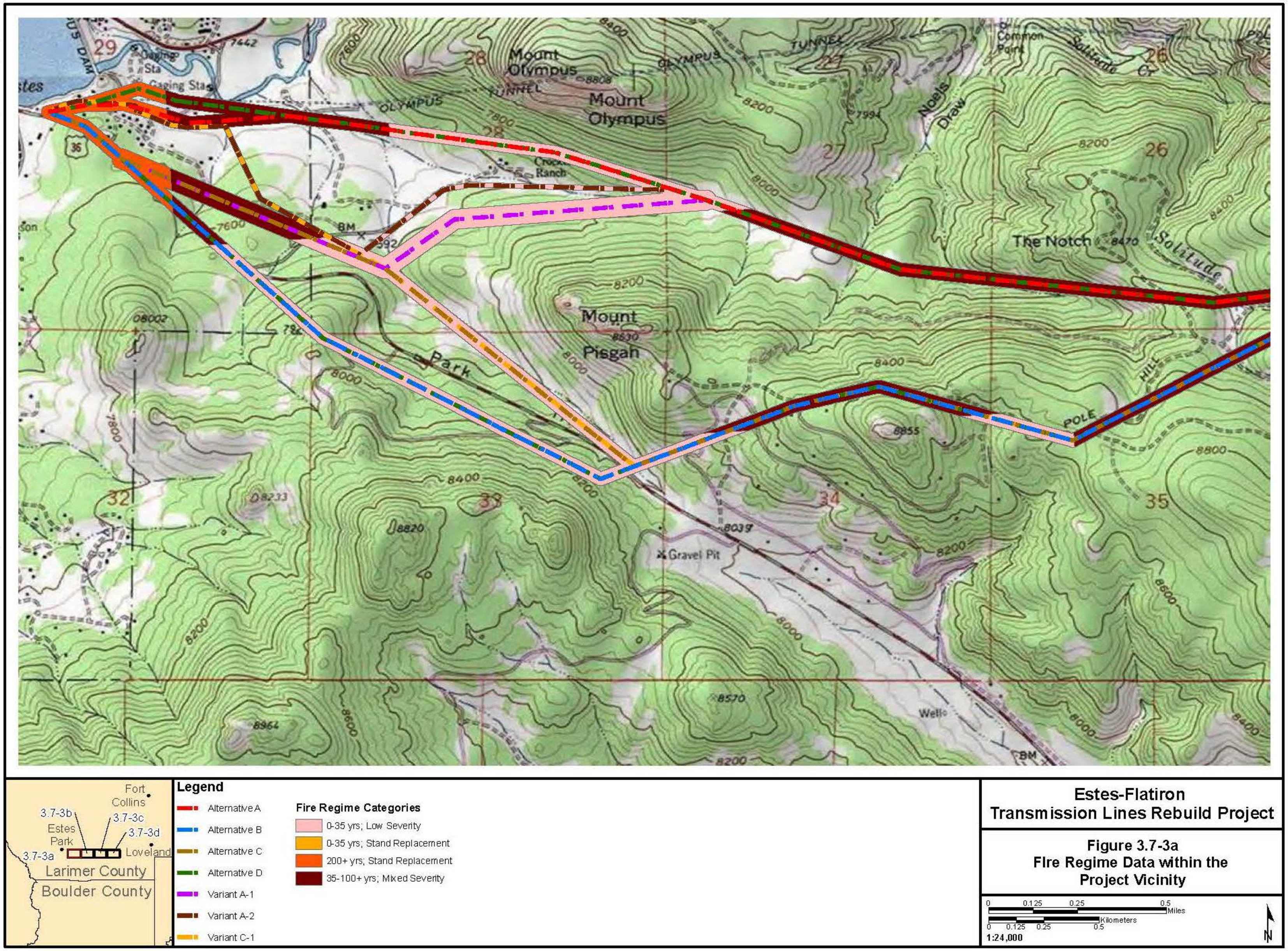


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Figure 3.7-3b Fire Regime Data within a 200-Foot-Wide Corridor

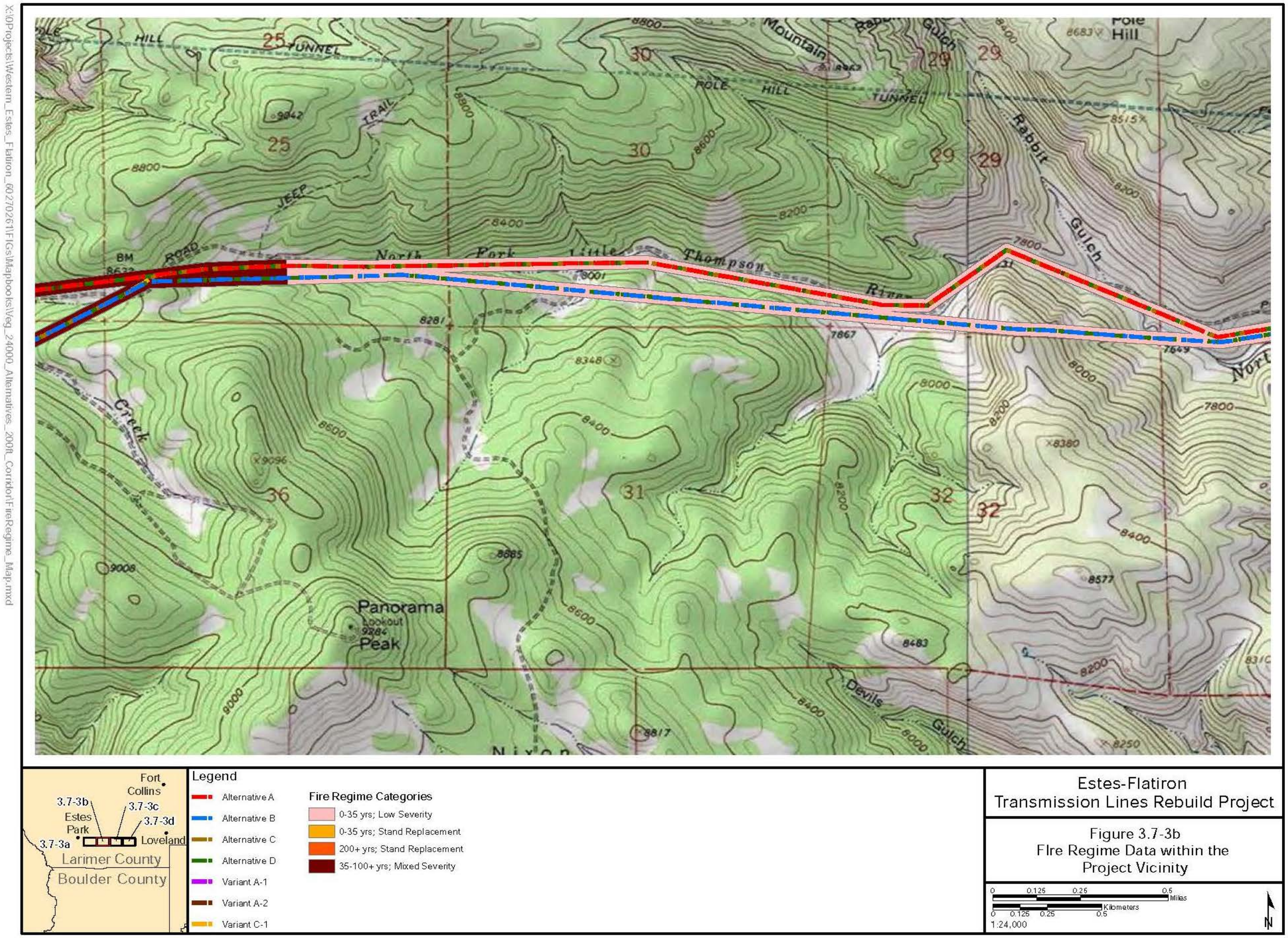


Figure 3.7-3c Fire Regime Data within a 200-Foot-Wide Corridor

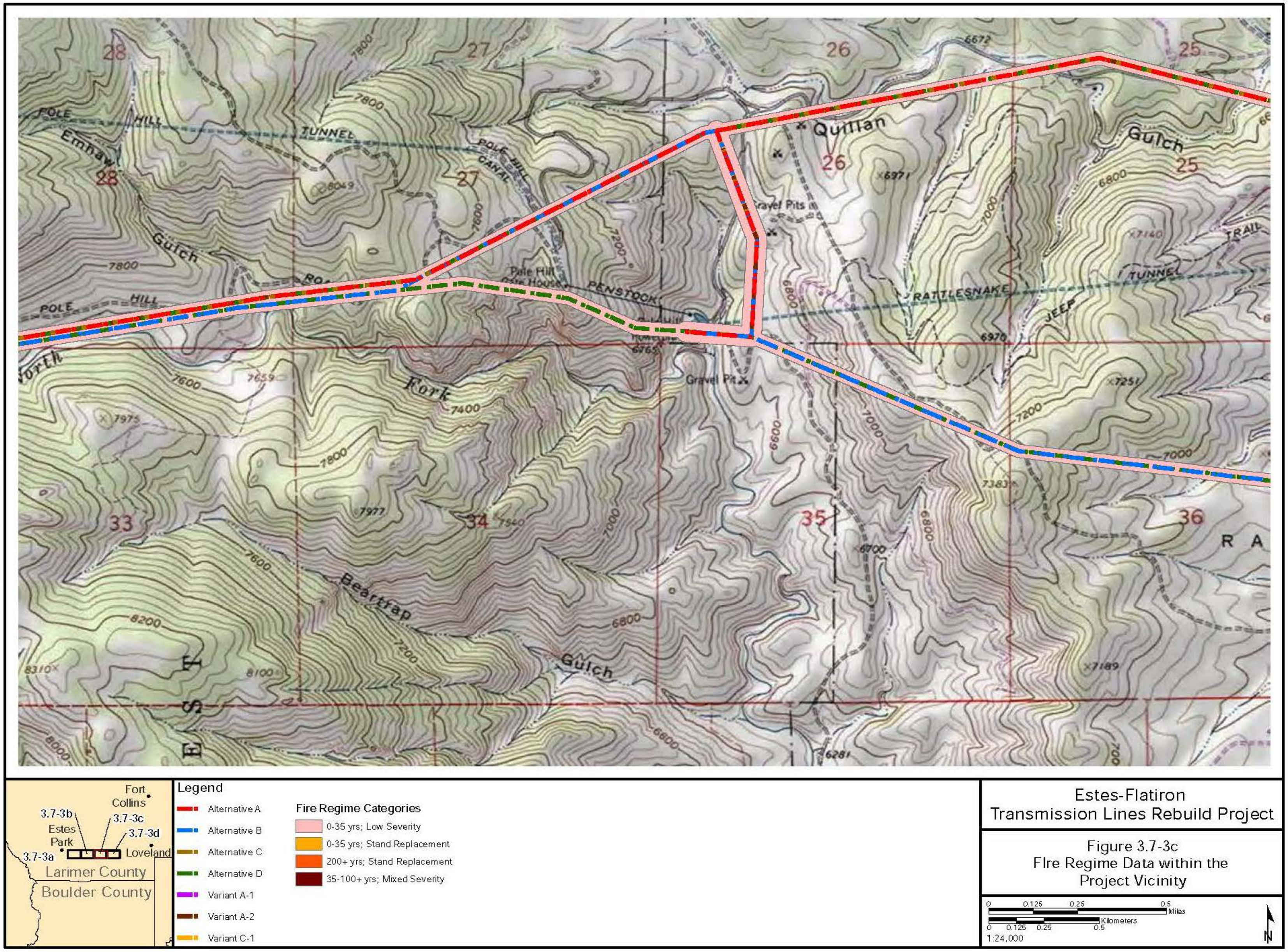
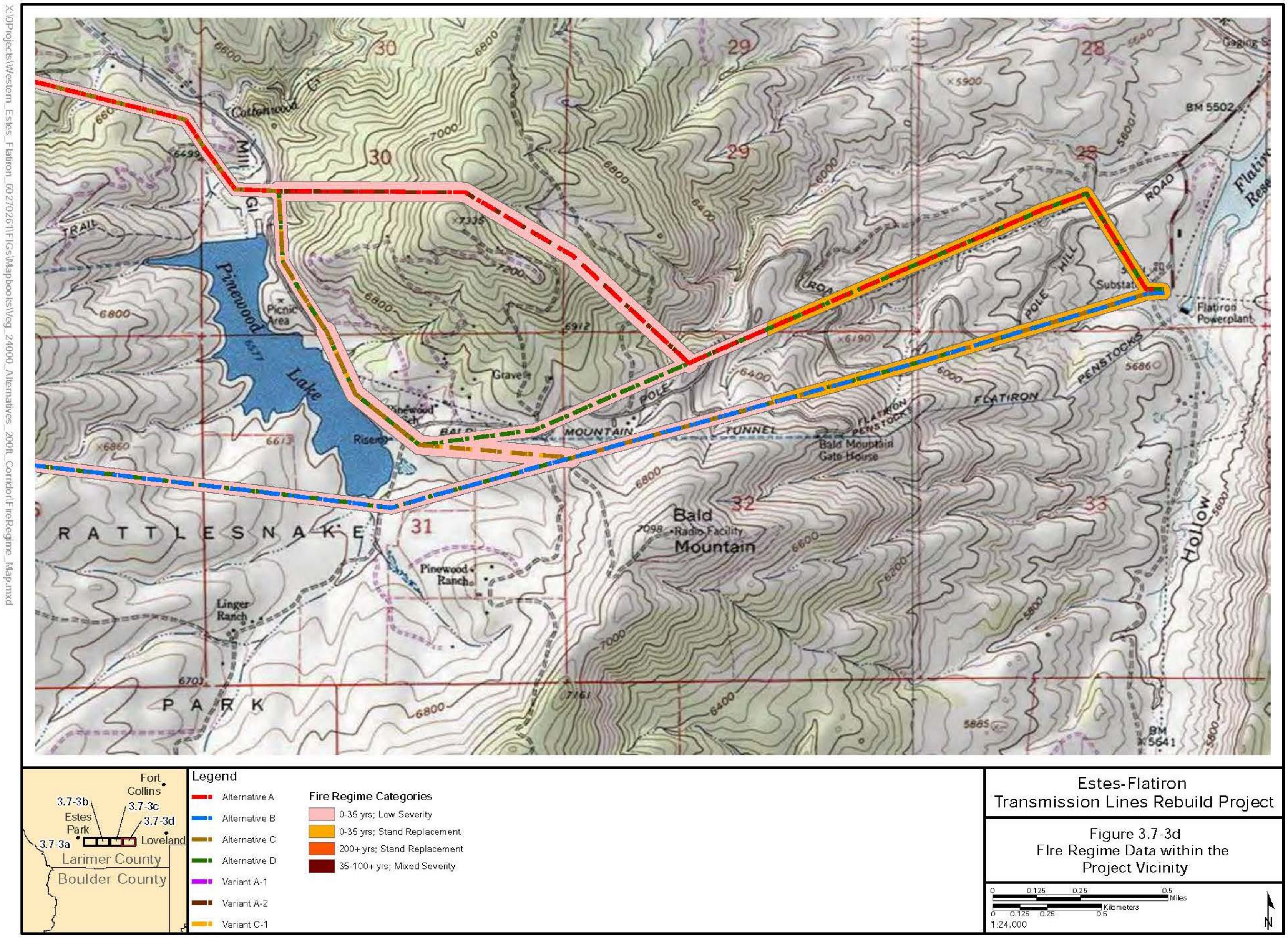


Figure 3.7-3d Fire Regime Data within a 200-Foot-Wide Corridor



3.8 Special Status and Sensitive Plant Species

Special status plant species are those species for which state or Federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed and federally proposed species that are protected under the ESA, or are considered as candidates for such listing by the USFWS, species that are state listed as threatened or endangered, and USFS sensitive species. In addition, the USFS defines Management Indicator Species (MIS) for each National Forest. An MIS is a plant or animal species selected because its status is believed to: 1) be indicative of the status of a larger group of species; 2) be reflective of the status of a key habitat type; or 3) act as an early warning of an anticipated stressor to ecological integrity. The key characteristics of MIS are that their status and distribution trends provide insight to the integrity of the larger ecological system to which they belong.

The analysis area for the affected environment for Special Status and Sensitive Plant Species is a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for the underground variants. See Section 3.7, Vegetation, for a description of the affected environment for general vegetation resources, and special status plant species within the project area.

Based on data obtained from agency websites and agency contacts, 52 special status plant species were identified by the USFWS and USFS as potentially occurring within the project area (Cedar Creek Associates 2013). Occurrence potential within the project area was evaluated for each of these species based on their habitat requirements and/or known distribution. Based on these evaluations, 31 special status plant species have been eliminated from detailed analysis because their known range is outside of the project area, and/or the project area does not include suitable habitat for these species. The remaining 21 species that have the potential to occur within the project area are discussed below. No designated critical habitat for ESA-listed species occurs in the project area. Species characterizations were compiled based on the USFS Biological Report (Cedar Creek Associates 2013).

3.8.1 Federal Threatened, Endangered, Proposed, and Candidate Species

Ute ladies'-tresses orchid (*Spiranthes diluvialis)* is the only Federal listed species with potential to occur in the analysis area. This species occurs in seasonally moist soils and wet meadows near springs, lakes, or perennial streams and their floodplains at or below approximately 7,000 feet elevation. Typical sites include old stream channels and alluvial terraces, sub-irrigated meadows, seasonally flooded terraces, various human-modified wetlands (irrigation canals, etc.) and other sites where the soil is saturated to within 18.0 inches of the surface at least temporarily during the spring and summer growing seasons. Over one-third of all known Ute ladies'-tresses populations are found on alluvial banks, point bars, floodplains, or ox-bows associated with perennial streams. It also appears to prefer well-drained soils with fairly high moisture content. This species rarely occurs in deeply shaded sites and is not found in uplands, sites entirely inundated by standing water, heavy clay soils, very saline sites, heavily disturbed sites (including plowed fields), steep stream banks, and sites supporting stands of dense rhizomatous plant species. Associated vegetation typically falls into the Facultative Wet classification and occurs primarily in areas where vegetation is relatively open and not overly dense, overgrown, or overgrazed. Species typically associated with the Ute ladies'-tresses orchid include scouring rush (*Equisetum* sp.), swamp milkweed (*Asclepias incarnata*), blue vervain (*Verbena hastata*), slender false foxglove (*Agalinus tenuifolia*), great blue lobelia (*Lobelia siphilitica*), blue-eyed grass (*Sisyrinchium* sp.), redtop (*Agrostis stolonifera*), reedgrass (*Calamagrostis* sp.), and goldenrod (*Solidago* sp.) (USFWS 2011c).

The majority of the project area is above 7,000 feet except for the portions immediately west of Pinewood Reservoir and east to the eastern portion of the project area. The project area below 7,000 feet crosses 22 drainages and a few wetlands. Eight of the drainages are channels supporting only upland plant communities. Ten others are ephemeral drainages exhibiting incised channels with narrow, dense, abutting wetlands, notably dense shrub overstories, plant communities dominated by obligate wetlands, or a combination of these characteristics, which do not provide suitable habitat conditions for the Ute ladies'-tresses orchid. Four wet meadows habitats were identified in the remaining drainages. Three of these wet meadows exhibited notably tall, dense vegetation and were dominated primarily by obligate wetland plant species. As a result of these conditions, these three wet meadows features do not support suitable habitat for the orchid. Only one wet meadow, at the south end of Pinewood Reservoir, exhibited the habitat characteristics that could support the orchid, although vegetation cover was relatively dense for the orchid. This species was not observed in this meadow within the project area during field surveys, although survey timing was early for the accepted survey time period for this species (late July through August). Western has committed to additional surveys and appropriate consultation with the USFWS and USFS along the preferred transmission line route prior to construction for all applicable species.

3.8.2 Forest Service Sensitive Species

Park milkvetch (*Astragalus leptaleus*) is a perennial forb with mat-forming stems. The species is found from 6,500 to 9,500 feet in sedge-grass meadows, swales, hummocks, and in association with streamside willows. It is often found in the transition zone between saturated soils and dry uplands. The species is found in Idaho, Montana, Wyoming, and Colorado. In Colorado, the species is found in Jackson, Chaffee, Larimer, Summit, Park, and Gunnison counties. It is a regional endemic that has been collected in Larimer County on the Roosevelt National Forest. The population trend of Park milkvetch is unknown, but the species appears to be in decline. Threats to this species' populations and habitat include conversion of wet meadows to haying, livestock grazing, peat and placer mining, weed invasion, and other activities that contribute to a drying of habitat. Suitable habitat was observed in and adjacent to wetland drainages, meadow wetlands, and a fen within the project area.

Triangle moonwort (*Botrychium ascendens*) is a fern found throughout Yukon Territory, British Columbia, Alberta, Saskatchewan, Ontario, Oregon, Washington, Idaho, California, Nevada, Montana, and Wyoming. Habitat for the species is montane, moist, early successional vegetation communities on volcanic or granitic alluvium. It has been found growing on moist hummocks within wetlands. There are no known occurrences of the species in Colorado. Primary threats to this species include road construction and maintenance, herbicide applications, grazing and trampling, weed competition, and site development. Suitable habitat for the species is found in the project area in and adjacent to wetland drainages, and wetlands. Early successional habitats for this species would be the same as described for *Botrichium lineare*.

Narrow-leaf grape fern (*Botrychium lineare*) is a small perennial fern found in montane, moist, early successional habitats, grassy slopes among medium-height grasses, and edges of streamside forests. In Colorado it grows on historically disturbed but stabilized open sites on grassy slopes, among medium height grasses, and along edges of streamside forests at elevations ranging from 7,900 to 9,500 feet. There are four extant Colorado populations of this moonwort located in El Paso County (2), Lake County, and Grand County and four historic populations (considering all observed sites as separate entities). It is considered to be a very rare species subject to site disturbance. Primary threats to this species include road construction and maintenance, herbicide application, grazing and trampling, weed competition, and site development. Suitable habitat is found in the project area. Habitat for the species is found in successional habitats, grassy slopes, and streamside (ephemeral) forest edges in the project area.

Paradox (peculiar) moonwort (*Botrychium paradoxum*) is a fern found in montane and mesic to wet subalpine mountain meadows with grasses and sedges. Detailed habitat information on this species is limited. Threats to the species include grazing, trampling, and off-road vehicles. Suitable habitat is found in the project area.

Plains rough fescue (*Festuca hallii*) is a perennial graminoid of the grass family (Poaceae) that typically inhabits alpine and subalpine grasslands and meadows. It is found in Canada, Washington, Montana, Wyoming, North Dakota, and Colorado, where it reaches its southernmost Rocky Mountain distribution. In Colorado, *F. hallii* has been seen at only one location within the last 20 years, at Cordova Pass on the San Isabel National Forest. Two other occurrences are known from the Roosevelt National Forest, but these have not been seen since the 1950s. Two other vague records report *F. hallii* from Custer and

Park counties. Although the Colorado rank is SH (state historical, a rank given to species not seen in the state since 1920), fieldwork in 2005 and 2006 (Anderson 2006b) showed that the species is present at the historical site near Spanish Peaks. Threats include livestock grazing, fire and fire suppression, invasion by exotic species, residential development, recreation, effects of small population size, pollution, and global climate change. Livestock grazing, in particular, appears to be detrimental to Hall's fescue (Anderson 2006c). Suitable habitat occurs in association with upland meadows.

Rocky Mountain cinquefoil (*Potentilla rupincola*) is a perennial forb found in mountains between 6,900 and 10,500 feet on granitic outcrops or thin, gravelly granitic soils with west or north exposure. It is often associated with ponderosa pine and limber pine communities. It is known to occur at 23 locations in Larimer, Boulder, Clear Creek, and Park counties in Colorado. Most populations occur in Larimer County in Cherokee Park and Virginia Dale. It occurs on the Roosevelt National Forest, and this species has been observed to the west of The Notch in Section 24, Township 5 North, Range 73 West (1897) and in Sections 28 and 33, Township 5 North, Range 72 West. Populations of Rocky Mountain cinquefoil appear to be relatively stable. However, a single disturbance event could feasibly extirpate or severely reduce a small occurrence. Threats include invasion by non-native plants, habitat loss from residential and commercial development, secondary impacts of grazing, ROW management, off-road vehicle use and other recreation, global climate change, and pollution. Suitable habitat for the species is found in the project area in areas of rock outcrops and adjacent coarse soils.

Rocky Mountain monkeyflower (*Mimulus gemmiparus*) is a perennial herb of the figwort family (Scrophulariaceae) found in granitic seeps, slopes, and alluvium in open sites in spruce-fir and aspen forests at 8,500 to 10,500 feet elevation. The species is endemic to the mountains of central and northern Colorado, where it is known from only eight occurrences in Grand, Jefferson, Larimer, and Park counties. The species has a unique reproductive strategy; the leaf petioles are modified to contain dormant embryos (the specific epithet gemmiparus refers to a gemma, an asexual reproductive mechanism often found in mosses). The primary threat to Weber's monkeyflower is the small size of populations; a single disturbance could feasibly completely destroy an occurrence. Activities that could impact an occurrence include recreation; invasion by nonnative plant species; trail and road construction and maintenance; wildfires; and forest management activities such as logging, thinning, or prescribed fires (Beatty et al. 2003). Suitable abitat occurs in association with the mixed conifer woodland.

Scarlet gilila *(Ipomopsis aggregata* ssp*. Weberi*) is a rare taxon with a limited geographic range. It is known from the Park Range region in Colorado and the Sierra Madre Range in Wyoming. The majority of the total known occurrences (approximately 17 of 27) are located on the Routt National Forest. There are approximately three known occurrences on the Medicine Bow National Forest. There may have been some loss of range within the last century in Colorado. In 1903, a specimen was collected from the Chambers Lake area, which is currently managed by the Roosevelt National Forest. No specimens have been reported from that area since then. *Ipomopsis aggregata* ssp*. Weberi* is restricted to areas with low vegetation cover, suggesting that it will be unable to compete with invasive plant species. It grows on old road cuts and in forest and shrub clearings and appears to be an early or mid-successional species. It can persist in, or re-colonize, areas after vehicle or animal disturbance although the sustainability of populations at high disturbance sites is unknown (Ladyman 2004a). Suitable abitat occurs in association with the upland meadows.

Selkirk violet (*Viola selkirkii*) is small perennial herb that may grow to a few inches in height. The species is found in cold mountain forests, moist woods, and thickets. It is rare in Colorado, typically found at the base of aspen trees at 8,500 to 9,100 feet. The species ranges from Alaska and Canada to the northeastern U.S., upper Midwest, and Washington, with disjoint populations in New Mexico and Colorado. In Colorado, the species has been found in Douglas, El Paso, and Larimer counties. In Region 2 Selkirk violet occurs in small and disjoint populations, leaving it vulnerable to stochastic events. Threats to the species include recreation, invasion by non-native plant species, wildlife and livestock grazing and trampling, road and trail construction and maintenance, forest management activities, and climate change. Suitable habitat is found within the project area in the higher elevation areas in forested areas, and small, scattered aspen stands.

Yellow lady's slipper (*Cypripedium parviflorum* [*C. calceolus* spp. *parviflorum*]) is a perennial herb found in a variety of shaded, moist habitats, including moist aspen forests, and ponderosa pine/Douglas fir forests, in rich humus and decaying leaf litter in wooded areas, rocky wooded hillsides on north- or east facing slopes, on wooded loess river bluffs, and moist creek borders at elevations ranging from 7,400 to 8,500 feet. The species is widespread in North America but uncommon in most of its range. Populations are widely scattered in Colorado where the species is known in ten counties at a narrow elevation range of 7,400 to 8,500 feet. It has been present in Larimer County. Little is known regarding the population trend of *Cypripedium parviflorum*. It is believed to be in decline due to habitat loss. This species is threatened by habitat alteration (including conifer encroachment, grazing, development, etc.), overstory modification, changes in soil and hydrological regimes, land management activities, unauthorized recreation, and over-collection. Suitable habitat is located in the project area along north-facing slopes and in association with wetland drainages.

3.8.3 Additional Species of Concern

The USFS provided a list of additional plant species of local concern for the project area (Cedar Creek Associates 2013). Thirteen species of concern have suitable habitat in the project area or potentially could be impacted by the proposed project.

Bitter-root (*Lewisia rediviva*) is a small, perennial herb that typically blooms in early spring on gravelly flats. There is one record of the species from the east slope. The species also has been found in Larimer County in habitat similar to that supporting *Botrychium* species (described above). Gravelly flats are rare to non-existent across the project area.

Fragile fern (*Cystoperis fragile),* similar to other fern species, typically grows in moist, rich soil in forests and at the bases and cracks of rock cliffs at elevations in excess of 5,000 feet. Habitat occurs along the majority of the drainages exhibiting abutting wetlands (e.g., Solitude Creek, tributary to Noels Draw, etc.), the fen located along the proposed project, and where rock outcrops are a dominant topographic feature. Rock outcrop habitat occurs in other areas sporadically across the project area. A few populations of *Cystoperis fragilis* were observed in rock outcrop habitat within the project area.

Dwarf rattlesnake-plantain (*Goodyera repens*) is a perennial orchid that typically inhabits shady sites on north- to east-facing slopes in mixed conifer stands and also can be found along banks of small streams, in forest duff, and in moss at elevations from 8,000 to 9,500 feet. Habitat for this species occurs in the project area, especially in the wetland drainages.

Lance-leaved grapefern (*Botrychium lanceolatum*) is a perennial forb found in rocky or gravelly sites in montane, often in sparsely vegetated areas, but occasionally under young trees or shrubs. It is often associated with old disturbances. It is currently considered one of the more common moonwort species in Colorado. This species is classified as a facultative wetland plant by the USACE. Available habitat preference data is at somewhat varied for this species. Rocky/gravelly sites and old disturbances occur in sporadic areas in the project area. The species could occur in the project area in historically cleared areas resulting from previous construction activities. However, no *Botrychium* species were observed during previous surveys in these areas. Suitable habitat was observed occurring as small, scattered patches in three spots in the project area. Suitable habitat for this species within the USFS tracts associated with wetlands is the same as listed for *B. multifidum*.

Larimer aletes (*Aletes humilis*) is a perennial forb that occurs in cracks in massive rocks and adjacent thin soils composed of disintegrated granite. It also may occur in duff under ponderosa pine at elevations ranging from 6,500 to 8,700 feet. Suitable habitat occurs in areas of rock outcrops and adjacent coarse soils. Other areas of smaller, localized rock outcrops occur in a mosaic pattern with soils lacking outcrop features that could provide marginal habitat. With respect to occurrence in duff soil types, this species could occur at numerous sites within the project area where ponderosa pine overstories dominate.

Least grapefern (*Botrychium simplex*) is a perennial forb. Habitat for this species is centered upon wetlands and wet substrates in Colorado. Sutiable habitat for this species within National Forest System lands is the same as listed for *B. multifidum*.

Leathery grapefern (*Botrychium multifidum*) is a perennial forb that inhabits graminoid wetlands and willow carrs, and is rare in Colorado. Suitable habitat is found in the project area in wetlands across the project area.

Botrychium pinnatum is a perennial forb most commonly found in moist grassy sites in open forests and meadows and often occurs near streams and other sites where soil moisture is constant. Suitable habitat occurs near wetlands and in wet/moist meadows along the project area.

Pictureleaf wintergreen (*Pyrola* picta) is a perennial subshrub found in cool, moist slopes and ravines in lodgepole pine, Douglas-fir, and Ponderosa pine forests at elevations ranging from 6,000 to 9,800 feet. Suitable habitat for this species is found in the project area.

Purple lady's slipper (*Cypripedium fasciculatum*) is a perennial forb found in open to densely shaded lodgepole pine and less often spruce-fir forests at elevations ranging from 8,000 to 10,500 feet. Given the elevation range, habitat for this species is confined to the center of the project area in coniferous stands.

Rattlesnake fern (*Botrychium virginianum*) is a perennial forb that inhabits aspen stands and cool ravines. Habitat preference data for this species is limited. The species is classified as a facultative upland species by the USACE. Aspen stands are limited to rare within the project area. Cool, north-facing ravines were not observed, although a similar habitat supporting a dense vegetation community was found on a south-facing ravine near the center of the project area.

Silkyleaf cinquefoil (*Potentilla ambigens*) is a tall, conspicuous plant that inhabits waste places, weedy sites, and edges of forests at elevations ranging from 6,000 to 9,400 feet. Waste places and weedy sites are rare to non-existent along the project area. However, if cleared areas along the edges of the existing transmission lines and roads function as “forest edges,” the species could occur along the majority of the project area boundaries and the edges of existing roads. As noted above, this species is a conspicuous plant that was not observed during the field surveys, and it is assumed that suitable habitat is limited.

Spatulate moonwort (*Botrychium spathulatum*) is a perennial forb found within stabilized, sparsely vegetated grassy meadows. The type of habitat is limited within the project area, consisting of rocky/gravelly sites and old disturbances that occur in sporadic areas in the project area. *Botrychium* habitat was identified in the project area, but no plants were observed.

Wood lily (*Lilium philadelphicum*) is a perennial forb found in cool, moist slopes and ravines with lodgepole pine, Douglas-fir, and ponderosa pine overstories. The elevation range for this species in Colorado is 6,000 to 9,800 feet. Suitable habitat for the species occurs in the project area in forested, fen and drainage features.

3.9 Wildlife

Wildlife resources in the project vicinity include wildlife habitats and features that were field evaluated along the existing ROWs and accessible access roads for the E-FL lines on July 7-8, July 12-14, and September 9, 2011 (Cedar Creek Associates 2013). Field surveys were conducted to accurately characterize existing wildlife habitats, as well as to identify any unique or sensitive natural resource features. Observations recorded during the field evaluation of the project vicinity included: major wildlife habitats/vegetation communities present within the property; dominant vegetation associated with each habitat/community; unique habitat features; and observations of wildlife species or their definitive sign. The locations of unique wildlife habitat features were recorded with a hand-held global positioning system (GPS) unit.

Information regarding wildlife species and their habitat within the project vicinity was obtained from multiple sources: (1) published literature; (2) unpublished agency reports and data; (3) Colorado Natural Heritage Program (CNHP) database search; (4) CPW Natural Diversity Information Source (NDIS) mapping system; and (5) field surveys. The CNHP database search for Federal threatened, endangered, proposed and candidate species was requested for a 1-mile-wide corridor on each side of all ROWs. A more detailed request was submitted for National Forest System lands crossed by the existing E-PH and E-LS ROWs. The specifics of the request for National Forest System land and the results of this request are provided in the Biological Report (Cedar Creek Associates 2013) submitted to the USFS. Results of the CNHP database search request were received on November 18, 2011. The CPW NDIS mapping system was accessed on January 26, 2012 (NDIS 2012) to obtain distribution and range information for state game species of interest addressed by this analysis.

The topography, water resources, and vegetation of the project vicinity create a diversity of habitats and habitat features that support a variety of wildlife species. Additional discussion of vegetation community/habitat types are discussed in detail in Section 3.7, Vegetation. More detailed descriptions of riparian/wetland communities and upland communities are provided in Sections 3.5 and 3.6, respectively.

Aquatic habitat within the analysis area is restricted to the North Fork Little Thompson River and the Big Thompson River. The Big Thompson River is within the analysis area near a short segment of the west end of the ROW but would not be affected by the proposed project. The North Fork Little Thompson River is the only perennial drainage within the analysis area that is crossed by the existing ROWs, but portions of the drainage within the analysis area have flows too low to support any significant fisheries. Existing ROWs and new aboveground ROW alignments would span the North Fork Little Thompson River. Therefore, aquatic habitats and fisheries resources are not further described in this section.

3.9.1 Big Game

Five big game species are found within the project vicinity: Rocky mountain elk (*Cervus canadensis*), mule deer (*Odocoileus hemionus*), moose (*Alces alces*), black bear (*Ursus americanus*), and mountain lion (*Puma concolor*). Bighorn sheep occur in the region, but the project vicinity is outside of the documented range of occurrence of this species (NDIS 2012).

3.9.1.1 Elk

In Colorado, elk range covers the western two-thirds of the state, generally at elevations above 6,000 feet, although they are occasionally reported in the South Platte River drainage on the eastern plains (Armstrong et al. 2011).

Elk breed in the fall with the peak of the rut in Colorado occurring during the last week of September and first week of October. Breeding typically is over by late October. Most calves are born in late May to early June. Calving grounds generally are in areas where forage, cover, and water are in juxtaposition. Elk tend to inhabit higher elevations during spring and summer and migrate to lower elevations for winter range. Spring and fall migrations are tied to weather and forage availability. Snow depths of about 6 inches may trigger elk movement to lower elevation winter ranges (Armstrong et al. 2011).

The project vicinity is within the Big Thompson River Basin and is located within the Saint Vrain Herd Unit (Data Analysis Unit [DAU] E-9, Game Management Unit 20), which overlaps the Canyon Lakes District south of the Buckhorn Road and east of Rocky Mountain National Park. According to CPW information, the herd currently numbers about 2,470 elk (post-hunt 2011), which is within the current population range objective of 2,200 to 2,600.

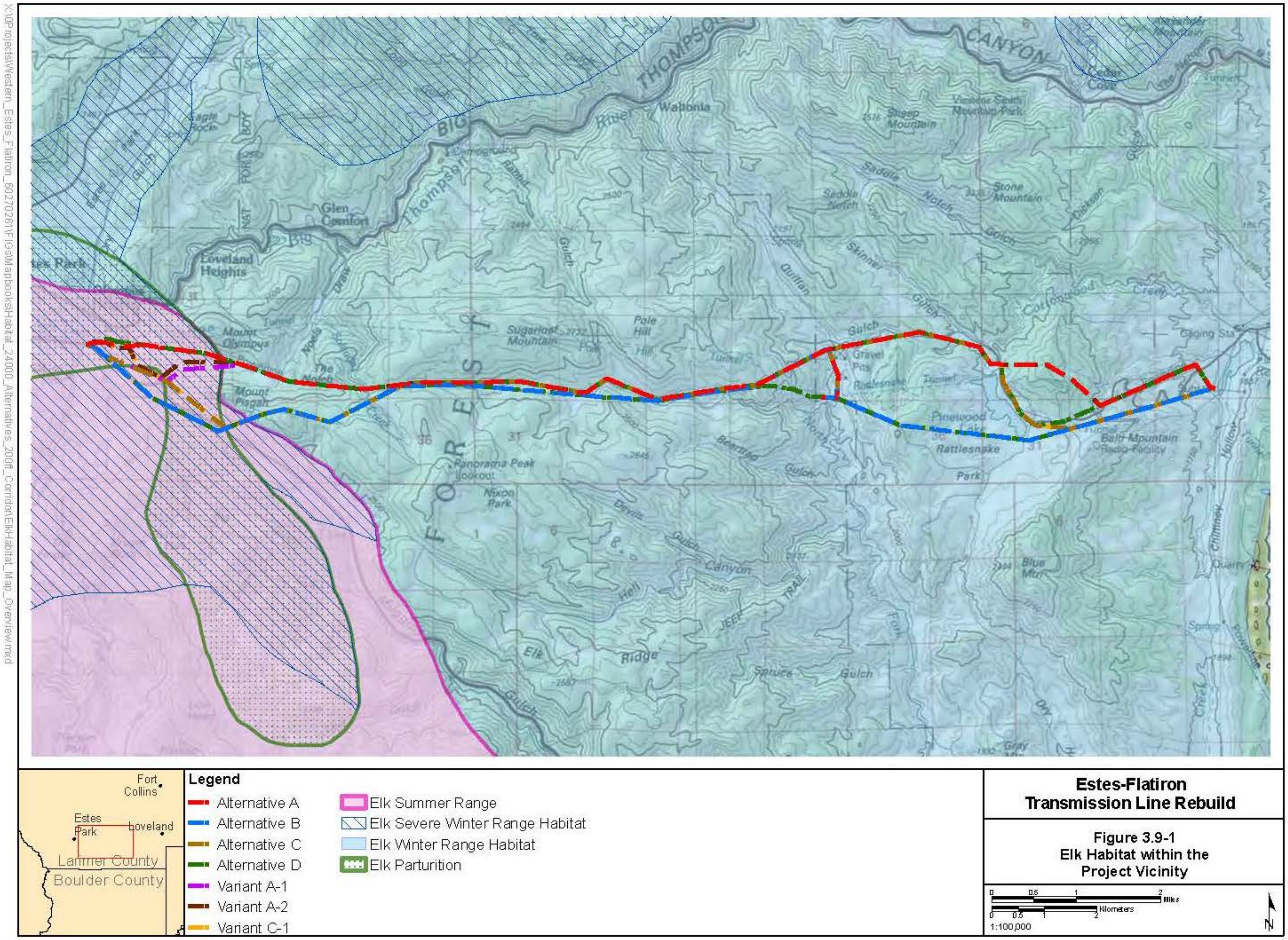
NDIS (2012) big game range mapping shows the entire project vicinity to be within overall and winter range for elk. The far western portions of the area (existing structure numbers 2-4 to 0-7, E-LS and 3-3 to 0-7, E-PH) are within severe winter range and a winter concentration area (NDIS 2012). Elk summer range is located primarily at higher elevations to the west of the proposed project, but a small segment of summer range overlaps a small portion (structure number 3-3 to 2-8) of the E-PH ROW (NDIS 2012). An elk production area also is identified at the west end of the project (structure numbers 2-8 to 2-1, E-PH and 2-4 to 0-7, E-LS) (NDIS 2012). The project vicinity also is contained within a designated elk migration corridor that begins in the Pole Hill area (structures 8-8, E-LS and 7-1, E-PH) and extends to the western edge of Loveland. This is considered a major migration corridor used by approximately 1,000 elk from about the third week of August to the end of January (Spowart 2012a). Elk habitat in the project vicinity is displayed on **Figure 3.9-1**.

Overall range is defined as the area that encompasses all known seasonal activity areas within the observed range of an elk population. The CPW defines winter range as that part of the overall range of a species where 90 percent of the individuals are located during the average 5 winters out of 10 from the first heavy snowfall to spring green-up, or during a site-specific period of winter as defined for each DAU. Severe winter range is defined by the CPW as that part of the range of a species where 90 percent of the individuals are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten. Winter concentration areas are described as that part of the winter range of a species where densities are at least 200 percent greater than the surrounding winter range density during the same period used to define winter range in the average 5 winters out of 10. The CPW defines summer range as that part of the range of a species where 90 percent of the individuals are located between spring green-up and the first heavy snowfall, or during a site-specific period of summer as defined for each DAU. Finally, elk production areas are described by the CPW as that part of the overall range of elk occupied by the females from May 15 to June 15 for calving. (Only known areas are mapped and NDIS mapping does not include all production areas for a DAU.)

Based on CPW range mapping, elk may be found in the project vicinity at any time of the year, but higher summer use, production, and winter use is restricted primarily to the far west end of the area.

Although all five of the vegetation types present within the project vicinity and discussed in Section 3.7.1, General Vegetation, provide suitable habitat for elk, the specific use of these habitats can vary depending on the seasonal availability of forage and cover. Field surveys indicated that vegetation types (grassland/forb meadows, shrublands, and aspen) provide moderate-quality forage habitat. There are areas of open mature pine forest and grassland/meadow and riparian areas along Solitude Creek and the North Fork Little Thompson River. These vegetation types also are common on the private parcels located between National Forest System lands. Forage also is present within forested stands in the form of shrubs, grasses, and herbaceous species, but less so in cover types other than open mature and sapling/pole stands, which are not present in the analysis area. The mix of habitat types in the general area provides moderate to high quality elk habitat.

Figure 3.9-1 Elk Habitat



3.9.1.2 Mule Deer

The project vicinity within the Big Thompson River Basin is located within the Big Thompson Deer Herd range (DAU D-10, Game Management Unit 20), which overlaps the Canyon Lakes District south of the Buckhorn Road and east of Rocky Mountain National Park. According to CPW information, the herd currently numbers about 4,970 deer (post-hunt 2011), which is just above the current population objective of less than 5,000 deer. This objective was implemented in 2001 to reduce the herd in an attempt to reduce the prevalence of chronic wasting disease.

NDIS big game range mapping shows the project vicinity to be within overall, winter, and summer range for mule deer (NDIS 2012). The far west end of the project vicinity is within mule deer severe winter range and a winter concentration area (NDIS 2012). The approximate eastern third of the project vicinity also is within a winter concentration area (NDIS 2012). The project vicinity is not within or near any identified mule deer summer concentration areas (NDIS 2012). CPW definitions for mule deer ranges are the same as those provided for elk in the previous section.

Based on CPW range mapping, mule deer may be found in the project vicinity at any time of the year, and higher numbers are likely to occur at the far west end and in the eastern third of the project vicinity during winter months. Although all five of the vegetation types present within the project vicinity and discussed in Section 3.7.1, General Vegetation, provide suitable habitat for mule deer, the specific use of these habitats can vary depending on the seasonal availability of forage and cover. Field surveys indicated that vegetation types (grassland/forb meadows, shrublands, and aspen) providing high-quality forage within the analysis area. There are areas of open mature pine forest and grassland/meadow and riparian areas along Solitude Creek and the North Fork LittleThompson River. These vegetation types also are common on the private parcels located between National Forest System lands. Forage also is present within forested stands in the form of shrubs, grasses, and herbaceous species, but less so in cover types other than open mature and sapling/pole stands, which are not present in the analysis area. The mix of habitat types in the general area provides moderate to high quality mule deer habitat.

The project vicinity is within the Big Thompson River Basin and is located within the DAU M-99, Game Management Unit 20. Currently there are no moose population estimates for DAU M-99. According to NDIS (2012) mapping, the western half of the project vicinity (west of structure numbers 7-5, E-LS and E-PH) is in moose overall and winter range. CPW definitions of moose overall and winter range are the same as those described for elk. Although all five of the vegetation types present within the project vicinity and discussed in Section 3.7.1 General Vegetation, provide suitable habitat for moose, these vegetation types do not represent the preferred habitat of local populations. As a result of this, it is likely that moose may occasionally move through the project vicinity but are not likely to be common since preferred aquatic and willow foraging habitats within the project vicinity are essentially lacking.

3.9.1.3 Black Bear

Black bears are omnivorous but feed primarily on herbaceous vegetation and berries. Riparian, wetland, and other habitats along the perennial drainages area may represent some of the more important habitats for black bear in the project vicinity. The entire project vicinity is located in black bear overall range (NDIS 2012) and all five of the existing vegetation types discussed in Section 3.7.1, General Vegetation**,** provide suitable habitat for black bear . Overall range is defined by the CPW as the area that encompasses all known seasonal activity areas within the observed range of a population of black bear. The far west portions of the project vicinity (west of pole structure 2-6 on E-LS and pole structure 3-5 on E-PH) are identified as black bear summer and fall concentration areas (NDIS 2012). Summer concentration areas are defined by the CPW as that portion of the overall range of the species where activity is greater than the surrounding overall range during that period from June 15 to August 15. Fall concentration areas are defined by the CPW as that portion of the overall range occupied from August 15 until September 30 for the purpose of ingesting large quantities of mast and berries to establish fat reserves for the winter hibernation period.

3.9.1.4 Mountain Lion

The project vicinity is located within mountain lion overall range (NDIS 2012). Overall range is defined by the CPW as the area that encompasses all known activity areas within the observed range of a mountain lion population. Mountain lion occur throughout all five of the existing vegetation types occurring within the project vicinity as discussed in Section 3.7.1, General Vegetation. A major habitat requirement is the presence of deer (Armstrong et al. 2011), and mountain lion movement is closely related to their principal prey, deer and other ungulates. Preferred habitat of mountain lions consists of rough or steep terrain in remote areas with suitable rock or vegetation cover. They are typically shy and avoid areas with human activity. Mountain lion, like their prey, are typically wide-ranging. They follow their prey's seasonal movement and inhabit summer range or winter range in conjunction with deer. As a result of their wide-ranging habits, population densities are usually low.

3.9.2 Other Mammals

Based on known ranges and habitat preferences, a variety of mammalian predators and small mammal species, including bats, are likely to be present in the project vicinity. Most of these species are relatively widespread and common. The USFS listed sensitive species potentially occurring in the project vicinity, and other mammalian species of concern are addressed in Section 3.10.

3.9.3 Upland Game Birds

Merriam’s wild turkey (*Meleagris gallopavo*), dusky grouse (*Dendragapus obscurus*), mourning dove (*Zenaida macroura*), and band-tailed pigeon (*Columba fasciata*) are upland game birds potentially occurring within the project vicinity.

Preferred habitats for the native Merriam’s wild turkey in Colorado include primarily lower elevation (below 8,000 feet) ponderosa pine woodlands, oak brush, and riparian woodlands intermixed with grassland and brushy draws (Boyle 1998a). Ponderosa pine woodlands in the project vicinity represent suitable habitat for wild turkey. The project vicinity is located in wild turkey overall range (NDIS 2012) and a portion (structure numbers 7-4 to 9-4, E-LS and 7-5 to 9-6, E-PH) of the project vicinity is within a wild turkey production area (NDIS 2012). The project vicinity does not include wild turkey winter range or winter concentration areas (NDIS 2012). Overall range is defined by the CPW as the area that encompasses all known seasonal activity areas within the observed range of a wild turkey population. Wild turkey production areas are defined by the CPW as those area(s) that are used by turkeys for nesting during the period from March 15 to August 15.

Dusky grouse (formerly known as blue grouse) are a year-round resident and breed from the foothills to timberline and within the project vicinity, inhabit the following vegetation types; mixed conifer forest, areas of mountain shrub mosaic, upland meadow edges, and open mountain-park meadows. They tend to prefer edge areas between woodlands and open herbaceous habitats as well as open-canopied woodlands with shrub understories (Toolen 1998).

Band-tailed pigeons are summer residents in Colorado that winter in Mexico and South America. In Colorado they prefer ponderosa pine, piñon pine, and oak brush habitats, and are found at the highest densities between 6,000 and 9,000 feet in elevation (Dexter 1998). Band-tailed pigeons are most common on the western slope of Colorado, but breeding also has been documented in western Larimer County (Dexter 1998). Band-tailed pigeons may occur in the project vicinity throughout ponderosa pine woodlands, although none were recorded by field surveys.

Mourning doves occur nearly statewide in Colorado except at higher elevation and densely forested habitats. They inhabit shrubland and grassland habitats in the region. However, they prefer agricultural areas, riparian areas, and open woodlands with scattered trees and shrubs near water (Kuenning1998). They nest on horizontal branches of trees and on the ground. Within the project vicinity, mourning doves are likely to occur in more open habitats near water east of the Pole Hill portion of the project vicinity. This species migrates to warmer climates in the southern U.S. and Mexico for the winter.

3.9.4 Raptors

Raptors are protected under state and Federal laws including the MBTA and the Bald and Golden Eagle Protection Act. A variety of raptor habitats are within the project vicinity, from lower elevation grassland and shrublands to montane shrublands and forests. As a result, there are a variety of raptor species likely to hunt and breed in the area. Open-country raptors likely to occur near the proposed project include golden eagle (*Aquila chrysaetos*), turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and prairie falcon (*Falco mexicanus*). Suitable hunting habitat for these species is present primarily east of the Pole Hill section of the proposed project.

Species closely associated with open water and riparian habitats are osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), and peregrine falcon (*Falco peregrinous*). Suitable open water and riparian habitats are restricted to Flatiron Reservoir, Pinewood Reservoir, Big Thompson River, and Lake Estes within and near the project vicinity. Peregrine falcon and bald eagle are state species of special concern and are discussed in Section 3.10. Common montane forest or forest edge dwelling species include Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), northern goshawk (*Accipiter gentilis*), great horned owl (*Bubo virginianus*), long-eared owl (*Asio otus*), flammulated owl (*Otus flammeolus*), northern pygmy-owl (*Glaucidium gnoma*), and northern saw-whet owl (*Aegolius acadicus*). Suitable habitat for these species is located in the project area primarily west of the Pole Hill area.

In the project vicinity, osprey, golden eagle, red-tailed hawk, northern goshawk, and great horned owl typically nest in relatively large trees with open crowns. Ospreys require trees along major rivers, lakes, and reservoirs. Osprey also will nest on power poles, artificial platforms, and other man-made structures. All but northern goshawk and osprey also may nest on rock ledges on cliffs and rock outcrops. Suitable-sized nest trees generally are lacking in the project vicinity except for cottonwoods around Flatiron Reservoir. Human presence and recreation would likely preclude nesting near the shoreline portions of reservoirs near the project vicinity. There is, however, an osprey nest on an artificial pole platform near the south end of Pinewood Reservoir and the project vicinity. The nest site has been active for several years and produced three chicks in 2011 (Larimer County 2011). No other large raptor tree nests were located during field surveys.

Northern goshawks typically nest in mature to old-growth stands of aspen, ponderosa pine, and lodgepole pine. Ponderosa pine and mixed conifer woodlands in the project vicinity represent potential nesting habitat for northern goshawk, and Canyon Lakes Ranger District file data indicate there is one historic and one recently active nest site in the vicinity of the project vicinity (Oberlag 2011). However, most conifer trees within and adjacent to the project vicinity were judged to be relatively small and lacked suitable configurations to support goshawk nest construction. This species is discussed in greater detail in the Estes-Flatiron Biological Report (Cedar Creek Associates 2013).

Prairie falcons nest on ledges and in rock cavities on cliff faces. Suitable cliff face nesting habitat generally is lacking for this species in the project vicinity. No prairie falcon nesting activity has been documented within the project vicinity (Spowart 2012a).

The American kestrel is a cavity nester, and abandoned woodpecker holes are used as nest sites. American kestrel inhabits a variety of open and wooded habitats and avoids densely forested habitats. Suitable habitat for this species occurs primarily to the east of the Pole Hill section of the project. American kestrel was observed during the July 2011 field survey near Flatiron Reservoir and likely nests in the cottonwoods around the perimeter of the reservoir.

Northern harriers nest on the ground in low shrubs or in pockets of dense shrub and grass cover, often near wetlands. Other preferred habitats include native and non-native grasslands, agricultural areas, and marshes (Carter 1998). Suitable nesting habitats exist within the lower elevation portions of the project vicinity east of the Pole Hill area, but they were not observed during the July 2011 field survey.

Cooper's hawk nests in aspen or in deciduous trees in riparian situations but also is known to nest in mature conifers (Ehrlich et al. 1988; Terres 1980). Nests are typically constructed in an upper crotch of a tree near the trunk and below the canopy top. Sharp-shinned hawks, unlike the Cooper's hawk, nest in a wide variety of wooded habitats ranging from mountain mahogany stands to conifers. Both species are potential nesters in the ponderosa pine woodlands within the project vicinity, but no nests were located during field surveys.

Long-eared owls, like great horned owl, do not build their own nest and usually occupy abandoned magpie, hawk, crow, or squirrel nests in tall shrubs or trees (Ehrlich et al. 1998). Although primarily an open-country hunter, long-eared owls typically nest in juniper thickets, woodland perimeters, edges of riparian woodlands and at forest edges near water or moist meadow habitats (Terres 1980). Of the existing vegetation types discussed in Section 3.7.1, General Vegetation, ponderosa pine woodland edges, mountain shrub mosaic, and upland meadow/wetland mosaic vegetation types represent suitable nesting habitat for long-eared owl in the project vicinity.

Flammulated owl, northern pygmy-owl, and northern saw-whet owl are all cavity-nesting, coniferous forest dwelling species. The flammulated owl is considered a common summer resident in the foothills and lower mountains of Colorado (Andrews and Righter 1992). Preferred habitat in Colorado consists of open, mature stands of Douglas-fir and ponderosa pine (Reynolds and Linkhart 1987). Old growth (greater than 200 years) or mature (greater than150 years) stands of ponderosa pine and ponderosa/Douglas-fir forests, often mixed with mature aspen, are preferred as nesting habitat (Reynolds and Linkhart 1987; Jones 1991; Rashid 2009). Ponderosa pine woodland within the project vicinity is comprised of relatively young-age class trees with a closed-canopy structure and does not represent preferred habitat for flammulated owl. However, USFS flammulated owl surveys for a fuels reduction project in forested areas north of the project vicinity had several flammulated owl detections (Oberlag 2011); therefore, this species may be present in the project vicinity. This species is addressed in greater detail in the Estes-Flatiron Biological Report (Cedar Creek Associates 2013).

Northern pygmy-owls are year-round residents in Colorado, but probably exhibit some elevation movements over the seasons (Jones 1998a). Nest sites have been found from the lower foothills to the upper montane zone (Jones 1998a). Preferred breeding habitat in Colorado appears to be areas that include a mixture of pine, spruce, fir, and aspen with nearby meadows and a water source such as a creek or pond (Rashid 2009). Northern saw-whet owls also are year-round residents in Colorado that also exhibit some elevation movement in response to the seasons (Rashid 2009). The species is relatively widespread in Colorado and prefers old-growth piñon-juniper and ponderosa pine habitats (Boyle 1998b). They can be found nesting in the same higher elevation habitats and areas used by northern pygmy-owls (Rashid 2009). Areas with larger and more mature trees are more likely to provide cavities for nesting for these species. Both species are potential breeders in the project vicinity, although the general lack of mature stands may limit suitable nesting habitat.

3.9.5 Other Birds

A number of songbird and other bird species also may occur within the project vicinity, which include open-country species associated with grassland and shrubland habitats and woodland species associated with coniferous forests. The majority of these avian species are migratory and occur only as summer residents within the project vicinity. Many of the summer residents are neotropical migrants that winter in Central and South America.

The MBTA provides Federal legal protection for bird species listed at 50 CFR 10.13. In accordance with EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds (January 10, 2001) the USFS has agreed to a Memorandum of Understanding with the USFWS to promote migratory bird conservation (FS Agreement #08-MU-1113-2400-264). Under this Memorandum of Understanding, the USFS has committed to focus its evaluation the effects of agency actions on those species of management concern along with their priority habitats. The USFWS places the highest management priority on the Birds of Conservation Concern (BCC) list (USFWS 2008). The BCC list was developed as a 1988 amendment to the Fish and Wildlife Conservation Act. This Act mandated that the USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973." The goal of the BCC list is to prevent or remove the need for additional ESA bird listings by implementing proactive management and conservation actions.

The habitats and ranges of the BCC for the Southern Rockies/Colorado Plateau (Bird Conservation Region 16) (USFWS 2008) were reviewed to create a list of BCC potentially occurring in the project vicinity. Potential BCC breeding bird populations within the project vicinity include bald eagle, golden eagle, peregrine falcon, prairie falcon, flammulated owl, Lewis's woodpecker (*Melanerpes lewis*), and Cassin's finch (*Carpodacus cassinii*). The remaining species on the BCC list for Southern Rockies/Colorado Plateau either has ranges outside of the vicinity, prefer habitats not found in the vicinity, or occur only as migrants in the area during spring and fall migration. Golden eagle, prairie falcon, and flammulated owl are discussed in Section 3.9.4. Bald eagle and peregrine falcon are discussed in Section 3.10.

Lewis's woodpecker occurs as a summer resident in northern Colorado and is present in southern portions of the state, as well as northern New Mexico and Arizona, as a year-round resident and winter visitor. This species distribution closely matches that of ponderosa pine in the western U.S. (Abele et al. 2004). Breeding occurs most often in open forests or woodlands including park-like stands of ponderosa pine, riparian cottonwoods, and burned or logged conifer forest. In northern Colorado they breed from the northeast limit of Larimer County south along the Front Range to Denver (Andrews and Righter 1992).

Ponderosa pine woodlands and mixed conifer forests in the project vicinity may represent potential breeding and foraging habitat for Lewis's woodpecker, but canopy cover in most forested portions of the project vicinity was estimated to be in excess of 30 percent. In addition, most tree stands are relatively young and larger, decadent trees (suitable for cavity excavation) are not prevalent within the project vicinity. Therefore, habitat for Lewis's woodpecker in the project vicinity was judged to be marginal, and this species potential for occurrence is low. No Lewis's woodpeckers were observed during the 2011 field surveys in the project vicinity. In the future, habitat conditions for Lewis's woodpecker in the project vicinity may become more favorable as the mountain pine beetle epidemic continues to create dead and decaying trees and more open canopy conditions as dead trees fall.

Cassin's finch is a year-round resident in Colorado that breeds in higher-elevation (8,000 to 11,000 feet) coniferous forest habitats (Winn 1998). It winters in similar habitats, but usually at lower elevations. Although the majority of breeding birds are found in association with upper montane and subalpine spruce-fir, lodgepole and ponderosa pine forests, breeding populations also have been located in piñon-juniper, aspen, and riparian (narrowleaf cottonwood, *Populus angustifolia*) woodlands, as well as high-country towns (Winn 1998). Cassin's finches nest colonially, and nests are typically placed near the end of large tree branches. Cassin's finch is a possible breeder in the ponderosa pine woodlands within the project vicinity, but none were observed during the 2011 field surveys.

3.9.6 Amphibians and Reptiles

Common species potentially occurring within the project vicinity include the western chorus frog (*Pseudacris triseri*), Woodhouse's toad (*Bufo woodhousii*), and the tiger salamander (*Ambystoma tigrinum*). The majority of common amphibians and reptile species found in Colorado have life history requirements linked to the presence of aquatic habitats. Discussion of the availability of aquatic habitats located within the project vicinity is provided in Section 3.5.1, Surface Waters and Section 3.6, Wetlands and waters of the U.S. A detailed list of stream crossing by alternative is provided in **Table 3.5-2**. The three special status species potentially occurring within the project vicinity are discussed in Section 3.10 below.

3.10 Special Status and Sensitive Wildlife Species

Federal and state-listed species in the analysis area, as well as USFS sensitive species potentially occurring on National Forest System lands crossed by the existing transmission line ROWs are addressed in the following sections. Lists of species with the potential to occur within the project vicinity are included in **Table 3.10-1**.

3.10.1 Federal Threatened, Endangered, Proposed, and Candidate Species

An official USFWS, Colorado Ecological Services species list for the Estes-Flatiron Transmission Line Rebuild Project in Larimer County was requested and received from the USFWS on-line Information, Planning, and Conservation decision support system on December 6, 2011, and again on December 10, 2013, to check for updates. This list is provided in **Table 3.10-1**. No federally listed wildlife species identified in this list have potential to occur within the project area as determined in the project Biological Report (Cedar Creek Associates 2013) and are therefore not discussed further in this document.

3.10.2 Colorado State Threatened, Endangered, and Special Concern Species

The State of Colorado list of threatened, endangered, and special concern species was reviewed on the CPW website (CPW 2011) to determine state-listed species with potential to occur in the analysis area. In addition, the CNHP database was searched for sensitive species occurrence within the analysis area (CNHP 2011). Based on species' ranges and habitat preferences, it was determined that nine state-listed species could potentially be occurring within or near the project vicinity (**Table 3.10-1**).

3.10.2.1 Townsend's Big-eared Bat

Townsend's big-eared bat is widely distributed in Colorado except on the eastern plains (Armstrong et al. 2007). Occupied habitats include open montane forests, semi-desert shrublands, and piñon/juniper shrublands. These bats generally are solitary or gather in small groups. During the summer, females may form larger maternity colonies located in mines, caves, abandoned structures, and crevices in rock cliffs in woodlands and forests to elevations above 9,500 feet amsl (Adams 2003; Armstrong et al. 2007). Foraging occurs over water, along the margins of vegetation and over sagebrush. They are relatively sedentary and do not move long distances from hibernacula to summer roosts (Armstrong et al. 2011). Although all five of the vegetation types present within the project vicinity, as discussed in Section 3.7.1, General Vegetation, provide suitable habitat for this species, the specific use of these habitats can vary depending on the seasonal availability of forage and cover.

There are no open mine shafts and caves or abandoned buildings that might provide hibernacula, maternity sites, or roosts for Townsend's big-eared bat within or near the project vicinity. The only suitable habitat in the project vicinity would be possible foraging habitat, especially where stream courses cross the ROW.

Table 3.10-1 Special Status Species Occurrence

Common Name (Scientific Name)	USFWS Status	Colorado State Status	USFS Status	Management Indicator Community (MIC)	Potential Occurrence	Excluded from Further Analysis	Reason for Exclusion
Mammals							
American marten (*Martes americana)*			Sensitive		Yes	No	
Black-footed ferret *(Mustela nigripes)*	Endangered	Endangered			No	Yes	No suitable habitat in or near project area.
Canada lynx *(Lynx Canadensis)*	Threatened	Endangered			No	Yes	The project area is not within suitable habitat or a Lynx Analysis Unit.
Elk (*Cervus elaphus)*			MIS	Young to Mature Forest and Openings	Yes	No	
Fringed myotis (*Myotis thysanodes)*			Sensitive / MIS	Forest Openings	Yes	No	
Mule deer (*Odocoileus hemionus)*			MIS	Young to Mature Forest and Forest Openings	Yes	No	
Gray wolf (*Canis lupus irremotus*)	Endangered	Endangered			No	Yes	Project area is outside of current distribution.
North American wolverine Ψ (*Gulo gulo luscus*)	Proposed Threatened	Endangered			No	Yes	No occurrences or suitable habitat within the project area.

Common Name (Scientific Name)	**USFWS Status**	**Colorado State Status**	**USFS Status**	**Management Indicator Community (MIC)**	**Potential Occurrence**	**Excluded from Further Analysis**	**Reason for Exclusion**
White-tailed prairie dog (*Cynomys leucurus)*			Sensitive	No	No	Yes	
Preble's meadow jumping mouse *(Zapus hudsonius preblei)*	Threatened	Threatened			No	Yes	Preferred habitats of well-developed riparian vegetation with adjacent, relatively undisturbed grassland communities and a nearby water source (USFWS 2010) do not exist in the project area. Marginally suitable habitat exists along North Fork Little Thompson River, but this portion of the project area is above the upper elevation limit (7,600) of this species.
Pygmy shrew (*Sorex hoyi montanus)*			Sensitive		No	Yes	No occurrences or suitable habitat within the project area.
North American River Otter (*Lontra Canadensis)*		Threatened	Sensitive		No	Yes	No occurrences or suitable habitat within the project area.
Rocky Mountain bighorn sheep (*Ovis canadensis canadensis)*			Sensitive / MIS	Cliff and Canyons / Forest Openings	No	Yes	No occurrences or suitable habitat within the project area.
Townsend's big-eared bat (*Corynorhinus townsendii pallescens*)		Special Concern	Sensitive		Yes	No	
Hoary bat *Lasiurus cinereus*			Sensitive		Yes	No	

Common Name (Scientific Name)	USFWS Status	Colorado State Status	USFS Status	Management Indicator Community (MIC)	Potential Occurrence	Excluded from Further Analysis	Reason for Exclusion
Birds							
American peregrine falcon (*Falco peregrinus*)		Special Concern	Sensitive		Yes	No	
Bald eagle (*Haliaeetus leucocephalus*)		Special Concern	Sensitive		Yes	No	
Black swift (*Cypseloides niger)*			Sensitive		No	Yes	No occurrences or suitable habitat within the project area.
Boreal owl (*Aegolius funereus)*			Sensitive		Yes	Yes	Suitable habitat, mature to old growth spruce /fir forest not present in project area.
Flammulated owl (*Otus flammeolus)*			Sensitive		Yes	No	
Golden-crowned kinglet (*Regulus satrapa)*			MIS	Interior Forests	Yes	No	
Hairy woodpecker (*Picoides villosus)*			MIS	Young to Mature Forest	Yes	No	
Least tern *(Sterna antillarum)***	Endangered	Endangered			No Potential to Occur	Yes	No occurrences or suitable habitat within the project area. No project water depletions are anticipated.
Lewis's woodpecker (*Melanerpes lewis)*			Sensitive		Yes	No	
Mexican spotted owl *(Strix occidentalis lucida)*	Threatened	Threatened			No Potential to Occur	Yes	No occurrences or suitable habitat within the project area.

Common Name (Scientific Name)	USFWS Status	Colorado State Status	USFS Status	Management Indicator Community (MIC)	Potential Occurrence	Excluded from Further Analysis	Reason for Exclusion
Mountain bluebird (*Sialia currucoides)*			MIS	Forest Openings	Yes	No	
Northern goshawk (*Accipiter gentilis)*			Sensitive		Yes	No	
Northern harrier (*Circus cyaneus)*			Sensitive		No	Yes	
Cassin's sparrow (*Aimophia cassini*)			Sensitive		No	Yes	Suitable habitat not present in project area.
Grasshopper sparrow (*Ammodramus savannarum*)			Sensitive		No	Yes	Outside documented range of occurrence.
Brewer's sparrow (*Spizella* breweri)			Sensitive		No	Yes	Suitable nesting habitat is not present within project area.
Olive-sided flycatcher (*Contopus borealis)*			Sensitive		Yes	No	No occurrences or suitable habitat within the project area.
Piping plover *(Charadrius melodus)* **	Threatened	Threatened			No	Yes	No occurrences or suitable habitat within the project area. No project water depletions are anticipated.
Purple martin (*Progne subis)*			Sensitive		No	Yes	No occurrences or suitable habitat within the project area.
Pygmy nuthatch (*Sitta pygmaea)*			MIS	Aspen Forest	Yes	No	
Warbling vireo (*Vireo gilvus)*			MIS	Montane Riparian and Wetlands	No	Yes	No occurrences or suitable habitat within the project area.

Common Name (Scientific Name)	USFWS Status	Colorado State Status	USFS Status	Management Indicator Community (MIC)	Potential Occurrence	Excluded from Further Analysis	Reason for Exclusion
White-tailed ptarmigan (*Lagopus leucurus)*			Sensitive		No	Yes	No occurrences or suitable habitat within the project area.
Whooping crane *(Grus americana)***	Endangered	Endangered			No	Yes	No occurrences or suitable habitat within the project area. No project water depletions are anticipated.
Wilson's warbler (*Wilsonia pusilla)*			MIS	Montane Riparian and Wetlands	Yes	No	
Amphibians and Reptiles							
Boreal toad (*Bufo boreas boreas*)		Endangered	Sensitive / MIS	Montane riparian & wetlands	Yes	No	
Common garter snake (*Thamnophis sirtalis*)		Special Concern			Yes	No	
Northern leopard frog (*Rana pipiens*)		Special Concern	Sensitive		Yes	No	
Wood frog (*Rana sylvatica)*			Sensitive		No	Yes	Project area is outside of current distribution.
Fishes							
Greenback cutthroat trout *(Oncorhynchus clarki stomias*)	Threatened	Threatened			No	Yes	No suitable habitat in or near project area.
Pallid sturgeon *(Scaphirhynchus albus)***	Threatened				No	Yes	No water depletions will occur with project.

Common Name (Scientific Name)	USFWS Status	Colorado State Status	USFS Status	Management Indicator Community (MIC)	Potential Occurrence	Excluded from Further Analysis	Reason for Exclusion
Invertebrates							
Arapahoe snowfly (*Capria arapahoe*)			Sensitive		Yes	No	
Hudsonian emerald dragonfly (*Somatochlora hudsonica)*			Sensitive		Yes	No	
Rocky Mountain capshell (*Acroloxus coloradensis*)		Special Concern			No	Yes	No suitable habitat in or near project area.

**Species not present in or near project vicinity but water depletions may affect these downstream species.

Ψ These species are suspected to occur but unconfirmed on the Roosevelt National Forest.

Source: USFS 2013; USFWS 2011, 2013; CPW 2011; CNHP 2011.

3.10.2.2 Bald Eagle

Within the project vicinity, suitable nest trees generally are lacking around all but Flatiron Reservoir, and human presence and recreation would likely preclude nesting near the shoreline of this reservoir. No large raptor tree nests were located during field surveys, and no bald eagle nests are known to be present in or near the project vicinity (Cedar Creek Associates 2013).

3.10.2.3 American Peregrine Falcon

In Colorado, peregrine falcons are relatively rare spring and fall migrants in western valleys, foothills, lower elevation mountains, and mountain parks, and a rare winter visitor to western valleys (Andrews and Righter 1992). These raptors also are rare summer residents in the foothills and lower elevation mountains. Migration and/or wintering habitat includes wildlife (waterfowl) refuges or other habitats that concentrate prey species.

There is no suitable nesting habitat within the project vicinity (Cedar Creek Associates 2013). However, a known peregrine falcon eyrie exists within the general area of the project vicinity. The nest site is located north of the existing line, and peregrine falcons likely hunt waterfowl in the Lake Estes area. The project vicinity is within the hunting territory of this nesting pair since falcons have been found to range as far as 17 miles from an eyrie during hunting forays (USFWS 1984).

3.10.2.4 Boreal Toad

Suitable habitat for boreal toad within the project vicinity is restricted to the upland meadow/wetland mosaic habitats and open water associated with Solitude Creek (Cedar Creek Associates 2013). Boreal toads could inhabit both drainages, but shallow, still water areas suitable for breeding habitat generally are not present where the ROWs cross Solitude Creek. However, available evidence indicates that female boreal toads may disperse over greater distances and into drier habitats than males (Loeffler 1998). Studies of boreal toads by the CPW indicate that male toads remain within 300 meters of breeding sites, while females can move up to three to four miles from breeding areas (Jones 1999). Upland habitats for both boreal toad males and females include aspen and conifer habitats with rocky areas or ground squirrel holes where toads seek refuge in rock crevices or rodent burrows to avoid temperature extremes and desiccation.

3.10.2.5 Northern Leopard Frog

The northern leopard frog occurs in Colorado in a variety of wetland habitats, which provide relatively fresh water with moderate salinity, including springs, slow streams, marshes, bogs, ponds, canals, flood plains, beaver ponds, reservoirs, and lakes, usually in permanent water with rooted aquatic vegetation (Hammerson 1999; Smith and Keinath 2007). Northern leopard frogs are a highly aquatic species and are usually found in close association with the banks and shallow water areas of permanent marshes, ponds, streams, lakes, and reservoirs. Water bodies with rooted aquatic vegetation are preferred, although adult frogs can disperse into moist, grassy meadows away from aquatic habitat to forage during the summer months (Hammerson 1999). Suitable habitat may exist for northern leopard frog along the North Fork of the Little Thompson River and Solitude Creek and ponds located on private lands associated with these two perennial streams (Cedar Creek Associates 2013). Other areas of suitable habitat may occur in upland meadow/wetland mosaic habitats around the perimeters of Flatiron Reservoir, Pinewood Reservoir, and Lake Estes.

3.10.2.6 Common Garter Snake

In Colorado the common garter snake inhabits marshes, ponds, and edges of streams and is usually associated with aquatic, wetland, and riparian habitats along the floodplains of streams. It is seldom found far from water (Hammerson 1999). Its distribution in Colorado includes the South Platte River and its tributaries at elevations below 6,000 feet amsl (Hammerson 1999). Possible suitable, but marginal, habitat for this species below 6,000 feet amsl within or near the project vicinity is restricted to the upland meadow/wetland mosaic habitats located at the perimeters of Pinewood Reservoir and Flatiron Reservoir.

3.10.3 Forest Service Sensitive and Management Indicator Species

Table 3.10-1 presents 23 wildlife species, which are listed as sensitive by the USFS. Species that do not have suitable habitat present within the project vicinity are excluded from further analysis.

3.10.3.1 American Marten

Mature spruce-fir and lodgepole forests habitats preferred by American marten are not present within the analysis area, and their presence within the analysis area is unlikely. There is a low probability that wandering individuals may pass through the analysis area moving from higher valued habitats during the summer months but optimal foraging habitat is not present because of the predominately small size class of the forest within the analysis area.

3.10.3.2 Pygmy Shrew

Suitable habitat, including upper montane or subalpine landscapes dominated by conifer forest and dense stream networks that interact with various bogs, marshes, and other wetlands (Beauvais and McCumber 2006), is not present in the project area.

3.10.3.3 North American River Otter

Suitable river habitat is not present in project area.

3.10.3.4 Fringed Myotis

The fringed myotis is found in western North America, occurring from southern British Columbia, Canada south through southern Mexico (Keinath 2004). It occurs west to the Pacific coast and east to the Rocky Mountains, with a potentially isolated population in the Black Hills of South Dakota, Wyoming, and Nebraska. Occurrences have been documented in 14 states (Arizona, California, Colorado, Idaho, Nebraska, New Mexico, Montana, Nevada, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming).

Fringed myotis appear to use a fairly broad range of habitats. The most common habitats in which this species has been found are oak, piñon, and juniper woodlands or ponderosa pine forest at middle elevations. They also appear to use deserts, grasslands, and other types of woodlands (Keinath 2004). Although all five of the vegetation types present within the project vicinity, as discussed in Section 3.7.1, General Vegetation, provide suitable foraging habitat for this species, suitable roosting sites are a critical habitat component, the availability of which can determine population sizes and distributions. There appears to be considerable variation in roost selection by fringed myotis. The pattern of this variation and its underlying causes are unclear. It likely results from a combination of factors, including the relative quality and availability of different roost types, the habitat structure surrounding roosts, prevailing environmental factors (e.g., temperature, wind), proximity to water and foraging areas, and predator avoidance (Keinath 2004).

The analysis area is near or above the upper elevational distribution of fringed myotis, and there are no open mine shafts, caves, or abandoned buildings that potentially provide hibernacula or maternity sites for fringed myotis within or near the analysis area (Cedar Creek Associates 2013). The predominance of younger age class trees in the analysis area also does not create many opportunities for suitable tree roost sites. Areas of rock outcrop in Pole Hill portion of the analysis area may provide suitable day roost sites for individuals. The remainder of the analysis area would only be used as foraging habitat.

There are several know detections of fringed myotis within the Canyon Lakes Ranger District.

3.10.3.5 Townsend's Big-eared Bat

The Townsend's big-eared bat is described in Section 3.10.2.1.

3.10.3.6 Hoary Bat

The hoary bat is the most widespread of all North American bats, occurring throughout North America. They are highly associated with forested habitats in the West. In the Rocky Mountain States it has been found in juniper scrub, riparian forests, Douglas-fir and ponderosa pine forests, and open desert habitats (Adams 2003; Fitzgerald et al. 1994) and up to elevations of 10,000 feet in Colorado (Fitzgerald et al. 1994). Hoary bats are solitary and roost primarily in foliage of both coniferous and deciduous trees near the ends of branches, 3 to 12 meters above the ground. This species never seems to be abundant in any area and most collections are of single individuals. Hoary bats are migratory and only occur in Colorado during the summer months. They winter in the southern U.S. and Central and South America. Loss of roosting habitat due to timber harvest is likely the biggest threat to this species (Fitzgerald et al. 1994; Ellison et al. 2003). Locally, wildfire and the current back beetle epidemic may pose as bigger threats to this species habitat.

Ponderosa pine and mixed conifer woodlands in the analysis area could be used by hoary bat for foraging and roosting. Individual females also could use larger trees in these habitats as maternity sites during the summer months. Because of Western's vegetation maintenance activities, trees within the existing managed portion of ROWs are likely too small to provide suitable roost or maternity sites, but mature trees in the expanded ROW may provide suitable roost or maternity sites.

3.10.3.7 American Peregrine Falcon

The American peregrine falcon is described in Section 3.10.2.3.

3.10.3.8 Bald Eagle

The bald eagle is described in Section 3.10.2.2.

3.10.3.9 Boreal Owl

Considered imperiled in Colorado, boreal owls occupy a circumpolar distribution in northern hemisphere boreal forests. In North America, boreal forests in Colorado and northern New Mexico delineate the southernmost extent of their distribution. Although boreal owls are considered globally secure, their trend is unknown due to unreliable population estimates and nomadism caused by fluctuations in prey base abundance and distribution (NatureServe Explorer 2012). Boreal owls appear to be distributed in Colorado between 9,200 and 10,400 feet amsl (Hayward and Verner 1994).

In Colorado, boreal owls utilize late-successional, multi-layered habitats of spruce-fir and lodgepole pine interspersed with meadows. These owls also may be found in aspen and mixed conifer stands. Boreal owls are secondary cavity nesters, usually occupying cavities excavated by woodpeckers. Nest cavities are commonly found in snags with a diameter of at least 10 inches and may be used in consecutive years. Suitable habitat within the project vicinity is restricted to the ponderosa pine woodlands, mountain shrub mosaic, and mixed conifer vegetation types described in Section 3.7.1, General Vegetation.

3.10.3.10 Flammulated Owl

The flammulated owl occurs in western North America from southern Mexico and Guatemala north to southern British Columbia. It winters from central Mexico south to Guatemala and is found in the U.S. and Canada only from spring through fall. The flammulated owl is considered a common to uncommon summer resident in the foothills and lower mountains of Colorado (Andrews and Righter 1992). Flammulated owls arrive in Colorado in late April to early May and lay 2 to 3 eggs at the end of May and June. Young hatch in June and early July, and most young fledge by the end of July. Most owls migrate from Colorado by early October

These owls occur regularly from 6,000 to 10,000 feet elevation and prefer old growth or mature ponderosa pine. Key habitat features seem to be the presence of larger trees and snags, scattered clusters of shrubs or saplings, clearings, and a high abundance of nocturnal arthropod prey (Colorado Partners in Flight 2002). Preferred habitat in Colorado is open, mature stands of Douglas-fir and ponderosa pine (Reynolds and Linkhart 1987), and they are known to occupy these habitats in the Roosevelt National Forest (Verner 1994). Old growth (>200 years) or mature (>150 years) stands of ponderosa pine and ponderosa/Douglas-fir forests, often mixed with mature aspen, are preferred as nesting habitat (Reynolds and Linkhart 1987; Jones 1987, 1991). A preference for stands with an open, park-like spacing of trees may be due to this species foraging habitats (Reynolds et al. 1989). Flammulated owls are obligate cavity nesters, and they nest in natural or woodpecker cavities. Both live and dead ponderosa pine, quaking aspen, and Douglas-fir are used for nesting (Reynolds et al. 1989). Nesting territories are relatively small. Linkhart (1984) reported a mean size of approximately 14 ha (34.6 acres) for a population in Colorado. USFS flammulated owl surveys for a fuels reduction project in forested areas north of the analysis area had several flammulated owl detections (Oberlag 2011), and this species may be present in the analysis area.

3.10.3.11 Lewis's Woodpecker

Lewis's woodpecker occurs as a summer resident in northern Colorado and is present in southern portions of the state, as well as northern New Mexico and Arizona, as a year-round resident and winter visitor. This species distribution closely matches that of ponderosa pine in the western U.S. (Abele et al. 2004). Breeding occurs most often in open forests or woodlands including park-like stands of ponderosa pine, riparian cottonwoods, and burned or logged conifer forest. In northern Colorado they breed from the northeast limit of Larimer County south along the Front Range to Denver (Andrews and Righter 1992).

Ponderosa pine and mixed conifer forests in the project area may represent potential breeding and foraging habitat for Lewis's woodpecker, but canopy cover in most forested portions of the project area was estimated to be in excess of 30 percent. In addition, most tree stands are relatively young and larger, decadent trees (suitable for cavity excavation) are not prevalent within the project area. Therefore, habitat for Lewis's woodpecker in the project area was judged to be marginal, and this species potential for occurrence is low. No Lewis's woodpeckers were observed during the 2011 field surveys in the project area. In the future, habitat conditions for Lewis's woodpecker in the project area may become more favorable as the mountain pine beetle epidemic continues to create dead and decaying trees and more open canopy conditions as dead trees fall.

3.10.3.12 Northern Goshawk

Considered vulnerable in Colorado, the northern goshawk occurs throughout North America and circumpolar through Europe and Asia (NatureServe Explorer 2012). According to NatureServe Explorer (2012) and Kennedy (2003), trends are difficult to determine due to the lack of quantitative data and because of biases inherent in the various methods used to track avian populations. Christmas Bird Count data (1959-1988), North American BBS data (1966-1996), and counts of migrants in the eastern U.S. (1972-1987) do not indicate any changes in population size.

Ponderosa pine and mixed conifer woodlands in the analysis area represent potential nesting habitat for northern goshawk, although most conifer trees within and adjacent to the existing ROWs were judged to be relatively small and lacked suitable configurations to support goshawk nest construction. Aspen trees in the small pockets of aspen within the analysis area also were judged to be too small to support goshawk nesting activity. Loss of ponderosa, limber, and lodgepole pine trees from the mountain pine beetle epidemic may reduce the quality of potential goshawk nesting habitat in and near the analysis area in the next few years as beetle-killed trees die and dead trees fall, altering the character of existing woodland habitats. It also could increase habitat quality, particularly for goshawk foraging, as beetle mortality produces a forest thinning effect and increased snag densities may increase potential goshawk prey densities.

Canyon Lakes Ranger District file data indicate there are one historic and one recently active nest site in the vicinity of the existing ROWs (Oberlag 2011). The recently active site is approximately 1.4 miles from the nearest line and separated from the line by one or two ridges. The other site is approximately 0.65 mile from the nearest line but within the same drainage as the ROW. This site has not been active in several years, but it is possible a breeding pair of goshawks could be using an alternate nest site in the vicinity (Oberlag 2011).

3.10.3.13 Northern Harrier

Suitable habitat, including native and non-native grasslands, agricultural lands, marshes, and alpine tundra, is not present in the project area.

3.10.3.14 Olive-sided Flycatcher

Considered vulnerable in Colorado and declining globally, olive-sided flycatcher breeding habitat occurs throughout the U.S. and Canada. Non-breeding territory occurs in central and South America. North American BBS data indicate declines since 1966 across much of North America. Many structural stages of forest may be used if large snags are present for perching and foraging. The olive-sided flycatcher's diet consists almost entirely of flying insects, particularly bees. Nests are placed most often in conifers on horizontal limbs from 5 to 30 feet above the ground. Olive-sided flycatchers will use openings, old burns, or clear-cuts for foraging habitat, as long as snags are present. BBS surveys found 84 percent of olive-sided flycatcher occurrences in coniferous forests (Jones 1998b).

In Colorado, olive-sided flycatchers breed in old growth coniferous forests from 7,000 to 11,000 feet (Jones1998b). Olive-sided flycatchers typically prefer higher elevation spruce-fir forest with openings and are not likely to be common within the analysis area. None were observed in the analysis area during field surveys. Linear openings created by the ROWs through forested habitat may serve to increase areas of suitable foraging habitat for olive-sided flycatcher. Although the lack of spruce-fir forest stands reduce the likelihood of its presence in the analysis area.

3.10.3.15 Purple Martin

The project area is outside of known breeding range for the purple martin (Wiggins 2005).

3.10.3.16 Boreal Toad

The boreal toad is described in Section 3.10.2.4.

3.10.3.17 Northern Leopard Frog

The northern leopard frog is described in Section 3.10.2.5.

3.10.3.18 Arapahoe Snowfly

The Arapahoe snowfly is a small winter stonefly know from only two locations in Larimer County in north-central Colorado. It inhabits reaches of two small cool streams that are tributaries to the Cache la Poudre River. The species was first collected at Elkhorn Creek, 22 miles west of Fort Collins, at an elevation of 2,012 meters (6,600 feet). It also was found at Young Gulch above Ansel Watrous Campground in the Poudre Park area at an elevation of 1,768 m (5,800 feet) (Nelson & Kondratieff 1988). Young larvae undergo a period of inactivity (diapause) during the warm months, complete development during late fall and early winter, and the dark-colored adults emerge in late winter or early spring. This species' limited habitat is threatened with degradation and destruction from extensive recreational use and increasing development pressures in the two streams from which it is known. Research should focus on assessing and strengthening current management practices for existing habitat and evaluating the population size, distribution, and stability (Mazzacano 2013).

Suitable habitat for the Arapahoe snowfly within the analysis area is restricted to pebble, cobble, and bedrock substrate of Solitude Creek. Habitat is lacking at the E-PH crossing since this portion of the drainage is characterized by a relatively broad sedge dominated (fen) community with soils saturated to the surface but with minimal expression of open water at the surface. Suitable habitat may be present at the E-LS crossing where flowing surface water is present within in a defined, narrow (1- to 2-foot) stream channel.

3.10.3.19 Hudsonian Emerald Dragonfly

The Hudsonian emerald dragonfly apparently is a rather uncommon species based on the infrequency of its occurrence in collections and known population locales. Although apparently widespread in Canada, occurrence records in the continental U.S. are restricted to seven locales in Colorado, possibly three in Wyoming, and one in Montana (Packauskas 2005). Its known distribution in Colorado is relatively localized and restricted to mountainous areas within a 40-mile radius of Boulder, Colorado, which may indicate it's been poorly collected in other possible habitats (Packauskas 2005). There is insufficient data to make any inferences regarding population trends of this species.

Suitable habitat for Hudsonian emerald within the analysis area is restricted to the boggy edges of flowing water associated in Solitude Creek. Habitat is lacking at the South Line crossing since this portion of the drainage is characterized by a relatively broad sedge dominated (fen) community with soils saturated to the surface but with minimal expression of open water at the surface. Suitable habitat may be present at the North Line crossing where flowing surface water is present within in a defined, narrow (1- to 2-foot) stream channel.

The project area is outside of the known range of this species.

3.10.4 Forest Service Management Indicator Species

MIS are designated by the USFS as indicators of the health of selected ecosystems or associated habitats. Through monitoring population and habitat relationships of MIS, the effects of management activities on invertebrate, fish, plant, and wildlife species can be evaluated. MIS are selected based on five criteria: (1) a strong, yet not exclusive affinity for vegetation type; (2) a life cycle keyed to a specific vegetation type; (3) sensitivity to habitat change; (4) relative ease of monitoring; and (5) somewhat representative of other species that utilize the same vegetation types. The 10 wildlife species considered MIS for actions within the Roosevelt National Forest are presented in **Table 3.10-1**.

3.10.4.1 Elk

Elk are described in Section 3.9.1, Big Game Species.

3.10.4.2 Mule Deer

Mule deer are described in Section 3.9.1, Big Game Species.

3.10.4.3 Golden-crowned Kinglet

This kinglet species was never abundant in Colorado and most occur west of the Continental Divide (Roth and Potter 1998), so there is not a high likelihood of presence in the analysis area. Breeding habitat for the golden-crowned kinglet is coniferous forests. The species constructs open cup nests of moss, lichen, spider web, and bark strips, lined with feathers, fine grasses, plant down, lichens, and fur in a well-concealed hanging cup suspended from a conifer branch (Cornell Lab of Ornithology 2013). Breeding has been confirmed in Larimer County (Roth and Potter 1998), but this species was not detected during field surveys in the analysis area. It is not likely to be present because of the lack of spruce-fir forest and/or old-growth characteristics of conifer stands in the analysis area.

This kinglet species was never abundant in Colorado and most occur west of the Continental Divide (Roth and Potter 1998), so there is not a high likelihood of presence in the analysis area. Breeding has been confirmed in Larimer County (Roth and Potter 1998), but this species was not detected during field surveys in the analysis area (Cedar Creek Associates 2013). It is not likely to be present due to the lack of spruce-fir forest and/or old-growth characteristics of conifer stands in the project area.

3.10.4.4 Hairy Woodpecker

The hairy woodpecker is secure in Colorado. The species inhabits mature forests, open woodlands, beaver ponds, urban areas, recently burned forests, and forests infested with bark beetles, typically up to 6,500 feet amsl. They forage along trunks and main branches of large trees. Across North America the hairy woodpecker can be found from sea level to high mountains. It is a year-round resident, but may migrate to lower elevations or coastal areas during winter (Cornell Lab of Ornithology 2013).

Ponderosa pine and mixed conifer forests within and adjacent to the ROW provide suitable habitat conditions for hairy woodpecker. Field surveys indicated that the age class of tree cover in the analysis area is relatively young, but does include mature conifer habitat and snags. No observations of this species were recorded by field surveys.

Suitable habitat within the project vicinity is present across all of the vegetation types. Ponderosa pine and mixed conifer forests within and adjacent to the ROW provide suitable habitat conditions for hairy woodpecker as described in Section 3.7.1, General Vegetation. Field surveys indicated that the age class of tree cover in the analysis area is relatively young, but does include mature conifer habitat and snags (Cedar Creek Associates 2013).

3.10.4.5 Mountain Bluebird

The mountain bluebird is secure in Colorado (NatureServe Explorer 2012). The species inhabits open areas of the western U.S., from 5,000 feet to 14,000 feet. The mountain bluebird prefers more open habitats than other bluebirds and can be found in colder habitats in winter. It occurs in orchards, agricultural land, and open, mountain meadows near trees. Typically, the species occurs in Colorado from early May through the summer (CPW 2012). Mountain bluebirds typically forage in open areas, but nest in nearby forests. Nests are constructed in cavities in trees, snags, and frequently in nest boxes. The project area is within mountain bluebird summer breeding range, but preferred nesting and foraging habitat is lacking because of a lack of larger openings and forest edge areas preferred by mountain bluebird. In addition, snags suitable for mountain bluebird nesting with adjacent meadow openings are not prevalent in the analysis area but may become more common as the mountain pine beetle epidemic progresses. Mountain bluebirds may occasionally forage in or near upland grassland openings in ponderosa pine in the analysis area, but none were observed during field surveys.

Suitable habitat within the project vicinity is restricted to the ponderosa pine woodlands, upland meadow/wetland mosaic, and mountain shrub mosaic vegetation types described in Section 3.7.1, General Vegetation. The project area is within mountain bluebird summer breeding range, but preferred nesting and foraging habitat is lacking because of a lack of larger openings and forest edge areas preferred by mountain bluebird. In addition, snags suitable for mountain bluebird nesting with adjacent meadow openings are not prevalent in the analysis area but may become more common as the mountain pine beetle epidemic progresses. Mountain bluebirds may occasionally forage in or near upland grassland openings in ponderosa pine in the analysis area (Cedar Creek Associates 2013).

3.10.4.6 Pygmy Nuthatch

The pygmy nuthatch is apparently secure in Colorado (NatureServe Explorer 2012). The species inhabits forests in western North America; especially mature ponderosa pine forests. They are typically found at lower and middle elevations, but can sometimes occur up to 10,000 feet amsl. Pygmy nuthatches forage by climbing trunks and branches to search under bark and in needle clusters for insects and seeds. They are highly social, breed cooperatively, and roost communally in cavities during winter.

Ponderosa pine forests adjacent to the ROWs likely provide suitable habitat conditions for pygmy nuthatch, although the paucity of older age class trees and snags within and near the analysis area may reduce the suitability of habitat conditions. Field surveys indicated that the age class of tree cover in the analysis area is relatively young, but mature forest habitat suitable for pygmy nuthatch is present. No observations of pygmy nuthatch were recorded by field surveys. The mountain pine beetle epidemic will increase the availability of snags in the near future, and this may improve overall habitat quality for pygmy nuthatch in the short-term

Ponderosa pine forests adjacent to the ROW likely provide suitable habitat conditions for pygmy nuthatch. Although the paucity of older age class trees and snags within and near the analysis area may reduce the suitability of habitat conditions. Field surveys indicated that the age class of tree cover in the analysis area is relatively young, but mature forest habitat suitable for pygmy nuthatch is present (Cedar Creek Associates 2013). These suitable habitats within the project vicinity are restricted to the ponderosa pine woodlands, mountain shrub mosaic, and mixed conifer vegetation types described in Section 3.7.1, General Vegetation.

3.10.4.7 Warbling Vireo

Suitable habitat, including riparian stream bottoms and aspen forest (Barrett 1998a), are not present in the project area.

3.10.4.8 Wilson's Warbler

Suitable habitat for Wilson's warbler in the analysis area is restricted to the E-LS and E-PH crossings of Solitude Creek. The elevation at these crossing is about 8,400 feet, and wetlands along Solitude Creek support pockets of willows and alder that could be utilized by Wilson's warbler for nesting and foraging.

Generally suitable habitat types within the project vicinity are restricted to the upland meadow/wetland mosaic, and mountain shrub mosaic vegetation types described in Section 3.7.1, General Vegetation. These habitats are restricted to the crossings of Solitude Creek within the analysis area. The elevation at these crossing is about 8,400 feet, and wetlands along Solitude Creek support pockets of willows and alder that could be utilized by Wilson's warbler for nesting and foraging (Cedar Creek Associates 2013)

3.11 Land Use and Recreation – Existing and Planned

This section describes the historical and existing land use patterns in the project area and provides a description of the affected environment for recreational opportunities, resources, and activities. Land use and recreation data was collected from Larimer County, and local, state, and Federal sources.

3.11.1 Affected Environment

The project area is entirely contained within Larimer County, Colorado. It includes public and private lands and is principally located in the Rocky Mountains between Estes Park and Loveland, Colorado. The towns of Loveland and Estes Park are the largest communities in the area. The USFS, BOR, SLB, Larimer County Department of Natural Resources, and NCWCD manage tracts of land within the area and some provide developed and dispersed recreation resources. The remaining lands are privately owned, typically by individuals or ranch holdings.

Private land uses in the project area include rural residential development on large tracts of private land, ranch holdings, and residential subdivisions. Dispersed grazing land occurs throughout the project area, but primarily on the east and west end. There is little if any farm or cropland within the project area. There is no "Prime Farmland" or "Farmland of Statewide Importance" within the study area.

Public lands afford a vast diversity of recreational uses on National Forest System lands located in the central portions of the project area and Larimer County Open Space lands on the east end. The Larimer County Natural Resources Department provides developed recreational resources at Flatiron Reservoir, Pinewood Reservoir, and Ramsey Shockey Open Space adjacent to Pinewood Reservoir. SLB property abuts the southern boundary of the Ramsay-Shockey Open Space. This land is undeveloped and leased for grazing. While in the Trust, the property will remain under its current management practices. These recreational areas are described in more detail below. Other recreational activities in the project area include dispersed activities such as hiking, four-wheel driving and ATV use, hunting, dispersed primitive camping, sight-seeing, and wildlife viewing.

3.11.1.1 Private Land Use

Private land use is primarily rural residential and agricultural land for grazing. Land parcels vary in size from small acreages to large tracts of land. In addition to rural residential parcels, there also are a number of residential subdivisions located within the project area either adjacent to the ROW or in close proximity. These subdivisions generally are located on the eastern or western end of the project area. The existing transmission lines, with 65-foot H-frame structures and ROWs varying between 20 and 110 feet, are located within or adjacent to these subdivisions.

Residential subdivisions on the east side of the project area include Newell Lake View subdivision located north of Pinewood Reservoir, Pittington subdivision located just west of Flatiron Reservoir on the north side of County Road 18E, and Yelek, Dallas Benton, and Slota subdivisions all located near Flatiron Reservoir and South County Road 31.

Subdivisions on the west side of the project area near Estes Park include Park Hill subdivision, Ravencrest Heights, and Meadowdale Hills. The largest subdivision is the Meadowdale Hills subdivision, which consists of 165 residential lots ranging in size from 1 to 4 acres. Meadowdale Hills, an unincorporated subdivision, is located on the north side of U.S. Highway 36, approximately 5 miles outside of the Town of Estes Park. The Larimer County Assessor's data show that 121 of the lots have been improved (developed). The Park Hill subdivision, adjacent to the Town of Estes Park, also is a single family subdivision within proximity of the ROW and has approximately 23 residential lots and 20 single family homes.

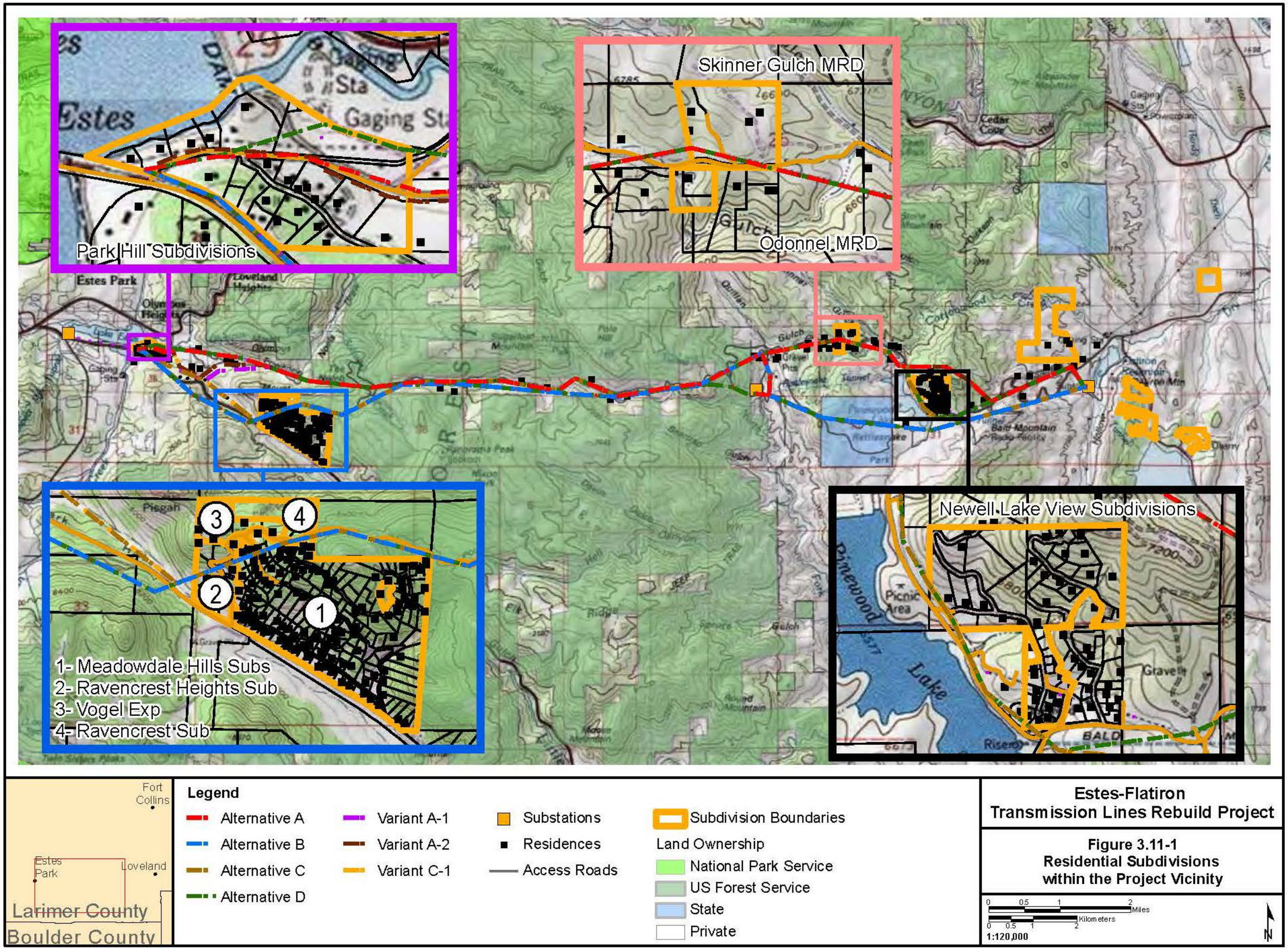
Table 3.11-1 shows the subdivisions located in the project area, the number of developed and undeveloped lots in each subdivision, and the use type and county zoning. **Figure 3.11-1** shows the location of the subdivisions in the project area.

Table 3.11-1 Residential Subdivisions within Project Area

Subdivision	Estimated Undeveloped Lots	Developed Lots	Total Residential	Use Type/Zoning	Location
East Side					
Yelek	2	8 - Farm	4	Residential, Farm utility, Industrial/Open	East of Flatiron Reservoir
Slota	0	1	1	Residential/Open	West of S County Road 31
Dallas Benton	0	1	1	Residential/Open	West of S County Road 31
Pittington	17	4	4	Residential and Grazing land/Open	West of Flatiron Reservoir
Newell Lake View	7	46	46	Single Family, Duplex, Storage/Open	North of Pinewood Reservoir
West Side					
Meadowdale Hills	44	121	165	Single Family/Open	North of U.S. Highway 36 off Pole Hill Road
Ravencrest Heights	5	7	12	Single Family/Open	Same vicinity as Meadowdale Hills
Park Hill	3	20	23	Single Family and Equipment Storage (2)/Rural Residential	Near Mall Road

Source: Larimer County 2012a.

Figure 3.11-1 Residential Subdivisions in the Project Vicinity



3.11.1.2 Recreation

High quality, diverse recreation opportunities are present in the general Estes Park area, particularly given the town's proximity to Rocky Mountain National Park. Year-round recreation opportunities in the general area include, but are not limited to, fishing, hiking, horseback riding, hunting, jeep tours, four-wheel driving, mountain biking, boating, camping, canoeing, scenic driving, scenic/wildlife viewing, golfing, kayaking/rafting, mountaineering/rock climbing, outfitter and guide services, cross-country skiing, and snowshoeing. Estes Park is the main gateway to Rocky Mountain National Park, which receives an estimated 3 million visitors annually.

The recreation analysis area encompasses recreation uses/areas within or immediately adjacent to the transmission lines' ROWs, as well as any recreation uses/areas accessed from roads or trails within the transmission lines' ROWs. Within the study area, recreation occurs at several different locations as detailed in **Table 3.11-2**. The following sections describe the recreation opportunities and uses on Federal, county, local, and private lands.

Table 3.11-2 Recreation Areas within the Analysis Area

Ownership/Management	Recreation Area
Federal	Roosevelt National Forest
County	Flatiron Reservoir County Park Pinewood Reservoir County Park Ramsay-Shockey Open Space Chimney Hollow Open Space
State and Local Estes Valley Recreation and Park District Colorado Parks and Wildlife	 Lake Estes Game Management Unit 20
Private	Blue Mountain Bison Ranch

Roosevelt National Forest

The central portion of the analysis area includes lands within the Canyon Lakes Ranger District of the Roosevelt National Forest. Recreation opportunities on National Forest System lands in the analysis area include dispersed camping, hunting, hiking, ATV and four-wheel drive vehicle use, mountain biking, and wildlife viewing.

The National Forest System lands within the analysis area include areas known as The Notch and Pole Hill. Access to the Roosevelt National Forest is available on the west and east side of the analysis area via USFS Road 122 (Pole Hill Road). On the west side, access to the forest is located just east of Meadowdale Hills subdivision. On National Forest System lands beyond the subdivision, Pole Hill Road is only open seasonally. The road is open between June 15 and November 30 and receives substantial off-highway vehicle use during this time. Pole Hill Road can be used to access other USFS roads to create loop opportunities for motorized recreation. On the east side of the analysis area, USFS Road 122 (Pole Hill Road) does not have seasonal restrictions (USFS 2009). Recreation use within the analysis area on National Forest System lands generally occurs on or from Pole Hill Road. Popular recreational uses on Pole Hill Road include OHV use and hunting. One outfitter and guide is currently permitted to use Pole Hill Road for four-wheel drive tours on the west side of the analysis area. Dispersed camping is permitted up to 300 feet from the centerline of the road (USFS 2009) on both the east and west sides of the analysis area. Additional information on hunting is provided under Local Recreation opportunities. Travel management issues on Pole Hill Road include the creation of illegal routes and the resulting resource damage.

According to the USDA 2010 National Visitor Use Monitoring survey, the Arapaho and Roosevelt National Forests received an estimated 6 million site visits (USFS 2012b). Though the Canyon Lakes Ranger District does not have recreation use estimates for particular roads, due to Pole Hill Road's location near Estes Park, the highest-use gateway to Rocky Mountain National Park, the road receives a high level of use.

Recreation Opportunity Spectrum

The USFS (1976) has developed the Recreation Opportunity Spectrum (ROS) to describe recreation settings and opportunities available on National Forest System lands. ROS classes are delineated and mapped to identify which areas provide certain types of recreation settings, ranging from urban settings to unmodified primitive settings. The ROS class currently applicable to National Forest System lands in the analysis area is "roaded natural". This class is characterized by a predominantly natural-appearing environment with moderate evidence of the sights and sounds of humans; conventional motorized use is allowed in this ROS class. Evidence of humans usually harmonizes with the natural environment. The interaction between users may be moderate to high and evidence of other users is apparent. Resource modification and utilization practices are evident but harmonize with the natural environment (USFS 1976).

Recreation Opportunities on County Lands

Recreation opportunities at Larimer County managed parks and open spaces are concentrated in the eastern portion of the analysis area. County lands support a variety of developed and dispersed recreational uses, including hiking, mountain biking, camping, boating, fishing, and picnicking. **Table 3.11-3** below summarizes the recreation facilities at three of the four county parks and open spaces in the analysis area; Chimney Hollow Open Space does not have any recreation facilities at this time.

Table 3.11-3 Larimer County Recreation Sites with Facilities

Recreational Site	Campsites	Occupancy/ Use	Amenities	Activities	Information/ Location
Flatiron Reservoir County Park	38 campsites including electric campsites, camper cabins, and tent sites	NA	Campground, restrooms, picnic areas, group picnic area, cabins, water, wheelchair accessible fishing pier	Fishing picnicking, camping	47 acres of open water, 200 acres of public lands, open year-round
Pinewood Reservoir County Park	23 campsites including non-electric campsites and tent sites	NA	Campground, boat launch, restrooms, picnic areas, water	No-wake boating, camping, fishing, picnicking	100 acre reservoir, 327 acres of public lands, open year-round
Ramsay–Shockey Open Space	NA	15,000 annually for fishing, hiking, horseback riding and mountain biking	4 mile natural surface trail (2 loops), 2 short wheelchair accessible trail segments (one at each trailhead)	Hiking, mountain biking, fishing access, horseback riding	177 acres, open year-round

NA = not applicable.

Sources: Larimer County 2013 a-c, 2012b.

Located northwest of Carter Lake, Flatiron Reservoir County Park contains 47 acres of open water and 200 acres of land at the base of the foothills in a fairly undeveloped natural setting. The park is open year-round for camping, fishing, and picnicking. The park provides a wheelchair accessible fishing pier, campground, two cabins, picnic areas, restrooms, water, and a group picnic area (Larimer County 2013a; Larimer County 2012b). All of these facilities are located on the northwest side of the reservoir (Larimer County 2013d). The lake is stocked with rainbow trout in the spring and fall (Larimer County 2013a).

Larger than Flatiron Reservoir, Pinewood Reservoir County Park contains 100 acres of open water and 327 acres of land in a mostly natural forest and meadow setting with limited development along one portion of the lakeshore. The park is open year-round for camping, fishing, picnicking, and boating (no wake). Three campground loops, restrooms, water, picnic areas, and a boat launch are provided at the park (Larimer County 2013b, 2012b). These facilities are located on the northeast side of the reservoir, while the Ramsay-Shockey Open Space is located northwest of the reservoir (Larimer County 2013e). The reservoir is popular for boat, shore, and fly fishing for trout (Larimer County 2013b).

The Ramsay-Shockey Open Space area is located immediately adjacent to Pinewood Reservoir. Larimer County purchased this 177-acre open space area in 1997 to provide a buffer to the existing Pinewood Reservoir and as an additional area for passive recreation opportunities (Larimer County 2013c). The area contains four miles of easy to moderate trails that are used for hiking, mountain biking, horseback riding, and fishing access (Larimer County 2013f). The four miles of trail is split into two 2-mile loop trails, the Shoshone Trail and the Besant Point Trail (Larimer County 2013c). There are two brief wheelchair accessible segments on the Besant Point Trail, one at the Ramsay-Shockey Trailhead and the other at the Blue Mountain Trailhead (Larimer County 2013f). A self-guided interpretive brochure is available for the Shoshone Trail (Larimer County 2009).

Although all three areas are open year-round, most recreation use occurs during the summer months. From Memorial Day to Labor Day, most campsites at Pinewood and Flatiron Reservoirs are fully occupied during the weekends and holidays. Campsites at Flatiron Reservoir also are often full during the week. Pinewood Reservoir and Ramsay-Shockey Open Space are very popular for fishing.

Larimer County parks have an estimated 1.3 million visitors annually; however, this total encompasses all Larimer County parks, including Horsetooth Mountain Park and Carter Lake, which have much higher use levels than Pinewood and Flatiron Reservoirs. No occupancy statistics are available for the Pinewood and Flatiron campgrounds and recreational facilities. Recreational use has been increasing over the years as reflected in increased revenues from facility user fees. Fees have not increased in the past several years, but total revenues have increased substantially. A recreation use survey was completed at Pinewood Reservoir 6 years ago and annual use is estimated at 15,000 users for all activities, including fishing, at the Ramsay-Shockey Open Space area.

Located between Flatiron and Pinewood Reservoirs, the 1,847-acre Chimney Hollow Open Space Area was purchased by the Larimer County Open Lands Program in 2004 and is currently undeveloped. The open space area includes rolling hills, meadows, shrublands, riparian areas, and forested areas. Recreational facilities anticipated for the area include a trailhead, parking area, and approximately 10 miles of trails for mountain biking, equestrian use, and hiking. The NCWCD purchased 1,600 acres east of the open space area for a proposed storage reservoir. Should the reservoir be built, it is anticipated that kayaking, canoeing, sailing, fishing and other passive, non-motorized recreation will be available at the reservoir (Larimer County 2013g). Though Chimney Hollow is still not open to the public, in 2012, guided public tours of the open space area were offered on 2 days in June 2012 (Larimer County 2012c). It is anticipated that the Chimney Hollow Open Space Area will open congruently with completion of the Chimney Hollow Reservoir, possibly as early as 2020.

State and Local Recreation Opportunities

At the very western end of the analysis area is Lake Estes, where the Estes Valley Recreation and Park District provides many recreation opportunities and facilities. At the lake, the district provides a marina, pavilion, the Lake Estes Trail, and several picnic areas. Across from the lake at Stanley Park, the district provides athletic fields, a gun club, a playground, tennis, basketball and volleyball courts, skate parks, and a dog park (Estes Valley Recreation and Park District 2013a,b).

The analysis area also provides hunting opportunities on public and private lands. Hunting in Colorado is managed by Colorado Parks and Wildlife, which has divided the state into game management units. The analysis area is within Game Management Unit 20. The unit is large and extends generally from Niwot in Boulder County north to Buckhorn Road in Larimer County, and from I-25 west to Rocky Mountain National Park. The area is within the Big Thompson Deer Herd Management Plan (DAU D-10) and Saint Vrain Herd Elk Management Plan (DAU-E9). National Forest System lands and private land off of Pole Hill Road receive heavy hunting use for big game (deer and elk), particularly on the west side of the analysis area (Spowart 2012b). The east side of the analysis area receives only moderate use for deer, elk, small game, and wild turkey, primarily due to limited public access along Pole Hill Road.

Harvest figures for Game Management Unit are shown in **Table 3.11-4**. Only a small percentage of the harvest and total recreation days occur in the analysis area due to the size of Game Management Unit; however, wildlife officials concur that hunting pressure is strong due to its Front Range location near large population centers. As mentioned previously, Pole Hill Road is seasonally closed on the west side of the analysis area between December 1 and June 14; however, the dates can vary somewhat based on weather/road conditions. Hunting generally occurs from the third week in August to the end of January. The area is accessed on horseback or foot once the road closes December 1 (Spowart 2012b).

Table 3.11-4 Game Management Unit 20 Harvest, Hunter, and Recreation Days for all Manners of Take

Year	Game	Harvest	Total Hunters	Total Success (%)	Total Recreation Days
2011	Elk	269	631	43	6,377
2010	Elk	178	529	34	3,377
2009	Elk	297	860	35	7,627
2011	Deer	592	1,667	36	8,455
2010	Deer	629	1,666	38	8,526
2009	Deer	730	2,108	35	14,145

Source: CPW 2012.

Although Estes Park is a year-round tourist attraction and attracts winter recreationists for cross-country skiing, snowshoeing, and other winter activities in Rocky Mountain National Park and surrounding areas, the analysis area is not as popular for winter recreation.

3.11.1.3 Wilderness

There are no federally designated wilderness areas within the analysis area. The closest wilderness area is Comanche Peak Wilderness Area, approximately 6 miles north toward Glen Haven, Colorado.

3.11.2 Management Considerations

A number of land management plans apply to the land use and recreation analysis area. These include the ARP 1997 Forest Plan; the 2008 Colorado Statewide Comprehensive Outdoor Recreation Plan;

Stewardship Plan for the Chimney Hollow Open Space; Larimer County Parks Master Plan 2007; Resource Management Plan for Horsetooth, Carter, Flatiron, and Pinewood Reservoirs 2007; and Supplemental Resource Management Plan for Pinewood Reservoir: Ramsay-Shockey Open Space. These plans are described below as they relate to land use and recreation management.

3.11.2.1 1997 Revision of the Land and Resource Management Plan for the Arapaho and Roosevelt National Forests and Pawnee National Grassland

The 1997 Forest Plan provides desired conditions (goals or objectives) and guidelines and standards for recreation. Specific guidelines state that "…utility corridors and electronic sites will be located and designed to blend with the landscape. They will be compatible with the scenic integrity objectives of adjacent management areas" (Chapter 3.0, Section 8.3, Goal 2) (USFS 1997a).

The project area is located in the Elk Ridge Geographic Area and has Management Area Prescriptions of 3.5 - Forested Flora and Fauna Habitats - Limited Management and 4.2 - Scenery. The Goals and Desired Conditions for this area related to land use, recreation, and scenery management include emphasizing wildlife habitat and non-motorized recreation, implementing seasonal road closures when appropriate for habitat protection and erosion control, providing dispersed recreation opportunities outside of critical wildlife periods, providing access to natural attractions, water features, or areas that provide desired recreation opportunities with high quality scenic value, and allowing natural or manmade facilities to enhance viewing or recreation opportunities. More detailed information on desired goals, standards and guidelines for the management prescriptions within the analysis area can be found in Chapters 2 and 3 of the Forest Plan (Estes-Poudre Ranger District, Elk Ridge Geographic Area) (USFS 1997b).

The Forest Plan also states that evidence of disturbance and human use may be present, but a healthy and attractive appearance of these ecosystems should be maintained because of their desirability for recreational use (USFS 1997b).

3.11.2.2 2008 State Comprehensive Outdoor Recreation Plan

The 2008 Colorado Statewide Comprehensive Outdoor Recreation Plan states that over 75 percent of Coloradans participate weekly in outdoor recreational activities. The most popular forms of recreation are walking, family gatherings, viewing/photographing natural scenery, sightseeing, pleasure driving, and wildlife viewing/photography. Outdoor recreation and tourism of all types is a highly popular and very important component of Larimer County's identity and economy. The Front Range region is anticipated to experience a 45 percent increase in population from 2007 to 2030, which will significantly impact the demand for recreation in the area. The majority of the population in Colorado is located in the Front Range, causing the highest demand for recreation opportunities.

Spending related to recreation and tourism in the Front Range Region also is important. It is estimated that in 2006 alone, recreation and tourism contributed more than $9.1 billion to the economy of the Front Range Region (Colorado State Parks 2008).

3.11.2.3 Stewardship Plan for the Chimney Hollow Open Space

The Stewardship Plan for the Chimney Hollow Open Space (Larimer County undated) provides the formal guidelines for short-term stewardship of the area until a management plan is developed in the future. The Chimney Hollow Open Space is part of the larger vision for the Blue Mountain Conservation Area, as identified in the 2001 Larimer County Open Lands Management Plan, to protect natural, visual, cultural, and open space values. The vision for the Chimney Hollow Open Space area "is to protect the native vegetation, natural rock outcrops, native wildlife, and cultural resources while in the long-term providing outdoor recreational opportunities" (Larimer County undated). Potential recreation opportunities in the future would be based on a management plan and may include a trailhead and non-motorized trails. Near-term educational opportunities include guided public tours of the site, development of educational materials, and encouraging appropriate research/educational activities (Larimer County undated).

3.11.2.4 Larimer County Parks Master Plan 2007

The Master Plan outlines the desired visitor experience, resource conditions, managerial conditions, and future visitation and facilities for Horsetooth, Carter, Flatiron, and Pinewood Reservoir parks. At Flatiron Reservoir, desired recreation experiences include opportunities for highly social and developed full-service camping, shoreline fishing, picnicking in a scenic location, group picnicking, and trail use. Desired managerial conditions include a good level of safety, maintenance of facilities at a high quality condition, and management for a moderate to high level of visitation and revenue. Future improvements at Flatiron Reservoir could include up to three new cabins and connector trails to future Chimney Hollow Open Space trails and other areas, potentially enabling non-motorized travel between Flatiron Reservoir, Carter Lake, and Pinewood Reservoir.

At Pinewood Reservoir, desired recreation experiences include opportunities primarily for fishing, as well as non-motorized boating and no-wake motorized boating, somewhat social and rustic camping adjacent to the reservoir, picnicking in a scenic location, and trail use. Desired managerial conditions include a good level of safety, maintenance of facilities in a high quality condition, and management for a moderate level of visitation and revenue. Future improvements at Pinewood Reservoir could include reconfiguring the Blue Mountain area to include two new cabins and a new Shoreline Trail, reconfiguring the boat ramp area to add picnic tables and benches and convert all camping to tent-only, renovating the Windy Pines campground to include new pull-through, recreational vehicle, and walk-in sites as well as a formal trail network connecting campsites to the Shoreline Trail, and reconfiguring the parking at Pinewood Dam area and adding a new overlook and benches to this site (Larimer County 2007).

3.11.2.5 Resource Management Plan for Horsetooth, Carter, Flatiron, and Pinewood Reservoirs 2007

The Resource Management Plan (RMP) states that Larimer County reservoirs are owned by the BOR, but are managed through a land use agreement by Larimer County. The Plan includes a goal to provide appropriate opportunities for nature-based recreation. Objectives for this goal include providing additional low-intensity activities, developing additional trails, encouraging repeat and year-round visitation, further developing certain recreational activities, improving/expanding visitor access and use of shoreline areas, adapting to changing recreation trends, monitoring carrying capacity of the reservoirs, and limiting exclusive use of public resources. The plan also includes guiding statements for Flatiron and Pinewood Reservoirs, which are the same desired recreation experiences and managerial conditions as stated in the Larimer County Parks Master Plan. Recreation and Visitor Services Management actions include Larimer County Parks continuing to operate and manage the recreation and other visitor services at the reservoirs, providing visitor and interpretive information, and providing shoreline access for all populations wherever possible. Implementation actions included in the plan for Flatiron and Pinewood Reservoirs are the same future improvements noted in the Larimer County Parks Master Plan (BOR and Larimer County Parks and Open Lands Department 2007).

3.11.2.6 Supplemental Resource Management Plan for Pinewood Reservoir: Ramsay-Shockey Open Space

The Ramsay-Shockey Open Space Management Plan is a supplement to the RMP for Horsetooth, Carter, Flatiron, and Pinewood reservoirs. Many of the recreation-related actions included in the management plan have already been implemented. The vision for the open space area is “the creation of a multi-use trail that would allow for such activities as hiking, mountain biking, and horseback riding” (Larimer County undated). Implementation of the outdoor recreation management component of the plan includes designing and building the trail; adding trail signage; providing ongoing trail and parking area maintenance; incorporating the area into the regular park ranger public activities, education and enforcement schedule; building a scenic overlook; expanding the parking area; installing picnic sites;

removing interior fences; and adding road signage. Education opportunities include interpretive brochures and signs, a trailhead marker with a map of the area and trails, and volunteer-led hikes (Larimer County undated).

3.11.3 Planned Land Uses

Larimer County is planning to renovate the Pinewood Reservoir Campground. The existing footprint will likely not be expanded, but improvements will be made to the campground and facilities. Renovations are expected to be complete in spring of 2014 (Larimer County 2013h).

Chimney Hollow Reservoir is proposed as part of the Windy Gap Firming Project. The 90,000-acre-foot reservoir would be located southwest of Loveland and just west of Carter Lake. The Final EIS for the project has been released and a ROD is anticipated in late 2014. With design and construction slated to take about 5 years, Chimney Hollow Reservoir could be operational by 2020.

NCWCD will manage the water use, while Larimer County will manage the recreational use rights on the reservoir. It is anticipated that there will be 10 to 12 miles of non-motorized hiking/mountain biking/horseback riding trails west of the reservoir. The reservoir will be open to sailing, canoes, and other wakeless boating activity, as well as fishing and similar activities available at Pinewood and Flatiron Reservoirs. Limited deer and elk hunting also is anticipated for Chimney Hollow.

3.12 Visual Resources

3.12.1 Methodology

The Scenery Management System (SMS), adopted by the USFS in 1995 (USFS 1995), has been used to evaluate the quality of scenery for the Estes-Flatiron Transmission Line Rebuild Project. The SMS system employs a systematic approach for analyzing landscape character, including scenic attractiveness and scenic integrity, and landscape visibility associated with sensitive viewers. Photographs from key observation points (KOPs) were selected and described for detailed analysis.

3.12.1.1 Visual Resource Definitions

Several key terms from the USFS's SMS methodology are used in this section to describe the visual resources of the Estes-Flatiron project area (USFS 1995). The SMS system applies the following ratings to National Forest System lands, which also are applied to other affected lands for consistency:

Landscape character consists of the physical, cultural, and biological attributes that make a landscape identifiable, unique, or give it a memorable sense of place.

Scenic attractiveness is a measure of the visual appeal of a given landscape and can range from *Class A* (distinctive) to *Class C* (indistinctive).

Scenic integrity is a measure of the intactness associated with the visual elements that define a landscape character unit and can range from *Very High* to *Unacceptably Low*. Scenic integrity is defined in the SMS system according to six levels, defined below.

- *Very High* – The valued landscape character 'is' intact with only minute, if any, deviations. The existing landscape character and sense of place is expressed at the highest possible level.
- *High* – The valued landscape character 'appears' intact. Deviations may be present but must repeat form, line, color, texture and pattern common to the landscape character so completely and at such scale that they are not evident.
- *Moderate* – The valued landscape character 'appears slightly altered.' Noticeable deviations must remain visually subordinate to the landscape character being viewed.

- *Low* – The valued landscape character 'appears moderately altered.' Deviations begin to dominate the valued landscape character being viewed, but they borrow valued attributes such as size, shape, edge effect and pattern of natural openings, vegetation type changes, or architectural styles outside the landscape being viewed. They should not only appear as valued character outside the landscape being viewed, but compatible or complementary to the character within.
- *Very Low* – The valued landscape character 'appears heavily altered.' Deviations may strongly dominate the valued landscape character. They may not borrow from valued attributes such as size, shape, edge effect and pattern of natural opening, vegetation type changes, or architectural styles within or outside the landscape being viewed. However, deviations must be shaped and blended with the natural terrain (landforms) so elements such as unnatural edges, roads, landings, and structures do not dominate the composition.
- *Unacceptably Low* – The valued landscape being viewed appears extremely altered. Deviations are extremely dominant and borrow little if any form, line, color, texture, pattern, or scale from the landscape character. Landscapes at this level of integrity need rehabilitation.

Landscape Visibility is a measure of discernible detail in the landscape, relative to the viewer and their viewing conditions. Landscape visibility varies dramatically depending on many, interconnected factors including: 1) context of viewers; 2) duration of view; 3) degree of discernible detail; 4) seasonal variations; and 5) number of viewers.

Sensitive Viewers. Constituents evaluated as 'sensitive viewers' have a high degree of concern, activities and attitudes toward scenery and potential changes to landscape character. Travelways and recreation use areas considered sensitive viewing locations for the proposed project include, among others, local roads, parks, recreational reservoirs, visitor centers, campgrounds, hiking trails, as well as lands generally used for dispersed activities such as hunting, photography, wildlife viewing, and general solitude experiences.

Concern Levels are a measure of the degree of public importance placed on landscapes viewed from travelways and use areas. Three levels – 1, 2, and 3 – are used to denote the intensity of viewer concern, based on type of use and volume of use, with 1 being the highest level of concern. Input received from field observation, agency and public scoping comments, National Visitor Use Monitoring results (USFS 2012b), and media coverage was used to determining concern levels.

Distance Zones are defined as four categories in the SMS system: Immediate Foreground – 0 to 300 feet; Foreground – 300 feet to 0.5 mile; Middleground – 0.5 mile to 4 miles; and Background – 4 miles to the horizon.

Visual Sensitivity is used in this section as a measure for expressing the composite landscape visibility conditions from specific KOPs. Three levels are used to describe the combined influences of viewer type, concern level and distance zone: *High, Moderate*, and *Low.*

Visual Absorption Capability is the relative ability of a landscape to accept human alterations without loss of character or scenic quality (USFS 1995). Visual absorption capability is an indicator of the fragility or potential difficulty, and thus the potential cost, of predicting achievable scenic condition levels resulting from management activities in a landscape. Slope, vegetation cover, geology and soils are key factors in determining how visual absorption capability is expressed for each unit, as *High, Moderate*, and *Low.*

KOPs are representative viewing locations within the project area, which have been chosen based on scoping comments in consultation with Western and the USFS for detailed analysis and visual simulations The selection of KOPs is based on a variety of factors including the type of use and concern level, distance zone, landscape character type and associated scenic attractiveness and integrity.

Fourteen KOPs have been identified among the primary and secondary travelway/use areas for detailed visual analysis. The KOP's are listed below, and shown on **Appendix C**. See Section 4.12, Visual Resources, for a comparison of the existing condition to simulated condition photography for each alternative.

- KOP 1 – Stanley Hotel: view Looking southeast toward E-PH and E-LS transmission lines;
- KOP 2 – U.S. Highway 34: view looking southeast toward E-LS and E-PH transmission lines;
- KOP 3 – U.S. Highway 36: view looking northwest toward E-PH transmission line;
- KOP 4 – U.S. Highway 36/Estes Park Overlook;
- KOP 5 – Meadowdale Hills subdivision: view looking northeast toward E-PH transmission line;
- KOP 6 – Pole Hill Road: view from National Forest System lands near Pole Hill Road and Microwave Station, looking southwest toward E-PH transmission line;
- KOP 7 – Pole Hill Road: view from Quillan Gulch Road, looking west toward E-LS transmission line and National Forest System lands;
- KOP 8 – Pinewood Reservoir: view looking south/southwest toward F-PH transmission line;
- KOP 9 – W County Road 18E: view looking southeast toward F-PH transmission line;
- KOP 10 – Pole Hill Road/CR 18E at Flatiron Picnic and Day Use Area: view looking west toward F-PH and E-LS transmission line;
- KOP 11 – Hermit Park: looking towards South Line through Meadowdale Hills;
- KOP 12 – Lake Estes Causeway/U.S. Highway 36: view looking east towards project end point;
- KOP 13 – Newell Lake View subdivision: view looking east; and
- KOP 14 – Pole Hill Road: view looking west from Pole Hill Road on National Forest System lands towards Mount Pisgah, east of Meadowdale Hills subdivision.

3.12.2 Project Area Overview

The Estes-Flatiron project study area is located in the Southern Rocky Mountains Physiographic Province (Fenneman 1946). Project lands fall within the ecological subregion M331 Southern Rocky Mountain Steppe – Open Woodland – Coniferous Forest – Alpine Meadow Province' (Bailey et al. 1994). The project area is characterized as an aspect-dependent dry continental forest. Precipitation is around 20 inches per year, with approximately 50 percent occurring in the form of snow. Elevations within the project study area generally range from 5,500 to 9,200 feet. Mountains within the project area generally reach 8,500 to 9,000 feet in the western and central project area, while less dominant ridge and mountain features are found to the east, at elevations of 7,000 to 8,000 feet.

This area is a mixture of foothills shrub-grass communities, juniper-ponderosa pine communities on south slopes, and Douglas fir-mixed conifer on north slopes, as described in the USFS Elk Ridge Geographic Area (USFS 1997a). Vegetation management has occurred throughout the area for the past 100 years beginning with harvesting for materials for homesteads and ranches. Most of the vegetation in the area is second growth with patches of remnant old growth ponderosa pines. Ponderosa Pine has encroached into historic meadows as a result of fire suppression resulting in more views being screened. Pine beetle fuel treatments and mixed/variable-severity wildland fires are increasingly common in and corridor patches throughout National Forest System lands and private lands, as fuel loadings are high due to the subsequent mortality in the ponderosa pine community as described in Section 3.7, Vegetation.

Numerous residential developments, resorts, golf courses, and visitor services are present along with parks, trails, and several utility corridors. Existing utility corridors include lattice and wood pole transmission lines, a gas pipeline, and water facilities for the CBT project. In the eastern part of the project area, larger acreage rural residential homes, horse farms, pipelines and reservoirs of the CBT, distribution and transmission lines and local roadways are visually prominent. Development on private lands of both year-round and seasonal housing and tourism continues to increase as described in Section 3.11, Land Use and Recreation. Recreational use (motorized) is moderate during most of the year, except for winter, and increases during the hunting season as described in Section 3.11, Land Use and Recreation.

Travel routes in the western project area are numerous and include U.S. Highways 36 and 34, which are major transportation corridors between Rocky Mountain National Park and the Front Range cities of Loveland, Fort Collins, Boulder, and Denver. Travel routes are in the eastern and central part of the project area are limited, with Pole Hill Road (USFS Road 122) being the only east-west route across the project area and National Forest System lands. Approximately 5 miles of Pole Hill Road is closed to public access from T5N R72W, Section 36 to T5N R71W, Section 27. In the eastern part of the project area, several county roads, including W County Road 18E and N County Road 31 provide access.

Figure 3.12-1 shows the study area for visual resources and topographic features and elevations.

3.12.2.1 Landscape Character Units, Scenic Attractiveness, Existing Scenic Integrity, and Visual Absorption Capability

Landscape character units were delineated for the Estes-Flatiron project area, based on similarities in physiographic landforms, rock forms, water forms, vegetation colors and patterns, and similar land use characteristics (View Point West 2012). Three landscape character types are crossed by the project and were evaluated for Scenic Attractiveness, Existing Scenic Integrity, and Visual Absorption:

- Estes Park, or the Estes Valley. This unit begins at the western terminus of the project and affords most views of the project from The Notch westward.
- The Southern Rocky Mountains, west and east of Estes Park. This unit comprises most of the central project area including mountainous terrain north and south of Pole Hill Road, and Rocky Mountain National Park that surrounds Estes Park.
- The Front Range Foothills. This unit is located on the eastern edge of the project area.

Estes Park Landscape Character Unit (Figure 3.12-2)

In the western part of the project area lays Estes Valley, a broad, bowl-shaped valley that is surrounded by steep mountains. The scale and open character of the valley and steep slopes of adjacent mountains affords panoramic views in most directions.

Estes Valley is characterized by a mosaic of natural grasses, conifer stands of ponderosa and lodgepole pine, sagebrush, and deciduous trees along stream beds that are intermixed with community landscapes and commercial and housing developments. Prominent water features in the project foreground include Lake Estes and the Big Thompson River. Lake Estes is approximately 185 acres in size and lies in the center of the valley, above the Olympus Dam. The Big Thompson River has its headwaters in Rocky Mountain National Park and flows through Estes Park, before entering the Big Thompson Canyon below Lake Estes. These water features are major influences on the valley’s landscape character, providing movement, color and scenic enhancement. Other smaller water features are associated with streams and ponds that provide variety in wetland vegetation patterns and colors, which contrast with the adjacent native grasses and conifers.

Figure 3.12-1 Visual Resources Analysis Area

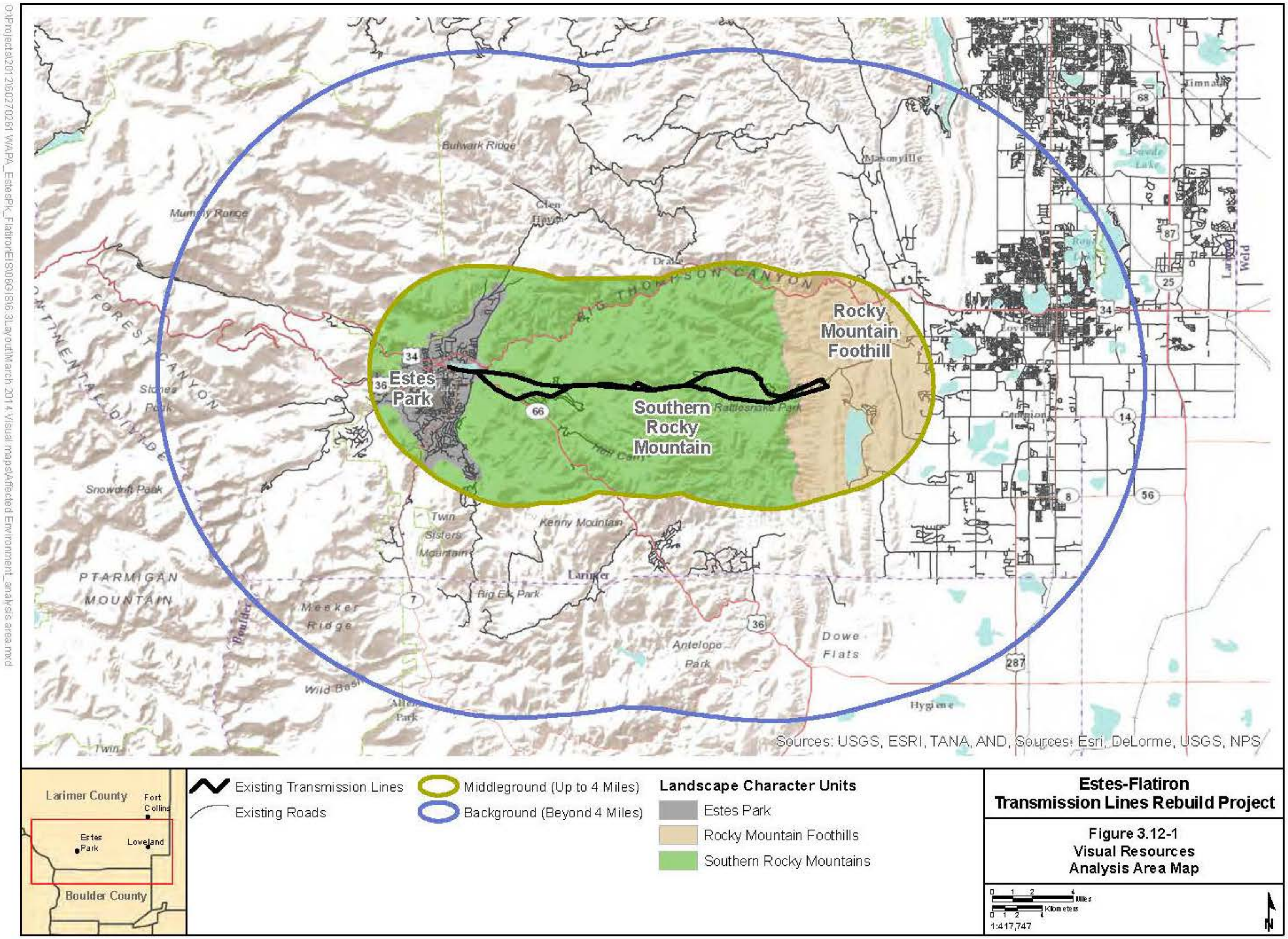
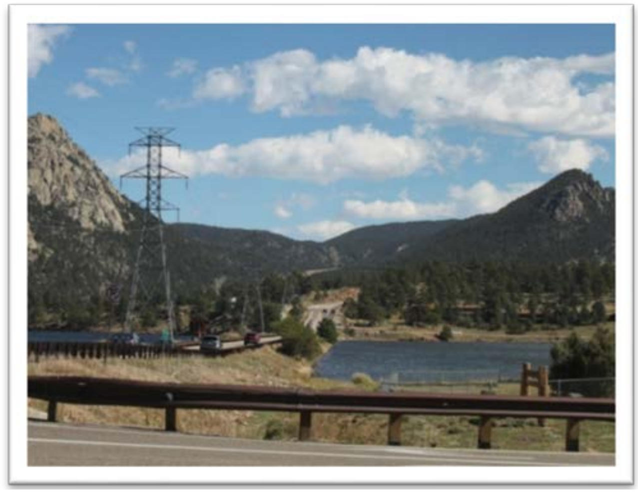


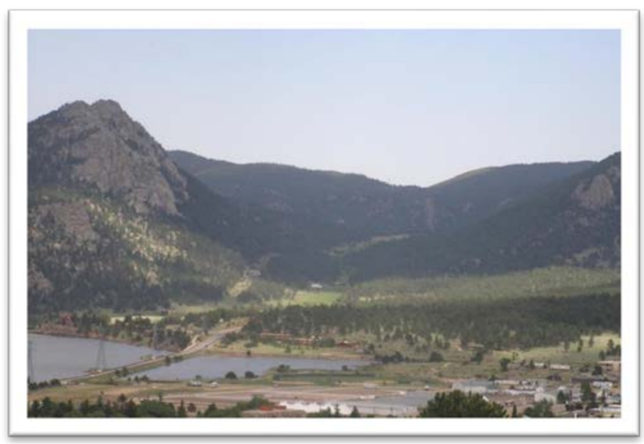
Figure 3.12-2 Photographs of the Estes Park Landscape Character Unit

Photograph of Lake Estes within Estes Valley, with E-LS Transmission Line and maintained ROWs in the Middleground (View Point West 2012)



The E-LS and E-PH transmission lines join lattice transmission lines at the western terminus of the project along U.S. Highway 36 and Lake Estes. The southeastern entrance to Estes Park parallels existing transmission lines heading to the Estes Power Plant to the west of this photograph.

Photograph of Ranch Meadows neighborhood, as an example of how the project area is typically screened by or seen in context with highway commercial, tourism, and housing developments intermingled in a mosaic of pines and meadows (View Point West 2012).



Photograph of the maintained E-LS ROW from an elevated position in southwestern Estes Park. Natural meadows have feathered, curvilinear edges whereas the utility ROW has straight edges.

Man-made elements of the landscape include the Town of Estes Park, surrounding residential and commercial developments, cultural attractions, golf courses, recreational parks and trails, local and regional transportation systems, lattice and H-frame transmission lines, wood and steel distribution utility lines, and the Estes Power Plant and Lake Estes Reservoir. The lattice transmission structures along the Lake Estes Causeway dominate foreground views. The Town of Estes Park is surrounded by scattered, unincorporated residential and commercial uses, and a variety of visitor services and amenities. Prominent land use features within the valley include the historic Stanley Hotel, the Lake Estes golf course, the Stanley Village commercial complex, and the Estes Power Plant. Numerous commercial and hotel developments are located along U.S. Highways 34 and 36, Highway 7, and other local roadways. Cumulatively, these land use developments have created broken lines and complex irregular forms, colors and textures throughout much of the valley. Existing roads and utility corridors have created strong linear features that are visible across the valley and up adjacent mountain slopes. Existing lattice and H-frame transmission lines, structures and conductors have cumulatively created strong horizontal and vertical line and form elements in the western part of the project environment.

The *scenic attractiveness* of Estes Park is *Class B, Typical* (**Table 3.12-1**). The open-closed pattern of meadows and Ponderosa Pine communities, abundant year-round wildlife viewing opportunities, and riparian and water features that add movement, variety and color to the landscape are Estes Park's most attractive characteristics, however this environment is dominated by human developments. It is positively influenced by open, panoramic views from the valley towards adjacent scenery, such as Mount Olympus, Mount Pisgah, and other mountains in Rocky Mountain National Park.

Existing scenic integrity ranges from *high* to *very low* depending on the degree of development, development standards, and site-specific conditions visible from any given location. The surrounding mountains generally have retained high scenic integrity although mixed residential developments, roads and utility corridors are evident on some mountain slopes.

Landscape visibility and *visual absorption capability* ranges from *high* to *moderate*. Although framed within a forested and mountainous context, linear urban infrastructure (roads, trails, power lines, etc.) and buildings are common and highly visible throughout Estes Park. Project facilities are less likely to contrast the natural environment where they are co-located with other urban developments.

Table 3.12-1 Summary of Estes Park Landscape Character Unit

Scenic Attribute	Attribute Rating
Scenic attractiveness class rating	B (typical)
Existing scenic integrity rating	High to very low
Landscape visibility	High to moderate
Visual absorption capability	High to moderate
Key observation points	1, 2, 11, 12

Southern Rocky Mountains West and East of Estes Park (Figure 3.12-3)

To the north, west and south of Estes Park are spectacular views toward the towering snow-capped mountain peaks and sculptured rock outcroppings of Rocky Mountain National Park. Within the visual resources project area, named places within the national park are Lumpy Ridge and Twin Owls.

The central part of the project area is characterized by mountainous terrain, which creates undulating lines on the landscape. Slopes are predominantly moderate to steep, with steeper terrain, jagged textures and patterns occurring on rocky peaks. Mount Olympus is a prominent mountain feature, with its jagged rock face soaring above the conifer forest slopes. Other named mountains include Sugarloaf Mountain, Pole Hill, and Panorama Peak.

Figure 3.12-3 Photographs of the Southern Rocky Mountains West and East of Estes Park Landscape Character Unit

Photograph of E-PH transmission line along U.S. Highway 36 approaching leaving Estes Park in the Southern Rocky Mountains landscape character unit.

Photograph from a helicopter of existing transmission lines and microwave tower along Pole Hill Road. Pine beetle damage is becoming more pronounced throughout the project area, and will likely result in a more open landscape in the future

Photograph of Southern Rocky Mountains (View Point West 2012). Homogeneous conifers with rock outcroppings and rural residential development.

Photograph from a helicopter traversing the Southern Rocky Mountains. Vegetation management and the dissected terrain allows for mature trees to grow under the transmission lines in ravines and other low points.

Vegetation primarily consists of mixed conifers, including junipers, lodgepole pine and ponderosa pine, with understories of native shrubs and grasses. Overall, the conifers create homogeneous medium textures throughout much of this landscape. Increased vegetation diversity and patterns are created where deciduous aspen trees and grasslands occur in dispersed meadows. Overall, textures range from coarse textured escarpments on rocky mountain peaks to medium textures where conifers dominate. Consequently, landscape visibility is often screened by terrain and trees.

In addition to the Big Thompson River and Fall River, there are several intermittent streams and incised drainages including Rabbit Gulch and Quillan Gulch. Drainages typically create localized vegetation patterns, which add interest against adjacent grasses or conifers.

The dominant scale and scenery of Rocky Mountain National Park and nearby mountains to the west strongly enhances the scenery in the western part of the central project area. In these areas, the color and texture of the homogeneous conifers are viewed against a background of snow-capped sculptured mountain peaks.

Cultural modifications primarily consist of rural residential subdivisions and scattered homes, Pole Hill Road, existing H-frame transmission lines, the Pole Hill Substation and associated CBT water facilities, radio facilities on Bald Mountain and above Newell Lake View subdivision, a microwave station located along Pole Hill road, and a network of unpaved roads and trails.

Overall, the *scenic attractiveness* of the mountains east of Estes Park is *Class B,* with some *Class A* scenery occurring where the landscape is viewed against Rocky Mountain National Park to the west (**Table 3.12-2**). Overall, however, the predominant character of the central project area, including most National Forest System lands, is a classic western landscape with ponderosa pine, aspen, meadows and rock outcrops.

Existing scenic integrity ranges from *moderate* to *low*. Undeveloped landscapes generally are perceived to have high scenic integrity, while the existing transmission lines and residential subdivisions contribute to low to moderate scenic integrity conditions.

Landscape visibility and *visual absorption capability* ranges from *high* to *moderate*. The steep slopes, heavily dissected landform, frequent rock outcroppings, and dense vegetative cover partially screen and break up the visual continuity of most linear alterations. Tree regeneration potential is high which can serve to mitigate openings created by disturbance. Open-closed pattern of meadows and pine stands can provide natural openings from which to borrow when designing utility corridors. At the same time, dense tree communities are more prone to exaggerate the contrast of cleared ROWs; south-facing slopes are less likely to be regenerate compared to north-facing slopes; and project facilities would more likely be visible in open meadows than in closed pine stands.

Table 3.12-2 Summary of Southern Rocky Mountains West and East of Estes Park Landscape Character Unit

Scenic Attribute	Attribute Rating
Scenic attractiveness class rating	B (typical); some A (distinctive)
Existing scenic integrity rating	Moderate to low
Landscape visibility	High to moderate
Visual absorption capability	High to moderate
Key observation points	3,4,5,6,7,8,11,13

Rocky Mountain Foothills (Figure 3.12-4)

At the eastern edge of project area, the terrain, vegetation, and water characteristics of the landscape change dramatically. Conifer-covered, south and east-facing mountain slopes rapidly transition to grassland and sagebrush vegetation on foothills and lower elevation mountains. Vegetation cover decreases in density and diversity, exposing highly eroded tan, brown and reddish soils and rocks. Prominent landforms are Bald Mountain, Blue Mountain, Flatiron Mountain and Chimney Hollow. Vegetation communities are predominantly native grasslands and shrubs that form a softly textured grey/green cover on gentle to rolling slopes. Contrasts in vegetation/soil colors and textures increase on steeper slopes, where sharp ridgelines, red soils and horizontal geologic strata are exposed.

Natural water features are not a major scenic element in this landscape type, although several of the CBT reservoirs, including Pinewood, Flatiron and Carter Lake, are present and provide scenic enhancements in color, movement and texture, as well as recreational opportunities. Natural water features, such as intermittent drainages and gulches generally are defined by increased diversity in vegetation patterns and colors along watercourses.

Land use developments include multiple existing H-frame transmission lines and substations the CBT water reservoirs and pipeline, which all increase in frequency and visibility near Flatiron Reservoir. Five transmission ROWs, the aboveground CBT pipeline, and an underground gas pipeline create strong vertical, horizontal and diagonal lines across much of this area. Added to these linear utility lines are numerous distribution power lines serving residential subdivisions. Rural residential subdivisions, larger acreage horse farms, rural developments, and their associated paved and unpaved roads become common throughout the flatter valley areas, and generally create broken lines and forms with a multitude of varying design elements.

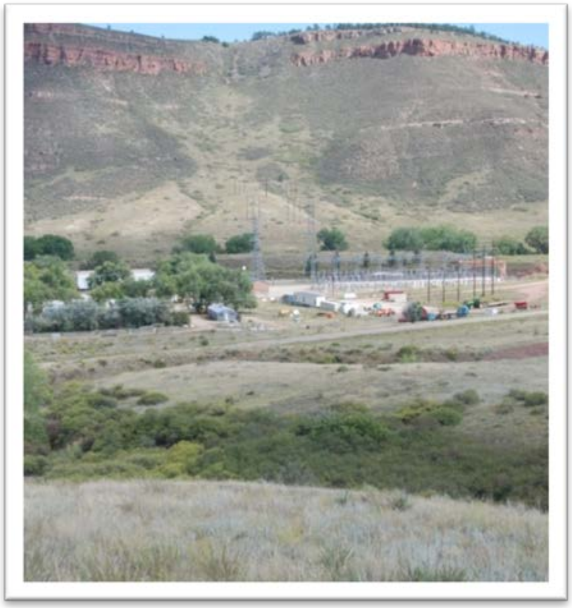
The *scenic attractiveness* of the foothills is assessed as Class B (**Table 3.12-3**). *Existing scenic integrity* ranges from moderate to low. Undeveloped areas of the unit generally have moderate scenic integrity, while the presence of numerous paved and unpaved roads, utility ROWs and various types of developments contribute to moderate to low scenic integrity conditions.

Visual absorption capability ranges from moderate to low. The foothills offer less terrain screening and the grasslands less tree stands to hide utilities. Tree regeneration potential is moderate to low. Soil disturbance is more likely to results in tan and reddish soils remaining visible for longer periods of time compared to the Southern Rocky Mountains. Existing residential subdivisions and linear infrastructure (power lines, roads, and water pipelines) are more visible and may provide opportunities for co-location to minimize potential reductions in scenic quality.

Table 3.12-3 Summary of Rocky Mountains Foothills Landscape Character Unit

Scenic Attribute	Attribute Rating
Scenic attractiveness class rating	B (typical)
Existing scenic integrity rating	Moderate to low
Landscape visibility	High to moderate
Visual absorption capability	Moderate to low
Key observation points	9, 10

Figure 3.12-4 Photographs of the Rocky Mountain Foothills Landscape Character Unit



Photograph of Flatiron Substation in the Rocky Mountain Foothills landscape character unit (View Point West 2012). Predominantly shrub and grassland vegetation cover on steep hillsides with rock escarpments, with mixed land uses and vegetation diversity in valley and drainages.

Photograph of Rocky Mountain Foothills (View Point West 2012). Flatiron Reservoir, open, rolling terrain with mixed shrub and grassland vegetation dominant.

Photograph of E-LS through the Newell Lake View subdivision where a number of buildings are immediately adjacent to a 20-foot ROW.

Photograph from County Road 18E north of Flatiron Reservoir of Bald Mountain, with the penstocks, radio towers and several electrical transmission and distribution lines including the E-LS and F-PH lines.

3.12.2.2 Landscape Visibility

Landscape visibility has been documented for the affected environment by assessing three elements in the study area: Sensitive Viewers, Concern Levels, and Distance Zones.

Sensitive Viewers

Sensitive viewer locations within the proposed project area are shown on **Figure 3.12-5** through **Figure 3.12-7**. Numerous visitor facilities, recreational trails, travel routes and residential areas occur throughout the project area.

'Seen area' mapping for sensitive viewers in the project area is shown on **Figure 3.12-5** through **Figure 3.12-7**. Potential visibility within the project area was determined through computerized viewshed, or 'seen area' mapping, using USGS digital elevation model 10-meter information. The viewsheds indicate where potential structures averaging heights of 105 feet would be visible by 6-foot tall viewers from highways, residences, and recreation areas within 1 mile of the project. Darker colors indicate landscapes seen by a larger number of viewers. 'Seen areas' represent potential 'worst-case' viewing conditions (i.e., leaf off/no trees) due to both typical winter conditions and long-term effects of bark beetle kills in the project area.

Concern Levels

The western part of the project area is considered highly sensitive (Level 1), due to both its location near Rocky Mountain National Park as well as the sentiments of persons providing scoping comments which frequently expressed concern for potential impacts to scenery at Estes Park, along U.S. Highways 34 and 36, from private residential areas, and from public recreation areas. The concern levels documented for the Southern Rocky Mountains and Foothills is predominantly moderate (Level 2) due to reduced number of viewers, and fewer expressed concerns for these parts of the project area.

Distance Zones

Distance zones from the project are identified from each sensitive use area in **Table 3.12-4**. The project and existing 115-kV lines are within the foreground viewing distance zone of many of the sensitive use areas.

3.12.2.3 Forest Service Scenic Integrity Objectives

The types, scales, and patterns of existing development on public and private land are the primary factors considered in determining Existing Scenic Integrity as discussed in the section *Landscape Character Units, Scenic Attractiveness, Existing Scenic Integrity, and Visual Absorption Capability*. The desired future condition is expressed as Scenic Integrity Objectives (SIOs) as contained in the USFS's 1997 Revision of the Land and Resource Management Plan, Arapahoe and Roosevelt National Forests and Pawnee National Grassland (USFS 1997a).

SIOs are long-term objectives that have been determined to have a 20-year threshold (USFS 2013). Scenic effects that occur less than 20 years are defined as "short-term" and are not seen as affecting the SIO as adopted in the Forest Plan.

Figure 3.12-5 Highway Viewsheds

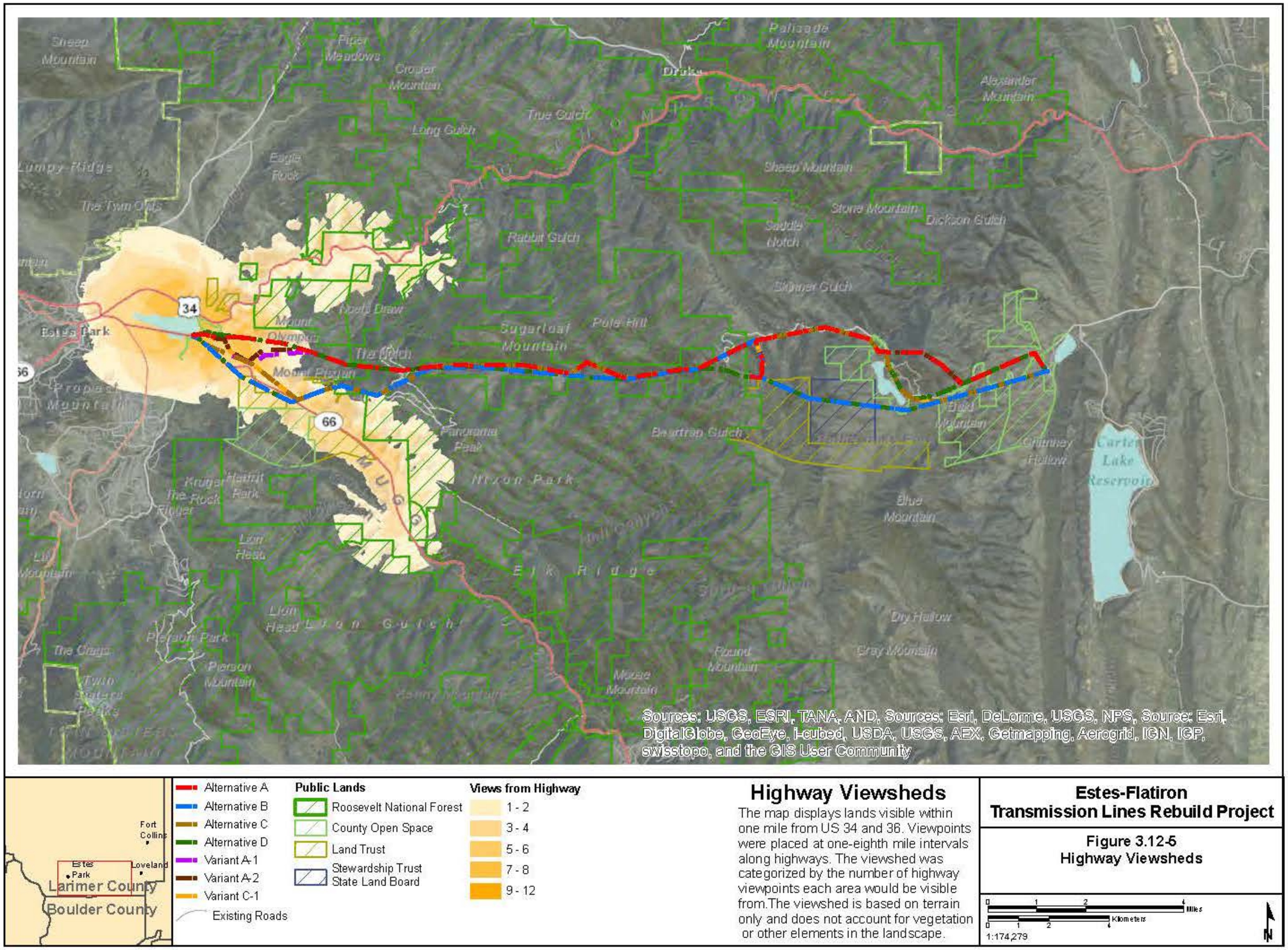


Figure 3.12-6 Residential Viewsheds

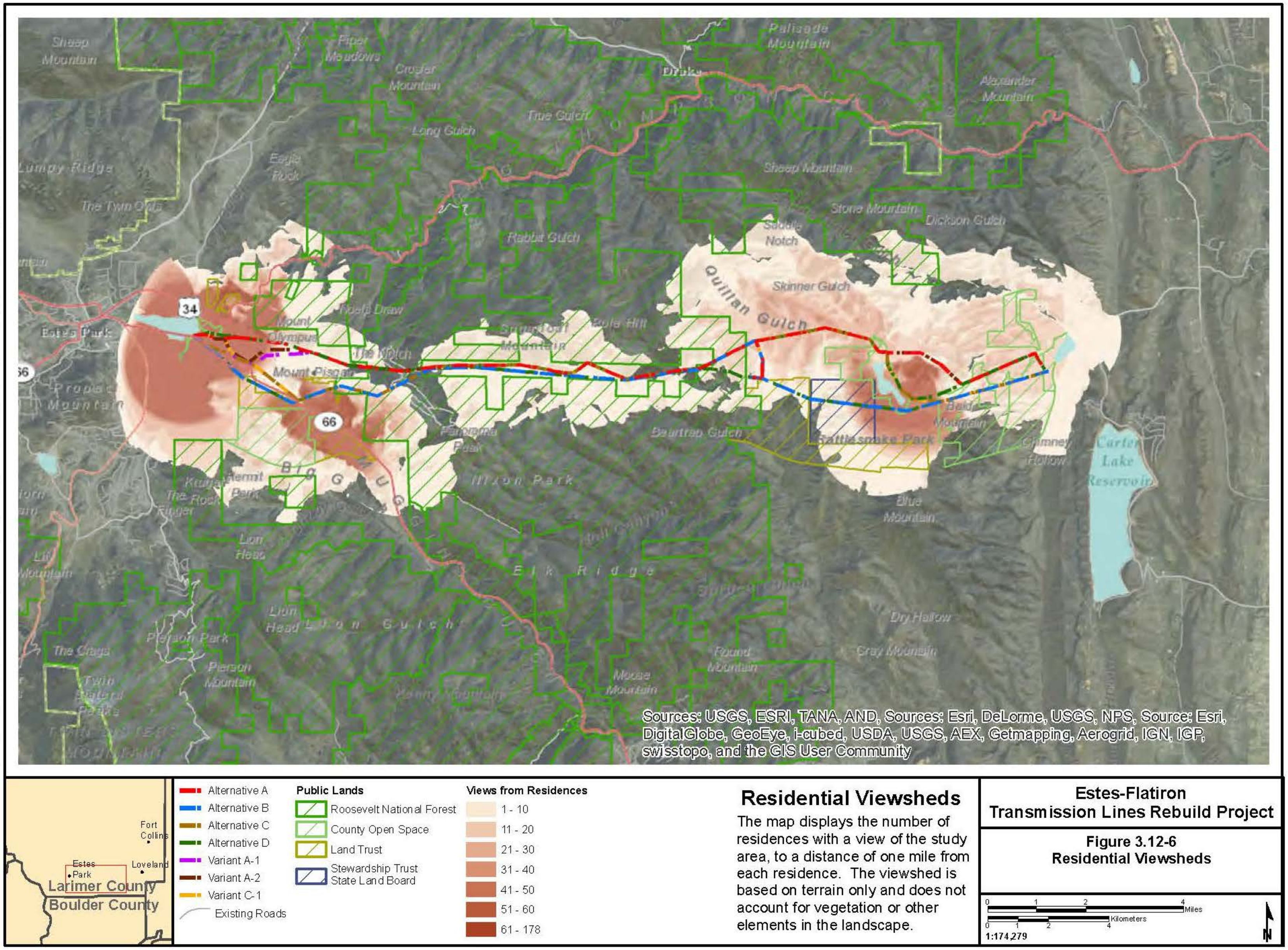


Figure 3.12-7 Recreation Viewsheds

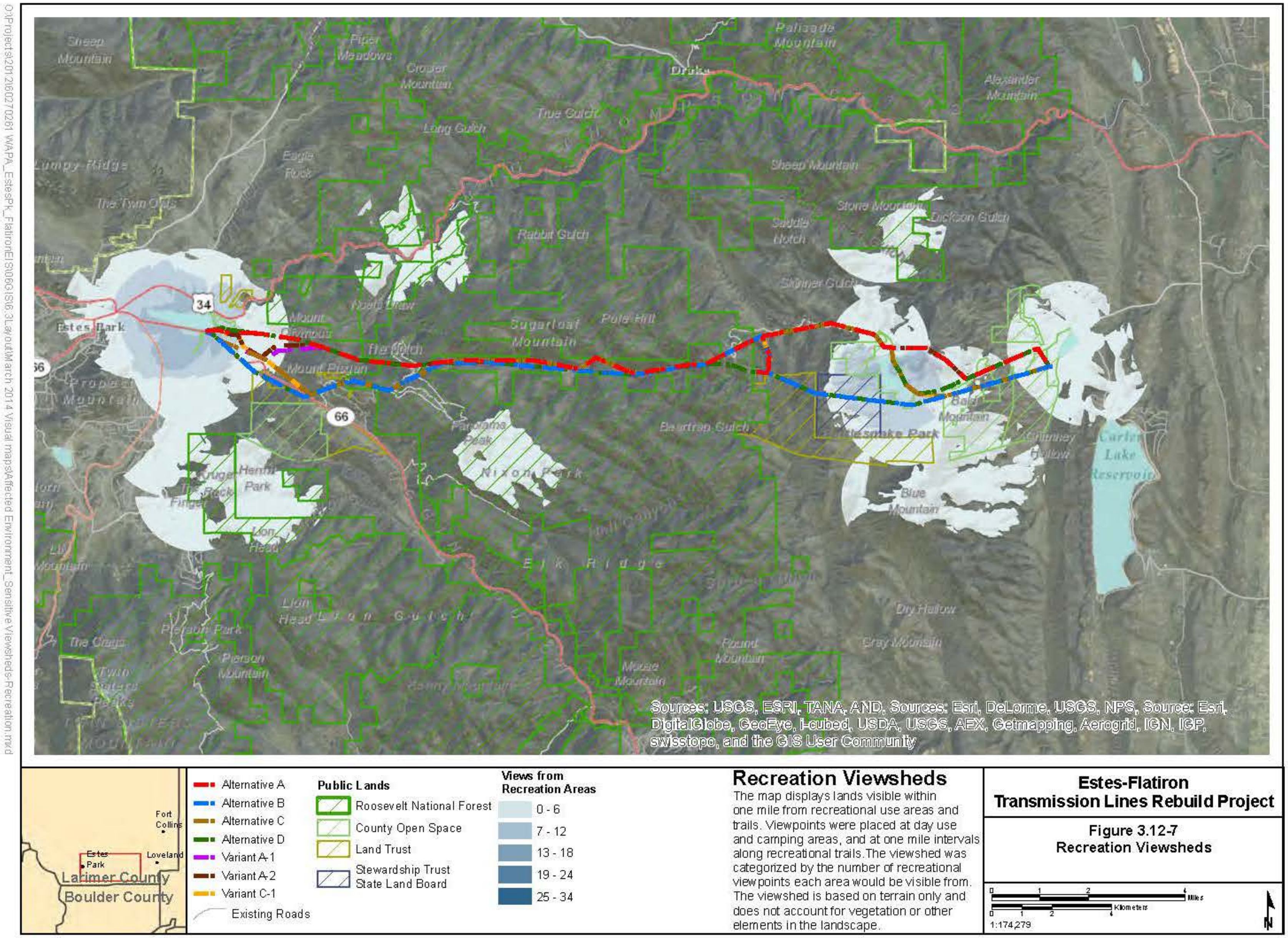


Table 3.12-4 Summary of Landscape Visibility

Location Name	Type and Volume of Use	Distance Zone to Project ROW
Travelways		
U.S. Highway 34/Big Thompson Avenue Major travel route to Rocky Mountain National Park	Primary Travelway High Use	FG/MG
U.S. Highway 36 Major travel route to Rocky Mountain National Park	Primary Travelway High Use	FG/MG
Pole Hill Road (USFS Road122) Access to National Forest System lands; off-road-vehicle use, cross-country skiing, hiking, mountain biking, dispersed recreational activities, and residences. Closed to public access between T5N R72W, Section 36 to T5N R71W, Section 25.	Secondary Travelway Moderate to Low Use	FG
Pole Hill Road (W County Road 18E) – near Pinewood and Flatiron Reservoir: Biking	Secondary Travelway Moderate Use	FG
Greenwood Drive – near Pinewood Reservoir; Residential	Secondary Travelway Moderate Use	FG/MG
Trail Ridge / Beaver Meadow Road. Primary travel route through RMNP and nationally designated as an All-American Road	Primary Travelway High Use	MG/BG
Peak to Peak Scenic Byway (Highway 7). Primary travel route to Rocky Mountain National Park and designated as a scenic byway by the State of Colorado and USFS	Primary Travelway High Use	MG/BG
Park and Recreation Areas		
Rocky Mountain National Park	Primary Use Area High Use	MG/BG
Lake Estes Park	Primary Use Area High Use	FG/MG
Estes Park Visitor Center	Primary Use Area High Use	MG
Estes Park Overlook, U.S. Highway 36	Primary Use Area High Use	FG
Lake Estes Trail	Primary Use Area High Use	FG/MG
Fall River Trail	Primary Use Area High Use	MG/BG
Fish Creek Trail	Primary Use Area High Use	MG/BG
Riverwalk Trail	Primary Use Area High Use	MG

Location Name	Type and Volume of Use	Distance Zone to Project ROW
Round Mountain National Recreation Trail	Primary Use Area High Use	MG
Pole Hill/Panorama Peak/Solitude Creek Peak/The Notch	Secondary Use Area Low Use	FG
Pinewood Reservoir, Picnic Area and Ramsay-Shockey Open Space and trail system	Secondary Use Area Moderate Use	FG/MG
Flatiron Reservoir Campground	Secondary Use Area Moderate Use	FG/MG
Chimney Hollow Open Space, Larimer County	Secondary Use Area Moderate Use	FG
Residential		
Meadowdale Hills subdivision	Secondary Use Area Moderate Use	FG
Ravencrest Heights subdivision	Secondary Use Area Moderate Use	FG
Pole Hill subdivision	Secondary Use Area Moderate Use	FG
Greenwood Drive/Newell Lake View subdivision	Secondary Use Area Moderate Use	FG/MG
Park Hill subdivision	Secondary Use Area Moderate Use	FG
Dispersed rural residential – Pole Hill Road	Secondary Use Area Low Use	FG
Cultural Sites		
Stanley Hotel	Primary Use Area High Use	MG

FG = foreground, MG = middleground, BG = background.

The existing North and South lines are included in one utility corridor (USFS 2012a). On National Forest System land, the existing 115-kV transmission lines are included within Utility Corridor Management Area 8.3 within the Elk Ridge Geographic Area. The Forest Plan's desired condition for Utility Corridors, is for "vegetation composition and structure to be altered to meet the needs of the site (e.g., larger trees are removed to allow for a safety area below and to the side of power lines; smaller trees are still present; and other areas have been cleared of all trees to accommodate facilities). The boundaries of the cut areas bordering the utility corridor are blended into the surrounding vegetation. Human development is obvious and may dominate the foreground views. An extensive road system exists throughout most of the area for purposes of allowing access for maintenance of the utility" (USFS 1997a).

Guideline number two in Management Area 8.3 suggests that "Utility Corridors and electronic sites will be located and designed to blend with the landscape. They will be compatible with the SIOs of adjacent management areas" (USFS 1997a). According to guideline number two, uses within the Utility Corridor will be compatible with adjacent management areas (USFS 1997a). Management areas adjacent to the utility corridor in the Elk Ridge Geographic Area includes Management Area 3.5 (Forested Flora or

Fauna Habitats-Limited Management). Goals and desired conditions emphasize wildlife habitat and non-motorized recreation.

The USFS's SIO for the Elk Ridge area is Moderate as shown in **Figure 3.12-8** (USFS1997a, 2006). Moderate refers to landscapes where the valued landscape character 'appears slightly altered'. Noticeable deviations must remain visually subordinate to the landscape character being viewed (USFS 2006). The Forest Plan provides examples of projects that would meet Moderate: "A power line that uses flat, low reflectivity, natural colors that blend with the background could meet this level, as could irregularly shaped timber harvests with some trees left and feathered edges, or ski slopes in areas with natural openings that allow some blending" (USFS 1997a, 2006).

Forest Plan Guideline 157 is to "design and implement management activities to meet the adopted scenic integrity objective for the area as shown on the SIO Map." Similarly, Forest Plan Standard 154 prohibits "management activities that are inconsistent with the scenic integrity objective unless a decision is made to change the scenic integrity objective. A decision to change the scenic integrity objective will be documented in a project level NEPA decision document" (USFS 1997a).

3.12.2.4 State and Local Visual Resource Guidance

State or local government visual resource standards or policies for visual resources in the analysis area include scenic byway management plans prepared by Colorado Department of Transportation, and comprehensive plans prepared by Larimer County. None of these plans contain design requirements for transmission lines.

State of Colorado

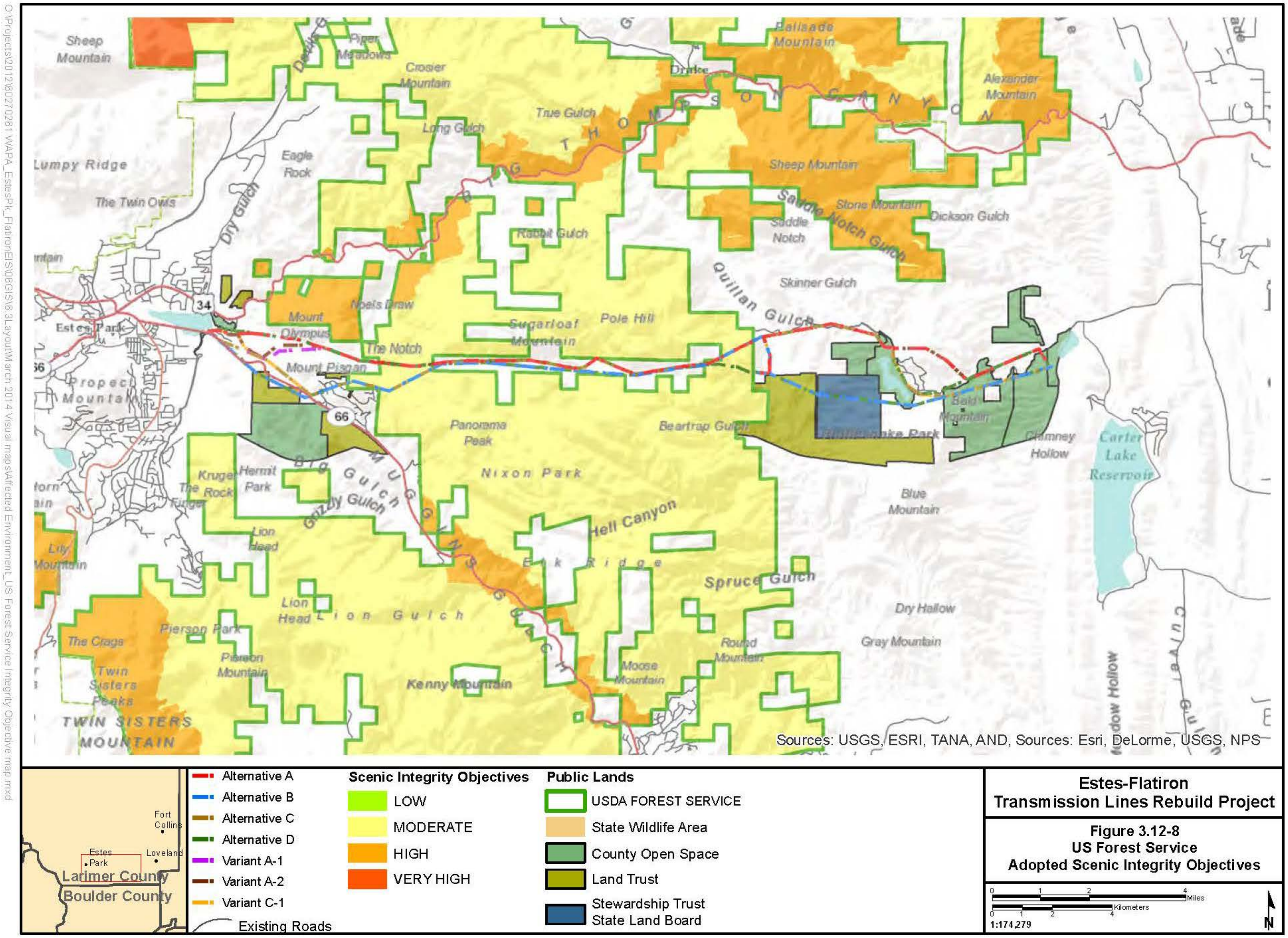
Two scenic byways to and through Rocky Mountain National Park are within the viewshed of the project, the Trail Ridge / Beaver Meadows Road and the Peak to Peak Scenic Byway (Highway 7). The Trail Ridge / Beaver Meadows Road was designated in 1996 as an All-American Road, the highest level of national designation. It travels east-west from Estes Park through Rocky Mountain National Park, beginning 1.7 miles from the project. The Peak to Peak scenic byway travels north-south to Estes Park, 0.8 mile from the proposed project.

Larimer County and Estes Valley

Section 6.8 Special Places: Archaeological, Cultural and Aesthetic Resources of the Larimer County Master Plan requires that development plans identify of historic landmarks, geological features, and unique aesthetic features in recognition of their irreplaceable character and importance to the quality of life in the County (Larimer County 1997). With exception of the Open Lands Program, below, the Master Plan and other County plans, policies, and codes do not address protection of visual resources in the analysis area.

Larimer - Blue Mountain Conservation Area is a priority area for the Larimer County Open Lands Program due to its scenic quality, recreation uses, wildlife and vegetation communities. Conserved properties in the Blue Mountain Conservation Area include the 4,100-acre Blue Mountain Bison Ranch Conservation Easement, the 1,847-acre Chimney Hollow Open Space, the Harper Conservation Easement and the 177-acre Ramsay-Shockey Open Space adjacent to Pinewood Reservoir.

Figure 3.12-8 Adopted Scenic Integrity Objectives



Larimer County and the Town of Estes Park cooperated in preparing the Estes Valley Comprehensive Plan which encompasses the Estes Park Landscape Character Unit (Larimer County 1996). The Comprehensive Plan is currently being revised; a new plan is anticipated by 2017. Policies emphasize the importance of scenic quality as a basis for the Valley's quality of life, economic development, tourism, and recreation and include the following:

- 6.2 Protect the scenic character and visual quality of the open space and gateway experience to the Valley and Rocky Mountain National Park.
- 6.6 Ensure that new development minimizes the impacts to visual and environmental quality within the Valley.
- 6.7 Avoid development on sky lined ridgelines.
- 6.12 Work with landowners and appropriate agencies to reduce the threat of wildfires.

Ridgeline protection areas have been designated at the entrances to the valley. Developments in these areas require a special review process. The proposed project does not cross a designated ridgeline protection area.

3.13 Socioeconomics and Community Resources (including Environmental Justice)

The purpose of the socioeconomic analysis is to address the economic impacts of the proposed project alternatives, including employment and labor income, on the major sectors of the local economy and to examine potential impacts to property values. Particular emphasis focuses on the reliability of the electrical system and short-term construction impacts as related to the tourism industry.

3.13.1 Affected Environment

Larimer County is located in north-central Colorado. It is the seventh most populated county in Colorado. The county extends to the Continental Divide and includes several mountain communities and Rocky Mountain National Park. The county encompasses 2,640 square miles that include vast stretches of scenic ranch lands, forests, and high mountain peaks. Over 50 percent of Larimer County is publicly owned, most of which is land within National Forest and Rocky Mountain National Park. In addition to these Federal lands, Colorado State Parks, Larimer County Parks and Open Lands, and local parks within urban areas combine to provide a wide spectrum of recreational opportunities that are enjoyed by both residents and visitors. The towns of Loveland and Estes Park also are known as gateways to Rocky Mountain National Park, which receives over 3 million visitors each year.

The project vicinity lies entirely within Larimer County and within close proximity to Loveland and Estes Park; these areas are the focus of the following social and economic analysis. The portion of the system affected by this transmission system includes approximately 45,000 customers in the area, including the towns of Loveland (32,574 customers) and Estes Park (10,500 customers). These customers are directly serviced by the Platte River Power Authority. However, the Platte River Power Authority purchases a portion of its power from Western. Also included are rural areas along Pole Hill Road supplied by Poudre Valley Rural Electric Association, which purchases a portion of its power from Tri-State Generation and Transmission Cooperative. Tri-State also is a Western customer that purchases a portion of its power from Western. Many residents of the county depend directly and indirectly upon recreation-oriented activities for their economic livelihood. Because the demand for recreational activity and second homes in mountain environments continues to grow in Larimer County, electrical service reliability is increasingly important.

3.13.1.1 Demographics

Population

Population and population trends for the project vicinity are shown on **Table 3.13-1**. Between 2000 and 2011, population increased by 21 percent in Larimer County, 35 percent in Loveland, and 10 percent in Estes Park. Population in Colorado as a whole has increased by 19 percent between 2000 and 2011. Northern Colorado is one of the fastest growing areas in Colorado. Population and demographic data for the two census tracts within the project vicinity are displayed in **Table 3.13-9**.

Table 3.13-1 Population Growth in the Project Vicinity

	2000	2005	2010	2011 (estimate)	Average Annual % Increase 2000-2011	% Increase
State of Colorado	4,301,261	4,662,534	5,050,870	5,116,796	1.7	19
Larimer County	251,494	275,873	300,637	305,525	1.9	21
Loveland	50,608	60,346	67,083	68,203	3.2	35
Estes Park	5,413	5,618	5,878	5,976	0.9	10

Source: Colorado Department of Local Affairs, State Demography Office 2012, U.S. Census Bureau 2012a.

The Estes Valley includes the Town of Estes Park and the surrounding outlying areas east, north and south of Rocky Mountain National Park. The population in the Estes Valley is estimated at over 12,000, with an estimated additional second home owner population of 5,340 (RRC Associates, Inc. 2008). Rocky Mountain National Park receives over 3 million visitors annually (National Park Service 2013b). Many of these visitors stay in the over 150 lodging establishments throughout the area, adding to the population base of the resident and second home owners.

The race composition of the project vicinity is predominately White (92.8 percent), with Hispanics representing approximately 10.8 percent of the total population in the area (U.S. Census Bureau 2012a).

Employment and Income

The project vicinity has a diverse economic base, with the greatest percentages of total employment occurring in services, government, and health care. Loveland has a strong and diverse economic base and is home to many bioscience and high tech companies, as well as regional retail and wholesale centers and health care providers. Important industries include tourism-related sales and services in the Estes Park area. Estes Park is the gateway to Rocky Mountain National Park and is an international destination resort. The town is primarily a summer resort; the vacation and festival season runs from Memorial Day into October. The goods and services sectors are the primary economic generators in the Estes Valley.

Employment and unemployment for 2012 in Larimer County and the state of Colorado is shown in **Table 3.13-2**. The unemployment rate in Larimer County was lower at 6.0 percent in November 2012 compared to the state unemployment rate of 7.5 percent. It appears that the Larimer County unemployment rate has steadily declined over the past year and that the labor force has slowly increased. Depending on economic conditions and the speed in recovering from the economic recession of 2008, these unemployment rates may remain somewhat static for the near future.

Important employment sectors in the project vicinity include the tourism-related sectors of accommodations and food services, education, health care, retail trade, manufacturing, and professional and technical services.

Table 3.13-2 Labor Force Summary January 2012 and Average Annual 2011

County	Labor Force	Employed	Unemployed	% Unemployed
Larimer County (November 2012)	180,009	169,283	10,726	6.0
State of Colorado (November 2012)	2,713,371	2,509,051	204,320	7.5
Larimer County (2011)	178,043	166,001	12,042	6.8
State of Colorado (2011)	2,723,027	2,497,297	225,730	8.3

Source: Colorado Department of Labor and Employment 2011.

The concentration of tourism-related sectors is significant, in part, because these sectors pay relatively low wages. **Table 3.13-3** shows the number of establishments, employment, and wages for Larimer County in 2010. Average weekly wages for arts, entertainment, recreation, food and accommodations are some of the lowest wages for all sectors. Construction weekly wages of $864 would be considered moderate.

Median household income for the 2007 to 2011 timeframe was estimated at $57,587 for Estes Park and $54,763 for Loveland (U.S. Census Bureau 2012b).

Table 3.13-3 Employment and Wages, Total Data for Larimer County, Aggregate of All Types based on 2010 Quarterly Census

Industry	Average Number of Establishments	Average Employment	Average Weekly Wage
Total, all industries	10,029	126,658	$785
Agriculture, forestry, fishing and hunting	76	613	$544
Mining	36	308	$886
Utilities	32	716	$1,318
Construction	1,186	7,273	$864
Manufacturing	422	10,582	$1,418
Wholesale trade	583	2,890	$1,021
Retail trade	1,174	16,528	$455
Transportation and warehousing	176	2,416	$749
Information	178	2,709	$937
Finance and insurance	536	3,178	$980
Real estate and rental and leasing	501	2,228	$608
Professional and technical services	1,694	8,798	$1,335
Management of companies and enterprises	73	508	$1,632
Administrative and waste services	583	8,191	$556

Industry	Average Number of Establishments	Average Employment	Average Weekly Wage
Educational services	144	15,409	$752
Health care and social assistance	878	16,668	$819
Arts, entertainment, and recreation	177	2,489	$440
Accommodation and food services	758	14,223	$282
Other services, ex. public administration	753	3,452	$540
Public administration	62	7,445	$1,062
Unclassified	10	33	$1,159

Source: U.S. Bureau of Labor Statistics 2012.

Employment Seasonality

Employment in the Estes Valley fluctuates significantly with the season. Results from a 2007 employer survey indicate that just over half of the workforce during the summer months is seasonal. Employment drops significantly during the winter months with approximately 3,366 people holding year-round positions and 950 employed in seasonal jobs. Survey data indicate that winter employment as a percent of summer employment has remained between 58 and 64 percent since 1989 (RRC Associates, Inc 2008). **Table 3.13-4** shows seasonal employment in the Estes Valley.

Table 3.13-4 Seasonality in Employment, Estes Valley

	Total Summer	Total Winter	Average
Number of employees	6,857	4,316	5,587
Number of year-round employees	3,360	3,366	3,364
Number of seasonal employees	3,497	950	2,223
Percent seasonal	51%	22%	40%

Source: RRC Associates, Inc 2008.

Surveys asked employers to estimate the percentage of seasonal employees who return to work for them from past seasons. Employers reported that an average of 46 percent of summer seasonal employees and 18 percent of winter seasonal employees returned to work for them from previous seasons; therefore, the majority of seasonal employees must be newly recruited each year.

Housing

Adequate housing throughout the project vicinity exists for permanent and temporary accommodations. Temporary accommodations in the Estes Valley are provided by over 150 lodging establishments. The City of Loveland provides temporary accommodations such as motels, hotels, bed and breakfasts, cabins, and recreational vehicle camping sites.

In 2011, there was an estimated total of 133,263 housing units in Larimer County, of which 78,924 units were owner occupied; 42,987 units were renter occupied; and the remainder were vacant (**Table 3.13-5**). In the Estes Valley, many vacant units are used for seasonal use or occasional use. These units include those that are owned by non-residents (second homes) as well as seasonal and recreational rentals. Seasonal homes are a small percent of the total housing units in Colorado, including Loveland. However, in the Estes Valley, these homes make up 34 percent of total housing units.

Table 3.13-5 Housing Availability and Vacancy Rates - State of Colorado, Larimer County, Loveland, and Estes Park

	Colorado 2011	Larimer County 2011	Loveland 2011	Estes Park 2011	Estes Valley 2006
Total housing units	2,224,661	133,263	30,137	4,004	6,544
Vacant housing	249,273	11,352	1,610	1,138	2,225
Vacancy rate	11.2%	9.9%	5.3%	28.4%	34%
Occupied	1,975,388	121,911	28,527	2,866	NA
Owner occupied	1,271,804	78,924	17,178	1,892	4,456
Renter occupied	703,584	42,987	11,349	974	NA
Seasonal units	NA	NA	NA	NA	2,225
% seasonal	NA	NA	NA	NA	34%

NA = not applicable.

Source: RRC Associates, Inc 2008; U.S. Census Bureau 2012a, 2012b.

This level of second homes or absentee homeowners, can have an impact on the local economy and community. In some cases, second homes provide a variety of service job opportunities within the community. But these homes also tend to be somewhat remote from the urban center, and can often cost the local government more in services (fire, sheriff, etc.) than they receive in taxes. Second homeowners are not counted in census figures but require government facilities and services when they are in the area. Assuming a 2.4-person household size (average household size of an owner-occupied unit in 2000 census) for second homeowners, an additional 5,340 people live in the Estes Valley area for a portion of the year.

Housing prices in Loveland and Estes Park have increased as shown in **Table 3.13-6**. However, during the period 2001 through 2010, market activity and home prices have fluctuated, particularly after the peak period of 2006 and 2007. The economic recession in 2008 has had a dampening effect on new construction, but sales activity for existing housing has only declined slightly and is on the upswing.

Table 3.13-6 Residential Sales in Loveland and Estes Park

	Loveland			Estes Park		
	2001	2008	2011	2001	2008	2011
Homes sold	1,711	1,415	1,423	121	190	209
Median sales price	$185,000	$217,000	$215,000	$260,000	$339,000	$313,000
Land sold	103	76	123	47	41	30
Median sales price	$170,000	$125,000	$159,750	$107,500	$140,000	$133,000

Source: Larimer County 2012d.

The majority of the residential units in the Estes Valley house local residents. However, the percentage of second/vacation homes is increasing. According to Colorado Department of Local Affairs, approximately 34 percent of the units in the Estes Valley are vacant, up from 31 percent in 2000. Of these, most are second homes and vacation accommodations occupied only for seasonal or occasional use.

Within the immediate project vicinity, there are approximately 88 residential owners adjacent to the ROW. There also are rural residential and residential subdivisions located within the project vicinity either adjacent to the ROW or in close proximity. The subdivisions generally are located on the eastern or western end of the project vicinity.

Residential subdivisions on the east side of the project vicinity include Newell Lake View subdivision located north of Pinewood Reservoir; Pittington subdivision located just west of Flatiron Reservoir on the north side of County Road 18E; and Yelek, Dallas Benton, and Slota subdivisions, all located near Flatiron Reservoir and County Road 31.

Subdivisions on the west side of the project vicinity near Estes Park include Park Hill subdivision, Ravencrest Heights, and Meadowdale Hills. The largest subdivision is the Meadowdale Hills subdivision, which consists of 165 residential lots ranging in size from one to four acres. Meadowdale Hills, an unincorporated subdivision, is located along the South Line on the north side of U.S. Highway 36, approximately 5 miles outside of the Town of Estes Park. The Larimer County Assessor’s data shows that 121 of the lots have been improved (developed). The Park Hill subdivision also is a single family subdivision within proximity of the existing transmission lines and has approximately 20 single family homes in the subdivision. Both the Meadowdale Hills and Park Hill subdivisions have a number of second home owners. **Table 3.13-7** shows the range of residential values of the properties located within the subdivisions based on the county assessor records. These values may or may not reflect actual market values. Typically assessor values tend to be lower than market values but this is not always the case.

3.13.1.2 Public Services

Public services throughout the project vicinity are provided by various private and public entities, including counties, municipalities, special districts, and private interests. Because of the minimal level of population impacts expected during the construction phase of the project, only public facilities that might potentially be impacted by accidents during transmission line construction are covered in this section. It is assumed that all necessary public services and facilities are available within the project vicinity. In all cases, adequate capacities and service levels exist.

In Larimer County, public services are provided by the county and the incorporated towns or special districts. The Upper Thompson Sanitation District was formed in 1971 and provides wastewater treatment service for the areas surrounding the town of Estes Park. The plant was constructed in 1976 and is located on the western end of the project vicinity. Larimer County, municipal governments, and special districts provide general government and administrative services, sheriff and police protection, road and bridge construction and maintenance, ambulance and fire protection, medical services, and social services.

Loveland and Estes Park provide various city/town services for their local residents. Service capacities generally are adequate for the existing population in all towns. Loveland and Estes Park have maintained stable financial situations in spite of the economic downturn.

Public Safety and Fire Protection

Larimer County Sheriff provides public safety throughout Larimer County, with the main office in Fort Collins. The sheriff's department has 374 employees including sheriff, undersheriff, lieutenants, patrols, investigators, patrol deputies, jailers, detention officers, animal control officers, communications officers, and administrative professionals serving a population of 300,000. A satellite office is located in Estes Park with a Sergeant, a Corporal, and four deputies. The Town of Estes Park has an estimated population of 5,976; however, the Estes Valley has a total population of over 12,000.

The Loveland Police Department has a staff of 117 department members in operations (patrol services), support, investigative and detective services, business, information, and professional standards. The

Estes Park Police Department has a total 23 full time employees including patrol division, community services, and dispatch.

The Loveland Rural Fire Protection District is served by the Loveland Fire Rescue Authority crews and works in partnership in the Big Thompson Canyon area with the Big Thompson Volunteer Fire Department. Loveland Fire Rescue Authority has a three tier work force of full time paid firefighters and fire officers, part time paid firefighters, and volunteer firefighters. The minimum staffing is three crews with three full time personnel, three crews with two full time personnel; the remaining part time or volunteer firefighter staff is utilized to augment the two person crews as available. The staff consists of 80 career members and approximately 20 volunteer firefighters.

The Loveland Fire Rescue Authority and Rural Fire Protection District work collaboratively with Thompson Valley Emergency Medical Services to provide medical care. It also works in partnership with the fire jurisdictions surrounding Loveland, utilizing both automatic and mutual aid for multiple fire crew response to mitigate emergency incidents. Loveland Fire Rescue Authority has 9 fire stations strategically placed within the 190 square miles of the district boundaries, thus maximizing the ability to respond as efficiently and effectively as possible during an emergency. This includes three stations in the Big Thompson Canyon.

The Estes Valley Fire Protection District is comprised of five District Board Members, the Estes Park Volunteer Fire Department & Dive Team, Fire Chief, Training Captain, Fire Marshal, Administrative Assistant, and 21 fire fighters. The Estes Valley Fire Protection District serves a portion of southwestern Larimer County and the Town of Estes Park, encompassing a 66.3-square-mile area. There are two fire stations that serve the Estes Valley community.

McKee Medical Center and Medical Center of the Rockies provide full service hospital service to Loveland and northern Colorado. In addition, Estes Park is served by the Estes Park Medical Center, a 25-bed critical access acute care facility with a 24-hour emergency department, 24-hour ambulance service, emergency air transport, medical/surgical services, obstetrics, home health care, and hospice. The ambulance department is owned by the hospital and provides 24-hour-a-day advanced life support to the community, and responds to approximately 1,500 calls per year.

Thompson Valley Emergency Medical Services operates 10 advanced life support ambulances and has a staff of 55 including three captains and three lieutenants. The District covers 450 square miles located in the southeast corner of Larimer County including the City of Loveland and the project vicinity (approximately 100,000 people).

Table 3.13-7 Residential Values in Subdivisions within the Project Vicinity

Subdivision	Undeveloped Lots	Developed Lots	Total Residential	Use Type	Range of Residential Values	Location
East End near Loveland						
Yelek	2	8- Farm	4	Residential, Farm Utility, Industrial	$300,000 to $1 million+	East of Flatiron Reservoir
Slota	0	1	1	Residential	$246,000*	West of S County Road 31
Dallas Benton	0	1	1	Residential	$196,000*	West of S County Road 31
Pittington	17	4	4	Residential and Grazing Land	$490,000 to $624,100	West of Flatiron Reservoir
Newell Lake View	7	46	46	Single Family, Duplex, Storage	$178,500 to $710,000	North of Pinewood Reservoir
West End near Estes Park						
Meadowdale Hills	44	121	165	Single Family Residential	$115,700 to $715,000	North of U.S. Highway 36 off Pole Hill Road
Ravencrest Heights	5	7	12	Single Family Residential	$145,800 to $595,000	Same vicinity as Meadowdale Hills
Park Hill	3	20	23	Single Family Residential	$141,700 to $703,400	Near Mall Road

*No price range since the value pertains to one property.

Source: Larimer County Assessor 2012a.

3.13.1.3 Environmental Justice

Under EO 12898 (Federal Register 1994), Federal agencies are required to identify and address disproportionately high or adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income populations. A specific consideration of equity and fairness in resource decision-making is encompassed in the issue of environmental justice. As required by law and Title VI, all Federal actions will consider potentially disproportionate negative impacts on minority or low-income communities.

Minimal minority populations are located within the proposed project vicinity. Income levels throughout the project vicinity are diverse. Median household income from the 2007 to 2011 timeframe was estimated at $57,587 for Estes Park and $54,763 for Loveland (U.S. Census Bureau 2012a).

The most recent poverty status statistics are from 2011 U.S. Census Bureau data. These data showed poverty status for 14.2 percent of the population in Larimer County, 11.6 percent in Loveland, 5.6 percent in Estes Park, and 13.5 percent for the State of Colorado (U.S. Census Bureau 2012a). Low income areas are dispersed throughout the region including the project vicinity. People with poverty status may reside along the route, but not in disproportionate numbers. **Table 3.13-8** highlights demographic statistics for identifying potential areas of concern.

Table 3.13-8 2011 Census Community Statistics for Environmental Justice Analysis

Population	Larimer County	Loveland	Estes Park (2007-2011)	State of Colorado	Census Tract 28.01*	Census Tract 19.03*
Total population (2011 estimated)	305,525	68,203	5,976	5,116,796	3,135	3,703
% below poverty	14.2	11.6	5.6	13.5	7.0	2.9
% White	92.7	88.6	98.1	87.4	94.3	97.2
% Black	1.5	1.9	0.3	5.0	0.4	0
% American Indian	1.8	1.9	2.0	2.3	0.2	0
% Asian	2.9	5.1	0	3.7	0	2.6
% Native Hawaiian or Pacific Islander	0.2	0	0	0.3	0	0
% persons reporting more than one race	1.7	1.1	1.2	3.4	4.4	0.2
% Hispanic origin	10.8	9.5	7.2	20.9	3.5	0.9

* Census Tract 28.01 encompasses the town of Estes Park. Census Tract 19.03 encompasses the remainder of the project vicinity.

Source: U.S. Census Bureau 2012a.

3.14 Electrical Effects and Human Health

3.14.1 Affected Environment

Electrical effects and related human potential health issues described in this section include public health concerns regarding long-term exposures to EMF and corona effects.

Current and voltage are required to transmit electrical energy over a transmission line. Current is flow of an electrical charge measured in amperes and is the source of a magnetic field. Voltage represents the potential for an electrical charge to do work expressed in units of volts or kV and is the source of an electrical field. The electrical effects of the proposed 115-kV transmission lines rebuild can be characterized as "corona effects" and "field effects" that are associated with current-induced magnetic fields and voltage-induced electrical fields.

3.14.1.1 Corona Effects

Corona is the electrical breakdown of air into charged particles caused by the electrical field at the surface of conductors, insulators, and hardware of energized high-voltage transmission lines. Corona occurs where the field has been enhanced by protrusions, such as nicks, insects, or water drops. Transmission line corona varies with atmospheric conditions, being more intense during wet weather. During fair weather, these sources are few and corona is minor. Effects of corona are audible noise, visible light, radio and television interference, and photochemical oxidants.

It has been hypothesized that corona creates ions that can be dispersed by winds, inhaled and deposited on the skin and in the lung leading to adverse human effects (Fews et al. 1999). The Independent Advisory Group on Non-ionizing Radiation (National Radiological Protection Board 2004) concluded that:

> *"…it seems unlikely that corona ions would have more than a small effect on the long-term health risks associated with particulate air pollutants, even in the individuals who are most affected. In public health terms, the proportionate impact will be even lower because only a small fraction of the general population live or work close to sources of corona ions."*

Subsequent reviews have reaffirmed the lack of correlation between exposure to EMF or corona ions and adverse health effects (Energy Network Association 2009; World Health Organization 2007).

Audible Noise

Corona-generated audible noise generally is characterized as a crackling/hissing noise, most noticeable during wet-weather conditions. There are no design-specific regulations to limit audible noise from transmission lines. Transmission line audible noise is measured and predicted in decibels (A-weighted), or dBA. A typical 115-kV transmission line would produce a noise level of approximately 15.0 dBA at the edge of the ROW (Enterprise Park to Crooked Lane Environmental Assessment 2012). Some typical noise levels are: light automobile traffic at 100 feet, 50 dBA; an operating air conditioning unit at 20 feet, 60 dBA; and freeway traffic or freight train at 50 feet, 70 dBA. This last level represents the point at which a contribution to hearing impairment begins.

Visible Light

Corona can be seen as bluish tufts or streamers surrounding the conductor under conditions of darkness, and probably only with the aid of telescopic devices. Light would be difficult to detect at the operating voltage of 115 kV.

Radio and Television Interference

Radio and television interference stemming from transmission lines, are often caused by loose or worn hardware. Additionally, corona-generated radio interference is most likely to affect the amplitude modulated (AM) broadcast band; frequency modulated (FM) radio reception is rarely affected. Only AM-radio receivers near transmission lines are affected by radio interference. An acceptable level of maximum fair-weather radio interference at the edge of a ROW is 40 to 45 decibels above one microvolt per meter. Average levels during foul weather are typically 16 to 22 decibels higher than average fair-weather levels. Television interference due to corona occurs during foul weather and generally is caused by transmission lines with voltage more than 345 kV.

Photochemical Oxidants

When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place, producing small amounts of O_3 and other oxidants. Approximately 90 percent of oxidants are ozone and the remainder are mainly NO_X.

The NAAQS for photochemical oxidants, of which O_3 is the principal component, is 235 μg/m^3 or 120 ppb.

3.14.1.2 Field Effects

The electric field created by high voltage transmission lines extends from the energized conductor to other conducting objects. Resulting field effects include induced current and voltage in the ground, structures, vegetation, buildings, vehicles, and people near the transmission line; spark discharge shocks; steady state current shocks; field perception at ground level; and magnetic field. The electric field or voltage gradient is expressed in units of volts per meter or kVs per meter.

There are no Federal standards for transmission line electric fields. Several states have set guidelines for EMF levels that must be met for newly constructed transmission lines.

Primary Shocks

The greatest hazard from a transmission line is primary shocks or direct electrical contact with the conductors. Primary shocks can result in physiological harm. The lowest category of primary shocks is “let go,” which represents the steady-state current that cannot be released voluntarily. The maximum induced current (milliampere) criterion for vehicles closely approximates the estimated 4.5-milliampere let-go threshold for 0.5 percent of children (Keesey and Letcher 1969).

Steady-State Current Shocks

Steady-state currents are those that flow when a person contacts an ungrounded object, providing a path for the induced current to flow to the ground. Secondary shocks could cause an involuntary and potentially harmful movement, but cause no direct physiological harm.

Induced Current and Voltage

When a conducting object, such as a vehicle or person, is placed in an electric field, currents and voltages are induced in that object. The magnitude of the induced current depends on the strength of the electric field and the size and shape of the object. Voltage induction and the creation of currents in long conducting objects, such as fences and pipelines, would be possible near the proposed transmission line. If the object is grounded, the induced current flows into the earth and is called the short-circuit current of the object. In this case, voltage on the object is effectively zero. If the object is insulated (not grounded), then it assumes some voltage relative to ground. These induced currents and voltages represent a potential source of nuisance shocks near a high voltage transmission line.

Cardiac Pacemakers

Overall risk to cardiac pacemaker wearers as a result of current and voltage induction warrant individual discussion. Induced current and voltage represent a possible source of interference to pacemakers. Internal currents can be caused by electric fields, magnetic fields, or by direct contact. The interference threshold for the most sensitive pacemaker is estimated at 3.4 kVs per meter.

Spark-Discharge Shocks

Induced voltage appears on objects that conduct electricity, such as vehicles, fences, and railroad tracks, when there is an inadequate ground. If voltage were sufficiently high, a spark-discharge shock would occur upon contact with the object.

Carrying or handling conducting objects such as irrigation pipe under the proposed line could result in spark discharges that are a nuisance. The primary hazard with irrigation pipe, however, is direct contact with conductors.

Field Perception

When the electric field under a transmission line is sufficiently high, persons standing under or near the line may perceive the raising of hair on an upraised hand.

Magnetic Field

Magnetic field strength is expressed in terms of teslas or gauss. While electrical fields can be easily shielded or reduced by walls and other objects, magnetic fields are not and they are more likely to penetrate into the body. Typical homes produce background magnetic field levels (away from appliances and wiring) that range from 0.5 mG to 4 mG, with an average value of 0.9 mG. The Colorado Public Utilities Commission states that magnetic field levels of less than 150 mG at the edge of a transmission line ROW are reasonable. The existing 115-kV transmission lines produce magnetic fields of 5.3 mG at the edge of the ROW, well below levels set by the Utilities Commission.

3.14.1.3 Long-term Exposure to Electric and Magnetic Fields

Questions concerning effects of long-term exposure to electric fields from transmission lines on human health are a controversial subject that has been raised primarily in hearings related to 500-kV and 765-kV transmission lines. These high voltage lines induce electrical fields at ground levels more than twice the maximum electrical field estimated under the proposed 115-kV Estes-Flatiron Transmission Lines Rebuild Project. Although available evidence has not established that induced electrical fields pose a measurable health hazard to exposed humans, the same evidence does not prove there is no hazard. Therefore, in light of the present uncertainty, it is Western's policy to design and construct transmission lines that reduce the EMF to the maximum extent feasible.

While considerable uncertainty remains about the EMF/health effects issue, the following facts have been established from evaluating the results and trends of EMF-related research:

- Any exposure-related health risks to an exposed individual would be small.
- The most biologically significant types of exposures have not been established.
- Most health concerns have been related to magnetic fields.
- The measures employed for field reduction can affect line safety, reliability, efficiency, and maintainability, depending upon the type and extent of such measures.

No Federal regulations have established environmental limits on the strengths of EMF from power lines. Some states have set limits on EMF from newly constructed lines, not based on factual health data. Below are brief summaries of some past and current studies on EMF health studies:

World Health Organization: Electromagnetic Fields (2013) concludes that despite extensive research, to date there is no evidence to conclude that exposure to low level EMF is harmful to human health. Furthermore, current public concern focuses on possible long-term health effects caused by exposure to EMF at levels below those required to trigger acute biological responses.

Electric and Magnetic Fields from 60-Hz Powerlines: What do We Know about Possible Health Risks? Morgan (1989) concluded that 60-Hz EMF do not pose a significant risk to agriculture, animals, or ecosystems.

The Electric Power Research Institute (1998) (along with the Veterans Affairs Medical Center and the Bonneville Power Administration) conducted a four-phase study that exposed sheep to fields from a

500-kV transmission line. The research was done to determine whether long-term EMF exposures impacted melatonin levels, immune function, and animal health. Early phase studies of exposed groups of animals showed no impact on melatonin levels. In later studies, immune cells were monitored in two exposed groups of animals to find out if exposure to fields resulted in immune cells reduction in the exposed animals. Cell reduction would affect immune function and animal health. Final results showed that immune cells were not consistently or significantly reduced in exposed sheep.

A team of Canadian researchers led by McBride reported in the May 1999 issue of the American Journal of Epidemiology that if there is a risk (of childhood leukemia from EMF exposure) it is undetectable through epidemiological studies.

A study sponsored by the National Institutes of Health, National Institute of Environmental Health Sciences (NIEHS) was published in June 1999. The *Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields*, stated that all theories concerning biological effects of EMF "suffer from a lack of detailed, quantitative knowledge," and concluded that laboratory data using a variety of animals, such as non-human primates, pigeons, and rodents, are inadequate to conclude that EMF field exposure alters cancer pattern rate and has not been adequately demonstrated for non-cancer health issues (e.g., birth defects) (NIEHS 1999). An additional NIEHS publication from 2002 detailing further studies and EMF information is located in **Appendix D** (http://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf). As a precaution regarding human health issues, the report recommends that the electrical field at the edge of a ROW measured one meter aboveground not exceed 1-kV per meter, and considered this recommendation conservative.

3.15 Cultural Resources and Native American Traditional Values

Cultural resources are those aspects of the physical environment that relate to human culture, society, and cultural institutions that hold communities together and link them to their surroundings. They include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic sites, buildings, structures, objects, districts, natural features, and biota, which are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices, and are associated with community values and institutions.

3.15.1 Cultural Resource Types

Cultural resources include prehistoric and historic sites and ethnographic resources. Prehistoric sites show use or modification by people before the establishment of a European presence and can include, but are not limited to, lithic scatters, open camps, lithic procurement areas, and features such as hearths, rock alignments, and rock art. Historic sites show use or modification since the arrival of Europeans and can include, but are not limited to, roads, trails, railroad grades, homesteads, canals, and architecture. Cultural resources that have a direct association with a living culture may be considered ethnographic resources. The reader is referred to Section 3.15.2, Native American Traditional Values, for the discussion of ethnographic resources.

3.15.1.1 Regulatory Framework

Federal historic preservation laws provide a legal framework for documentation, evaluation, and protection of cultural resources that may be affected by Federal undertakings. NEPA states that Federal agencies shall take into consideration impacts to the environment with respect to an array of resources, and that alternatives must be considered. The courts have made clear that cultural resources are regarded as part of the environment and to be considered under NEPA. The NHPA of 1966, as amended, established the Advisory Council on Historic Preservation and the NRHP, and mandates that Federal agencies consider an undertaking's effects on cultural resources that are listed or eligible for listing on the NRHP. Cultural resources listed on or eligible for inclusion on the NRHP are referred to as historic properties.

Section 106 of the NHPA establishes a four-step review process by which historic properties are given consideration during the conduct of Federal undertakings. The four steps are as follows:

- Initiate the Section 106 process by establishing the undertaking, defining the Area of Potential Effect (APE), and consulting with the appropriate parties, including Federal agencies, SHPOs, Advisory Council on Historic Preservation, Native American tribes, local governments, interested parties, and the public;
- Identify historic properties through inventory and evaluation;
- Determine effects to historic properties using the criteria of adverse effects found in 36 CFR 800.5; and
- If adverse effects occur, take appropriate measures to avoid, minimize, or mitigate those effects.

NRHP Criteria of Eligibility

Cultural resources are assessed for integrity or as having unique qualities that make the resources eligible for the NRHP, which provides for management and protection of these resources. There are three main standards that a cultural resource must meet to qualify for listing on the NRHP: age, integrity, and significance. To meet the age criteria, the resource generally must be at least 50 years old. To meet the integrity criteria, the resources must possess the applicable aspects of integrity, which may include location, design, setting, materials, workmanship, feeling, and association (36 CFR 60.4). Finally, the resource must be significant according to one or more of the following criteria:

- Criterion A – Be associated with events that have made a significant contribution to the broad patterns of history;
- Criterion B – Be associated with the lives of persons significant in history;
- Criterion C – Embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
- Criterion D – Have yielded, or may be likely to yield, information important in prehistory or history (36 CFR 60.4).

3.15.1.2 Cultural Resources Investigations in the Project Vicinity

Cultural resource investigations were performed along existing transmission lines and along routing segments outside of the existing transmission line ROWs, except portions of the underground variants and where rights-of-entry were not obtained. For the purposes of this EIS, the results of the surveys are considered to be representative of sites that occur in the project vicinity.

In September 2011, Alpine Archaeological Consultants, Inc. (Alpine) conducted a Class I files search through the Colorado Office of Archaeology and Historic Preservation to identify previously conducted cultural resources inventories and previously recorded cultural resources within 1 mile of the existing transmission lines (Satterwhite 2012). In addition, General Land Office maps, USGS quadrangles, and historic aerial photographs were reviewed to identify potential historic-era resources. The files search and map/aerial photograph review identified a total of 23 previously recorded cultural resources within 300 feet of the existing transmission lines ROW and 20 previously conducted inventories within or intersecting the overall files search study area. With the exception of one site (prehistoric lithic scatter), all of the previously recorded sites are identified as historic-era resources, most of which are transmission lines and canals.

In August and September 2011, Alpine conducted a Class III pedestrian inventory which covered a total of 27.8 miles of the transmission line ROW, 14.25 miles of access roads, and 1.99 miles of areas located outside of the existing transmission lines (Satterwhite 2012). The survey corridor for the transmission line ROW measured 150 feet centered on the transmission line centerline and measured 300 feet centered on the transmission line centerline for the areas located outside of the existing transmission lines. For the existing access roads, the survey corridor measured 50 feet (centered on the road) on private land and 100 feet (centered on the road) on Federal and state lands. The inventory resulted in the documentation of four newly recorded historic sites and the re-evaluation of nine previously recorded historic sites. In addition, five isolated finds were documented. **Table 3.15-1** lists the historic sites documented during the Class III inventory and their NRHP-eligibility status.

Table 3.15-1 Sites Documented During the 2011 Class III Inventory

Site Number	Site Type	NRHP-Eligibility Determination by Western
5LR801	Rowe Cabin	Determined not eligible
5LR2148	Log cabin	Determined not eligible
5LR3992\ 5LR9390	Pole Hill Power Plant and Switchyard	Within existing CBT project Historic District; contributing element – determined eligible
5LR3994	Pole Hill Afterbay Dam	Within existing CBT project Historic District; contributing element – determined eligible
5LR3995	Little Hell Creek Diversion Dam	Within existing CBT project Historic District; contributing element – determined eligible
5LR4003	Pole Hill Canal	Within existing CBT project Historic District; contributing element – determined eligible
5LR9388	F-PH Transmission Line	Determined not eligible
5LR9453	E-PH Transmission Line	Determined eligible (only steel lattice-pole segments)
5LR9454	E-LS TAP	Determined eligible (only steel lattice-pole segments)
5LR12920	Ranch complex	Determined eligible
5LR12921	Mine adit	Determined not eligible
5LR12922	Log cabin and associated features	Determined eligible
5LR12923	Can scatter	Determined not eligible

Source: Satterwhite 2012.

Western submitted the Class III inventory report and their determination of NRHP eligibility to the Colorado SHPO for review and concurrence. In a letter dated June 21, 2012, the SHPO concurred with Western's determination that sites 5LR12920 and 5LR12922 are eligible for inclusion on the NRHP and that sites 5LR3992, 5LR3994, 5LR3995, and 5LR4003 are contributing elements to the CBT Historic District (Nichols 2012). In addition, the SHPO concurred with Western's determination that sites 5LR2148, 5LR12921, and 5LR12923 are not eligible for the NRHP and that four of the five isolated finds are not eligible. The SHPO did not concur with Western's determination that 5LR801 and one of the isolated finds were not eligible for the NRHP. Additional documentation is required for the site and isolated find. Until the additional work is completed, the SHPO recommends a finding of "needs data" for these two resources. As for the remaining three sites (5LR9388, 5LR9453, 5LR9454), the SHPO requested completion of additional management forms.

In May 2013, Alpine conducted an additional Class III pedestrian inventory of proposed reroutes along the E-LS, E-PH, and F-PH 115-kV transmission lines and portions of the existing transmission lines that had not been previously inventoried (Mullen et al. 2013). A total of 4.92 miles of proposed reroutes on private land and 0.24 mile of the existing E-PH transmission line on National Forest System land (for Alternative D) were inventoried by Alpine. In addition, Alpine updated the site forms for three inventoried transmission lines (E-PH, E-LS, and F-PH) that initially had been recorded on Architectural Inventory forms in 1998, but were not considered adequate by the SHPO.

Prior the Class III inventory of the reroutes, Alpine conducted a literature review of the data available at the Colorado Office of Archaeology and Historic Preservation to identify previously conducted cultural resources inventories and previously recorded cultural resources within 1 mile of the existing transmission lines. In addition, General Land Office maps were reviewed to identify potential historic-era resources. The files search and map review identified a total of seven previously recorded cultural resources within 300 feet of the existing transmission lines and eight previously conducted inventories within or intersecting the overall files search study area. All of the previously recorded cultural resources are historic-era resources (**Table 3.15-2**). Of the seven sites, only one (Olympus Siphon [5LR4004]) is not intersected by the existing transmission lines.

Table 3.15-2 Sites Identified During the 2013 Class I Literature Review

Site Number	Site Type	NRHP-Eligibility
5LR827	Pinewood School	No NRHP assessment found
5LR3985	Rattlesnake Dame and Pinewood Reservoir	Within existing CBT project Historic District; contributing element – determined eligible
5LR4000	Bald Mountain Pressure Tunnel	Within existing CBT project Historic District; contributing element – determined eligible
5LR4004	Olympus Siphon	Within existing CBT project Historic District; contributing element – determined eligible
5LR9388	F-PH Transmission Line	Determined not eligible
5LR9453	E-PH Transmission Line	Determined eligible (only steel lattice-pole segments)
5LR9454	E-LS	Determined eligible (only steel lattice-pole segments)

Source: Mullen et al. 2013.

During the Class III pedestrian inventory, Alpine recorded site 5LR13201 (John Grieg Homestead), re-evaluated site 5LR827 (Pinewood School), and recorded one historic isolated find. Of the two sites and isolated finds, Alpine recommended the John Grieg Homestead as eligible for the NRHP; the remaining site is recommended as not eligible. Isolated finds by definition are not eligible for the NRHP. The Pinewood School was the only previously recorded site revisited during the inventory. Of the remaining five previously recorded sites, the Rattlesnake Dam and Pinewood Reservoir (5LR3985) and Bald Mountain Pressure Tunnel (5LR4000) were not revisited because the sites previously had been misplotted and are actually located outside of the inventory area; Olympus Siphon (5LR4004) is entirely underground; and, the three transmission lines (5LR9388, 5LR9453, and 5LR9454) were recorded as part of the previous inventory conducted by Alpine in 2011. The results of the Class III inventory were compiled in an inventory report, which was submitted to the USFS and BOR for review and concurrence. Concurrence was received from the BOR on December 2, 2013 (Ronca 2013); as of this date, no concurrence has been received from the USFS. The final draft was submitted to the SHPO for review, and SHPO concurrence was received on February 21, 2014 (Nichols 2014).

3.15.2 Native American Traditional Values

Ethnographic resources are associated with the cultural practices, beliefs, and traditional history of a community. Examples of ethnographic resources include places in oral histories or myths, such as particular rock formations, the confluence of two rivers, or a rock cairn; large areas, such as landscapes and viewscapes; sacred sites and places used for religious practices; social or traditional gathering areas, such as dance areas; natural resources, such as plant materials or clay deposits used for arts, crafts, or ceremonies; and places and natural resources traditionally used for non-ceremonial uses, such as trails or camping locations.

If a resource has been identified through ethnographic research as having importance in traditional cultural practices and the continuing cultural identity of a community, it may be considered a traditional cultural property. The term “traditional cultural property” first came into use within the Federal legal framework for historic preservation and cultural resource management in an attempt to categorize historic properties containing traditional cultural significance. “Traditional cultural significance” refers to those beliefs, customs, and practices of a living community of people that have been passed down through the generations, usually orally or through practice. The traditional cultural significance of a historic property derives its significance from the role the property plays in a community’s historically rooted beliefs, customs, and practices. Examples of properties possessing such significance include a location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world; or a location where Native American religious practitioners have historically gone, and are known or thought to go today, to perform ceremonial activities in accordance with traditional cultural practice.

3.15.2.1 Regulatory Framework

Specific statutes, regulations, and EOs guide consultation with Native Americans to identify cultural resources important to tribes and to address tribal concerns about potential impacts to these resources. These include the NEPA, NHPA, American Indian Religious Freedom Act of 1978, Native American Graves Protection and Repatriation Act of 1990, and EOs 13007, Indian Sacred Sites, and 13175, Consultation and Coordination with Indian Tribal Governments. These statutes and regulations direct Federal agencies to consult with Native American tribal leaders and others knowledgeable about cultural resources that are important to them and their way of life. Consultation is conducted for Federal actions, such as decisions about the proposed project, that have the potential to affect locations of traditional concern, areas where religious ceremonies are conducted, areas of traditional cultural uses, archaeological sites, and other modern and ancestral tribal resources.

The DOE’s policy on the Management of Cultural Resources (DOE P141.1) and DOE’s American Indian and Alaska Native Tribal Government Policy require Western to conduct government-to-government consultation for any action with a potential impact to Native American tribes. Western understands that meaningful consultation and coordination with Native American tribes are not only good practices, but also lead to better government decisions.

The 1992 NHPA amendments place major emphasis on the role of Native American groups in the Section 106 review process. NHPA implementing regulations incorporate specific provisions for Federal agencies to involve Native American groups in land or resource management decisions and for consulting with these groups throughout the process. Before making decisions or approving actions that could result in changes in land use, physical changes to lands or resources, changes in access or alienation of lands, Federal agencies must determine whether Native American interests would be affected, observe pertinent consultation requirements, and document how this was done.

Native American tribes that the proposed project potentially may impact include the Cheyenne and Arapaho tribes of Oklahoma, Southern Ute Indian Tribe, Northern Arapaho Tribe of the Wind River Reservation, Ute Indian Tribe of the Uintah and Ouray Reservation, Northern Cheyenne Tribe, Eastern Shoshone Tribe, and Oglala Sioux Tribe. On November 17, 2011, Western initiated government-to-government consultation with the seven listed tribes as part of the Estes-Flatiron Transmission Line Project EA process. The letter was sent to inform the tribes of the previously proposed project and to solicit any concerns they may have regarding the possible presence of any places of traditional religious or cultural importance within or near the project area. In the letter, Western also informed the tribes of public meetings in Estes Park tentatively scheduled for November 29 and 30, 2011. On April 12, 2013, a second letter was sent to the tribes notifying the intent to begin the EIS process; it included the NOI (DOE 2012 and **Appendix A**). On July 16, 2012, a third letter was sent to the seven tribes as part of the Estes-Flatiron Transmission Line Project EIS process. The letter was sent to invite the tribes to participate in the project's EIS scoping meetings held in Loveland and Estes Park, Colorado, on August 6 and 7, 2012, respectively. None of the tribes responded to the letter or attended the public scoping meetings. On September 12, 2012, a fourth letter was sent to the tribes describing the workshops process and inviting them to participate. No response was received to the fourth letter, and no representatives from the tribes attended the workshops. On August 21, 2013, Western sent a fifth letter to the seven tribes informing them of the future release of the Draft EIS. Also included in the letter was information on 1) distribution of the Draft EIS via the project website and a compact disk; 2) the comment period and how to submit comments; and, 3) public meetings and hearings to be held early in the comment period. As of this date, none of the tribes have responded to any of the letters.

3.15.2.2 Native American Traditional Values Investigations in the Project Vicinity

The affected environment for Native American traditional values is the same as for cultural resources and includes the entire project vicinity, as well as a sufficient surrounding area to allow discussion of the regional prehistoric and historic context of tribal resources.

As of this date, no places of traditional religious or cultural importance to the seven contacted tribes have been identified in or near the project vicinity either through the government-to-government consultation efforts or Class III inventories. Opportunities for the identification of locations of possible traditional religious and cultural importance to the tribes that may be affected by the proposed project will remain open throughout the consultation process, which currently is ongoing and would continue through project implementation.

3.16 Transportation

Travel routes in the western project area are numerous and include U.S. Highways 36 and 34, which are major transportation corridors between Rocky Mountain National Park and the Front Range cities of Loveland, Fort Collins, Boulder and Denver. Travel routes in the central part of the project area are limited, with Pole Hill Road (USFS Road 122) being the only east-west route across the project area and National Forest System lands. Other USFS roads providing access to structures on National Forest System lands include USFS Road 247.D (Panorama Peak Spur D), USFS Road 247.A (Panorama Peak Spur A), and USFS Road 122.A (Solitude Creek). USFS roads that provide access to Western's ROWs are all presently classified as ML2 and Traffic Service Level "C". ML2 is assigned to roads open for use by high clearance vehicles where passenger car use is not considered. Traffic Service Level C provides for interrupted traffic flow, limited passing facilities, and low design speeds. In addition, there are approximately 0.6 mile of non-system access spurs that Western uses to access existing structures on National Forest System land.

Mall Road, a Larimer County road, is located in the far western part of the project area and connects U.S. Highways 34 and 36. In the eastern part of the project area, several county roads, including County Road 18E (aka Pole Hill Road) and County Road 31 provide access. Local roads in residential areas are either paved or gravel/dirt, and well-maintained. **Table 3.16-1** details the 2011 annual average daily traffic on U.S. Highways 36 and 34 near the western end of the project area, as well as County Road 18E (Pole Hill Road) near Pinewood and Flatirons Reservoirs.

Permitted uses of smaller roads in the area include access for the maintenance of electrical power lines, substations, pipelines, communication towers and other utilities. Traffic volumes to these facilities are low and access to these facilities is infrequent. Other permitted uses include those associated with National Forest activities.

The primary U.S. and state routes are hard surfaced and well maintained. Larimer County roads are paved or gravel and in good condition. Roads with direct access to the transmission lines are not heavily used. The Pole Hill Road associated with the existing transmission lines and other linear facilities, such as utility ROW managed by Western, provide access. Traveling west from Panorama Point to the Meadowdale Hills subdivision, the Pole Hill Road is predominantly a 4-wheel drive road and inaccessible to any other vehicles.

Table 3.16-1 Summary of Current Traffic near the Project Area

Route	2011 Annual Average Daily Traffic	2011 % Trucks
U.S. Highway 36 east of Mall Road, east of Estes Park	5,900	5
U.S. Highway 34 east of Mall Road, east of Estes Park	5,000	2
Mall Road, east of Estes Park	400-2,000	NA
County Road 18 E (Pole Hill Road) near Pinewood Reservoir	400-2,000	NA

Source: Colorado Department of Transportation 2012; Larimer County Road and Bridge Department 2012e.

3.17 Accidents and Intentional Destructive Acts

The proposed project may be the subject of intentional destructive acts ranging from vandalism and theft to sabotage and acts of terrorism intended to disable a line or project. The former, more minor type of act is far more likely for such projects in general and particularly for those like the proposed project, which are in relatively remote areas and serve relatively small populations. Vandalism is more likely to take place in relatively remote areas, and involve acts of opportunity (e.g., shooting out transmission line insulators) than premeditated acts. Intentional sabotage or terrorist acts would not be expected to target these electrical facilities, where a loss of service would not have substantial regional impacts. Accidents, such as a disruption to power from maintenance activities, could occur at any point along the lines.

The results of intentional destructive acts could be wide ranging or more localized, depending on the nature and location of the acts, and would be similar to outages caused by natural phenomena such as storms and ice buildup or accidents. If a transmission line was out of service as a result of a destructive act, residences could lose lighting, heating, or air conditioning. Electrical appliances would be non-functional until electrical service was restored. In such cases, perishable food could spoil residents would be inconvenienced, and could experience discomfort during cold or hot weather. However, some residents may already have backup generators and alternate means of refrigeration, cooking, and heating. Also, if the residences would be supplied with electricity from two or more sources, there may be no noticeable interruption or only minor, temporary interruptions if the alternate sources were not impacted.

Intentional destructive acts and accidents also can result in commercial and industrial electricity users losing lighting and ventilation, but also could include the shutting down of office equipment, computers, cash registers, elevators, heavy machinery, food preparation equipment, and refrigeration. Some commercial operations could be forced to shut down temporarily from a loss of power or concerns about safety. Municipalities could be affected by the shutting down of traffic signals, while city offices could have to close temporarily. Police and fire services could be affected if communication systems shut down. City services, such as sewer and water systems, could be affected by extended outages. Loss of electrical service at hospitals would be of special concern as it could be life threatening. Such effects might be mitigated at hospitals and for other critical uses through the use of temporary backup power (e.g., from a diesel or gas-powered generator).

In addition to the effects from loss of service, destructive acts or accidents could cause environmental effects from damage to the facilities. A possible effect would be fire ignition, should conductors be brought down.

4.0 Environmental Impacts

4.1 Introduction

This chapter describes the anticipated direct and indirect impacts of the alternatives and is organized in parallel with Chapter 3.0. The analysis of potential impacts from the proposed project alternatives assumed the implementation of the SCPs that would be implemented in association with the project. Mitigation measures developed in response to anticipated impacts are recommended for individual resources, and are discussed at the end of each resource section. The analysis of the potentially affected resources is based on the professional judgment and experience of Western, USFS, and EIS contractor resource specialists; discussions with other agency resource experts and professionals; literature reviews; and field trips to the study area by resource personnel. The level of analysis is commensurate with the expected level of potential impacts.

The goal of this chapter is to disclose, to the greatest extent possible, the effects of each alternative on the affected resources. If quantitative estimates are not possible, qualitative estimates are provided to facilitate the comparison of alternatives by the public and decision makers.

4.1.1 Impact Thresholds

4.1.1.1 Impact Type

Impact type classifies the effect as direct, indirect, or cumulative, and then determines whether the effect would result in beneficial or adverse effects.

Direct: Effect caused by the alternative and occurs in the same time and place (e.g., removal of vegetation, use of machinery, etc.).

Indirect: Effect caused by the alternative is later in time or farther removed in distance, but is still reasonably foreseeable (e.g., increased development in the area, accelerated erosion).

Cumulative: Incremental effect caused by the alternative when added to other past, present, and reasonably foreseeable future actions (e.g., combined effect of project and other actions). Cumulative effects are addressed in Chapter 5.0.

4.1.1.2 Impact Duration

Describes the length of time an effect would occur as short- or long-term.

Short-term: Lasting no longer than the immediate 1- to 5-year project implementation period (e.g., construction period, build-out period).

Long-term: Lasting beyond the implementation period (beyond 5 years), typically extending beyond a decade or indefinitely.

4.1.1.3 Impact Intensity

Intensity describes the degree, level, or significance of an effect as no effect, negligible, minor, moderate, or significant.

No effect: No discernible effect.

Negligible: Effect is at the lowest level of detection and causes very little or no disturbance or improvement.

Minor: Effect that is slight but detectable, with some perceptible effects of disturbance or improvement.

Moderate: Effect is readily apparent and has measurable effects of disturbance or improvement.

Significant: Effect is readily apparent and has measurable effects of disturbance or improvement that are of local, regional, or global importance; or sets a precedent for future project undertakings by Federal agencies. The significance criteria or threshold is determined on an individual resource basis; significance criteria are provided in each resource section.

4.1.2 Mitigation Measures

Potential mitigation measures are described in each resource section and will be considered by Western for final determination after public review, input, and recommendation.

4.1.3 Residual Impacts

After mitigation measures are taken in to consideration, the residual impacts are what remains and is described for each resource. Irreversible and irretrievable commitments of resources are the obligated resources or impacts that cannot be reclaimed. The selection of a transmission line ROW action alternative would likely result in an irreversible commitment of land and management of the ROW for the life of the transmission line. However there are no irretrievable commitments that cannot be reclaimed at some future date if the transmission line were removed and the land and resources reclaimed.

The relationship between the short-term use and long-term productivity also is described in Chapter 4.0.

4.2 Air Quality

The impact analysis area for impacts to air quality includes the area within 3.1 miles (5 kilometers), of the project boundaries. Visibility impacts to Class I areas are analyzed based on the proximity of Rocky Mountain National Park. No issues of concern were identified by Western through internal scoping, consultation with coordinating agencies, or through comments provided during public scoping. The following discussion is related to potential impacts to air quality associated with:

- Air pollutants emitted from the tailpipes of construction equipment, including criteria pollutants and greenhouse gas emissions;
- Fugitive dust generated during construction and facility maintenance;
- Windblown dust generated due to wind erosion of disturbed surfaces;
- Impairment of visibility conditions in Class 1 areas (Rocky Mountain National Park); and
- Conformity requirements in nonattainment areas.

4.2.1 Methodology

Impacts to air quality include changes in criteria pollutants including fugitive dust emissions, emissions of hazardous air pollutants and greenhouse gas emissions. Generally, minor surface-based particulate emissions have maximum impact levels within 1,640 feet (500 meters) of the source, and do not have noticeable effects (i.e., greater than 1 $\mu g/m^3$) in areas beyond 3.1 miles (5 kilometers). For the estimation of air quality related impacts, the methodology depends on the activity (construction equipment, windblown dust, etc.) and the type of air impacts (criteria emissions, greenhouse gases, etc.). The activity/air impact combinations are grouped together based on the issues identified above. **Table 4.2-1** lists the relevant management considerations for air quality. The calculation methodology and assumptions for analysis for each activity affecting air quality are described below.

Table 4.2-1 Relevant Management Considerations for Air Quality

Resource Topic	Management Considerations
NAAQS	Compliance with NAAQS and state standards
Visibility	Federal guidelines for visibility impairment
Atmospheric Deposition	Federal guidelines for atmospheric deposition
Greenhouse gas	Climate change

NAAQS = National Ambient Air Quality Standards.

4.2.2 Significance Criteria

A significant impact on air quality would result if any of the following were to occur from constructing the project:

- Predicted concentrations of criteria air pollutants exceed Colorado or Federal Ambient Air Quality Standards (AAQS);
- Predicted concentrations exceed the maximum allowable increments for PM_{10}, $PM_{2.5}$, NO_2, or $SO_{2;}$ or
- Predicted air pollutant emissions that would result in a change in visibility that would exceed Class I standards.

4.2.2.1 Fugitive Dust Emissions from Construction Equipment and Facility Maintenance

Fugitive dust is lofted into the air by construction equipment during many types of activities: driving over unpaved surfaces, excavation, and transfer of excavated material from one place to another. The EPA has developed a generic emission factor of 1.2 tons per acre per month for fugitive dust that includes all construction activities (EPA 1995). The emission calculations for fugitive dust associated with ROW construction activities are based on the estimated acres of land actively undergoing construction and emission factors for heavy construction operations from the EPA (EPA 1995). The estimate of area actively constructed on any given day includes the transmission line ROW, temporary construction staging areas, and access roads. However, all of this area would not be undergoing construction simultaneously; for the purposes of project emission calculations, it is estimated that approximately 5 percent of the disturbed acreage would be under active construction. Fugitive dust emissions during construction would be controlled as specified in the SCPs. For the purposes of emission calculations, the estimated fugitive dust emissions are assumed to be reduced 50 percent by either natural precipitation or the use of appropriate control measures such as watering as specified in SCP 14.

Localized air quality emissions at a given location due to construction activities are expected to be short-term (i.e., less than 1 year), consistent with the project schedule. No construction or operating permits for stationary sources, such as batch plants or operating permits for larger combustion sources, are expected to be required for this project. Existing concrete batch plants would already have any necessary operating permits. In the case of portable concrete batch plants, should such facilities be used, it is likely that it would be on a contract basis and as such, air pollutant source permitting would be the responsibility of the plant owner. Based on throughput capacity, the owner may be required to comply with New Source Performance Standards set forth in 40 CFR Part 60, Subpart OOO. Specifically, portable sand and gravel and crushed stone plants are subject to Subpart OOO if maximum design capacities of greater than 150 tons per hour (based on the combined capacity of all initial or primary crushers). In addition, all affected equipment (i.e., equipment that is in-line with the primary or initial crusher) is subject to Subpart OOO. Any local operator of such a portable plant will likely already have the necessary permits for operation of a portable facility.

With respect to open burning of slash piles, Colorado Regulation No. 9 (Open Burning, Prescribed Fire, and Permitting) requires that no person shall conduct any open burning activity not exempted from state regulations without first obtaining a permit from the Division, or from a local agency authorized by the Division to issue burning permits. In Larimer County a General Open Burn Permit must be obtained from the Larimer County Health Department (http://www.larimer.org/burnpermit/). The open burn period 'season' for forest slash piles is from October 1 thru May 1, and is always dependent upon favorable conditions existing (3+ inches of snow on ground, light wind, daylight burning only) before ignition can occur.

In the event that there would be stationary source subject to Air Pollution Emissions Notice reporting or permitting, these would be obtained prior to construction activities. The proposed construction equipment would be comprised primarily of heavy-duty, non-road mobile equipment powered by diesel fuel. Some pickup trucks would operate on gasoline rather than diesel fuel. Emissions from diesel engines would be minimized because engines must be built to meet the standards for mobile sources established by the EPA mobile source emissions regulations (40 CFR Part 85). In addition, the EPA requires that the maximum sulfur content of diesel fuel for highway vehicles be no more than 15 ppm weight.

- For calculating tailpipe emissions from construction equipment, assumptions include:
  - Diesel construction equipment would consume ultra-low sulfur diesel fuel.
  - Pickup trucks are assumed to be equivalent to light-duty, gasoline powered, passenger vehicles.
  - Construction activities would occur for 12 hours per day, 6 days a week.
  - Not all pieces of construction equipment would operate simultaneously. At any given time, roughly a third of the equipment would be operating; thus, it is assumed that each piece of equipment would operate 4 hours out of a 12-hour construction day. This is a conservative approach because a particular piece of equipment, such as a crane, has a very specific function and must remain on-site to perform this function, but this function is not required to occur continuously.
  - Pickup trucks used for transporting crews and other local trips, would make two trips per hour on average over a 12-hour work day (24 trips per day). Each trip is assumed to be 4 miles on average.
- For calculating fugitive dust from construction and maintenance, assumptions include:
  - 75 percent of the construction fugitive dust is in the PM_{10} size range (EPA 1998), and 10 percent of the PM_{10} is in the $PM_{2.5}$ size range (Countess Environmental 2006);
  - Site grading in preparation for structure construction is the primary general construction activity that would produce fugitive emissions;
  - Site grading would be more for undergrounding portions; and
  - A control efficiency of 50 percent is assumed for purposes of emission calculations.

ROW facilities would be regularly maintained and a light-duty truck would travel the length of the accessible power line ROW once per month.

A Federal agency must make a determination that permitting or approving an activity conforms to the state implementation plan in accordance with 40 CFR Part 93.150. A conformity determination is required for each pollutant when the total of direct and indirect emissions caused by a Federal action in a non-attainment area would equal or exceed threshold quantities specified in 40 CFR Parts 93.153(b) (1) and (2). The applicable conformity thresholds for the project area are as follows:

- NSR – 100 tons per year (tpy) for nitrogen oxides, carbon monoxide, VOCs, sulfur oxides, and particulate matter with a diameter of less than 10 microns (NO_X, CO, VOC, SO_X, and PM_{10}, respectively).
- PSD – 250 tpy for NO_X, CO, VOC, SO_X, and PM_{10}.
- Title V – 100 tpy for NO_X, CO, VOC, SO_X, and PM_{10}.
- Conformity Thresholds – 100 tpy for NO_X, CO, VOC, SO_X, and PM_{10}.

Because the proposed project is predicted to emit all of these pollutants (or precursors in the case of ozone), a conformity review was conducted based on DOE guidance (DOE 2000). To conduct the conformity review, the impacts of the project ROW construction and facility maintenance activities were assessed in the nonattainment areas. Emissions in the nonattainment area were calculated using the methodology described above for tailpipe emission and fugitive dust emissions, except calculations were limited to the nonattainment area. Estimated emissions were compared with the emissions threshold for conformity determinations as published by DOE (2000).

4.2.3 Impacts Common to All Alternatives

Tailpipe emissions would occur from mobile sources including earth-moving equipment such as scrapers, loaders, bulldozers, backhoes, brush hogs, and ATVs during construction of access roads and preparation of structure sites as well as from pickup trucks and semi-tractor trailers used to transport crews and materials. Structure components and transmission line equipment, as well as electrical cable and other equipment and supplies would be delivered by large trucks and semi-tractors. Large cranes or helicopters would be used to install structures. Emissions from these activities include fugitive dust and tailpipe emission (CO, NO_X, VOCs, particulates, SO_2, and air toxics). Emissions for these criteria pollutants would have a minor effect on local air quality in the vicinity of each structure during construction. Impacts to air quality would be direct but short-term during construction and operation of the proposed project. No indirect impacts are expected.

Criteria Pollutant Air Emissions

Construction emissions would occur during construction of access roads, preparation of transmission structure sites, and construction of the transmission line. Fugitive dust results from the use of earth-moving equipment, including loaders, scrapers, bulldozers, shovels, and backhoes. **Table 4.2-2** shows the direct emissions by project component for each alternative and variant.

Short steel structures in visually sensitive areas would increase the emissions shown in structures row of **Table 4.2-2** since the shorter spans would require about twice as many structures to complete these segments of the transmission line.

Table 4.2-2 Fugitive Dust (Particulate) Emissions by Project Component and Alternative

Project Component Construction	PM_{10} (tpy)						$PM_{2.5}$ (tpy)					
	Alt A & Var A1	Var A2	Alt B	Alt C	Var C1	Alt D	Alt A & Var A1	Var A2	Alt B	Alt C	Var C1	Alt D
Structures	28.1	23.6	31.1	29.0	24.3	60.4	14.0	11.8	15.5	14.5	12.1	30.2
Trenches	NA	9.7	NA	NA	10.0	NA	NA	4.9	NA	NA	5.0	NA
Stringing Sites	2.4	2.4	2.4	2.4	2.4	2.4	1.2	1.2	1.2	1.2	1.2	1.2
Staging areas	18.0	18.0	18.0	18.0	18.0	18.0	9.0	9.0	9.0	9.0	9.0	9.0
Access Routes	16.2	16.2	13.0	17.8	17.8	14.9	8.1	8.1	6.5	8.9	8.9	7.4
H-frame removal	57.8	57.8	57.8	57.8	57.8	57.8	28.9	28.9	28.9	28.9	28.9	28.9
Total	122.5	127.8	122.3	125.0	130.2	153.5	61.3	63.9	61.1	62.5	65.1	76.8

Alt = Alternative, Var = Variant, PM_{10} = particulate matter 10 microns or less, $PM_{2.5}$ = particulate matter 2.5 microns or less.

In addition to fugitive dust, mobile construction equipment also would have tailpipe emissions of limited quantities of other criteria pollutants including CO, NO_2, SO_2, VOC, and PM_{10}. **Table 4.2-3** lists these emissions and greenhouse gas (GHG) (as carbon dioxide equivalent [CO_2e]) on an annual basis.

Table 4.2-3 Annual Tailpipe Emissions from Construction

	Pollutant (tpy)					
	CO	**NO_x**	**SO_2**	**VOC**	**PM_{10}**	**CO_2e**
Total	14.0	65.1	4.3	5.2	4.6	2413.6

<u>Dispersion Modeling Results to Assess Impacts to Air Quality</u>

Screening-level dispersion modeling was performed to assess PM_{10} and $PM_{2.5}$ impacts of fugitive dust from disturbed acres during construction. Air impacts modeling was performed using the EPA-approved SCREEN3 model. SCREEN3 is a single source Gaussian plume model which provides maximum ground-level concentrations for point, area, flare, and volume sources. SCREEN3 is a screening version of the ISC3 model. For this study, SCREEN3 model version 96043 was used to evaluate impacts from fugitive dust. The construction area was modeled as an area source using full meteorology as well as regulatory model default values for mixing heights and anemometer heights. Impacts were assessed at a distance of 50 meters from the disturbance that is representative of all such activities in the direct impacts assessment area. Results of the conservative screening level dispersion modeling analysis which are applicable for all alternatives are shown in **Table 4.2-4** and indicate that the impacts due to fugitive dust emissions from disturbed acres are well within the National and State AAQS. Background levels shown are representative of the rural background levels for the pollutants throughout the region including the locations all alternatives.

Table 4.2-4 SCREEN3 Model Results for Construction Fugitive Dust

Pollutant	Averaging Time	Impact ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	% of NAAQS
PM_{10}	24-hour	115.8	10.2	125.7	150	84
	Annual	28.9	9	37.9	50	76
$PM_{2.5}$	24-hour	11.6	6.9	18.5	35	53
	Annual	2.9	2.6	5.5	12	46

$\mu g/m^3$ = microgram per cubic meter, NAAQS = National Ambient Air Quality Standards.

Screening-level dispersion modeling using SCREEN3 also was performed to assess impacts of criteria pollutants from heavy and light duty truck emissions. The trucks were modeled as volume sources using full meteorology as well as regulatory model default values for mixing heights and anemometer heights. Gaseous pollutant emissions from light and heavy duty vehicles are much less than particulate emissions when vehicles are traveling on unpaved roads. Background concentrations of gaseous pollutants in rural settings are typically not available, since monitoring generally takes place where there are larger or more abundant sources of these pollutants. Impacts were assessed at a distance of 33 feet (10 meters) from the road for a generic road segment that is representative of all unpaved roads throughout the project area. Results of the conservative screening level dispersion modeling analysis for heavy duty vehicles are shown in **Table 4.2-5** and indicate that the impacts from unpaved road traffic are well within the National and State AAQS. Impacts due to light duty vehicles (pickup trucks) on unpaved roads are much less than impacts for the larger trucks.

Table 4.2-5 SCREEN3 Model Results for Heavy Duty Vehicles on Unpaved Roads

Pollutant	Averaging Time	Impact (μg/m³)	Background (μg/m³)	Total Impact (μg/m³)	NAAQS (μg/m³)	% of NAAQS
NO_2	1-hour	12.1	NA	12.1	188	6.40
	Annual	0.5	NA	0.5	100	0.5
CO	1-hour	3.5	NA	3.5	40,000	<0.1
	8-hour	2.5	NA	2.5	10,000	<0.1
SO_2	1-hour	1.1	NA	1.1	196	0.6
	3-hour	1.1	NA	1.1	700	0.2
	24-hour	0.5	NA	0.5	365	0.1
	Annual	<0.1	NA	<0.1	80	<0.1
PM_{10}	24-hour	39.9	10.2	50.1	150	33.4
	Annual	4.0	9	13.0	50	25.9
$PM_{2.5}$	24-hour	4.0	6.9	10.9	35	31.2
	Annual	0.4	2.6	3.0	12	19.9

μg/m³ = microgram per cubic meter, NAAQS = National Ambient Air Quality Standards.

The proposed project would have emissions below the permit levels and would be exempt from the requirement to obtain a Federal or state air quality permit.

Greenhouse Gas Emissions Related to Climate Change

Construction of the proposed project would result in gaseous emissions, including GHGs from fuel combustion in construction vehicles. Annual construction engine emissions of GHGs (CO_2e, which include CO_2, methane, and N_2O) from construction engine sources are shown in **Table 4.2-3**. The total GHG emissions from construction would be negligible in terms of impacts to climate change. In the final regulation on greenhouse gas permitting, the EPA considers a source that emits more than 100,000 tpy of CO_2e to be a major source and requires a stationary source that emits more than 25,000 tpy to report their emissions. The estimated annual GHG emissions for this project are under 2,500 tpy; therefore, the GHG emissions are negligible.

There would be maintenance activities during operations along the transmission line ROW resulting from fuel usage in mostly light duty vehicles and Western's helicopter.

Hazardous Air Pollutants

The regulated hazardous air pollutants listed in Section 112 of the CAA that are emitted from construction activities are benzene, toluene, xylenes, acetaldehyde, formaldehyde, and propylene. Emissions of the remaining hazardous air pollutants are orders of magnitude smaller. **Table 4.2-6** provides an estimate of emissions of hazardous air pollutants in pounds per year for the range of transmission line alternatives.

Hazardous air pollutants are regulated by emissions, and they do not approach the level of concern which is 10 tpy for individual hazardous air pollutants or 25 tpy in aggregate. The primary sources of hazardous air pollutants are internal combustion engines used to power construction equipment and vehicles and emissions are very minor; therefore, impacts associated with the proposed project are anticipated to be negligible.

Table 4.2-6 Principal Hazardous Air Pollutant (pounds per year)

Pollutant	Low	High
Benzene	8.45	10.20
Toluene	3.70	4.48
Xylenes	2.58	3.12
Acetaldehyde	6.95	8.40
Formaldehyde	10.70	12.90
Propylene	23.40	28.30

Impacts at Class I and II Areas – Acid Deposition

The proposed project would emit low levels of NO_X and SO_2, which are the potential acid producing pollutants emitted from mobile sources during construction and operation. Impacts are anticipated to be negligible.

Impacts at Class I and II Areas – Visibility

Construction of the proposed project would emit low levels of pollutants, principally PM_{10} and $PM_{2.5}$, as well as tailpipe emissions from mobile sources. Federal land managers have visibility protection responsibility under 40 CFR §51.307 (New Source Review), which spells out the requirements for State Implementation Plan visibility protection programs, as well as 40 CFR §52.27 (Protection of visibility from sources in attainment areas) and 40 CFR §52.28 (Protection of visibility from sources in non-attainment areas). These three provisions, taken together along with the State Implementation Plan-approved rules, establish the visibility protection program for new and modified sources throughout the country.

Section 165 (42 U.S.C. 7475) of the CAA requires the EPA, or the state/local permitting authority, to notify the Federal land manager if emissions from a project may impact a Class I area. Although the entire project lies within 30 miles (50 kilometers) of Rocky Mountain National Park, the proposed alternatives do not constitute a major stationary source and do not require notification to the Federal land manager. The limited duration and low levels of emissions from the project construction and operation would have no discernible effect on visibility in Rocky Mountain National Park.

Impacts on Ambient Ozone Levels

The proposed alternatives are unlikely to cause or contribute to the formation of regional ozone at detectable levels due to the low level of emissions of potential ozone forming compounds, including NO_X and VOCs. Therefore, the proposed project is anticipated to have no discernible effect on ambient O_3 levels.

Operation Impacts

Routine line maintenance and repairs during operation of the transmission line would result in negligible air emissions.

General Conformity Analysis for Larimer County

The line would be located in Larimer County, Colorado. Portions of Larimer County are designated non-attainment or maintenance for one or more federally regulated pollutants.

A Federal agency must make a determination that permitting or approving an activity will conform to the state implementation plan in accordance with 40 CFR Part 93.150. A conformity determination is required for each pollutant when the total of direct and indirect emissions caused by a Federal action in a non-attainment area would equal or exceed threshold quantities specified in 40 CFR Parts 93.153(b) (1) and (2). The applicable conformity thresholds for the proposed project area are as follows:

- NSR – 100 tpy for nitrogen oxides, carbon monoxide, volatile organic compounds, sulfur oxides, and particulate matter with a diameter of less than 10 microns (NO_X, CO, VOC, SO_X, and PM_{10}, respectively).
- PSD – 250 tpy for NO_X, CO, VOC, SO_X, and PM_{10}.
- Title V – 100 tpy for NO_X, CO, VOC, SO_X, and PM_{10}.
- Conformity Thresholds – 100 tpy for NO_X, CO, VOC, SO_X, and PM_{10}.

Since the proposed project is predicted to emit all of these emissions (or precursors in the case of ozone), a conformity review was conducted based on DOE guidance (DOE 2000). To conduct the conformity review, the impact of the construction and maintenance activities was assessed in the nonattainment areas. Emissions in the nonattainment area were calculated using the methodology described above for tailpipe emission and fugitive dust emissions, except calculations were limited to the nonattainment area. Estimated emissions were compared with the emissions threshold for conformity determinations as published by DOE (2000).

Based upon the use of conservative emissions estimates, the emissions from the construction and operation of the transmission lines rebuild in the nonattainment area as shown in **Table 4.2-2** would be below the conformity thresholds; therefore, the project is exempt from performing a comprehensive conformity analysis.

Short-term effects would include an increase in particulate and gaseous emissions during construction primarily due to fugitive dust released from travel on dirt roads and excavations for structure bases. The long-term effects would result from operations which would require periodic inspection of the transmission line and occasional maintenance. Short-term effects would be minor, and long-term effects would be negligible.

The following conclusions are derived from the analysis presented for various air quality factors. At the present time, there is no known phase or activity proposed to be conducted during the project that is not consistent with current air quality regulations in Colorado.

Neither the construction nor operations phase of the proposed alternatives is expected to:

- Cause or contribute to any violation of any state or Federal AAQS;
- Interfere with the maintenance or attainment of any state or Federal AAQS in the project area;
- Increase the frequency or severity of any existing violations of any state or Federal AAQS in the project area;
- Delay the timely attainment of any standard, interim emission reduction, or other air quality milestone promulgated by the EPA or state air quality agency;
- Cause any adverse impact to air quality-related values in a Federal Class I area;
- Exceed state or Federal general conformity thresholds;
- Increase GHG emissions to notable levels; and
- Cause or contribute to an exceedence of a NAAQS in the non-attainment area.

4.2.4 No Action Alternative

The No Action Alternative, including the small segment involving the re-location of the line at the Newell Lake View subdivision, would pose impacts similar to the other alternatives. Additional maintenance would be required for operations that would potentially increase fugitive dust from various vehicles required during replacement of old poles and insulators. Impacts associated with maintenance and replacement of the existing lines would be incremental and minor, occurring over a period lasting several years.

Short-term effects include an increase in particulate and gaseous emissions during operations primarily due to fugitive dust released from travel on dirt roads. The long-term effects would result from operations and additional maintenance which would require periodic inspection of the transmission line. Short-term effects would be negligible and long-term effects would be minor.

4.2.5 Impacts Unique to Specific Action Alternatives

There are no impacts that would be unique to any of the action alternatives. Impacts would be similar between alternatives with only slight differences based on the varying segment lengths, area of disturbance, number of towers or undergrounding of the transmission line.

4.2.6 Mitigation

Because impacts to air resources would not be significant for any alternative, no additional mitigation measures to are required beyond the proposed SCPs to further mitigate adverse air.

4.2.7 Residual Impacts

No mitigation has been identified; there would be no significant impacts to air quality from any of the alternatives.

4.2.8 Irreversible and Irretrievable Commitment of Resources

Air quality impacts due to the proposed project would be reversible. Once construction activities are completed, the air quality would return to pre-project state. Since impacts are not anticipated to exceed the NAAQS for the project, irretrievable impacts to air quality would not be anticipated (no discernible effect).

4.2.9 Relationship between Short-term Uses and Long-term Productivity

Project activities that would produce emissions of PM and criteria air pollutants would cease after construction of the project and would not result in continued, long-term impacts to air quality. GHG emissions would likewise cease following project activities but the GHGs would remain in the atmosphere over the long-term. Impacts would be anticipated to be negligible.

4.3 Geology and Paleontology

The impact analysis area for geological, mineral, and paleontological resources consists of an area bounded by a 1-mile buffer around the proposed alternatives.

No major issues of concern were identified by Western through internal scoping, consultation with coordinating agencies, or through comments provided during public scoping. The following discussion is related to potential impacts to unique geological features, scientifically important paleontological resources, and access to mineral resources, as well as potential impacts to project components from geological hazards.

4.3.1 Methodology

Various sources of information were reviewed including published maps, reports, and accessible online databases provided by USGS, Colorado Geological Survey, and other sources such as scientific journals and publications. The information was used to determine if the proposed project poses a risk of impact to the resources identified in Section 4.3.2. In the case of geological hazards, information was reviewed to determine whether potential hazards are present and to determine what level of risks they would present to the proposed project.

4.3.2 Significance Criteria

A significant impact to geology, minerals, and paleontological resources would result if any of the following were to occur from constructing and operating the project:

- Areas of geological importance are lost or made inaccessible for future use.
- Known mineral resources of economic value to the region or residents of the state are lost or made inaccessible for future use.
- Increases in the probability of magnitude of mass geological movement (e.g., slope failures, slumps, rockfalls) occur.
- Scientifically important paleontological resources are lost or made inaccessible for future use.

4.3.3 Impacts Common to All Alternatives

4.3.3.1 Geology and Geological Hazards

Direct impacts to unique geological features would occur if such features were damaged or access to such feature was precluded by the project. However, no unique geologic features are located within the analysis area; therefore, the proposed project is anticipated to have no effect on such features.

Direct impacts from geological hazards would occur if those hazards resulted in damage to facilities causing loss of electrical service or presenting a health and safety hazard to people. While seismic hazards are not a concern, landslides and slope instability may present potential hazards to the construction and operation of the proposed project. Direct impacts of geological hazards during construction would be the potential for grading and excavation to exacerbate or accelerate slope instability. Impacts may be increased during periods of high precipitation or high soil moisture. Indirect effects during construction may include changes in slope or grade that may increase runoff or erosion that increases the risk of slope instability and landslides. Direct impacts from slope instability or landslides would be considered minor to moderate. Implementation of SCPs 26, 28, 29, and 31 (**Table 2.5-1**) would reduce or eliminate ground instability impacts.

Potential impacts from slope instability and landslides could either be short-term or long-term. Short-term effects could be incurred during construction, but would be anticipated to be minor. Long-term effects may occur during the operational life of the proposed project. Because there are no known mineral resources in the vicinity, there would be no effect on access to mineral resources.

4.3.3.2 Mineral Resources

Direct impacts to mineral resources would include temporary loss of access during construction or permanent (lifetime of project) loss of accessibility for mineral resource extraction. It is not likely that there are potentially commercially extractable mineral resources within the study area so no impacts from construction of the alternatives would be anticipated.

4.3.3.3 Paleontological Resources

Direct impacts would include the destruction or loss of scientifically important fossil resources as a result of construction activities. Indirect impacts during construction and operation would involve damage or loss of fossil resources due to the unauthorized collection of scientifically important fossils by construction workers or the public due to increased access to fossil localities near construction areas. Any harm to paleontological resources from construction activities or unauthorized collection is balanced by the fact that many important fossil discoveries have occurred because of construction activities. These fossils were only discovered and made available to the scientific community because of construction activities. Because there is a low potential for this adverse impact to occur and SCP 47 would be implemented to minimize impacts if scientifically important fossils are found, this potential is considered to be negligible.

As discussed in Section 3.3, there is low potential for the presence of scientifically important fossils within the study area, so it is unlikely that paleontological resources would be adversely affected by transmission line construction. Therefore, impacts to scientifically significant paleontological resources are expected to be negligible from constructing or operating a transmission line in the proposed ROW. Any harm to paleontological resources from construction activities or unauthorized collection is balanced by the fact that many important fossil discoveries have occurred because of construction activities exposing them to the surface.

4.3.4 No Action Alternative

The No Action Alternative, including the small segment involving the re-location of the line at the Newell Lake View subdivision, would pose impacts similar to the other alternatives, except potential impacts would occur over a longer span of time.

4.3.5 Impacts Unique to Specific Action Alternatives

There are no impacts that would be unique to any of the action alternatives. Impacts would be similar between alternatives with only slight differences based on the varying segment lengths, area of disturbance, number of towers or undergrounding of the transmission line.

4.3.6 Mitigation

Because impacts to geological resources would not be significant for any alternative, no additional mitigation measures to avoid, minimize, or mitigate impacts would be required.

4.3.7 Residual Impacts

No mitigation has been identified; there would be no significant impacts to geological, mineral, or paleontological resources from any of the alternatives.

4.3.8 Irreversible and Irretrievable Commitment of Resources

Because the potential to impact geological resources is low, no irreversible and irretrievable commitment of resources is anticipated.

4.3.9 Relationship between Short-term Uses and Long-term Productivity

Short-term impacts associated with project construction would have negligible effect on paleontological resources in the area, and would have no effect on the long-term availability or use of geological resources in the area.

4.4 Soil Resources

This assessment focuses on impacts to soils. The discussion includes an overview of issues that may affect soil resources, methods used to analyze impacts, the related significance criteria and descriptions of proposed and additional mitigation measures that would reduce the occurrence and significance of impacts. The analysis area for soil resources includes a width of 200 feet for the existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for the underground variants.

No issues were identified during the EIS scoping process for soil resources.

4.4.1 Methodology

Impacts to soil resources from the proposed project are based on the locations of the resources in relation to the proposed surface disturbance areas. The exact structure sites for the newly proposed transmission lines and locations of associated access roads and temporary work areas are unknown. The impacts to soil resources in the project area were estimated by multiplying the percentage of the project area impacted from new surface disturbance-related activities by the acreage of each soil type within the proposed ROW for each alternative. Western has the flexibility to site structures to avoid soils with severe limitations if they are not widespread within a specific area. Therefore, this impact assessment method is conservative and likely to overestimate the acreage of soils where small areas with severe limitations can be avoided.

The disturbance area was calculated based on using double-circuit steel structures for Alternatives A, B, and C, including their variants with an average span between structures of 850 feet for the proposed 115-kV line. The area disturbed for Alternative D was based on using a wood H-Frame structure design that would involve replacing structures at their current locations. Construction disturbance also includes two to three staging areas, six to eight conductor stringing sites, and the removal of 221 existing H-frame structures. Exact acreages are provided in **Table 2.3-5**.

The analysis of the impacts to soil resources is based on the assumption that Western's SCPs (Section 2.5) would be implemented as part of the proposed project. These proposed measures address the compensation for damage to ditches, terraces, and other land features; erosion control and related best management practices; correction of rutting and compaction; recontouring; and other practices that would minimize soil resources impacts when implemented. To minimize construction-related impacts to soil resources, reclamation would be conducted as soon as practical following surface disturbance. Additionally, Western would be required to abide by the standards and guidelines outlined in the USFS Region 2 Forest Plan on National Forest System land.

Temporary impacts to soils are those that are anticipated to be short-term in nature and following construction would be reclaimed and revegetated. Long-term impacts to soils would include areas where structures, surface facilities, or long-term access roads would be located for the duration of the proposed project.

4.4.2 Significance Criteria

A significant impact on soils would result if any of the following were to occur from construction or operation of the proposed project:

- Accelerated erosion due to disturbance results in the formation of rills or gullies, or that result in sediment deposition in downgradient lands or waterbodies to the extent that existing uses cannot be maintained.
- Soil productivity reduced to a level that prevents the disturbed area from recovering to pre-disturbance soil/vegetation productivity levels.
- Increases in the potential for soil creep, slumping, or mass failure.

4.4.3 Impacts Common to All Alternatives

Impact assessments were based on how soils with a wide range of physical and chemical soil characteristics would be affected by project activities. The primary impacts that would occur during construction activities would apply to all action alternatives.

In general, most impacts associated with construction of the transmission line would be temporary and minor to moderate in intensity. Temporary disturbances would occur within the ROW from construction traffic along the ROW or along new or established access ways, material storage yards, batch plant sites, temporary staging areas, and work areas around each structure.

Direct impacts to soil resources would result from the clearing or crushing of surface cover within the ROW (vegetation, duff, litter) and blading/grading of soils during construction. Surface disturbance using equipment to remove vegetation may reduce soil productivity and alter soil development in the short term. Although long-term soil productivity may be altered, nutrient cycling would continue due to the continual addition of leafy vegetative litter associated with grass or shrub species.

Grading and leveling would be required to construct structures and for temporary work areas and staging areas, with the greatest level of effort required on more steeply sloping areas. During construction, the soil profiles would be mixed with a corresponding loss of soil structure.

Soil compaction and rutting could result from the movement of heavy construction vehicles along the construction ROW and on temporary access roads. The degree of compaction would depend on the moisture content and texture of the soil at the time of construction. Compaction would be most severe where heavy equipment operates on moist to wet soils with high clay contents. Soil compaction and a reduction in ground cover would lead to an increase in bulk density, increased runoff, and water erosion. Construction on wet or moist soils would increase the potential for compaction. Compaction to soils would be minimized through implementation of SCP 1.

Rutting or soil mixing could occur when soils are saturated. Rutting affects the surface hydrology of a site as well as the rooting environment. The process of rutting reduces the aeration and infiltration of the soil, thereby degrading the rooting environment. Rutting may result in soil mixing of topsoil and subsoil, thereby reducing soil productivity. Rutting also disrupts natural surface water hydrology by damming surface water flows or by diverting and concentrating water flows creating accelerated erosion. Rutting would be minimized by implementation of SCP 2. Soil mixing typically results in a decrease in soil fertility and a disruption of soil structure.

The potential for accelerated erosion would increase through the loss of vegetation cover and increases in bulk density as compared to an undisturbed state. Although accelerated erosion due to construction-related soil disturbance could occur at any stage of construction, the maximum potential for erosion at structure sites would be expected when soils are disturbed or loose, in spoil piles, or where there is a lack of soil cover protecting the surface of the soil. Reclamation and erosion control would be difficult on soils that occur on steeper sloping areas (15 percent or more), particularly those steeper sloping areas with shallow soils (20 inches or less to bedrock). Additionally, soils with lithic bedrock within 60 inches of the soil surface may require blasting.

Water erosion prone soils crossed by the various alternatives are shown in **Figures 4.4-1a** through **4.4-1d**. Soils with bedrock within 60 inches of the soil surface are illustrated in **Figures 4.4-2a** through **4.4-2d**. Steep slopes crossed by the project alternatives are shown in **Figures 4.4-3a** through **4.4-3d**. Erosion and sedimentation would be minimized through the implementation of SCP 3, SCP 6, SCP 7, SCP 26, SCP 29, and SCP 49.

Soil contamination along the proposed routes could result from material spills during construction. If spills occur, it could result in the removal and disposal of large amounts of soil. Saturated soils may have the potential to diffuse contaminants. Mitigations that buffer wetlands and waterbodies from refueling or fuel storage would help to prevent spills in saturated areas. Impacts to wetlands and waterbodies would be minimized by the implementation of SCP 7, SCP 9, SCP 10, SCP 11, SCP 21, and SCP 22. Corrosion potential pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel. The effects of corrosion on steel transmission line structures would be offset by the use of protective coating and cathodic protection. No soils that would be corrosive to concrete are located along any of the alternative transmission line ROWs. No substantive effect from corrosion would be expected for any alternative.

For much of the proposed transmission lines rebuild project, Western has adequate existing access for construction. New, short spur roads to structure sites may be required in some locations to accommodate heavy equipment or unusual soil conditions. Whenever possible, overland travel (without grading) would occur, and existing trails and roads would be used wherever available. Where access is especially problematic (e.g., below The Notch) existing poles would be cut and left in place for Alternatives B, C, and Variant C1, but new access would need to be established for Alternatives A and D and Variants A1 and A2. The direct effect of roads is a long-term loss of soil quality. Indirect effects may include landslides, gullies, generation of side cast materials (loose sediment), and disruption and interception of subsurface flow of water that could alter soil moisture regimes upslope and downslope from the road. Other indirect effects may be trespassing traffic and off road use. **Table 4.4-1** provides the percent of erodible soils associated with access roads by alternative. Alternative A has the highest percentage of erodible soils associated with access roads. Each of the alternatives include roads with severely erodible soils that cross intermittent waterbodies. **Figures 4.4-4a** through **4.4-4h** illustrate the soil erodibility along access roads and their proximity to waterbodies. In locations where roads constructed on severely erodible soils cross streams, erosion and sedimentation would be of concern. SCP 22 and 33 would prevent disturbance of vegetation within 100 feet of a stream, where possible, except for vegetation that would threaten the safe operation of the transmission line. Additionally, Western would comply with all storm water permit requirements.

Table 4.4-1 Percent of Erodible Soils Along Access Roads*

	Alternative A	Alternative B	Alternative C	Alternative D
Low	0%	0%	0%	0%
Moderate	2.75%	40.44%	40.44%	20.89%
Severe	97.25%	59.56%	59.56%	79.11%

* Variants A1, A2, and C1 do not utilize access roads on USFS administered land.

Figure 4.4-1a Water Erosion Prone Soils

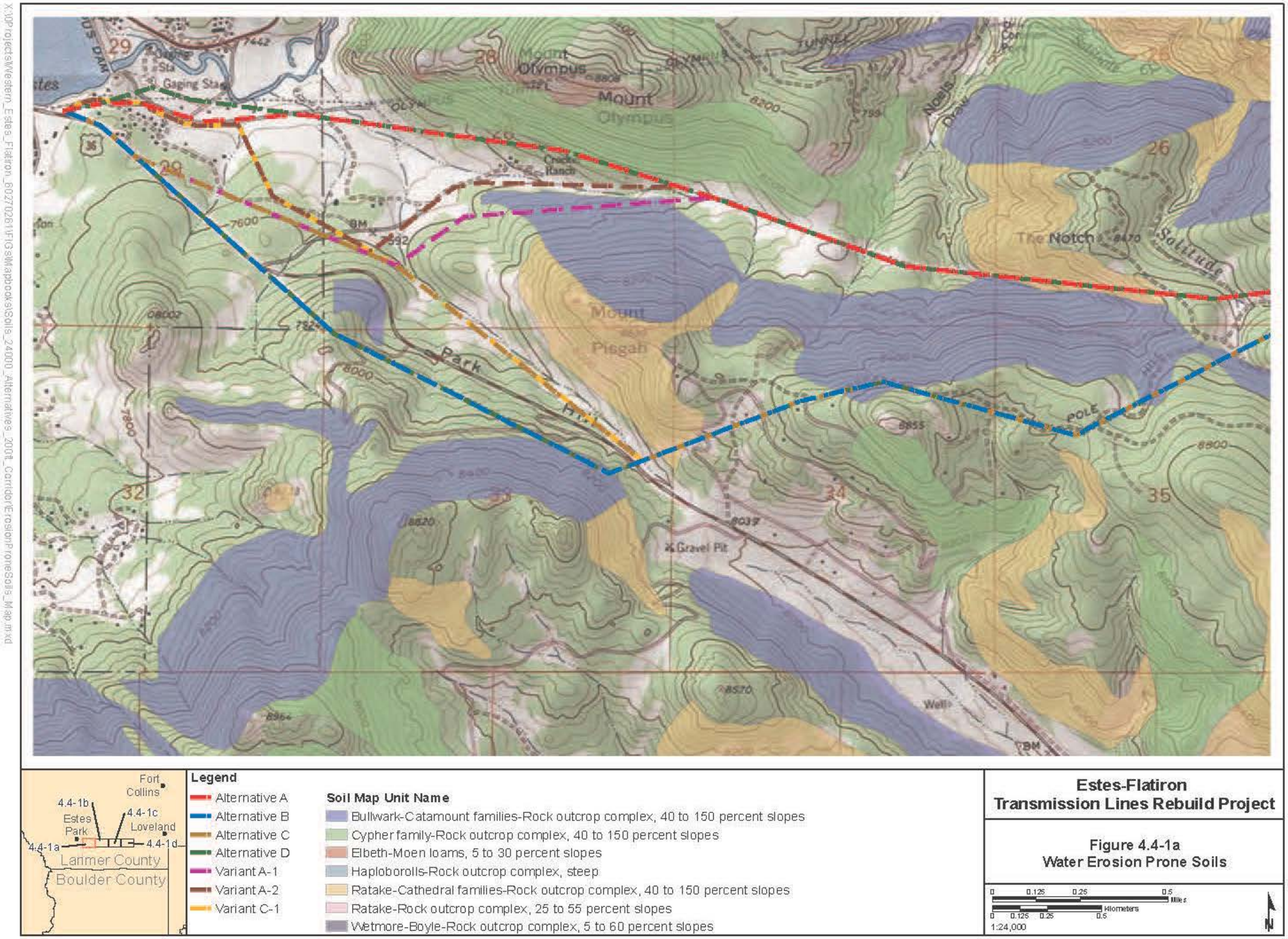


Figure 4.4-1b Water Erosion Prone Soils

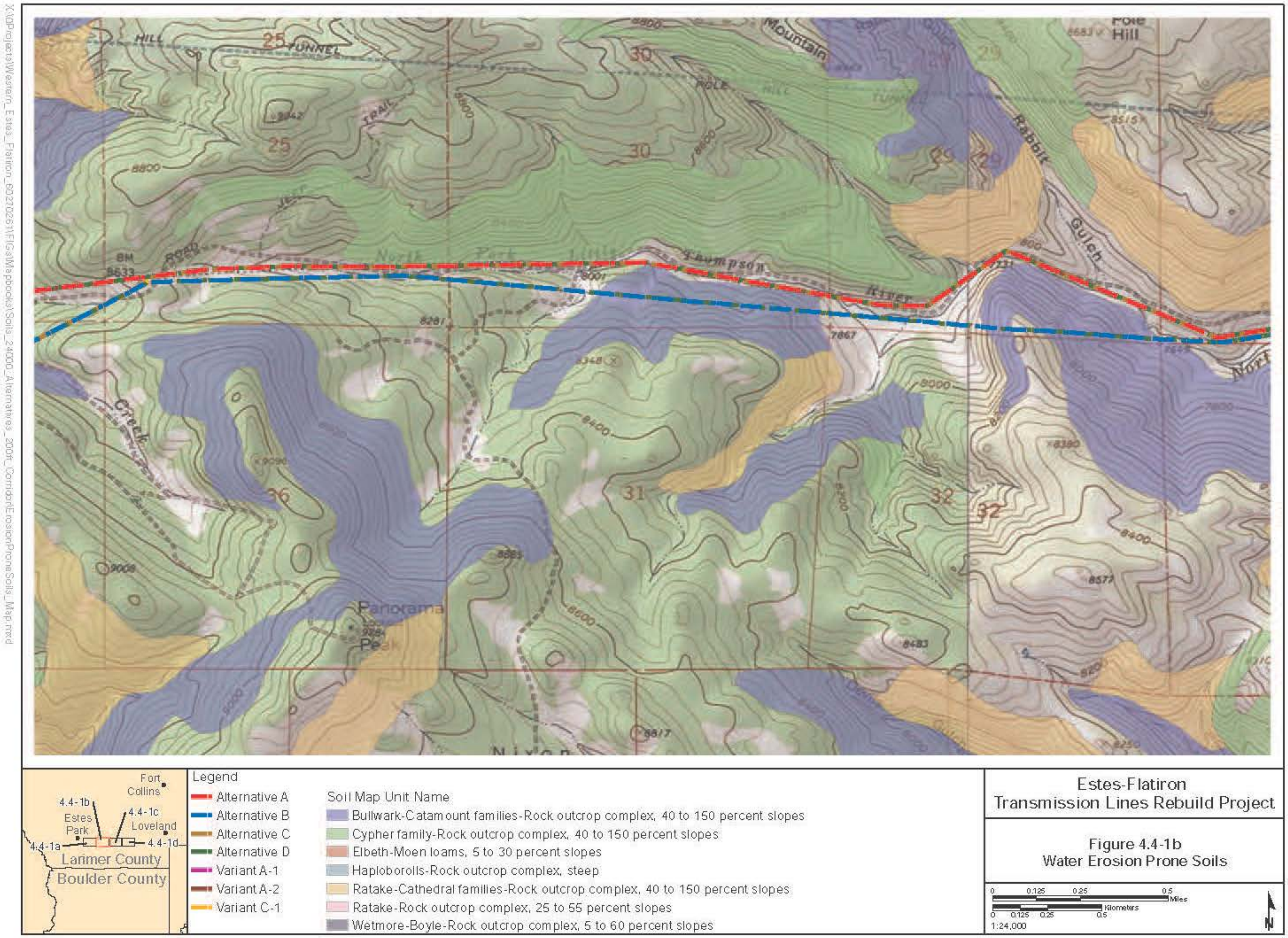


Figure 4.4-1c Water Erosion Prone Soils

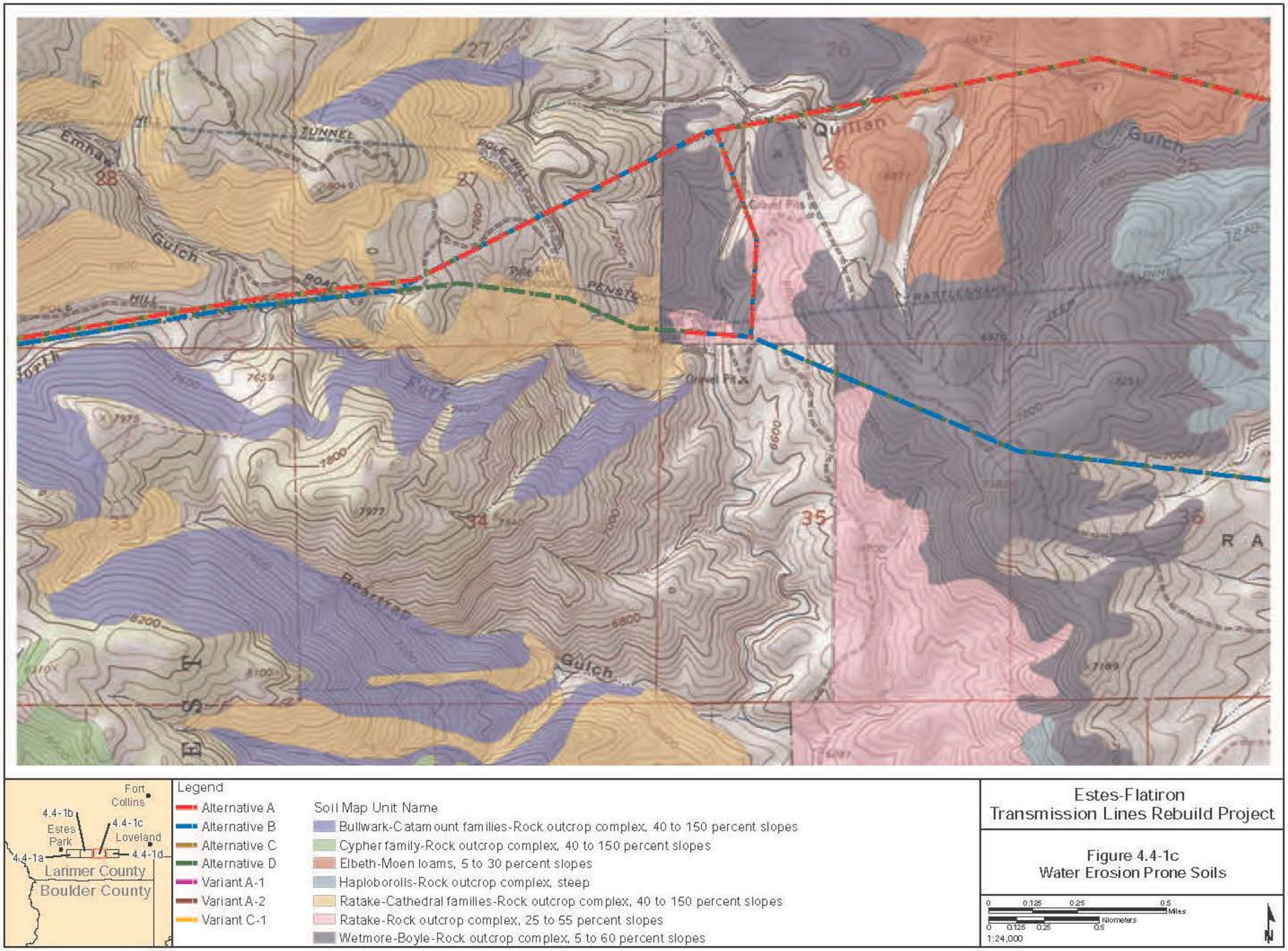


Figure 4.4-1d Water Erosion Prone Soils

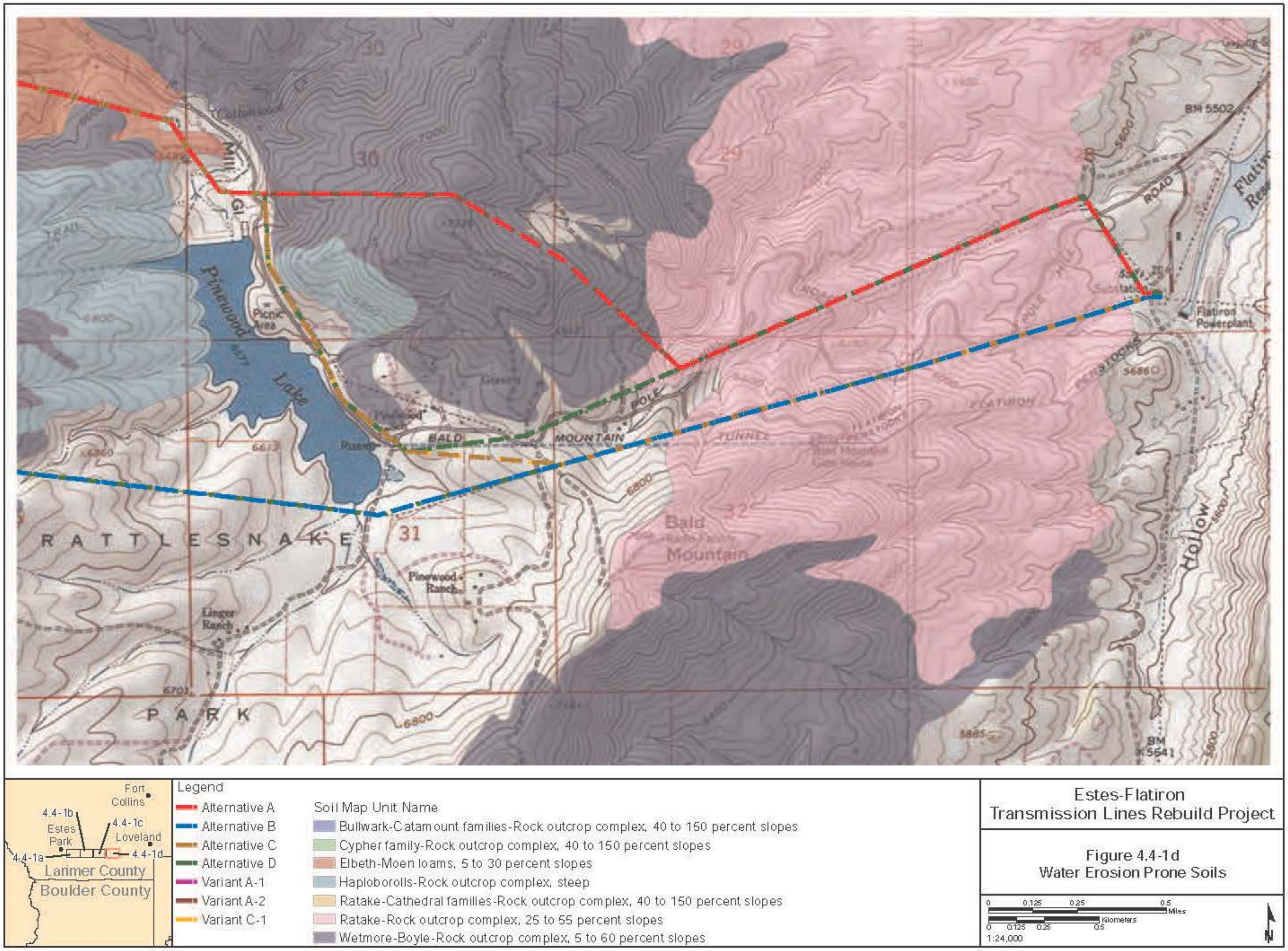


Figure 4.4-2a   Soils with Shallow Bedrock (60 inches or less)

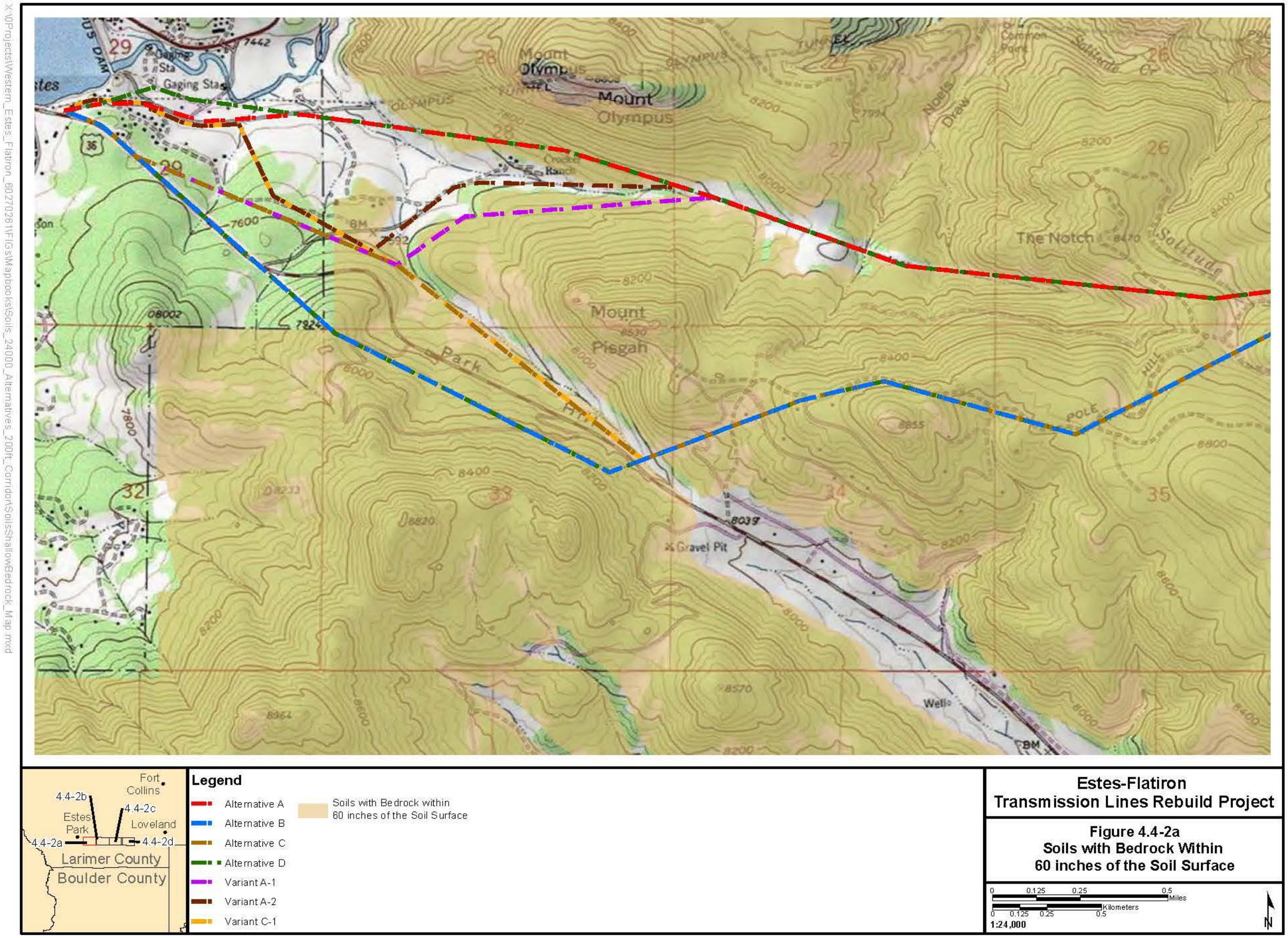


Figure 4.4-2b Soils with Shallow Bedrock (60 inches or less)

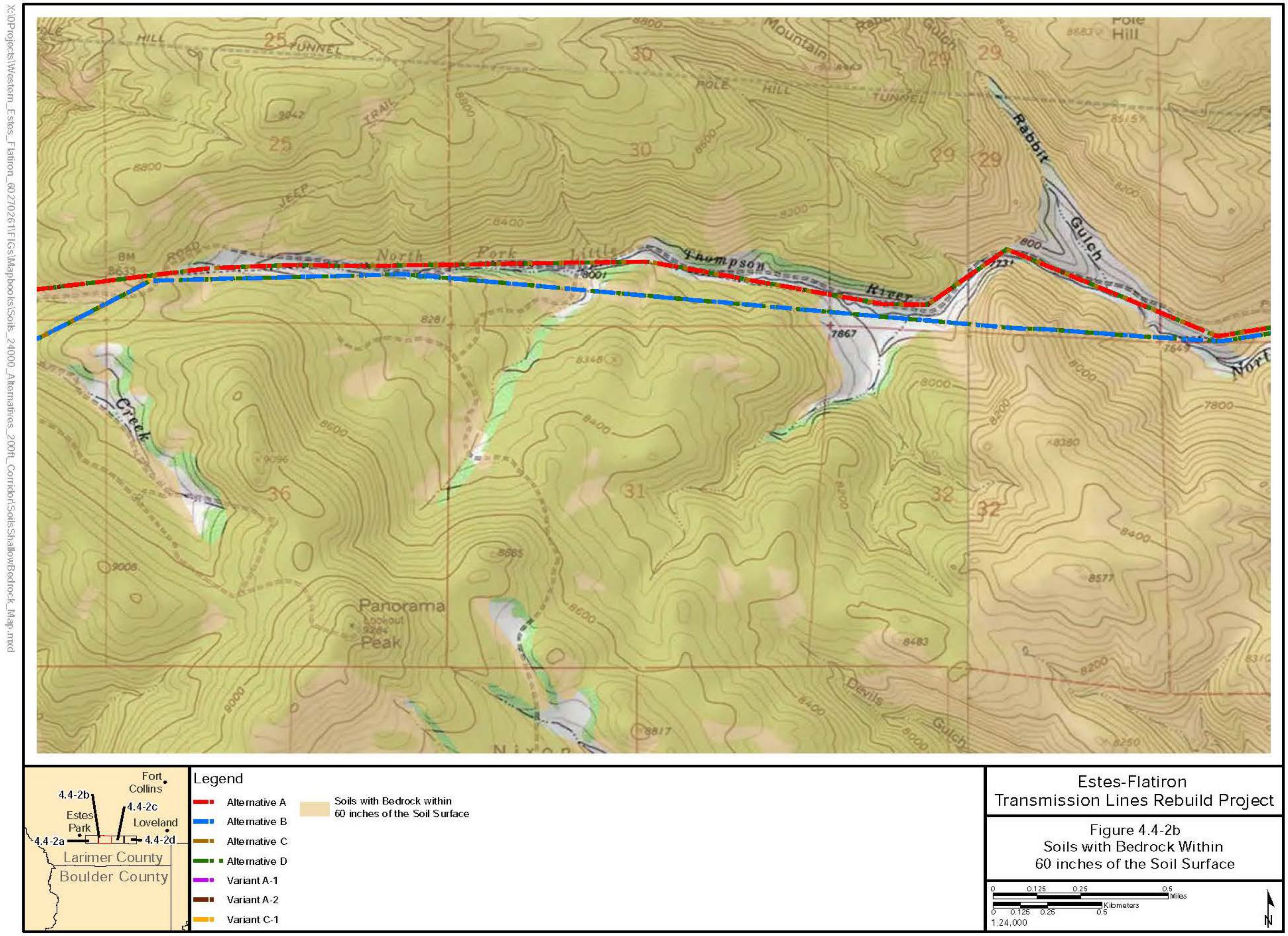


Figure 4.4-2c Soils with Shallow Bedrock (60 inches or less)

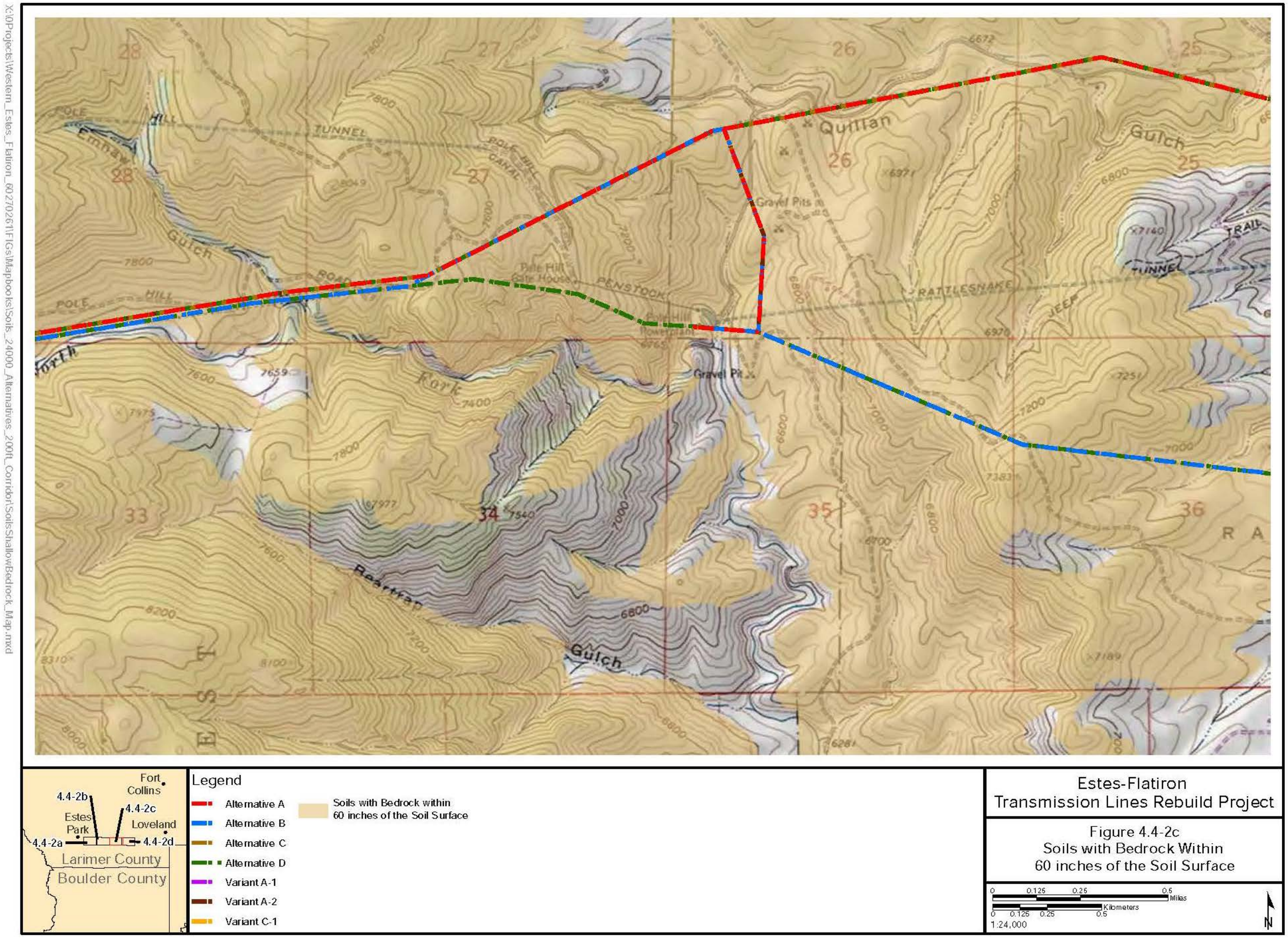


Figure 4.4-2d Soils with Shallow Bedrock (60 inches or less)

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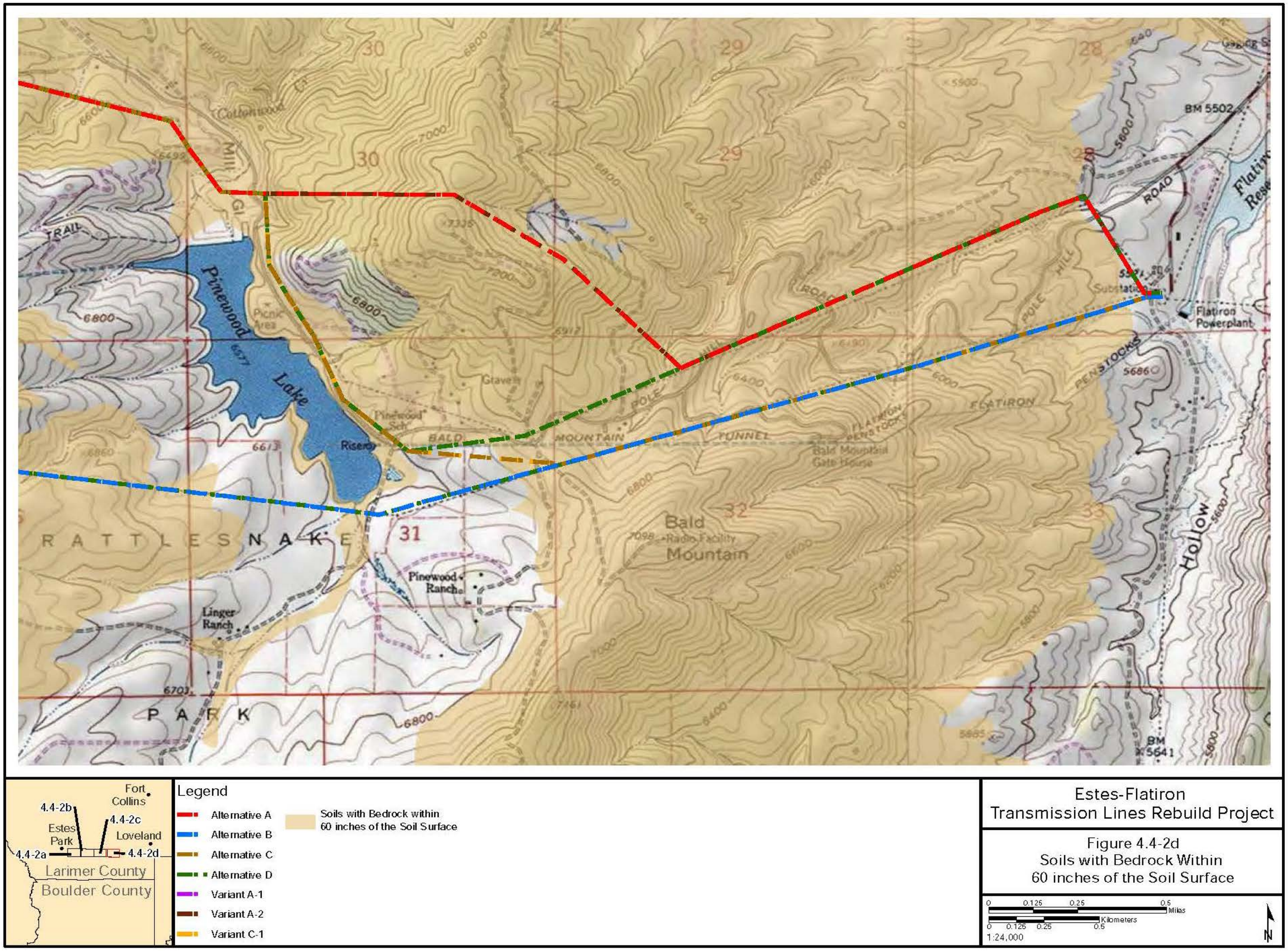


Figure 4.4-3a Topography

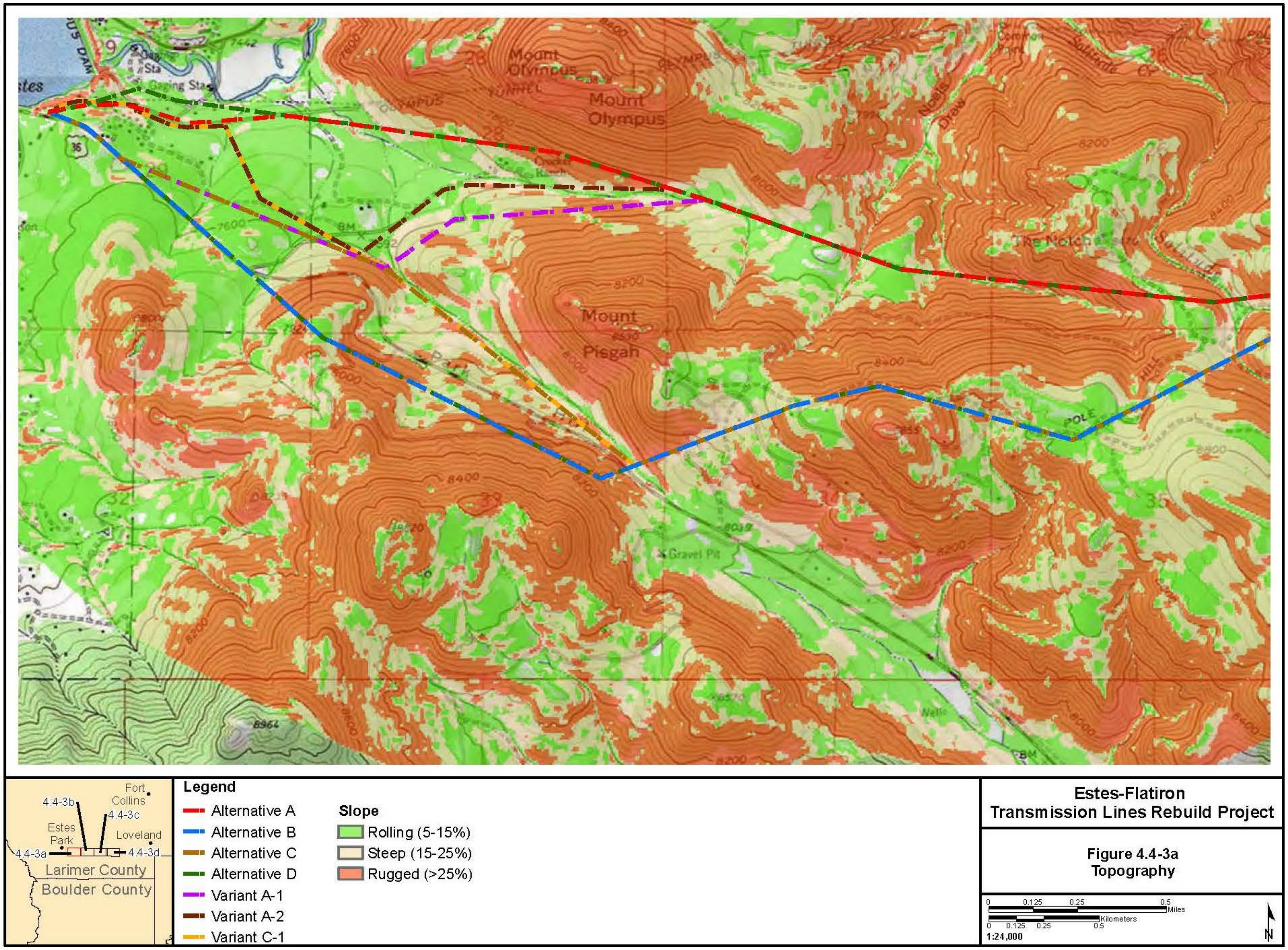


Figure 4.4-3b Topography

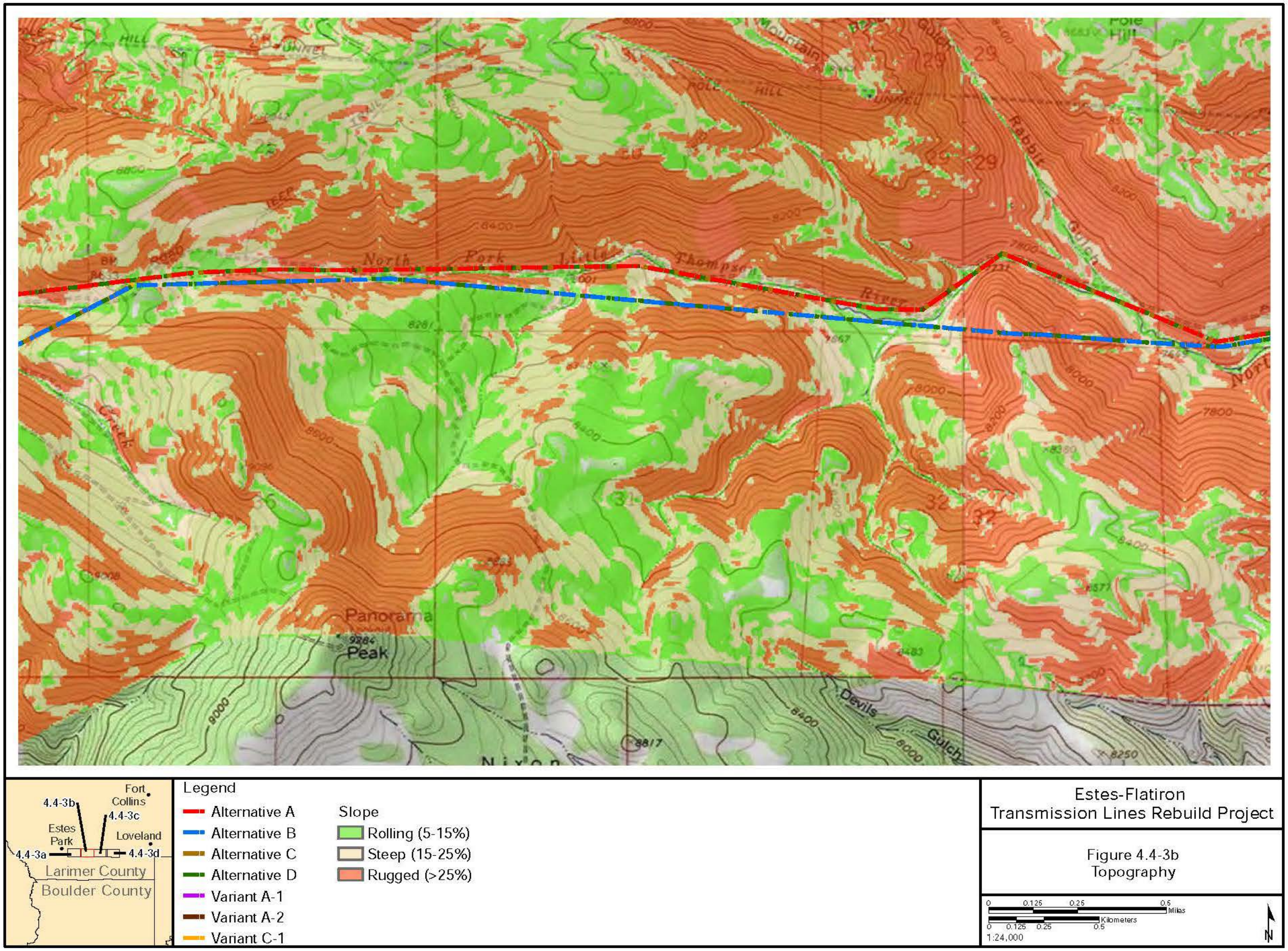


Figure 4.4-3c Topography

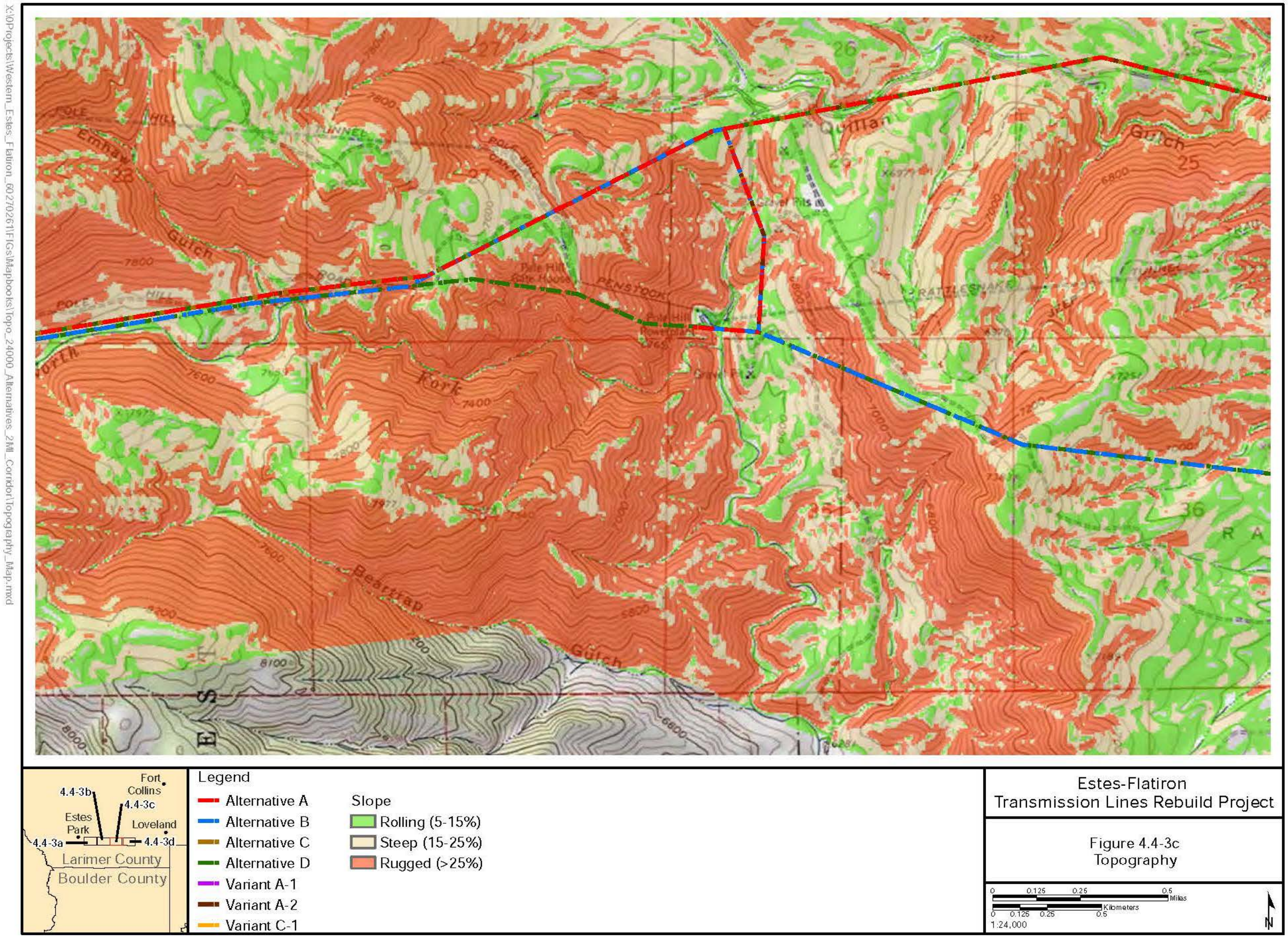


Figure 4.4-3d Topography

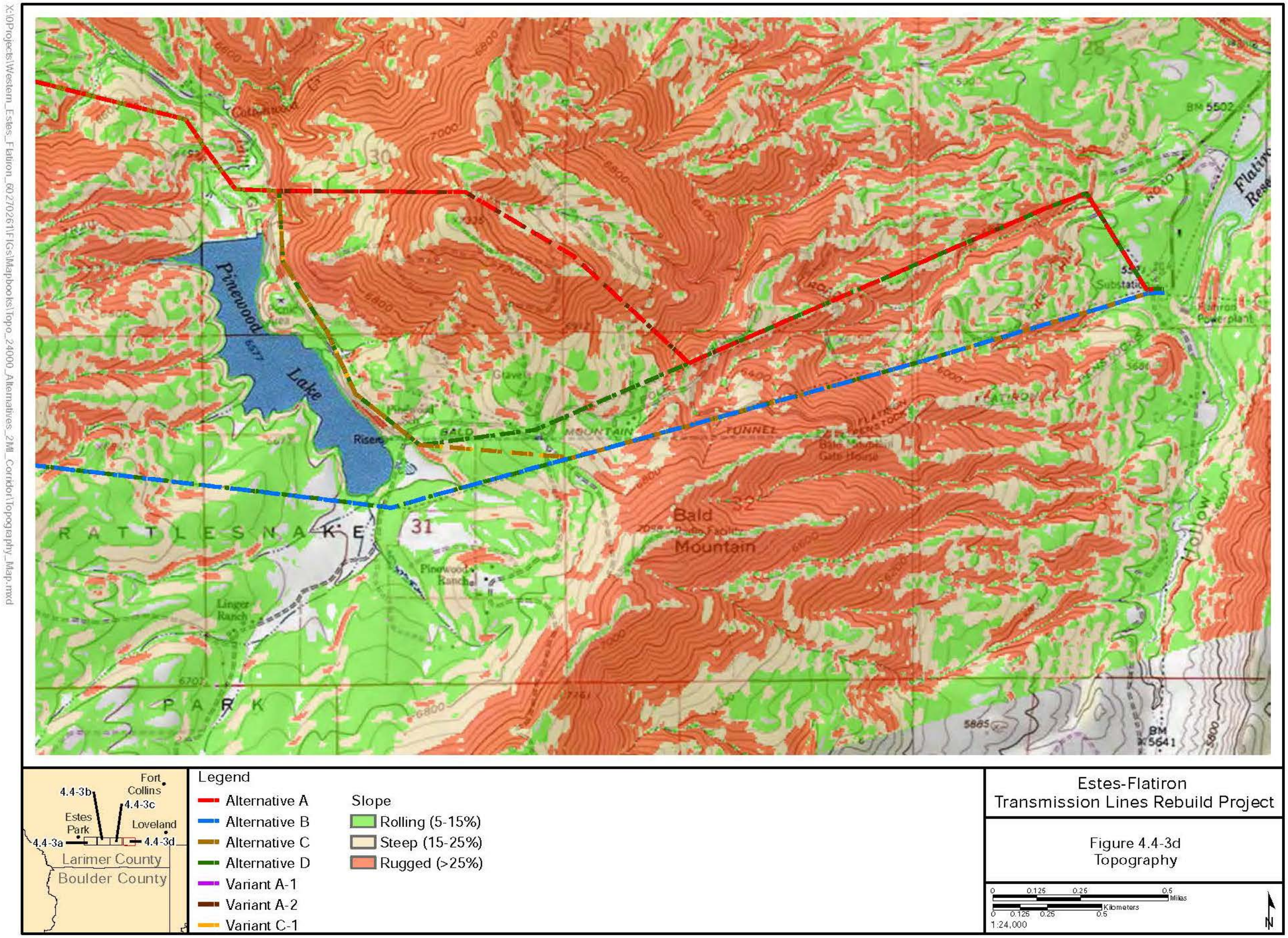


Figure 4.4-4a Access Roads and Erosion Hazard Level

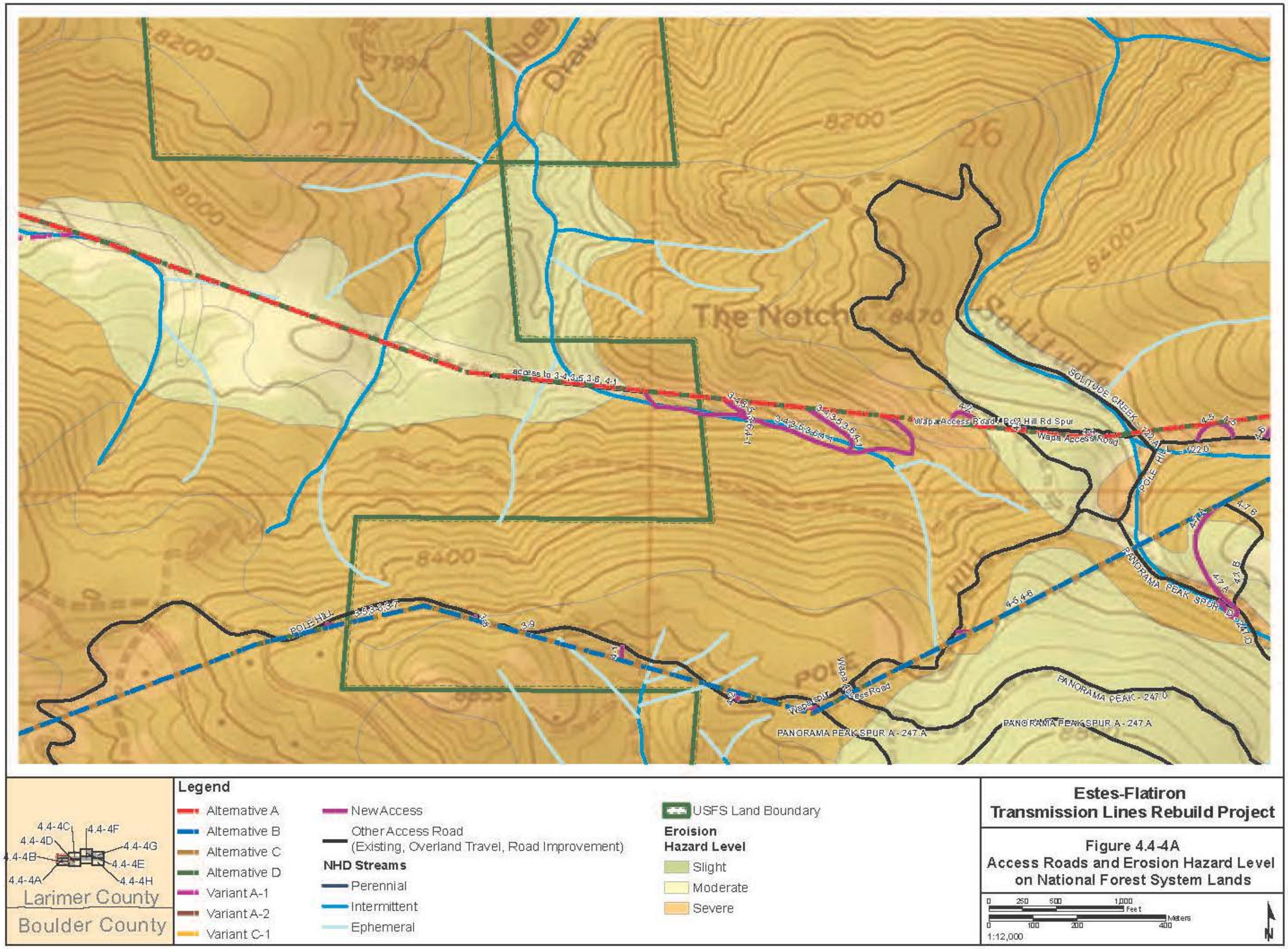


Figure 4.4-4b Access Roads and Erosion Hazard Level

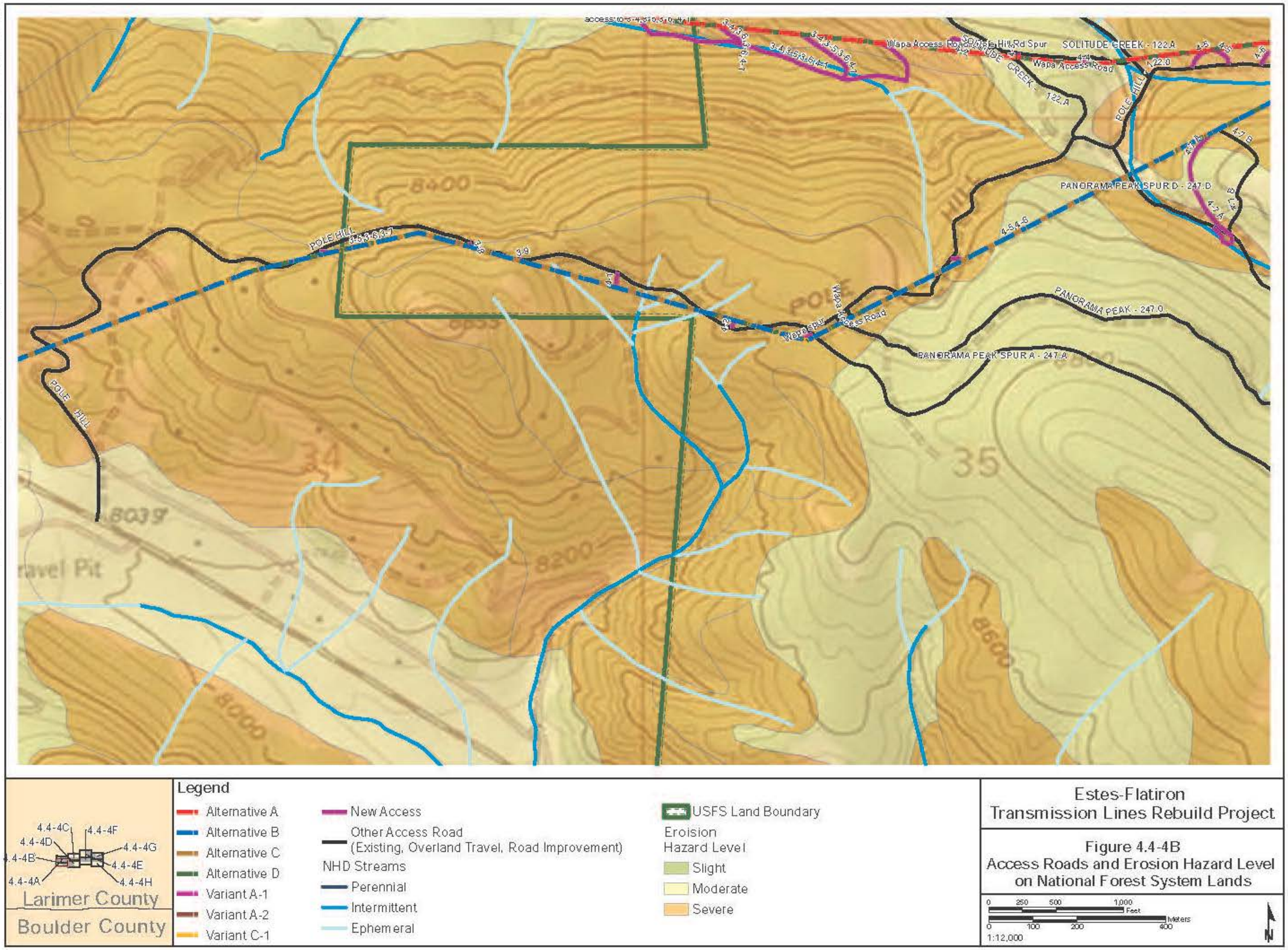


Figure 4.4-4c Access Roads and Erosion Hazard Level

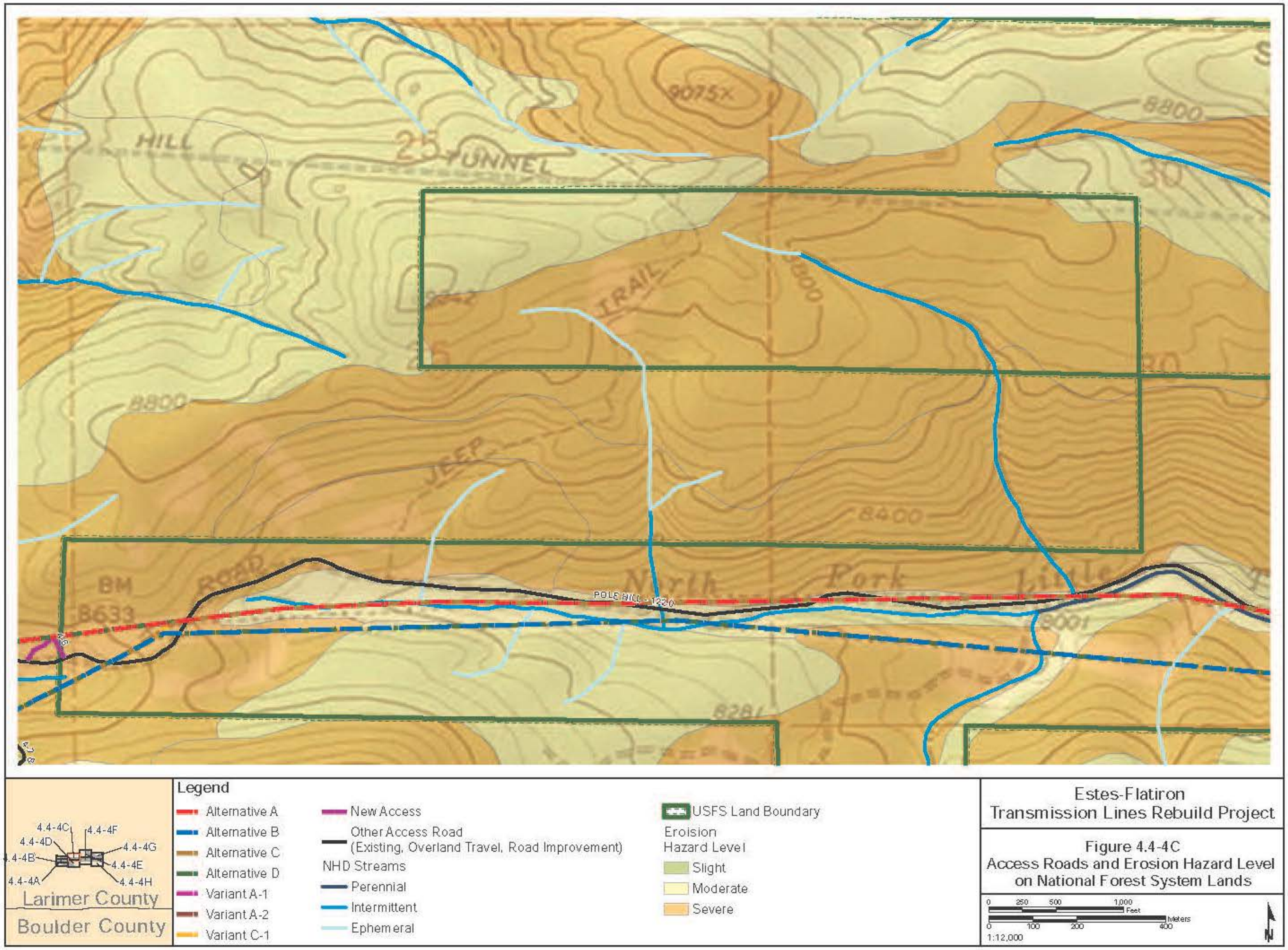


Figure 4.4-4d Access Roads and Erosion Hazard Level

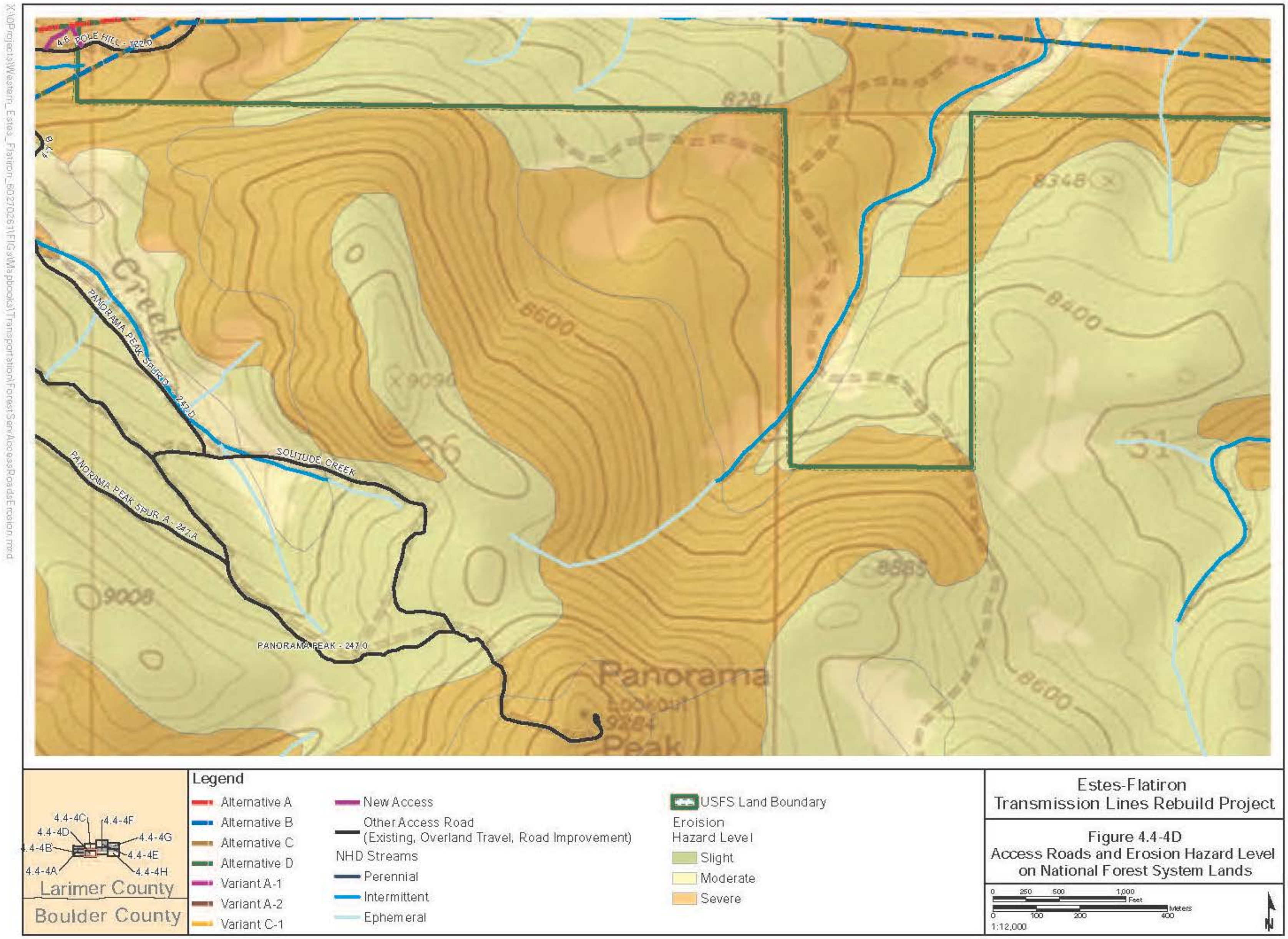


Figure 4.4-4e Access Roads and Erosion Hazard Level

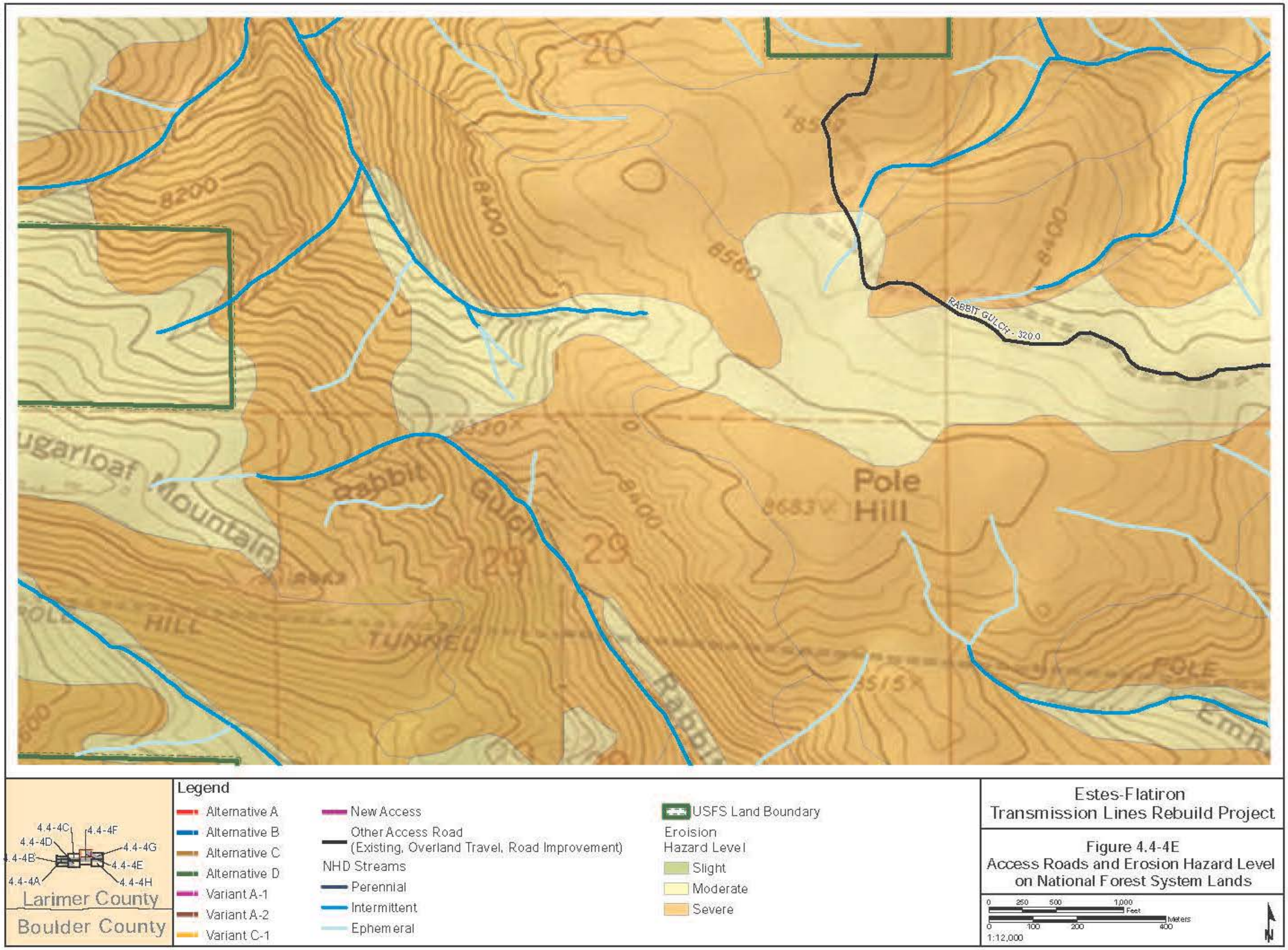


Figure 4.4-4f Access Roads and Erosion Hazard Level

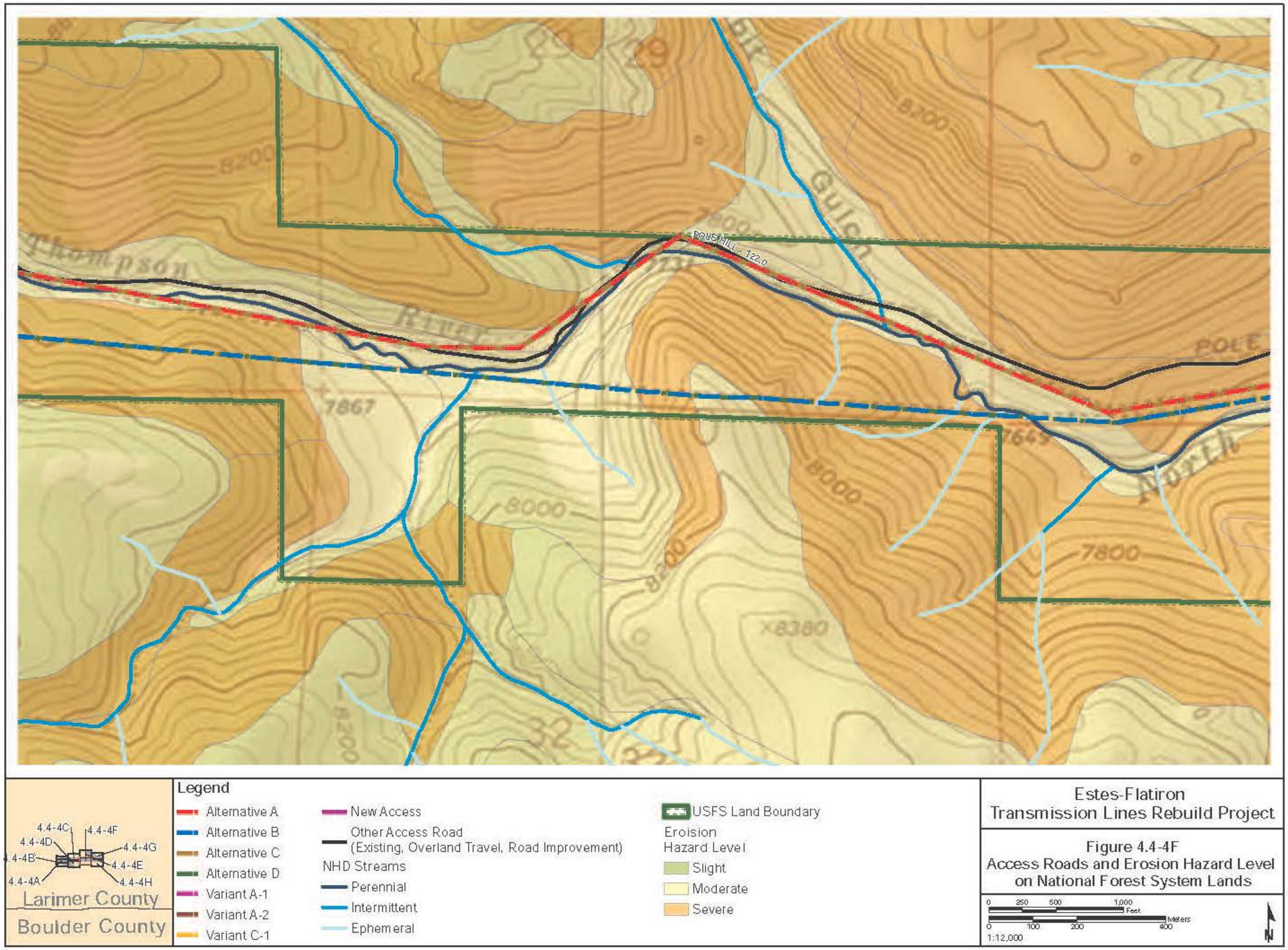


Figure 4.4-4g Access Roads and Erosion Hazard Level

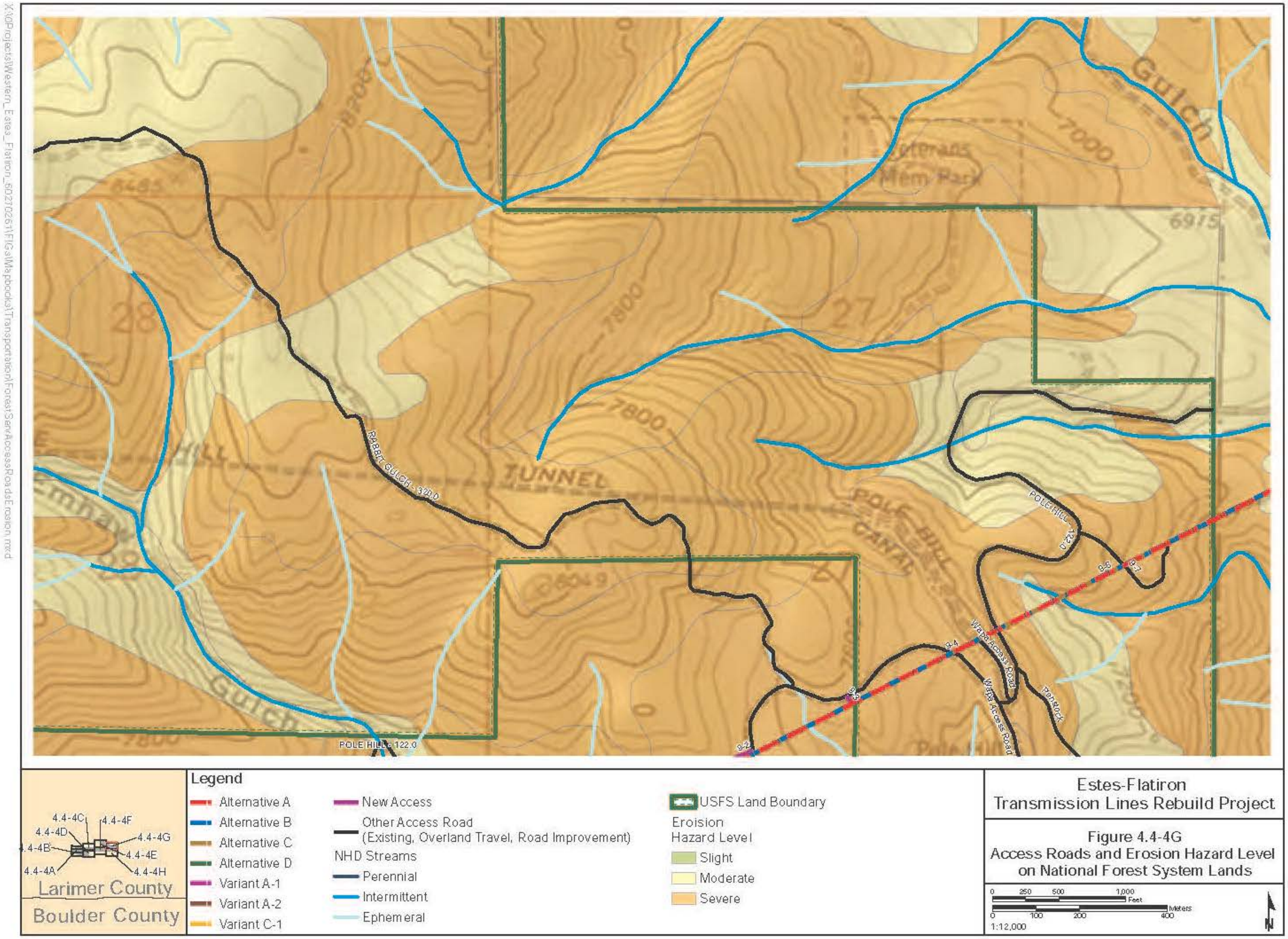
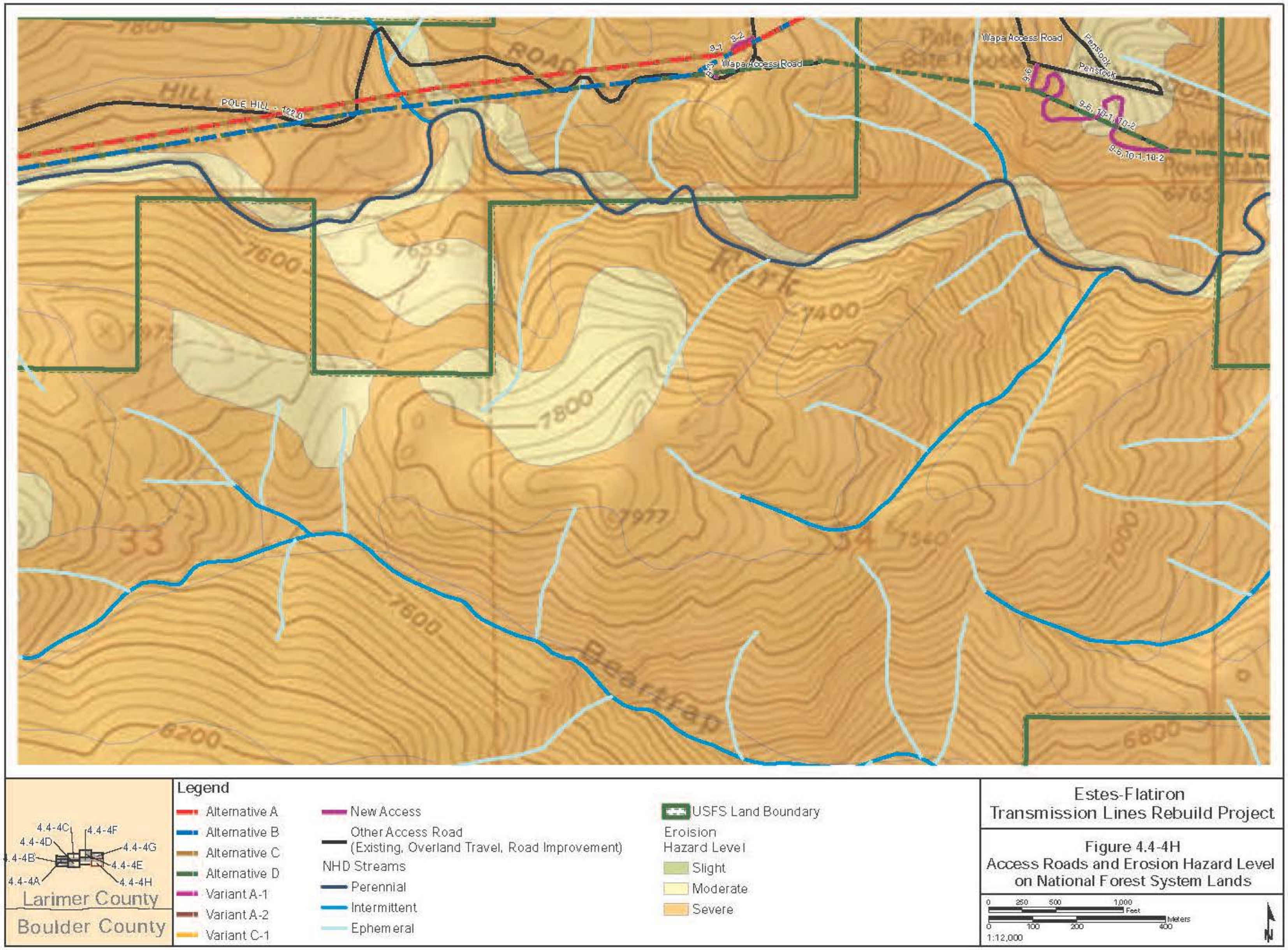


Figure 4.4-4h Access Roads and Erosion Hazard Level



Road decommissioning, which involves reclaiming and barricading the road to inhibit vehicular use, would help reduce effects. Additionally, erosion impacts would be reduced where surfacing and erosion controls are engineered into the road. **Table 4.4-1** provides an assessment of the soil characteristics anticipated to be disturbed within the ROW for each alternative. Note that the totals exceed the total amount of potential disturbance due to the fact that some locations have more than one soil characteristic (e.g., shallow depth to bedrock and prone to water erosion).

Short-term impacts such as erosion, compaction, and rutting are anticipated wherever surface disturbance occurs due to construction activities. These impacts would be limited to the ROW, staging areas, structure and pad placement, pulling and tensioning areas, and turnarounds. Where multiple passes by heavy mechanical equipment occur anywhere except existing established roadways, detrimental compaction may occur. SCPs described in Section 2.5 would limit rutting and erosion. If soil mitigation measures S-1 and S-2 described below are adopted and implemented successfully for all alternatives, immediately following completion of construction, the impacts should be short-term.

Long-term moderate impacts to vegetation are anticipated associated with adaptive vegetation management, specifically in areas with deciduous or coniferous tree species. Modifying vegetation types (e.g., converting a forested area to vegetation more compatible with transmission line operation) would modify soil productivity and soil development. Although long-term soil productivity would be altered, nutrient cycling would continue due to the continual addition of leafy vegetative litter associated with grass or shrub species.

Construction of the transmission line would result in areas of localized permanent impacts associated with the foundations of steel poles, wood poles, and new permanent access roads. Localized long-term impacts to soils would result from loss of surface lands and soil productivity and quality due to installation of structure foundations. The acreage of long-term disturbance associated with each alternative is estimated under “Operation Impacts” in **Table 4.4-3**.

Table 4.4-2 Soil Characteristics within the Analysis Area for each Alternative and Variant

	Total Acres	Water Erodible	Low Revegetation Potential	Compaction Prone	Shallow Bedrock	Corrosion to Steel	Droughty
Analysis Area acres (%)							
Alternative A	411	82 (20)	32 (8)	58 (14)	135 (33)	28 (7)	7 (2)
Variant A1	386	76 (20)	32 (8)	57 (15)	125 (32)	26 (7)	7 (2)
Variant A2	348	63 (18)	13 (4)	56 (16)	99 (28)	26 (8)	3 (<1)
Alternative B	346	57 (17)	44 (13)	26 (8)	137 (40)	27 (8)	12 (4)
Alternative C	389	52 (15)	21 (5)	71 (18)	133 (34)	28 (7)	3 (<1)
Variant C1	351	50 (14)	14 (4)	70 (20)	114 (33)	27 (8)	3 (<1)
Alternative D	639	115 (18)	60 (9)	90 (14)	225 (35)	55 (9)	15 (2)
110-foot ROW acres (%)							
Alternative A	200	40 (20)	16 (8)	28 (14)	66 (33)	14 (7)	4 (2)
Variant A1	201	40 (20)	17 (9)	29 (14)	65 (32)	14 (7)	4 (2)
Variant A2	203	37 (18)	8 (4)	33 (16)	58 (29)	15 (7)	2 (1)
Alternative B	221	36 (16)	28 (13)	17 (8)	88 (40)	17 (8)	8 (4)
Alternative C	207	27 (13)	11 (5)	38 (18)	70 (34)	15 (7)	2 (1)
Variant C1	208	30 (14)	8 (4)	41 (20)	68 (33)	16 (8)	2 (1)
Alternative D	381	69 (18)	36 (9)	53 (14)	134 (35)	33 (9)	9 (2)

Table 4.4-3 Construction and Operation Impacts to Soil Resources

Alternative	Total Acres Impacted	Wind Erodible	Water Erodible	Low Revegetation Potential	Compaction Prone	Shallow Bedrock	Corrosion to Steel	Droughty
Construction Impacts acres (percent)								
Alternative A	104.00	0	21 (20)	8 (8)	15 (14)	34 (33)	7 (7)	2 (2)
Alternative A1	419.00	0	21 (5)	9 (2)	15 (4)	34 (8)	7 (2)	2 (<1)
Alternative A2	355.00	0	18 (5)	4 (1)	16 (5)	28 (8)	7 (2)	1 (<1)
Alternative B	109.00	0	18 (17)	14 (13)	8 (7)	43 (40)	8 (7)	4 (4)
Alternative C	106.00	0	14 (13)	6 (6)	19 (18)	35 (33)	8 (8)	1 (1)
Alternative C1	370.00	0	14 (4)	4 (1)	19 (5)	32 (9)	8 (2)	1 (<1)
Alternative D	147.00	0	23 (16)	12 (8)	18 (12)	44 (30)	11 (8)	3 (2)
Operation Impacts acres(percent)								
Alternative A	10	0	2 (20)	1 (10)	1 (10)	3 (30)	1 (10)	0
Alternative A1	26	0	5 (19)	2 (8)	4 (15)	8 (31)	2 (8)	1 (4)
Alternative A2	11	0	2 (18)	0	2 (18)	3 (27)	1 (9)	0
Alternative B	13	0	2 (15)	2 (15)	1 (8)	5 (39)	1 (8)	0
Alternative C	10	0	1 (10)	0	1 (10)	3 (30)	1 (10)	0
Alternative C1	26	0	4 (15)	1 (14)	5 (19)	8 (31)	2 (8)	0
Alternative D	21	0	0	0	0	0	0	0

4.4.4 No Action Alternative

Activities associated with the maintenance and repairs of the existing line, including soil compaction and other disturbances, would result in minor short-term effects in localized areas. Maintenance frequency is expected to increase as the line ages. Natural and anthropogenic actions such as erosion, agriculture, fire, recreation, and grazing would continue to impact soil resources at present levels in the analysis area.

Direct and indirect impacts from the No Action Alternative, including the relocation of the transmission line at the Newell Lake View subdivision , would be similar to those described in Impacts Common to All Alternatives. Although not quantified in **Table 4.4-2**, over time the amount of disturbance and types of soils disturbed would be similar to those shown for Alternative D.

Repeated disturbance during operational activities within the existing ROW may increase the direct impacts to soil resources resulting from compaction and disturbance to soil cover. Indirect impacts would include an increase in runoff and erosion due to the reduction in soil cover and compaction.

Impacts to soils associated with acquisition of a wider ROW on adjacent previously undisturbed soils, would include impacts to soil productivity and quality related to vegetation clearing and soil disturbance as described above in Section 4.4.3, Impacts Common to All Alternatives. On National Forest System lands, Western would not seek authorization to expand its ROW. No additional impacts beyond what is described above for maintenance activities would occur.

Short-term and long-term impacts associated with the relocation of the transmission line at the Newell Lake View subdivision would be similar to those described in Impacts Common to All Alternatives.

4.4.5 Impacts Unique to Specific Action Alternatives

4.4.5.1 Alternative A

Alternative A would impact 21 acres of water erodible soils. Soils shallow to bedrock are common (34 acres). Rock drilling may be necessary in these areas. These soils may be difficult to reclaim if disturbed. Approximately 7 acres of soils that are corrosive to steel would be impacted.

Much of the soil disturbance would occur within the existing ROW. Alternative A would result in fewer direct and indirect effects to soils in the project area, in relation to the other action alternatives. However the ROW would be expanded to accommodate current requirements and regulations. Activities associated with the maintenance and repairs of the existing line, including soil compaction and other disturbances, would result in minor short-term effects in localized areas. Maintenance frequency is expected to increase as the line ages.

Temporary short-term disturbances would occur within the ROW due to construction traffic along the ROW, temporary staging areas, and work areas around each structure. Permanent long-term impacts to soil resources would occur at each structure location.

4.4.5.2 Variant A1

Much of the soil disturbance for Variant A1 would occur within the existing ROW, except the new routing across Bullwark-Catamount family soil units (**Figure 4.4-2a**). Impacts would be similar to those described for Alternative A and Impacts Common to All Alternatives.

4.4.5.3 Variant A2

Approximately 20 additional acres of soil resources would be impacted. Variant A2 would impact 18 acres of water erodible soils. Soils shallow to bedrock are common (28 acres). Rock drilling or blasting may be necessary in these areas. These soils may be difficult to reclaim if disturbed. Approximately 7 acres of soils that are corrosive to steel would be impacted.

More soil disturbance would be anticipated due to the trenching that would be required to bury the transmission line. Soil mixing could result from trenching practices, resulting in a reduction in soil productivity caused by mixing the more productive topsoil with the subsoil. Soils with shallow bedrock would be encountered where trenching occurs. Rock may be brought to the soil surface during trenching in locations where there was no rock previously, which may inhibit revegetation. Impacts to soils resources would be minimized by the implementation of SCP 1, SCP 6, SCP 11, SCP 22, SCP 25, SCP 26.

4.4.5.4 Alternative B

Within the ROW for Alternative B, soil inventories indicate that shallow soils are common. Rock drilling may be necessary in these areas. These soils may be difficult to reclaim if disturbed. Approximately 43 acres of soils shallow to bedrock would be impacted by Alternative B. Approximately 14 acres of LRP soils would be impacted by Alternative B. The success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical and chemical characteristics of the soils. Approximately 8 acres of soils that are corrosive to steel would be impacted. The effects of corrosion on steel transmission line structures would be offset by the use of protective coating and cathodic protection.

4.4.5.5 Alternative C

Alternative C would impact the least acreage of soil resources overall. Soil inventories indicate that shallow soils are common. Rock drilling may be necessary in these areas. These soils may be difficult to reclaim if disturbed. Approximately 35 acres of soils shallow to bedrock would be impacted by Alternative C. Approximately 6 acres of LRP soils would be impacted by Alternative C. The success of stabilization and restoration efforts in these areas may be limited unless additional treatments and practices are employed to offset the adverse physical and chemical characteristics of the soils. Approximately 8 acres of soils that are corrosive to steel would be impacted. The effects of corrosion on steel transmission line structures would be offset by the use of protective coating and cathodic protection.

Under this alternative, certain sections of Pole Hill Road (USFS Road 122) and USFS Road 247.D would be reconstructed. Grinding, chipping, or blasting could be used to level the grade on the west end of Pole Hill Road. Road reconstruction would result in additional bare ground and loose soils. No imported aggregate would be used to surface roads. Impacts to soil resources from the road reconstruction could include compaction, increased runoff, and erosion. However, in the long term, reconstruction of this road could be a beneficial impact to soil resources, if the proper best management practices are utilized and drainage is improved, due to the current rates of erosion from this unimproved native surface road. Section 4.5.5 provides additional detail on erosion and sedimentation impacts related to the Pole Hill Road reconstruction.

4.4.5.6 Variant C1

Impacts for Variant C1 would be similar to those described for Alternative A and Impacts Common to All Alternatives. However, more soil disturbance would be anticipated due to the trenching that would be required to bury the transmission lines. Soil mixing could result from trenching practices resulting in a reduction in soil productivity. Soils with shallow bedrock would be encountered where trenching occurs. Rock may be brought to the soil surface during trenching in locations where there was no rock previously.

Under this alternative, certain sections of Pole Hill Road (USFS Roads 122 and 247.D) would be reconstructed. Grinding, chipping, or blasting could be used to level the grade on the west end of Pole Hill Road. Road reconstruction would result in additional bare ground and loose soils. No imported aggregate would be used to surface roads. Impacts to soil resource from the road reconstruction could include compaction, increased runoff, and erosion. However, in the long term, reconstruction of this road could be a beneficial impact to soil resources, if the proper best management practices are utilized and drainage is improved, due to the current rates of erosion from this unimproved native surface road. Section 4.5.5 provides additional detail on erosion and sedimentation impacts related to the Pole Hill Road reconstruction.

4.4.5.7 Alternative D

Alternative D would rebuild both the existing north and south transmission lines in-kind as single circuit lines using structures very similar to those currently in use. The existing ROWs would be expanded as needed and minor adjustments made to the alignments where necessary to comply with Federal requirements.

Impacts for Alternative D would be similar to Alternative A and those described in Impacts Common to All Alternatives. Total acres of soils with limitations impacted by Alternative D are listed in **Table 4.4-1**. Within the ROW for Alternative D, soil inventories indicate that fewer soils with limitations occur than compared to the other action alternatives. Approximately 44 acres of soils have hard bedrock within 60 inches of the surface. Rock drilling may be necessary in these areas. These soils may be difficult to reclaim if disturbed. Approximately 23 acres of soils that would be impacted by Alternative D are highly water erodible.

4.4.6 Mitigation

The following mitigation measures are recommended to reduce, minimize, or mitigate impacts associated with disturbances for all action alternatives, and if adopted, would further reduce adverse effects so soils.

S-1: Where permanent facilities or structures would be located, the entire topsoil horizon would be salvaged for use in reclamation, prior to surface disturbance. Additionally, prior to any trenching the topsoil would be salvaged and stockpiled separately from subsoil, for use in reclamation.

Salvaging all topsoil from locations where permanent facilities or structures would be located, would increase the potential for successful reclamation.

S-2: Construction, excavation, or re-spreading with frozen or saturated soils is prohibited. If adopted, the implementation of measure S-2, impacts to soils due to uneven settling, compacted surfaces, and physical crusts reducing water infiltration would be reduced.

S-3: During construction, erosion control measures would be inspected after every storm event and maintained.

Erosion controls are only effective if they are maintained. Monitoring of erosion controls after storm events would keep erosion control in effective working order and reduce or prevent sediment from moving off-site.

S-4: During reclamation and decommissioning, compacted areas (typically any area that received repeated traffic or three or more passes by heavy equipment) would be decompacted, to the depth of compaction, by subsoiling, paraplowing, or ripping on the contour to the depth of compaction. Soils would be decompacted only when needed, and where decompaction would result in more net benefit than not employing decompaction methods to help prepare the seed bed, encourage infiltration, and help to prevent accelerated runoff and erosion. Scarification would only be used on shallow soils.

Decompacting to the depth of compaction reduces the potential for buildup of alkalinity, salts, or sodium over a subsurface compacted layer. Additionally it prevents water from infiltrating and flowing laterally once it hits a deep compacted layer, carrying surface soils away, or causing instability of saturated soils on slopes.

S-5: Soil stockpiles left in place for more than one week would be protected from wind and water erosion using the proper best management practices (mulch, tackifier, cover crop, etc.).

This would help to protect disturbed soils from losses to wind and water erosion.

4.4.7 Residual Impacts

Residual impacts would result from the removal of soils by project footprints and permanent access roads. These impacts would be long-term but not significant.

All alternatives would result in minor impacts with the exception of Variants A2 and C1. Variants A2 and C1 would result in moderate impacts due to trenching and burying of the transmission line.

4.4.8 Irreversible and Irretrievable Commitments of Resources

Long-term to permanent impacts would be associated with structure footprints and permanent access roads. An irretrievable loss in soil productivity and soil quality would occur where maintenance roads and transmission line structures are located. Soils whose characteristics could limit reclamation success also could result in long-term impacts.

4.4.9 Relationship between Short-term Use and Long-term Productivity

Where surface disturbance occurs, short-term impacts are anticipated due to construction activities and would be limited to the temporary ROW, staging areas, structure and pad placement, pulling and tensioning areas, and turnarounds. Where multiple passes by heavy mechanical equipment occur, detrimental compaction may occur. If soil mitigation measures (described above) are adopted and implemented immediately following completion of construction, the impacts should be temporary.

Long-term to permanent impacts would be associated with structure footprints. An irretrievable loss in soil productivity and soil quality will occur where structures are located. Continued traffic and any other surface disturbance associated with operation and maintenance activities also would be considered a long-term impact.

4.5 Water Resources and Floodplains

Potential impacts to water resources have been analyzed within the analysis area, defined as a 200-foot-wide area for existing ROW and 300-foot-wide for new alternatives, in addition to a one-mile buffer surrounding the alternatives.

Scoping concerns, existing conditions, potential project activities and locations, and agency environmental commitments formed the basis of the water resources assessment. DOE regulations in 10 CFR Parts 1021 and 1022 require public notification of floodplain involvement (DOE 2003). Agency environmental procedures, including policies from Western and DOE, as well as permit requirements from CDPHE and the Forest Plan, identified most concerns for the water resources assessment. In combination with public scoping comments, related issues focused on the following:

- Disturbance of stream channels and banks, roads, and culverts;
- Accelerated water erosion and sedimentation;
- Degraded water quality;
- Reduced floodplain conveyance and floodplain values; and
- Disruption of water wells and septic tank filter fields.

4.5.1 Methodology

The impact evaluation first reviewed inputs from the scoping process. Baseline conditions were inventoried from existing information and new fieldwork. Project activities were examined, and then Western's SCPs and Federal and state regulatory provisions that direct the activities were reviewed. The SCPs and other measures to protect water resources and reclaim disturbed sites have been included by Western as part of the proposed project. These measures were compared to evaluate for potential construction and maintenance effects on floodplains and streams, water quantity, and water quality. Potential changes from the baseline setting were then qualitatively examined with respect to significance criteria.

4.5.2 Significance Criteria

4.5.2.1 Surface Water

A significant impact to surface water would result if any of the following were to occur from constructing or operating the proposed project or an action alternative:

- Contamination of surface water from erosion or storm water runoff that would result in a violation of Federal and/or state water quality standards.
- Alteration of the existing drainage pattern of the area that would result in off-site erosion or sedimentation.
- Surface water impacts that would violate Section 404 of the CWA or other applicable surface water regulations, including state-established standards for designated uses.

4.5.2.2 Groundwater

A significant impact to groundwater would result if any of the following were to occur from constructing or operating the project or an action alternative:

- Spills of fuel or other fluids that would reduce groundwater quality below applicable regulations by uncontrolled seepage into water-bearing zones used for domestic supplies; and
- Excavation disturbance that would result in a measurable reduction of groundwater flow to springs or wells.

4.5.2.3 Floodplains

A significant impact to floodplains would result if any of the following were to occur from constructing or operating the project or an action alternative:

- Modification of a floodplain that would impede or redirect flood flows resulting in property damage on- or off-site.
- Increased scouring during a flood event that would result in structural or property damage.
- Spills or releases of fuels, hazardous or toxic materials, or other contaminants stored within a FEMA-designated SFHA that would substantially affect floodplain natural resources or functions.

4.5.3 Impacts Common to All Alternatives

Potential effects on streams, and the watersheds that contribute to them, could result from increased runoff and accelerated water erosion along roads and at stream crossings. Existing roads could require repairs, upgrades or improvements and would undergo heavier traffic during construction, which could further concentrate runoff along vehicle tracks and encourage sediment delivery over the short-term. New road construction would take place to a limited extent, and would be limited to locations where there is currently no existing access along some parts of some alternatives. This is further described in

Chapter 2.0, and distinguished below in separate alternative discussions. Where it would occur, construction of new ROW segments would reduce canopy cover and increase the amount of bare ground and loose soil. This could increase the potential for sediment and runoff to be directed into streams.

In general, however, impacts from runoff, erosion, or sedimentation would be avoided or reduced on any alternative by implementation of Western's SCPs and by storm water management best management practices. Best management practices would complement Western's SCPs, and would be implemented in accordance with a Storm Water Pollution Prevention Plan submitted to CDPHE for review and approval.

In accordance with CWA Section 402, an approved permit from the state would be required for the project under the General Permit for Stormwater Discharges Associated with Construction Activities from the CDPHE. Compliance with the provisions under this permit (CDPHE COR030000) would minimize and mitigate surface water impacts from storm water runoff or snowmelt. Any impacts that might occur after the implementation of SCPs and compliance with permit provisions would be less than significant, short-term direct impacts.

Additional impacts to surface water or groundwater could occur from spills or leaks of fuel or lubricants, from discharge of groundwater at excavations, from access road construction at stream crossings, or from releases of contaminants at staging areas or concrete facilities. Implementation of SCPs as described in Section 2.5, would avoid or reduce these potential impacts to water resources. Any remaining impacts would be short-term direct impacts and would be less than significant. Spill responses and post-construction clean-up and monitoring would mitigate any impacts that occurred. Numerous SCPs are directly related to managing construction activities to avoid water resource features, minimize construction activities near them, or to mitigate disturbance, preserve flow conveyance, and encourage channel and bank stability. Refer to Section 2.5 for these measures.

CWA Section 404 and 401 permit requirements would apply to the project, since waters of the U.S., including wetlands, occur along the proposed alternative routes (see Section 3.6) and may be disturbed by access roads associated with their construction. Under Section 404, Nationwide Permit 12 (NWP 12, Utility Line Activities) would likely apply to the construction of the line structures, foundations, access roads, and temporary structures or work needed to complete the proposed project (*Federal Register*, Vol. 77, No. 34, Part III, February 21, 2012). Compliance with NWP 12 provisions would limit any impacts to less than significant, short-term, direct impacts.

Potential impacts to shallow groundwater, wells, or septic systems could occur from excavating structure foundations. Implementation of the SCPs would generally avoid these impacts. Further discussion of potential effects related to these resources is presented below for the specific action alternatives.

4.5.4 No Action Alternative

Under the No Action Alternative, some impacts would occur to water resources. These would mainly result from maintenance activities conducted over a longer period of time than that of an action alternative and the construction of access roads where current access is limited or non-existent. Direct impacts would occur in the form of short-term increases in surface water turbidity and sediment transport from stream crossing disturbance during ROW expansion, access road construction, vegetation removal, and maintenance activities. Indirect impacts, such as water-related effects on aquatic habitat or wetlands, are described in Sections 4.6, 4.9, and 4.10. Direct impacts would range in intensity from "no effect" to minor, and would be avoided or minimized by existing practices that are the same or similar to the SCPs currently employed by Western. Relocation of the ROW in the Newell Lake View subdivision area would generate negligible to minor local, short-term direct surface water effects similar to those from maintenance activities elsewhere along the ROW. Only negligible impacts to groundwater or floodplain resources would occur.

No long-term effects to water resources would occur under the No Action Alternative.

4.5.5 Impacts Unique to Specific Action Alternatives

4.5.5.1 Alternative A and Variant A1

Implementation of the proposed SCPs would generally address potential impacts to surface water from Alternative A; and compliance with permit provisions set by the USACE would further avoid or mitigate impacts at surface water crossings where construction would be necessary. Approximately 43 waterbodies would be crossed by equipment traffic under Alternative A. As listed in **Table 3.5-2**, four waterbodies would involve perennial streams, 27 would involve intermittent streams, and 11 would involve ephemeral streams. If necessary to allow transport of equipment or materials, or to minimize impacts from repeated traffic, culverts or stabilized low-water crossings would be used to reduce impacts and allow vehicle and equipment traffic at selected stream crossings.

On the basis of successful implementation of the proposed SCPs, and compliance with permit provisions generated through review and approval of applicable state and Federal permits as discussed above, minor to negligible direct impacts to surface water quantity and quality would be anticipated from Alternative A under normal operations. Should an accident occur, minor to moderate adverse effects on surface water quantity and quality could occur. These conditions would generally involve uncontrolled runoff and sediment transport generated by unusual runoff conditions, exceptional flow rates at disturbed channel crossing features (such as culverts or bank stabilization), or an accidental release of fuel, concrete, or other material into a stream.

As described under Section 3.5, Affected Environment, numerous water wells and septic systems are located along the Alternative A. Other areas of relatively shallow recorded water levels occur immediately southeast of Lake Estes in the vicinity of the western project terminus. These areas generally have deep soils and substrates that would not require blasting for excavation. Small, short-term declines of water in nearby wells could occur if dewatering were required for structure foundations. There may be no discernible effects, depending on excavation conditions, well proximity, and seasonal groundwater levels. If they occurred, these short-term local water level declines would be negligible or minor. Groundwater level recovery would begin as soon as any necessary dewatering ceased.

Over the remainder of these alternatives, depths to groundwater are typically greater than 100 feet (and often much greater), well beyond excavation depths that could be required for structure construction. This also pertains to Variant A1. No springs are known to occur over the proposed ROW. Because of these factors, impacts from foundation excavation or access road disturbance that would result in a measurable reduction of groundwater flow to springs or wells are not likely to occur under normal operations or accident conditions.

If removal of groundwater is required during excavation, compliance with SCP 10 and CDPHE General Permit COG070000 (Construction Dewatering) would avoid or mitigate impacts from groundwater discharges. Spill controls would be implemented in accordance with SCP 4 and SCP 9 (see Section 2.5). Implementing these protocols would avoid impacts to groundwater quality, or reduce them to negligible or minor levels during construction and under normal operations or accident conditions. With the application of SCPs, and the practices implemented in compliance with permits to be approved by CDHPE, no significant adverse impacts to surface water or groundwater quantity or quality would result from Alternative A or Variant A1.

A floodplain (defined here as a SFHA Zone A or similar as delineated by FEMA) occurs near Alternative A near its western terminus. Variant A1 would avoid this locale. Based on close inspection of maps, the floodplain delineation is about 250 feet north of Mall Road. It is associated with low-lying topography along the Big Thompson River. Alternative A would closely follow Mall Road in the vicinity, and is likely to entirely avoid the delineated floodplain. In any case, no measurable effects on the water surface elevations of floods would occur from structure installations if they were to occur in the floodplain. The structures and foundations would present a comparatively negligible cross-section with respect to flood conveyance in the area. However, staging areas for equipment, vehicles, fuel, concrete, and other materials have not been defined for the project. As stated in Section 2.3.3, staging areas would be located by the contractor according to Western's SCPs. SCP 7 addresses the location of staging areas with respect to vegetation conditions. In contrast, FEMA floodplain delineations are based on the estimated or calculated extent of inundation from a 100-year, 24-hour flood event.

Because the Big Thompson River is a major water feature in the project vicinity and supports a number of resource values. The presence of materials, equipment, or vehicles in its floodplain would present an unnecessary risk to water quality in shallow on-site groundwater and/or in the river downstream. If a flood, leak, or spill occurred while construction vehicles, equipment, or materials were located on the floodplain, significant adverse direct and indirect impacts to surface water quality could occur in the Big Thompson River from the release of fuels, concrete, or other contaminants. Given the relatively steep slope of the river in the vicinity, these effects could be transmitted well downstream, creating indirect effects on surface water quality and related designated beneficial uses. However, based on SPC 7, staging areas would not be sited in proximity to surface waters, minimizing the risk to water quality.

Short-term effects of Alternative A on water resources would include temporary, limited additional runoff and sedimentation in streams due to construction activities. These impacts are not anticipated to be significant, and would be avoided or limited in their intensity and extent by the implementation of Western's proposed SCPs and compliance with applicable state and Federal permits.

Long-term effects of Alternative A on surface water quantity or quality are not expected. No long-term effects on floodplains, groundwater quantity, or quality are expected.

4.5.5.2 Variant A2

Potential impacts under Variant A2 would be similar to those described for Alternative A, but would require excavating generally to a 9-foot depth, and occasionally to greater depths to accommodate vaults as discussed in Section 2.2.1.4. It is likely that Variant A2 would encounter groundwater in the valley topography along the western part of the alignment, where underground construction would take place. If groundwater were encountered that required discharge, Western would comply with CDPHE permit requirements for General Permit COG070000 - Construction Dewatering. The trench would be backfilled with native backfill approximately 5 feet thick over the concrete enclosing the transmission conduits. These procedures would avoid or mitigate the potential for degrading water quality during and after construction. Significant effects on the movement of shallow groundwater would not be anticipated, due to the cover depth and relatively shallow nature of the concrete structure.

Given the construction space available between the road and floodplain, Variant A2 would avoid excavation within the Big Thompson River floodplain; however, some equipment and materials would be required to be staged nearby during construction.

4.5.5.3 Alternative B

Direct and indirect effects to water resources under Alternative B would be generally the same as those described under Alternative A. In addition, Alternative B would cross one perennial waterbody (see **Table 3.5-2**). The SCPs and permit requirements discussed under Alternative A also would pertain to Alternative B. Potential impacts to surface water quantity and quality would be of the same types and nature as those described under Alternative A, but would differ in extent and location.

Alternative B would cross steep, rocky terrain along its western portion south of U.S. Highway 36 in the Meadowdale Ranch area. Potential impacts from construction traffic in this area would have greater potential for increasing runoff, erosion, and sedimentation than Alternative A. Alternative B would avoid the eastern shore of Pinewood Lake on the eastern end of the project area. Alternative B would cross the Pinewood Lake area beyond the south end of the lake, but would be near several residences and associated domestic wells near the lake. Similarly, on the western end of the project area, Alternative B would avoid areas of shallow groundwater immediately east of Lake Estes in Section 29, T5N, R72W. Under Alternative B, however, areas having domestic water wells with relatively shallow water levels (depths of 25 feet or less below the ground surface) occur in Sections 29 and 34, T5N, R72W. These are in the western portion of the alternative, with the wells in Section 34 located in the Ravencrest Heights/Ravencrest vicinity.

There are a number of homes along County Road 122 (Pole Hill Road), Timber Lane, Pine Tree Drive, and Alpine Drive along Alternative B as it climbs from the highway to the ridgetop. Domestic wells and septic systems in this area, the northwest quarter of Section 34, T5N, R72W, may be adversely affected by foundation excavation. Adverse effects could be more likely if blasting were required to prepare structure foundations in areas of hard, near-surface bedrock. If it were required, blasting could damage underground piping associated with domestic water supply and septic systems. Resulting impacts, which could range from negligible to significant, could involve reduced water levels in wells, damage to pumps or well casings, and cracked septic tanks or drainfield pipes. Because of the potential for significant adverse impacts to domestic water systems if blasting was necessary for foundations through this portion of Alternative B, implementation of additional mitigation measure WR-1 is recommended (see Section 4.5.6, Mitigation, below).

Under Alternative B, other potential impacts from foundation excavation and potential dewatering in areas of shallow groundwater would be the same as those described for Alternative A.

Alternative B would avoid the FEMA-designated floodplain along the Big Thompson River.

Short-term and long-term impacts under Alternative B generally would be the same as those described for Alternative A. Incorporating recommended mitigation measure WR-2 into Alternative B would avoid or reduce the potential for impacts to domestic water supply and septic systems if blasting were required for foundation excavation in the Ravencrest Heights/Ravencrest area.

4.5.5.4 Alternative C

Alternative C would cross steep, rocky terrain along its western portion north of U.S. Highway 36 in the Meadowdale Ranch area. Potential impacts from construction traffic in this area would have greater potential for increasing runoff, erosion, and sedimentation than Alternative A, and would be similar to Alternative B. In addition, Alternative C would involve re-construction of the Pole Hill Road on National Forest System lands, which would increase the potential for impacts from runoff, erosion and sedimentation in that area. This potential would be addressed by Western’s SCPs and other environmental practices in compliance with permits as needed.

Along the eastern portion of the study area, Alternative C trends along the eastern side of Pinewood Lake. Based on water well records from the Colorado State Engineer, an area with potential for encountering groundwater during excavation exists in the vicinity of Pinewood Lake on the eastern end of the project area. Several well records in that area indicate depths to water within 25 feet of the land surface in the south half of Section 30 and the north half of Section 31, T5N, R70W. These areas generally have deep soils and substrates that would not require blasting for excavation. Small, short-term declines of water in nearby wells could occur if dewatering were required for structure foundations.

There may be no discernible effects, depending on excavation conditions, well proximity, and seasonal groundwater levels. If they occurred, these short-term local water level declines would be negligible or minor. Groundwater level recovery would begin as soon as any necessary dewatering ceased. As with Alternative A, if removal of groundwater is required during excavation, compliance with SCP 10 and CDPHE General Permit COG070000 (Construction Dewatering) would avoid or mitigate impacts from groundwater discharges. Spill controls would be implemented in accordance with SCP 4 and SCP 9 (see Section 2.5). Implementing these protocols would avoid impacts to groundwater quality, or reduce them to negligible or minor levels under normal operations or accident conditions.

Alternative C would avoid the FEMA-designated floodplain along the Big Thompson River. Incorporating recommended mitigation measure WR-2 into Alternative C would avoid or reduce the potential for impacts to domestic water supply and septic systems if blasting were required for foundation excavation in the Ravencrest Heights/Ravencrest area.

4.5.5.5 Variant C1

Potential impacts under Variant C1 would be similar to those described for Alternative C. If shallow groundwater was encountered along the valley portion of the underground installation, compliance with CDPHE permit requirements for General Permit COG070000 (Construction Dewatering) would avoid or mitigate the potential for degrading water quality during and after construction. The trench would be backfilled with native backfill approximately 5 feet thick over the concrete enclosing the transmission conduits. Significant effects would not be anticipated on the movement of any shallow groundwater that may be present, due to the cover depth and relatively shallow nature of the concrete ductbank.

4.5.5.6 Alternative D

Potential impacts to water resources and floodplains under Alternative D would essentially be of the same types as those described for Alternatives A and B but would differ in extent and location. In addition, at the western end of the project area, the northern part of this alternative would cross the FEMA floodplain associated with the Big Thompson River. The southern part of Alternative D in the Ravencrest Heights/Ravencrest area, and also near the south end of Pinewood Reservoir, would have the same potential impacts on domestic water and septic infrastructure as Alternatives B and C if blasting were necessary.

Alternative D would cross steep, rocky terrain along its western portion south of U.S. Highway 36 in the Meadowdale Ranch area. Potential impacts from construction traffic in this area would have greater potential for increasing runoff, erosion, and sedimentation than Alternative A. Short-term and long-term impacts under Alternative D generally would be the same as those described for Alternative A. Alternative D has a potential for encountering groundwater during excavation exists in the vicinity of Pinewood Lake on the eastern end of the project area. Several well records in that area indicate depths to water within 25 feet of the land surface in the south half of Section 30 and the north half of Section 31, T5N, R70W, near the eastern shore of Pinewood Lake. Incorporating recommended mitigation measure WR-2 into the southern variant on the eastern and western end of Alternative D would avoid or reduce the potential for impacts to domestic water supply and septic systems if blasting were required for foundation excavation in the Ravencrest Heights/Ravencrest area or south of Pinewood Reservoir.

4.5.6 Mitigation

WR-1: As site-specific planning and design proceeds, Western would locate foundations to avoid domestic water supply and septic systems. Western would ascertain the need for blasting to construct foundations in areas where hard, near-surface bedrock occurs alongside domestic water supply and septic systems. Where blasting would be required under such conditions, structure foundations would be located as far from domestic infrastructure as possible, and a blasting control plan would be developed and implemented to minimize adverse effects on underground water systems. Western would address any damage claims appropriately, verifying damages and restoring the function of individual or local water supply or septic systems, as needed.

If adopted, implementing recommended mitigation measure WR-1 would help reduce the potential for significant impacts to water wells and septic systems along Alternatives B, C, and C1, and would provide a means of avoiding or mitigating impacts to domestic water infrastructure that could occur under Alternatives B, C, and C1.

4.5.7 Residual Impacts

Direct and indirect impacts to water resources could include short-term increases in runoff and sediment yield. These short-term direct or indirect impacts would be minor to negligible, and would be addressed by Western's SCPs, and by coordination and compliance with environmental regulatory programs. Long-term impacts to water resources would be negligible due to monitoring and maintenance of site stability, including permanent practices to control runoff, erosion, and sedimentation. After implementation of Western's SCPs, there would be no significant impacts to surface water, groundwater, or floodplains from any of the alternatives.

4.5.8 Irreversible and Irretrievable Commitments of Resources

Because there would be no permanent uses or impacts to any water resources, there would be no irreversible or irretrievable commitments of surface water or groundwater.

4.5.9 Relationship between Short-term and Long-term Productivity

Local short-term impacts may occur if access road construction or traffic over existing ROWs increases runoff, erosion and sedimentation. Western's SCPs, project monitoring, and compliance with state permits as needed would ensure the temporary nature of impacts to water resources if they occurred. Only minor impacts to water resources and their productive beneficial uses are anticipated from any project alternative.

4.6 Wetlands and Waters of the U.S.

The analysis area for wetlands, riparian areas, and waters of the U.S. includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, and 300 feet for new routing options.

Issues related to wetland, riparian areas, and waters of the U.S. were identified during public scoping. Issues considered in assessing environmental impacts were identified by Western through internal scoping and consultation with cooperating agencies. They include the loss or reduction of jurisdictional and isolated wetland/riparian areas and the decline in wetland/riparian community functionality (e.g., wildlife habitat, sediment filtering, flood control, etc.). Losses and declines would result from the degradation of water quality as a result of construction and operation activities.

4.6.1 Methodology

Impacts to wetland and riparian areas, and waters of the U.S. from the project are based on the locations of the resources in relation to the proposed surface disturbance areas. Western's SCPs are taken into account to address the severity of the impact. The exact locations of transmission line structures, associated access roads, and associated temporary work areas are not yet defined. The Transportation Plan was prescriptive for National Forest lands only and does not address access routes on private property. On private property, the access road placement is unknown, thus forcing a programmatic approach at this time. Estimates of disturbance from construction and operation of the project are listed in **Table 2.3-5**. The location and need for new access roads would be determined when the final design and engineering are completed. Estimates of disturbance from access roads are summarized in **Table 2.3-6**.

SCPs to be implemented are listed in **Table 2.5-1**. Relevant SCPs for wetland, riparian areas, and waters of the U.S. include SCP 7, SCP 11, SCP 21, SCP 22, SCP 32, and SCP 33. Based on the SCPs, structures would be located to avoid wetlands where practical. If wetlands were crossed by access or spur roads, they would be crossed in an area where the least amount of damage would occur, and fen wetlands would be avoided. No structures or access roads would be located within wetlands on National Forest System lands. Staging areas would not be located in wetlands, including fen wetlands, riparian communities, or in proximity to surface waters. No disturbance of vegetation would occur within 100 feet of a stream, except for the removal of hazard trees. No fueling, staging, or storage areas would be placed within 100 feet of wetlands, stream, or riparian areas. Where practical new access ways would be located at least 100 feet from rivers, ponds, lakes, and reservoirs. Construction and operation activities are described in Chapter 2.0. Impacts to wetland, riparian areas, and waters of the U.S. associated with the project are classified as either as short- or long-term.

4.6.2 Significance Criteria

It is Western policy to avoid all sensitive areas. A significant impact on wetland and riparian areas would result if any of the following were to occur from construction and operation of the project:

- Degradation or loss of any Federal- or state-protected wetland(s), as defined by Section 404 of the CWA or other applicable regulations.
- Direct loss of wetland or riparian areas, caused by degradation of water quality, diversion of water sources, or erosion and sedimentation resulting from altered drainage patterns.

4.6.3 Impacts Common to All Alternatives

Direct impact to wetlands would occur from the removal of poles from existing wetlands, and installation of structures or access roads where wetlands could not reasonably be avoided. If wetlands could not be avoided, direct impacts would include the trampling of wetland vegetation. Wetland inventories will not be completed on all alternative alignments. The Preferred Alternative will avoid impacts to wetlands from roads and structures, re-routing as necessary after delineation results are compiled.

Based on the SCPs described in Section 4.6.1, new access roads would be located at least 100 feet from rivers, ponds, lakes, and reservoirs, where practical. Direct impacts would include long-term loss of vegetation associated with the permanent facilities and access roads during the life of the project, and the woody vegetation not reclaimed in the ROW due to vegetation management treatments.

Should construction or operation of access roads occur in wetlands or waters of the U.S., impacts could be significant. Erosion and sedimentation would be minimized through the implementation of SCP 3, SCP 6, SCP 7, SCP 26, SCP 29, and SCP 49. Any erosion that does occur as a result of construction activities, could impact native vegetation communities, sensitive species, and modify the floodplain surface as well as channel beds and banks. Impacts to channels would impact riparian vegetation, potentially affect habitat for wildlife and endangered fisheries, adversely impact water quality, and may adversely affect wildlife and plant species further downstream. Additional discussion on erosion impacts on streams is in Section 4.4, Soils.

Short-term impact to wetlands would occur from driving through wetlands and trampling wetland vegetation, which would occur during removal of poles from existing wetlands and installation of structures or access roads where wetlands cannot be avoided. Long-term direct impacts would include long-term loss of vegetation associated with the permanent facilities and access roads during the life of the project, and the woody riparian vegetation not reclaimed in the ROW due to vegetation management treatments.

4.6.4 No Action Alternative

Field surveys for wetlands and waters of the U.S. have been conducted along the majority of this alternative, except for the reroute around the Newell Lake View subdivision. Proposed mitigation measure WET-1, if adopted, would be implemented to determine impacts to wetland and riparian areas along the reroute around the Newell Lake View subdivision.

Drainage and wetland crossing located along the ROW for the No Action Alternative are listed in **Table 3.6-1**. Wetlands along the route are described in Section 3.6 and shown in **Figure 3.6-1a** through **Figure 3.6-1d**. Of the existing transmission line structures located within the project area, three occur in wetlands. Two are located along the existing North Line and are sited in wetland meadows east of Estes Park. These meadows are considered to be fens or potential fens. One is located in a wet meadow along the South Line. Jurisdictional status of these potential wetlands would define the impacts, and determine consultation with the USACE that would be required. If these locations are wetlands, impacts from construction of the project or removal of existing structures could be significant. There would be no additional short-term disturbance. Long-term disturbance would be related to the ongoing maintenance of two transmission line ROWs.

4.6.5 Impacts Unique to Specific Alternatives

4.6.5.1 Alternatives A, B, C, D, and Variant A1

Drainage and wetland crossings located along the ROW for the Alternatives A, B, C, D, and Variant A1 are listed in **Table 3.6-1**. Wetlands along the route are described in Section 3.6 and shown in **Figures 3.6-1a** through **Figure 3.6-1d**. Of the existing transmission line structures located within the project area, three occur in wetlands. Two are located along the existing North Line and are sited in wetland meadows east of Estes Park. These meadows are considered to be fens or potential fens. One is located in a wet meadow along the South Line. The method of removal of existing structures would be determined in consultation with the landowner. Options for removal of existing structures include complete removal by lowering to the ground, or being cut flush to the ground and left in place. Determination of new pole locations would be determined using the SPCs listed above, which would avoid wetlands to the extent practical. Impacts would result from removal activities, but would be minimized if the poles are cut off flush to the ground, and left in place. Impacts from construction and operation activities would only result if wetlands could not be avoided for structure placement. No structures or access roads would be located within wetlands on National Forest System lands.

4.6.5.2 Variants A2 and C1

Direct impacts for Variants A2 and C1 would result from surface disturbance within wetlands associated with burying the transmission line. The National Wetland Inventory does designate wetland areas along the underground routes. Wetland and waters of the U.S. field surveys have not been conducted along these routes. If wetlands are located along the route, impacts would be significant, resulting in the removal of the wetland and its associated vegetation. Indirect effects to any wetlands and riparian areas downslope of the route would include increased erosion, sedimentation, and the spread and establishment of noxious and invasive weed species. Significant impacts could occur if altered drainage patterns develop as a result of trenching to bury transmission lines. Altered drainage or channel development could cause loss of wetlands.

4.6.6 Mitigation

Additional measures are recommended for all alternatives to avoid, minimize, or mitigate impacts include the following:

WET-1: As part of final design and engineering, wetland surveys would be conducted along the ROW to identify any potential wetlands and fens located on site. Survey information collected would include wetland type, type and cover of hydrophytic and riparian vegetation species present, site hydrology, GPS location of the wetland and footprint, and associated information required to determine jurisdictional status. If wetlands or fens are identified on National Forest System lands, in addition to the consultation with the USACE as described in SPC 21, consultation with the USFS hydrologist and soil scientist would need to be conducted.

WET-3: Where wetland features cannot be avoided through site design, wetland construction techniques would be applied for any construction within wetlands. Wetland construction techniques could include: not removing existing structures in wetlands and riparian areas, cutting off existing structures at the base; or the use of timber mats, erosion controls, and the placement of equipment outside of the wetland and waters of the U.S. boundaries. Wetland construction techniques and best management practices would need to be approved by the USACE.

If adopted, implementation of WET-1 would clarify which wetlands that could not be avoided are jurisdictional prior to construction. Implementation of WET-2 would minimize impacts to wetlands and fens on National Forest System lands. Consultation with the USACE as described in SPC 21 would determine necessary mitigation for impacts in these wetlands. Implementation of WET-3, if adopted, would avoid impacts to the majority of the wetlands and riparian areas, and minimize impacts from the removal of the existing structures.

4.6.7 Residual Impacts

Residual impacts would include the loss of any wetlands or riparian areas due to unavoidable structure or access road placement and the loss of shrub and tree hydric vegetation in the ROW from construction and operation activities. Western has committed to avoiding wetland and riparian areas wherever possible to avoid impacts.

4.6.8 Irreversible and Irretrievable Commitments of Resources

Avoidance of wetlands and riparian areas would result in a lack of irreversible and irretrievable commitments. However, if wetlands and riparian areas cannot be avoided and cannot be restored, irreversible commitments could include the permanent loss of wetland and riparian areas during construction and operation activities, the permanent conversion of wetlands to upland vegetation types, or the permanent conversion of shrub and tree dominated wetlands to herbaceous wetlands. Any permanent loss of wetlands would represent an irretrievable commitment of resources.

4.6.9 Relationship between Short-term Use and Long-term Productivity

Avoidance of wetlands and riparian areas would not affect short-term use or long-term productivity. However, if wetlands and riparian areas cannot be avoided, the loss of wetlands would affect short-term use. The conversion of shrub and tree dominated wetlands to herbaceous wetlands would affect long-term productivity to wetlands.

4.7 Vegetation

The analysis area for vegetation resources includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants.

Issues selected for detailed analysis per Section 1.6.3.2 related to vegetation include effects on vegetation, including threatened and endangered, and USFS sensitive, and management indicator plant species. Other issues brought up during the scoping period and those related to impacts to vegetation resources associated with construction and operation activities include: effects of construction activities on the spread and establishment of noxious and invasive weed species; habitat alteration; erosion, soil compaction and surface disturbance resulting in the loss or decline in native species or their associated habitat; impacts to areas with rehabilitation constraints; increased risk of wildfire occurrence and higher intensity; and visual impacts.

4.7.1 Methodology

Impacts to vegetation resources from the proposed project were identified based on the locations of the resources in relation to the proposed surface disturbance areas. The acres of disturbance associated with each alternative were estimated based on the anticipated extent of disturbance for construction and operation activities outlined in Chapter 2.0. Western has the flexibility to site structures and temporary work areas to minimize removal of vegetation within the project ROW. Therefore, the exact structure sites for the transmission lines and locations of structures, access roads, and associated temporary work areas would be determined during the design phase of the project. Because most exact locations of new surface disturbance-related activities are unknown for the proposed alternatives, the impacts to vegetation were estimated by multiplying the percent of the analysis area impacted by new surface disturbance-related activities by the acreage of each vegetation type within the analysis area. This method assumes construction is equally likely to occur within any vegetation type. Surface disturbance total acreages for each alternative are provided in **Table 2.3-5** for transmission line construction, and **Table 2.3-6** for short and long-term surface disturbance for access roads. Calculations are based on the highest potential disturbance for each alternative. This impact assessment method is conservative and likely overestimates the acreage of vegetation communities that would be removed or altered by surface-disturbing activities by discounting the area that would not be disturbed through avoidance and the implementation of the special design features. It does provide the means to compare broad impacts and the number of acres of vegetation affected across the alternative alignments.

Western's SCPs are taken into account in addressing the intensity of the impact. SCPs proposed are listed in **Table 2.5-1**. Relevant SCPs specifically for vegetation resources include SCPs 1-3, SCPs 5-7, SCP 16, SCP 21,SCPs 25-26, and SCP 37.

4.7.2 Significance Criteria

A significant impact on vegetation would result if any of the following were to occur from construction and operation of the project:

- New noxious weed species introduced into the project area, or existing species spread into areas that were previously dominated by native species.
- New or existing noxious weed species introduced that impact sensitive plants and/or plants protected under Federal or state law. Section 3.8 covers special status and sensitive plant species.

4.7.3 Impacts Common to All Alternatives

4.7.3.1 General Vegetation

Impacts of all alternatives would include surface-disturbance associated with construction and operation activities in the ROW and along access roads. Direct surface disturbing impacts to vegetation would include the trampling/crushing of vegetation, the removal of vegetation, and soil compaction. Indirect effects to vegetation could include increased erosion, sedimentation, fugitive dust generation, the spread and establishment of noxious and invasive weed species, and habitat fragmentation. Construction related surface-disturbing activities would consist of establishing access, removing the existing structures, ROW clearing, and installation of transmission structures and lines. Estimated acreage of disturbance associated with operations includes the permanent footprint for the structures and permanent access roads. Construction ROW clearing would consist of removing trees and shrubs from the construction work area around each structure prior to construction. Vegetation clearing would be minimized in areas that are able to be spanned as described in SCPs 30 and 37. All areas where existing transmission lines would be decommissioned (all alternatives except for Alternative D) would be reclaimed and allowed to revegetate to a native vegetation community, or revegetated.

Methods for vegetation clearing and debris disposal are described in **Appendix B**. The slash piles and woody debris from clearing would be disposed of in a manner acceptable to the landowners or the land management agency. When clearing, construction crews would preserve native vegetation to the extent possible, particularly outside structure sites and near riparian areas. Most disturbances during this phase of construction would occur within the existing or expanded ROW. However, at some locations (e.g., at pulling and tensioning sites near an angle in the alignment) areas outside the ROW may be disturbed during construction.

After construction is complete, disturbed areas would be harrowed or disked to approximate pre-construction contours if compaction impacts are more detrimental than the damage remediation would cause. Ruts and scars that would interfere with overland travel would be filled or re-contoured. Excess soil would be spread evenly around the base of structures and revegetated or removed from the site. Disturbed areas would then be reseeded and mulched as needed, using a weed-free seed mixture as soon as practical. On National Forest System lands, an approved weed-free seed mixture would be used for restoration. The USFS would monitor reclamation success. In some areas, mulching, netting, or turf reinforcement mats may be necessary to protect seeded areas from erosion. If used, mulching would consist of weed-free hay or other approved material. Monitoring of percent cover would occur periodically on revegetated areas. Areas would be reseeded as necessary to establish cover.

Reclamation of the vegetation communities back to their native diversity and composition would depend on various factors such as soil mixing, timing and duration of disturbance, topography, slope, soil moisture, and precipitation. Although vegetation communities would recover at varying rates, it is estimated that overall, herbaceous-dominated plant communities would require a minimum of 3 to 5 years to establish adequate ground cover to prevent erosion and provide forage for wildlife species. Woody-dominated plant communities located outside the vegetation treatment areas or that are compatible with the transmission line based on topography, species type, and habitat quality, would require at least 10 to 25 years for shrubs to recolonize the area, while re-establishment of mature woodlands would require at least 30 to 50 or more years. In areas with steep slopes and increased risk of erosion, vegetation could take longer to re-establish. Impacts would be minor after reclamation is completed and vegetation re-established.

While fugitive dust mitigation would be minimized through the implementation of SCP 13 and SCP 16, vegetation in and adjacent to construction areas and access roads could be affected (e.g., reduction in growth rate) by any large accumulations of dust deposition that occurs. Therefore, deposition of fugitive dust would be a minor impact.

Any erosion occurring as a result of construction activities could impact native vegetation communities, sensitive species, and modify the floodplain surface as well as channel beds and banks. Erosion and sedimentation would be minimized through the implementation of SCP 3, SCP 6, SCP 7, SCP 26, SCP 29, and SCP 49, and impacts are anticipated to be minor.

Access to the structures for construction and operations would consist of existing access roads, overland travel, and new access roads. Depending on topography, soil, vegetation condition, and slope, Western would utilize overland access where feasible. Within the areas of difficult access, additional permanent and temporary access roads may be required. Where new access routes were required, Western would consult with the landowners and USFS and conduct cultural and biological surveys along the proposed access routes not previously surveyed. New access routes outside of the proposed ROW would require access agreements (on private lands) or USFS approval, and SHPO and USFWS concurrence. For more detail on proposed access see Section 2.3.2.

Vegetation management activities that would be performed during construction and operations are described in Section 2.6.1 and **Appendix B**. Western proposes to change its vegetation management methods from a needs based approach to an integrated vegetation management approach based on the ANSI Tree, Shrub, and Other Woody Plant Maintenance-Standard Practices. Inspections of the transmission line infrastructure and surrounding vegetation would be conducted annually aerially, by vehicle, and by foot. On-site inspections would be conducted if aerial or ground inspections identify problems, and could require bucket trucks.

The type of vegetation management treatment implemented would depend on the previous vegetation management, the topography, the type of vegetation, the vegetation height, the quality of habitat conditions, and vegetation cover. Based on the combination of these conditions, Western identified six categories of existing conditions in the ROWs that would result in six different vegetation treatment methods (**Table 2.6-1**). Impacts were determined based on the most conservative vegetation treatment category for each vegetation community. Treatment methods range from none for low-growing compatible species to communities requiring treatment every 2 to 6 years due to fast-growing incompatible species such as mature lodgepole pine, and mature aspen. All but category 1 would require initial treatment to clear incompatible vegetation from the ROW. For the purposes of this analysis, each of the vegetation communities identified in the analysis area was assigned to a vegetation treatment category. Several vegetation communities include areas and species that would fall in more than one vegetation treatment category, (e.g., a mixed conifer forest category could be composed of mature lodgepole pine [category 2], immature lodgepole pine [category 3], or spruce and fir species [category 4]). Within the vegetation treatment areas assigned to treatment categories 2 to 6, vegetation management would maintain vegetation at lower heights and density than may occur naturally. Special design features described in Section 2.5.1.2 would seek to minimize visual impacts from vegetation management by exceptions to tree removal in special case scenarios as feasible and without increasing wildland fire risk.

Short-term direct impacts to vegetation would include trampling of vegetation, the loss of herbaceous vegetation in areas disturbed during construction and subsequently reclaimed. The impacts of trampling would vary greatly based on the present vegetation, but will likely be short-term and minor where root stocks are not disturbed. Long-term direct vegetation impacts would include long-term loss of vegetation associated with the permanent facilities and access roads during the life of the project, and the loss of woody vegetation in the ROW in vegetation treatment categories 2 through 6. Long-term direct vegetation impacts also would include the long-term re-establishment of a natural state of vegetation along one ROW should two ROWs be consolidated into one. These long-term impacts would occur for the life of the project, and would be minor. No changes to genetic diversity or biodiversity are anticipated as a result of the proposed project.

4.7.3.2 Noxious Weeds

Following surface disturbance activities, noxious weeds and invasive species may readily colonize areas that lack or have minimal vegetation cover. It is anticipated that populations of weedy annual species (e.g., cheatgrass) may become established in localized areas for extended periods of time. In addition, linear construction surface disturbance-related activities can result in increased introduction and/or spread of noxious weeds and invasive species within adjacent areas (Gelbard and Belnap 2003; Watkins et al. 2003). Noxious and invasive weed species compete with native plants, can degrade and modify native communities, and can reduce resources for native species (e.g., moisture, soil nutrients, and light). The establishment of weedy annual species can lead to buildup of fine fuels that ignite readily and are consumed rapidly.

Three listed noxious weed species are found in a total of 49 patches along drainage bottoms or edges, on wetland edges, and in disturbed areas near road edges. Disturbance in and around these areas could easily spread these species into previously undisturbed areas. The introduction of new noxious weed species into the project area, or the spread of an existing weed species found in the project area into areas that were previously dominated by native species would be a significant impact. The introduction of a new or existing noxious weed species would impact sensitive plants and/or plants protected under state law. Noxious weeds are both a short-term and long-term impact depending on the success of reclamation and effectiveness of noxious weed control methods.

To minimize the spread or introduction of noxious weeds, all disturbed areas not returned to its original vegetation community be reseeded to minimize erosion and the invasion of noxious weeds. Disturbed areas would be reseeded and mulched, as needed, using a weed-free mix as soon as practical after construction activities are completed in any given area. On National Forest System lands, an approved weed-free seed mix would be used for restoration.

The introduction of new noxious weed species, or the spread of an existing noxious weed species found in the project vicinity into areas disturbed by project construction or operation that were previously dominated by native species would be a significant impact. However, Western will utilize its Vegetation Management Program (**Appendix B**) to proactively minimize potential introduction of noxious weed species. This program includes periodic weed species surveys along the site, treatment of any noxious weeds found (by manual or chemical means) and re-seeding of any areas disturbed to minimize invasion of noxious weeds, Methods of herbicide application are further described in **Appendix B**.

4.7.3.3 Fuels and Fire Management

Fire regimes in vegetation communities modified by construction operations could be altered by surface disturbance activities. Cover type conversions, the removal or rearrangement of canopy and surface fuels, the temporary creation of localized areas devoid of vegetation or firebreaks, and spread of annual invasive species would result in altered FRCCs for vegetation communities within the ROW (see **Figures 3.7-2a** through **3.7-2d**). These alterations could result in changes in fire frequencies.

Vegetation falling into the proposed project would have the potential to ignite a wildfire due to the increased fuel loading associated with the current bark beetle epidemic. To manage for wildfire concerns, Western has actively managed the vegetation along the existing transmission lines through the removal of danger trees, and has responded to maintenance problems.

As described in Sections 4.7.4 and 4.7.5, Western would implement a proactive approach to manage vegetation communities within the ROW using the integrated vegetation management method to control vegetation growth and fuel conditions. The desired vegetation condition is defined by the lack of undesirable species. Undesirable species are species that present a safety hazard, are not suitable for the intended use of the ROW, or at mature height would typically threaten transmission line reliability, operations, or maintenance. The removal of fuels along the transmission line ROW through vegetation management would reduce the hazard of wildland fire. These fuel treatments are designed to place as much of the fuel as possible in direct contact with the ground to facilitate decay through increased moisture retention, potentially lessening the intensity of a fire situation over time while providing increased access for firefighters. The removal of hazardous trees and fuels in a linear fashion along the transmission line ROW would create a zone of disturbed fuels, minimizing the potential for wildland fire in the event of transmission line discharge or arcing. Indirectly, removal of hazard trees and fuel loads along the transmission lines may prevent transmission line damage from wildfire by moving the sources of heat and flame away from transmission lines and transmission line structures, thus preventing transmission failure. In addition, by removing hazardous trees near the transmission lines, trees would not fall on or otherwise contact the transmission lines, further reducing the potential to cause a wildfire and/or power outage. New modern steel transmission line structures would further reduce threats to and from wildfire, as the old wooden poles and hardware would be decommissioned.

Mechanical fuel reduction methods would be used to remove accumulations of vegetation debris from intensive or repetitive vegetation treatments. Fuel treatments such as mastication, chipping, or lopping and scattering would be used to reduce overhead hazards; however, these methods only change the arrangement of fuels, not the fuel load. Masticated or chipped fuels may have different ignition, burn, and spread characteristics compared to standing fuels. However, these methods would do little to slow or prevent fire movement to the transmission line structures; and would place as much of the fuel as possible in direct contact with the ground to facilitate decay through increased moisture retention, potentially lessening the intensity of a fire situation over time while providing increased access for firefighters. The open ROW and access road system also would constitute a firebreak and allow for firefighting access, of considerable value in areas where any kind of access is limited. The density of remaining vegetation would be a consideration in assessing overall fire risk. Adequate access routes are required and must be maintained to provide for efficient, cost-effective vegetation treatment activities. In the short term, the removal of hazardous trees and fuels along the transmission line ROW would create a zone of modified fuels (little to no vegetation) that would reduce the likelihood of fire ignition in the event of transmission line discharge or arcing. In the long term, the modification of fuels in the transmission line ROW could influence landscape susceptibility to fire spread in areas of forest by breaking up continuous canopy fuels. The open ROW and access road system also would constitute a firebreak and allow for firefighting access, of considerable value in areas where any kind of access is limited. In non-forested ecosystems, the primary concern with vegetation in the ROW pertains to invasive species, which may alter the natural fire regime. The spread of invasive annual grasses over the long-term could increase fire frequency in areas not adapted to frequent fire; this would be considered a significant impact.

4.7.4 No Action Alternative

The No Action Alternative, including the small segment involving the re-location of the line at the Newell Lake View subdivision, would pose short-term impacts similar to the other alternatives, except potential impacts would occur over a longer span of time. Long-term disturbance would be related to the acquisition of additional ROW, the new route around the Newell Lake View subdivision, additional maintenance activities, and the maintenance of two transmission line ROWs. Wildland fire risk could be increased relative to other alternatives or variants due to the maintenance of two wooden transmission lines within separate ROWs. About 147 acres of vegetation habitat would be affected by the No Action Alternative, but over a longer time span than what is proposed for the action alternatives. Vegetation management would be carried out as part of Western's Proposed Action. Western also will be required to abide by NERC reliability standards.

4.7.5 Impacts Unique to Specific Alternatives

4.7.5.1 Alternative A and Variant A1

The total disturbance for Alternative A and Variant A1 associated with the analysis area, ROW, construction and operations by each vegetation community are listed in **Table 4.7-1**. Impacts associated with construction activities would be greatest in the ponderosa pine woodlands, which would remove 79 acres of ponderosa pine woodlands. There are 8 acres of upland meadow/wetland mosaic that would be potentially impacted by construction activities. Impacts to wetlands and riparian areas are covered in Section 4.6, Wetlands and Waters of the U.S.

Table 4.7-1 Acreage of Affected Vegetation under Alternative A and Variant A1

Vegetation Community	Analysis Area[1]	Right-of-Way[2]	Construction[3]	Operation[4]
Ponderosa pine woodland	324	139	75	7
Upland meadow/wetland mosaic	20	14	5	<1
Upland meadow	23	10	5	1
Mountain shrub mosaic	55	24	13	1
Mixed conifer forest	30	13	7	<1
Total Alternative A and Variant A1	**466**	**200**	**104**	**10**

[1] Analysis area includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants.

[2] Includes a 110-foot width centered on the anticipated line. All of this area could be cleared of some vegetation during construction; a portion of the disturbance estimates during construction would occur within the ROW. Vegetation treatments would occur within this area during operation; the type and extent of treatment would depend on species composition, topography, species height, vegetation cover, previous vegetation management, and habitat quality.

[3] Includes disturbance associated with installation of aboveground structures, stringing sites, staging areas, removal of existing structures, and temporary and permanent access roads.

[4] Includes permanent structures and permanent access roads.

Portions of Alternative A would require a wider ROW than the current existing ROW; however, much of this additional ROW would occur in the Upland Meadow and Upland Meadow/Wetland Mosaic which would not require vegetation treatment under category 1.

Long-term disturbance with this alternative would be decreased from the No Action Alternative due to the consolidation of two transmission line ROWs into one transmission line ROW.

4.7.5.2 Variant A2

Impacts to vegetation resources including noxious weeds and fuels and fire management for Variant A2 are identical to Alternative A except within the westernmost segment where the route would be constructed underground following a new alignment (see **Figure 2.2-2**). Disturbance associated with construction activities along the underground portion of Variant A2 are listed in **Table 4.7-2**. Impacts for Variant A2 would result from surface disturbance associated with burying the transmission line. Trees and shrubs would be cleared within a distance of 25 feet on each side of the centerline where the route is buried underground. Herbaceous vegetation would be removed along and surrounding the sloped trench or trench boxes during construction. Herbaceous vegetation in the 25-foot buffer would be trampled by construction activities.

Direct surface disturbing impacts to vegetation would include the removal of vegetation, trampling/ crushing of vegetation in temporary work areas, erosion, and soil compaction. Indirect effects to vegetation would include increased erosion, sedimentation, fugitive dust generation, the spread and establishment of noxious and invasive weed species, and habitat fragmentation.

Table 4.7-2 Acreage of Affected Vegetation under Variant A2

Vegetation Community	Analysis Area[1]	Right-of-Way[2]	Construction[3]	Operation[4]
Ponderosa pine woodland	239	136	82	18
Upland meadow/wetland mosaic	26	15	9	2
Upland meadow	29	16	10	2
Mountain shrub mosaic	47	27	16	4
Mixed conifer forest	16	9	5	1
Total Variant A2	**357**	**203**	123	27

1 Analysis area includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants.

2 Includes a 110-foot width centered on the anticipated line. All of this area could be cleared of some vegetation during construction; a portion of the disturbance estimates during construction would occur within the ROW. Vegetation treatments would occur within this area during operation; the type and extent of treatment would depend on species composition, topography, species height, vegetation cover, previous vegetation management, and habitat quality.

3 Includes disturbance associated with installation of aboveground structures, stringing sites, staging areas, removal of existing structures, and temporary and permanent access roads.

4 Includes permanent structures, permanent access roads, and cleared area (25-foot buffer) above buried lines.

4.7.5.3 Alternative B

The total disturbance associated with the analysis area, ROW, construction, and operation by each vegetation community are listed in **Table 4.7-3**. Impacts associated with construction activities would be greatest in the ponderosa pine woodlands, which would remove 58 acres of ponderosa pine woodlands. There are 9 acres of upland meadow/wetland mosaic that would be potentially impacted by construction activities. Impacts to wetlands and riparian areas are covered in Section 4.6, Wetlands and Waters of the U.S.

Table 4.7-3 Acreage of Affected Vegetation under Alternative B

Vegetation Community	Analysis Area[1]	Right-of-Way[2]	Construction[3]	Operation[4]
Ponderosa pine woodland	195	116	57	7
Upland meadow/wetland mosaic	31	19	9	1
Upland meadow	20	18	9	1
Mountain shrub mosaic	50	30	15	2
Mixed conifer forest	64	38	19	2
Total Alternative B	**370**	**221**	**109**	**13**

[1] Analysis area includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants.

[2] Includes a 110-foot width centered on the anticipated line. All of this area could be cleared of some vegetation during construction; a portion of the disturbance estimates during construction would occur within the ROW. Vegetation treatments would occur within this area during operation; the type and extent of treatment would depend on species composition, topography, species height, vegetation cover, previous vegetation management, and habitat quality.

[3] Includes disturbance associated with installation of aboveground structures, stringing sites, staging areas, removal of existing structures, and temporary and permanent access roads.

[4] Includes permanent structures and permanent access roads.

The majority of the vegetation management activities on Alternative B would occur in the ponderosa pine woodland community. Initial treatment would be required for the ponderosa pine woodland, mountain shrub mosaic, and mixed conifer forest community, and every 5 years or more in the ponderosa pine woodland community. The occurrence of treatment in the mountain shrub mosaic community would be determined during annual inspections.

4.7.5.4 Alternative C

The total disturbance associated with the analysis area, ROW, construction and operation by each vegetation community are listed in **Table 4.7-4**. Impacts associated with construction activities would be greatest in the ponderosa pine woodlands, which would remove 72 acres of ponderosa pine woodlands. There are 11 acres of upland meadow/wetland mosaic that would be potentially impacted by construction activities. Impacts to wetlands and riparian areas are covered in Section 4.6, Wetlands and Waters of the U.S. A total of 265 acres of woodlands could be impacted by vegetation management activities in the ROW.

The majority of the vegetation management activities on Alternative C would occur in the ponderosa pine woodland community. Initial treatment would be required in the ponderosa pine woodland, mountain shrub mosaic, and mixed conifer forest communities. Over the life of the project, vegetation treatment would occur every 2 to 6 years in the mixed conifer forest community, and every 5 years or more in the ponderosa pine woodland community. The occurrence of treatment in the mountain shrub mosaic community would be determined during annual inspections.

Portions of Alternative C would require additional ROW in addition to the current existing ROW; however, much of this additional ROW would occur in the upland meadow and upland meadow/wetland mosaic which would not require vegetation treatment under category 1.

Table 4.7-4 Acreage of Affected Vegetation under Alternative C

Vegetation Community	Analysis Area[1]	Right-of-Way[2]	Construction[3]	Operation[4]
Alternative C				
Ponderosa pine woodland	263	130	67	6
Upland meadow/wetland mosaic	38	19	10	1
Upland meadow	22	11	6	1
Mountain shrub mosaic	62	31	16	1
Mixed conifer forest	33	16	8	1
Total Alternative C	**418**	**207**	**106**	**10**

1 Analysis area includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants.

2 Includes a 110-foot width centered on the anticipated line. All of this area could be cleared of some vegetation during construction; a portion of the disturbance estimates during construction would occur within the ROW. Vegetation treatments would occur within this area during operation; the type and extent of treatment would depend on species composition, topography, species height, vegetation cover, previous vegetation management, and habitat quality.

3 Includes disturbance associated with installation of aboveground structures, stringing sites, staging areas, removal of existing structures, and temporary and permanent access roads.

4 Includes permanent structures and permanent access roads.

4.7.5.5 Variant C1

Variant C1 would be identical to Alternative C except for the westernmost segment from Mall Road to the USFS boundary adjacent to the Meadowdale Hills subdivision where the route would be constructed underground following a new alignment (see **Figure 2.2-2**). Impacts associated with construction activities along the underground portion of Variant C1 are listed in **Table 4.7-5**. Impacts for Alternative Variant C1 for would result from surface disturbance associated with burying the transmission line. Vegetation would be cleared a distance of 25 feet on each side of the centerline where the route is buried underground. Direct surface disturbing impacts to vegetation would include the removal of vegetation, trampling/crushing of vegetation in temporary work areas, erosion, and soil compaction. Indirect effects to vegetation would include increased erosion, sedimentation, fugitive dust generation, the spread and establishment of noxious and invasive weed species, and habitat fragmentation.

Table 4.7-5 Acreage of Affected Vegetation under Variant C1

Vegetation Community	Analysis Area[1]	Right-of-Way[2]	Construction[3]	Operation[4]
Ponderosa pine woodland	241	134	83	6
Upland meadow/wetland mosaic	26	14	9	1
Upland meadow	29	16	10	1
Mountain shrub mosaic	48	26	16	1
Mixed conifer forest	16	9	5	<1
Total Variant C1	**360**	**200**	124	9

[1] Analysis area includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants.

[2] Includes a 110-foot width centered on the anticipated line. All of this area could be cleared of some vegetation during construction; a portion of the disturbance estimates during construction would occur within the ROW. Vegetation treatments would occur within this area during operation; the type and extent of treatment would depend on species composition, topography, species height, vegetation cover, previous vegetation management, and habitat quality.

[3] Includes disturbance associated with installation of aboveground structures, stringing sites, staging areas, removal of existing structures, and temporary and permanent access roads.

[4] Includes permanent structures and permanent access roads.

4.7.5.6 Alternative D

Direct disturbance from construction and operation of Alternative D would be more than Alternatives A, B, and C because both the existing North and South transmission lines would be rebuilt in-kind as single circuit lines using structures very similar to those currently in use. Direct disturbance related to vegetation management could would increase as the existing ROW would be expanded as needed and minor adjustments would made to the alignments where necessary for compliance with NERC requirements. The total acres associated with the analysis area, ROW, construction and operation by each vegetation community are listed in **Table 4.7-6**. The majority of the required access roads already exist for this alternative; however, areas of difficult access would require additional access roads.

The majority of the vegetation management activities on Alternative D would occur in the Ponderosa Pine Woodland community. Initial treatment would be required in the Ponderosa Pine Woodland, Mountain Shrub Mosaic, and Mixed Conifer Forest communities. Over the life of the proposed project, vegetation treatment would occur every 2 to 6 years in the Mixed Conifer Forest community, and every 5 years or more in the Ponderosa Pine Woodland community. The occurrence of treatment in the Mountain Shrub Mosaic community would be determined during annual inspections.

Portions of Alternative D would require additional ROW in addition to the current existing ROW; however, much of this additional ROW would occur in the Upland Meadow and Upland Meadow/Wetland Mosaic which would not require vegetation treatment under category 1.

Table 4.7-6 Acreage of Affected Vegetation under Alternative D

Vegetation Community	Analysis Area[1]	Right-of-Way[2]	Construction[3]	Operation[4]
Ponderosa pine woodland	372	207	80	11
Upland meadow/wetland mosaic	80	45	17	2
Upland meadow	46	25	10	1
Mountain shrub mosaic	112	62	24	3
Mixed conifer forest	76	42	16	2
Total Alternative D	**686**	**381**	**147**	**21**

[1] Analysis area includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for underground variants.

[2] Includes a 110-foot width centered on the anticipated line. All of this area could be cleared of some vegetation during construction; a portion of the disturbance estimates during construction would occur within the ROW. Vegetation treatments would occur within this area during operation; the type and extent of treatment would depend on species composition, topography, species height, vegetation cover, previous vegetation management, and habitat quality.

[3] Includes disturbance associated with installation of aboveground structures, stringing sites, staging areas, removal of existing structures, and temporary and permanent access roads.

[4] Includes permanent structures, permanent access roads, and vegetation management treatments.

4.7.6 Mitigation

Mitigation measures are recommended for all alternatives to avoid, minimize, or mitigate impacts, and include the following:

NOX–1: A noxious weed management plan would be developed that includes education of construction and operation personnel, selective herbicide spraying, and post-construction monitoring. Survey information collected during pre-construction surveys per the specific design criteria would include species name, GPS location of weed infestations, percent cover, and approximate size of weed infestations. Control of noxious and invasive species can include chemical, physical, and biological methods and would be consistent with the State of Colorado, Larimer County, and USFS regulations and guidance.

Implementation of mitigation measure NOX-1, if adopted, would provide detailed documentation of noxious weeds, and specific methods in practice to manage noxious weeds in the area disturbed by the proposed project and the extent of the transmission line and access road ROWs. The intent of the weed management plan would be to specify general weed prevention and control methods to be implemented pre-, during, and post-construction. Control of the spread of noxious weeds and invasive species would reduce or minimize potential impacts to vegetation communities and to fire potential from construction and operation of project alternatives.

4.7.7 Residual Impacts

Residual impacts would include the loss of vegetation related to the permanent placement of facilities and access roads for the life of the project, any persistent noxious weeds and invasive species populations in the project area, and fragmentation of native habitats. The number of acres of vegetation that would be affected by the alternatives is provided in **Tables 4.7-1** through **4.7-6**. Alternative D would affect the greatest number of acres at 147 acres, versus 104 acres for Alternative A and Variant A1, 123 acres for Variant A2, 109 acres for Alternative B, 106 acres for Alternative C, 124 acres for Variant C1, and 147 acres for Alternative D. The direct or indirect loss of vegetation and fragmentation of native habitats is anticipated to be minor impact, and residual impacts also are anticipated to be minor. The spread of new noxious weed species, or expansion of existing species into previously native habitats, if it occurred, would be a significant impact.

4.7.8 Irreversible and Irretrievable Commitments of Resources

For areas successfully reclaimed to original community type, no irretrievable commitments are anticipated. For woody dominated plant communities, the alteration of these communities from vegetation management activities would persist during the life of the proposed project.

Irreversible commitments would result from construction and operation impacts that result in the permanent conversion of plant communities. This may occur in areas where vegetation management for category 1 areas is applied, reclamation is not successful, or fragmentation and noxious weed and invasive species permanently alternative habitats. If successful reclamation is not achieved, disturbed areas would no longer support native vegetation.

4.7.9 Relationship between Short-term Uses and Long-term Productivity

For all alternatives, project-related impacts that may affect productivity include the disturbance of shrub-dominated and woody vegetation cover types that would require 30 to 50 plus years to recover, and the potential for populations of weedy annual species (e.g., halogeton, cheatgrass) to become established in localized areas for extended periods of time. The decrease in vegetation cover types either through direct impacts (i.e., removal of vegetation) or indirect impacts (i.e., the spread of noxious and invasive species) could impact ecological function, wildlife grazing, and recreation activities in and around the areas to be disturbed.

4.8 Special Status Plant Species

The analysis area for special status plant species includes a width of 200 feet for existing lines centered on the ROWs for each alternative, 300 feet for new lines, and 75 feet for the underground alternative.

Issues related to impacts to special status species associated with construction and operation activities include habitat alteration, erosion, soil compaction, and surface disturbance resulting in the loss or decline in native species or their associated habitat.

4.8.1 Methodology

Impacts to special status plant species from the project are based on the locations of the resources in relation to the proposed surface disturbance areas. Species survey data were used to identify potential habitat and known locations of special status plant species in the study area. The analysis included a comparison of the number of acres of vegetation type for each alternative. SCPs were taken into account in addressing the severity of the impact. SCPs proposed to be implemented are listed in Section 2.5, Standard Construction Practices. Relevant SCPs specifically for special status plant resources include SCPs 1, 4, 5, 21, and 22. Western has committed to avoid, where possible, sensitive resources such as wetlands and would normally avoid steep drainages, swales, and similar topographic features. Western would avoid all wetlands. These areas support habitat for the majority of species considered for analysis. Specific species are discussed under each alternative below.

Special status species impacts associated with the proposed project are classified as either short- or long-term. Short-term is defined as lasting no longer than the immediate 1- to 5-year implementation and restoration periods. Long-term is defined lasting beyond the implementation period (beyond 5 years) or indefinitely. The construction of the transmission line is expected to take 8 to 12 months depending on the alternative.

4.8.2 Significance Criteria

A significant impact to special status plant species would result if any of the following were to occur from constructing and operating the project:

- Loss of listed threatened and endangered plants, rare native plant communities, or other sensitive features identified by a state or Federal resource agency.
- Loss to any population of plants that would result in a species being listed or proposed for listing as threatened or endangered.

4.8.3 Impacts Common to All Alternatives

Direct impacts would occur from surface disturbance associated with construction and operations activities in the ROW. These activities include access and spur road construction, existing pole removal, installation of new structures, operation of staging areas and conductor stringing sites, ROW expansion, and reclamation of abandoned access and spur roads. Because the specific locations of structures have not been determined, potential impacts to special status plants species cannot be accurately assessed. Surface disturbance acreages associated with new access roads could occur anywhere in the proposed ROW. If impacts occur within specific sensitive species habitat, direct impacts could include trampling/ crushing of special status species individuals, the removal of native vegetation and special status species individuals, and soil compaction. Indirect effects to special status species would result in increased erosion, sedimentation, fugitive dust generation, the spread and establishment of noxious and invasive weed species, and habitat fragmentation. Operation acres include the permanent footprint for the new structures. These effects would be minimized with implementation of the SCPs mentioned above.

Construction ROW clearing would consist of removing trees and shrubs from the construction work area around each structure, prior to construction. The slash piles and woody debris from clearing would be disposed of in a manner acceptable to the landowners. Construction crews, when clearing, would preserve native vegetation to the extent possible, particularly outside structure sites and near riparian areas. Most disturbances during this phase of construction would occur within the existing or expanded ROW. However, at some locations (e.g., at pulling and tensioning sites near an angle in the alignment), areas outside the ROW may be disturbed during construction. Vegetation management activities to be performed during construction and operations are described in Section 2.6.1 and **Appendix B**. For the project, Western proposes to change its vegetation management methods from a needs based approach to an integrated vegetation management approach.

Through the implementation of SCP 21, structures would not be located in wetlands and sensitive habitats where practical. On National Forest System lands, Western would avoid all wetlands. SCP 22 would avoid disturbance of vegetation within 100 feet of a stream, except for hazard trees. No fueling, staging, or storage areas would be placed within 100 feet of wetlands, stream, or riparian areas. Based on these SCPs, it is assumed that adverse impacts resulting from the construction and operation activities would be unlikely in habitat for sensitive species.

Any potential impacts to special status plant species habitat, if occurring at all from project activities, are likely to be adverse, minor, and short-term given that limited surface disturbance is anticipated and Western's commitment to reclaim disturbed areas. Long-term direct special status species impacts would include any long-term loss of habitat associated with the permanent facilities and access roads during the life of the project, and the woody vegetation cleared as part of the vegetation management treatments. These negative impacts would be relatively minor for special status species habitat. The acres of vegetation that would be affected by the alternatives are provided in **Tables 4.7-1** through **4.7-6**. Noxious weeds are both a short-term and long-term impact depending on the success of reclamation, and noxious weed control.

4.8.3.1 Federal Threatened, Endangered, Proposed, and Candidate Species

<u>Ute Ladies'-Tresses Orchid</u>

Along the south line, only one wet meadow at the south end of Pinewood Reservoir, exhibited the habitat characteristics for the Ute ladies'-tresses orchid. The habitat quality at this site is low as the vegetation cover was relatively dense. Individual species were not observed in this meadow within the ROW during field surveys, although survey timing was early for the accepted survey time period for this species (late July through August). This wetland meadow has been spanned by the existing transmission lines.

4.8.3.2 Additional Species of Concern

Potential habitat was observed for the additional species of concern including leathery grapefern, dwarf rattlesnake-plantain, lance-leafed grapefern, woody lily, Larimer aletes, spatulate moonwort, purple lady's slipper, pictureleaf wintergreen, rattlesnake ferns, and fern species. While fern *Cystoperis fragilis* populations are found in the analysis area, all other ferns are rare. It is anticipated that impacts would be minor based on the habitat requirements for the species and the absence of the fern species during surveys of the existing transmission lines. However, adverse impacts would result from vegetation maintenance activities and the removal or replacement of existing structures on the existing lines. In accordance with SCP 5 and the specific design criteria, any additional species of concern would be identified and preserved during construction. Given the limited area to be disturbed in the ROW, any potential impacts to suitable habitat present in the analysis area would not likely result in a loss of viability of the species population in the project area, or cause a trend to Federal listing.

4.8.4 No Action Alternative

4.8.4.1 Federal Threatened, Endangered, Proposed, and Candidate Species

<u>Ute Ladies'-Tresses Orchid</u>

The species would most likely not be impacted by maintenance requirements and structure replacement under the No Action Alternative.

4.8.4.2 Additional Species of Concern

The No Action Alternative, including the small segment involving the re-location of the line at the Newell Lake View subdivision, would pose impacts similar to the other alternatives, except potential impacts would occur over a longer span of time. Long-term disturbance would be related to the acquisition of additional ROW, additional maintenance activities, and the maintenance of two transmission line ROWs.

4.8.5 Impacts Unique to Specific Action Alternatives

4.8.5.1 Alternative A

<u>Additional Species of Concern</u>

Potential habitat was observed for the additional species of concern along Alternative A for leathery grapefern, wood lily, lance-leafed grapefern, Larimer aletes, spatulate moonwort, pictureleaf wintergreen, and ferns.

4.8.5.2 Alternative B

Federal Threatened, Endangered, Proposed, and Candidate Species

Ute Ladies'-Tresses Orchid

The wetland meadow in the ROW has been spanned by the existing transmission lines and would most likely continue to be spanned and avoided under Alternative B. It would most likely not be impacted by the new vegetation maintenance requirements.

Additional Species of Concern

Potential habitat was observed for the additional species of concern along Alternative B for dwarf rattlesnake-plantain, lance-leafed grapefern, spatulate moonwort, purple lady's slipper, pictureleaf wintergreen, rattlesnake ferns, and fern species.

4.8.5.3 Alternative C

Additional Species of Concern

Potential habitat was observed for the additional species of concern along Alternative C for dwarf rattlesnake-plantain, lance-leafed grapefern, woody lily, spatulate moonwort, purple lady's slipper, pictureleaf wintergreen, rattlesnake ferns, and fern species.

4.8.5.4 Alternative D

Federal Threatened, Endangered, Proposed, and Candidate Species

Ute Ladies'-Tresses Orchid

Per SPC 21, structures would be carefully located to avoid sensitive vegetative conditions, including wetlands, where practical. On National Forest System lands, Western would avoid all wetlands. The wetland meadow along the South Line near Pinewood Reservoir has been spanned by the existing transmission line and would most likely continue to be spanned and avoided under Alternative D. It would not be impacted by the new vegetation maintenance requirements since no vegetation management activities are planned within the meadow/mosaic complex.

Potential habitat was observed for the following USFS species: park milkvetch, triangle moonwort, narrow-leaf grape fern, paradox (peculiar) moonwort, plains rough fescue, Rocky Mountain cinquefoil, Rocky Mountain monkey flower, scarlet gilia, Selkirk violet, and yellow lady's slipper. Impacts to the habitat would result from maintenance requirements and structure replacement on the existing lines.

Park milkvetch habitat would be avoided during the transmission line rebuild activities. The three moonwort species (triangle moonwort, narrow-leaf grape fern, and paradox [peculiar] moonwort) are found in early successional habitats which are found in the study area along previously disturbed areas. Construction and operation impacts would potentially create additional habitat for these species. The current areas of early successional habitat could be disturbed due to construction and access road development.

Habitat for the Rocky Mountain monkey flower, scarlet gilia, and Selkirk violet and yellow lady's slipper is found in forested areas in higher elevation areas and small, scattered aspen stands could be impacted by vegetation maintenance activities that require the removal of fast-growing woody species, and/or hazard trees. Based on the rock outcrops habitat characteristics for the Rocky Mountain cinquefoil species, it is unlikely that impacts from construction and operation activities would occur. It is assumed that equipment passage across rock outcrops would be minimal. Habitat for the Plains rough fescue occurs in open meadows and would be subject to impacts from structure removal and installation disturbances.

Implementation of SCPs 21 and 22 and the specific design criteria would minimize impacts to these species. If the potential habitats for any of the USFS sensitive species are disturbed, there could be adverse impacts to the habitat as described above in Section 4.8.6, Impacts Common to All Alternatives. Due to the limited area to be disturbed in the ROW, any potential impacts to suitable habitat present in the analysis area would not likely result in a loss of viability of the species population in the project area, or cause a trend to Federal listing.

Additional Species of Concern

Potential habitat was observed for the additional species of concern along Alternative D for leathery grapefern, wood lily, dwarf rattlesnake-plantain, lance-leafed grapefern, Larimer aletes, spatulate moonwort, purple lady's slipper, pictureleaf wintergreen, rattlesnake ferns, and ferns species.

4.8.6 Mitigation

The recommended measure to avoid, minimize, or mitigate impacts include the following:

SSP-1: During construction or maintenance activities, if known federally listed species and USFS sensitive species are encountered, an avoidance plan would be created and implemented in consultation with a USFS Botany Representative to avoid or minimize impacts, as appropriate.

Implementation of mitigation measure SSP-1, if adopted, would avoid impacts to federally listed and USFS sensitive species habitat in the analysis area.

4.8.7 Residual Impacts

Residual impacts could result from indirect impacts such as fragmentation of suitable habitats, and establishment of noxious weeds and invasive species into previously undisturbed areas as a result of permanent placement of facilities and access roads. However, implementation of the SCPs and mitigation measure described above would minimize any potential impacts. There would be no significant impacts to special status plan species from any of the alternatives.

4.8.8 Irreversible and Irretrievable Commitments of Resources

For native plant habitats that are successfully reclaimed, no irretrievable commitments are anticipated. For woody dominated plant communities, the alteration of these communities from vegetation management activities would persist during the life of the project, resulting in an irretrievable loss of these resources for the life of the transmission line.

Irreversible commitments would result from construction and operation impacts that result in the permanent conversion of plant communities. This may occur in areas where vegetation management for category 1 areas is applied, reclamation is not successful, or fragmentation and noxious weed and invasive species permanently alter habitats. If successful reclamation is not achieved, disturbed areas would no longer support native vegetation which could affect sensitive species habitat and associated pollinators.

4.8.9 Relationship between Short-term Uses and Long-term Productivity

For all alternatives, project-related impacts that may affect productivity include the potential that as a result of ground disturbance, populations of weedy annual species (e.g., halogeton, cheatgrass) would become established in localized areas for extended periods of time. A decrease in vegetation cover types either through direct impacts (i.e., removal of vegetation) or indirect impacts (i.e., the spread of noxious and invasive species) could impact ecological function, which could impact sensitive species habitat and associated pollinators. If the Noxious Weed Program and the Vegetation Management Plan are successful, then weedy species that colonize in the short term would be eradicated over the long term.

4.9 Wildlife

The analysis area for wildlife resources includes a width of 200 feet for existing transmission lines centered on the ROWs for each alternative, 300 feet for new routing options, and 75 feet for the underground variants.

Issues selected for detailed analysis per Section 1.6.3.2 related to wildlife resources include effects on wildlife and fisheries including threatened and endangered, USFS sensitive, and management indicator wildlife and fishery species. Other issues considered in assessing the environmental consequences of the project on terrestrial and avian wildlife were identified by Western through internal scoping, consultation with cooperating agencies, and through comments provided during public scoping. The issues are summarized in the following paragraphs.

Issues related to wildlife from constructing and operating the proposed transmission lines include:

- Declining populations or local extinctions of wildlife populations from loss of habitat.
- Declining populations or local extinctions of migratory and resident bird species from the loss of habitat.
- Habitat fragmentation causing displacement of wildlife.
- Vehicle and equipment operation causing loss of eggs, nests or young.
- Loss of economic or recreational opportunities caused by impacts to habitat and associated wildlife.

Issues related to wildlife from constructing and operating the proposed transmission lines include:

- Electrocution or collision of birds with transmission lines.
- Mortality of individuals resulting from collision with construction equipment or maintenance vehicles.

The Big Thompson River, Pinewood Reservoir, Flatiron Reservoir, and Lake Estes support fisheries and are near or in the analysis area, but would not be affected by the project alternatives.

4.9.1 Methodology

The analysis for wildlife assumes that the USFS will continue to manage fish and wildlife habitats on National Forest System land in coordination with the CPW and relevant regulations pertaining to wildlife.

Impacts to biological resources from the project were determined based on the locations of the resources in relation to the proposed surface disturbance areas, and the number of acres of wildlife habitat affected. The acres of disturbed areas were estimated based on the extent of disturbance for construction and operation activities.

Impact analysis focused on wildlife species and habitats that could be affected by construction and operation of the project. This process considered compliance with Federal laws and state statutes.

Methods for establishing a baseline of status, occurrence, and associated habitat of wildlife that may occur within the analysis area include reviewing published literature, unpublished agency reports and data, CNHP database search, CPW NDIS mapping system, and field surveys. Biologists with the CPW, USFWS, and USFS were contacted for information about the status of wildlife species, habitat, special wildlife features and habitats in the analysis area. Field studies were conducted in portions of the analysis area to document and evaluate wildlife and habitat that may occur within the analysis area. Further studies will be conducted after the preferred alternative is selected.

Impacts to wildlife resources from the project are based on the locations of the resources in relation to the proposed surface disturbance areas. SCPs are taken into account in addressing the severity of the impact. SCPs to be implemented are listed in **Table 2.5-1**. The acres of disturbance associated with each alternative were estimated based on the process described in Section 4.7.1, Vegetation Methodology.

4.9.2 Significance Criteria

Impacts to wildlife would occur when habitats or individuals are disturbed or lost during the project's construction or operation. Significance of the impact depends, in part, on the sensitivity of the population. A significant impact on wildlife would result if any of the following were to occur from constructing and operating the project:

- Loss of individuals of a population of wildlife or habitat that would result in the species being listed or proposed for listing as threatened or endangered.
- Critical ranges (i.e., severe winter ranges, winter concentration areas, production areas, migration corridors, breeding sites) were affected during season of use.

4.9.3 Impacts Common to All Alternatives

Direct and indirect impacts to wildlife species and their habitats would occur from surface disturbance associated with construction and operations activities in the ROW. These activities would include establishing access, removing existing structures, installing new structures, establishing staging areas and conductor stringing sites, ROW expansion, access and spur road construction, and reclaiming abandoned access and spur roads. Specific locations of structures or access roads have not been finalized; therefore potential impacts to wildlife species may occur anywhere within or adjacent to the construction or operation ROW. In addition, impacts from access road construction may be reduced relative to impacts described in this document. Where construction by trenching is required, impacts would be similar, although disturbance would occur across the entire ROW. Surface disturbance acreages associated with new access roads could occur anywhere in the proposed ROW. Direct impacts could include trampling/crushing of wildlife individuals and the removal of native vegetation. Indirect effects to wildlife species would include increased erosion, sedimentation, fugitive dust generation, the spread and establishment of noxious and invasive weed species, disturbance from human presence during construction and maintenance activities, noise, and habitat fragmentation.

Short-term effects could result from construction-related surface-disturbing activities potentially impacting wildlife species, such as removing the existing structures, ROW clearing, and installation of transmission line structures and wires. The project access road network, which would be constructed or upgraded to fulfill the construction requirements of the project, would impact wildlife species to varying degrees depending on the geographical location and type of habitat disturbed. There are seven general impacts to wildlife and wildlife habitat including: 1) increased mortality from road construction; 2) increased mortality from collisions with vehicles; 3) modification of wildlife behavior; 4) alteration of the physical environment; 5) alteration of the chemical environment; 6) spread of invasive and exotic species; and 7) increased alteration and use of habitats by humans (Trombulak and Fissell 2000). Not all species and ecosystems are equally impacted by roads, but overall the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian habitats (Trombulak and Fissell 2000).

Operation impacts would include the loss of habitat in areas for the permanent footprint for the new structures. Long-term effects to wildlife species due to impacts from operations would be similar to short-term effects due to construction; however, they would be less intensive and longer in duration. During operation of the project, a portion of habitat disturbed during construction would not be reclaimed until after the end of the project's design life. Any potential impacts to wildlife species habitat, if occurring at all from project activities, would be adverse, minor, and short-term given that limited surface disturbance is anticipated and Western's commitment to reclaim disturbed areas. No changes to genetic diversity are anticipated as a result of the proposed project.

Long-term direct wildlife species impacts would include any long-term loss of habitat associated with the permanent facilities and access roads during the life of the project, and loss of woody vegetation habitat removed from the ROW for the life of the project. Although the removal of woody vegetation within the ROW would be an adverse impact to some avian and terrestrial wildlife species through the loss of potential breeding, nesting, and foraging habitat, some wildlife species have been shown to benefit from the increase in edge habitats (Temple and Flaspohler 1998). Abiotic and biotic conditions located along forest edge habitat differ from those found in the interior of a forest. Forest edges are exposed to increased light which often results in increased shrub species diversity and density (Raney et al. 1981). This increase in the diversity of shrub species and complexity of vegetation structure along forest edges has been shown to provide greater cover and available forage for various wildlife species (Johnson et al. 1979; Helle and Mouna 1985; Yahner 1988). Quantification of these impacts is not presented in this analysis due to the lack of available data and the variability of wildlife populations. Any impacts resulting from woody vegetation removal within the ROW would be minor and long-term considering that maintenance activities would occur through time for the life of the project.

There are benefits of consolidating two separate lines into one ROW, and letting the abandoned ROW revert to natural conditions. In addition, there may be a reduction in trails that could be utilized by off-roaders as well. This impact from the proposed project could be somewhat reduced if a combined alternative is selected.

4.9.4 No Action Alternative

The No Action Alternative, including the small segment involving the relocation of the line at the Newell Lake View subdivision, would pose impacts similar to the other alternatives, except potential impacts would occur over a longer span of time. Maintenance requirements on the existing lines would likely increase. In addition to on-going maintenance activities, including as-needed structure replacement, the No Action Alternative would involve the acquisition of additional ROW at locations where the current ROW is insufficient to maintain appropriate vegetation clearances and compliance with applicable reliability standards.

Direct and indirect impacts to wildlife species would be similar to those described for Action Alternatives in Section 4.9.5. Short-term and long-term effects under the No Action Alternative would be similar to current levels. General maintenance activities and corresponding impacts to wildlife would increase with time.

4.9.5 Impacts Unique to Specific Action Alternatives

The types of direct and indirect impacts to wildlife species resulting from action alternatives would be the same as those discussed in Section 4.9.3. Additional impacts to wildlife are described in the following sections.

4.9.5.1 Alternatives A, B, C, D, and Variant A1

<u>Big Game</u>

Alternatives A, B, C, or D, or Variant A1 would result in potential direct impacts to big game species (i.e., mule deer, moose, and Rocky Mountain elk), including the incremental reduction of potential forage and the incremental increase of noxious and invasive weeds and habitat fragmentation from vegetation removal. These impacts would be more pronounced within big game winter ranges. **Table 4.9-1** includes acres of elk summer range, elk parturition range, elk winter range, elk severe winter range, mule deer summer range, mule deer winter range, severe winter range, and moose winter range) that would be impacted under each of these routes.

The primary potential direct impact would be wildlife avoidance (displacement) from otherwise suitable habitat in the vicinity of the project due to noise and human activity. These impacts would be more pronounced within big game crucial winter range.

Construction of these alternatives would temporarily result in increased human activity and noise in the vicinity of the transmission line. The most common wildlife responses to noise and human activity are avoidance or accommodation. Avoidance would result in displacement of animals from an area larger than the actual disturbance area. Following avoidance of human activity and noise-producing areas during construction, certain wildlife species would likely return to areas that were formerly avoided.

Displacement of big game species as a result of direct habitat loss and indirect reduction in habitat quality has been widely documented (Irwin and Peek 1983; Lyon 1983, 1979; Rost and Bailey 1979). Studies have shown that big game species tend to temporarily move away from areas of human activity and roads; thereby reducing habitat utilization near disturbance areas (Cole et al. 1997; Sawyer et al. 2006).

Disturbance associated with construction activities would occur over a relatively short period, and it is likely that big game species would return to the area following completion of project construction. In addition to an avoidance response, increased human activity as a result of adjusted access roads intensifies the potential for wildlife/human interactions ranging from harassment of big game species to legal harvest or poaching. Adverse indirect impacts to big game species resulting from project construction and operation are anticipated to be minor. Any adverse impacts to big game wintering habitat could potentially be offset by the beneficial impact of increased edge habitat created by the ROW vegetation management practice of thinning. Edge habitats typically provide increased foraging opportunities to big game.

Direct impacts to mountain lions would be minor or negligible, as these species occur at low densities in and around the study area. Indirect impacts to mountain lions would be similar to those discussed for mule deer, as mountain lion movements tend to follow those of their prey (Seidensticker et al. 1973).

Direct impacts to black bears would be limited to minor habitat conversion and disturbance during construction and maintenance activities. Indirect impacts would be similar to those discussed in Section 4.9.3, Impact Common to All Alternatives.

Adverse short-term and long-term impacts to wildlife species resulting from project construction and operation are anticipated to be minor in significance. Short-term effects due to the construction of these aboveground alternatives would result in the incremental loss of big game habitat, of which a portion would immediately be reclaimed following construction. Recovery times of the various vegetation communities that provide habitat for the species within the Wildlife Analysis Area are discussed in Section 3.7, Vegetation.

Long-term impacts to big game species from surface disturbance activities would include the loss and conversion of habitat. Habitat loss would result in the displacement of more mobile big game species into adjacent habitats. Habitat conversion from canopied forest to more open edge type habitats is likely to be beneficial to big game species as these areas typically provide increased foraging opportunity. Surface disturbance also would result in an incremental increase in habitat fragmentation along the project until reclamation has been completed and vegetation is re-established.

Table 4.9-1 Direct and Indirect Impact Acreages to Big Game Habitats within the Project Analysis Area

Habitat Type[1]	Construction (Operation) Impacts (acres)						
	Alternative A	Variant A1	Variant A2	Alternative B	Alternative C	Variant C1	Alternative D and No Action
Elk Summer Range	17.8 (1.7)	14.9 (1.8)	16.0 (1.3)	14.9 (1.8)	15.2 (1.5)	18.7 (1.4)	9.4 (1.3)
Elk Parturition	14.7 (1.4)	11.1 (1.3)	13.5 (1.1)	8.1 (1.0)	10.3 (1.0)	14.0 (1.0)	14.8 (2.1)
Elk Winter Range	104.0 (10.1)	128.0 (15.2)	128.0 (1.8)	97.4 (11.7)	106.0 (10.1)	124.0 (9.1)	141.9 (20.4)
Elk Severe Winter Range	17.7 (1.7)	14.8 (1.8)	15.9 (1.3)	14.9 (1.8)	15.2 (1.5)	18.7 (1.4)	14.7 (2.1)
Mule Deer Summer Range	104.0 (10.1)	128.0 (15.2)	128.0 (1.8)	97.4 (11.7)	106.0 (10.1)	124.0 (9.1)	141.9 (20.4)
Mule Deer Winter Range	104.0 (10.1)	128.0 (15.2)	128.0 (1.8)	97.4 (11.7)	106.0 (10.1)	124.0 (9.1)	141.9 (20.4)
Mule Deer Severe Winter Range	8.6 (0.8)	9.7 (1.2)	10.1 (0.8)	9.9 (1.2)	10.7 (1.0)	13.4 (1.0)	7.1 (1.0)
Moose Winter Range	48.7 (4.7)	55.3 (6.6)	56.7 (1.8)	43.7 (5.3)	46.5 (4.4)	55.0 (4.0)	61.4 (8.8)

[1] Source: CPW NDIS.

Other Mammals

Based on known ranges and habitat preferences, a variety of small game, mammalian predators, and small mammal species including bats, are likely to be present in the analysis area. Most of these species are relatively widespread and common. There are no identified permanent issues regarding potential effects of the proposed project on these species.

Direct impacts to other mammals as a result of these aboveground alternatives would be similar to those described for big game mammals. Acres of habitat affected under Alternatives A, B, C, and D and Variant A1 are included in **Tables 4.7-1, 4.7-3, 4.7-4,** and **4.7-6**. Construction of these alternatives would result in direct impacts to other mammals, and would include the incremental loss of potentially suitable habitat. Impacts from construction also would include animal displacement from disturbed areas and increased habitat fragmentation, which would continue until reclamation was completed and vegetation re-established. Potential impacts also could include nest and burrow abandonment or loss of young. These temporary losses would reduce productivity for that breeding season.

Indirect impacts associated with human activity and noise has been shown to negatively affect small game populations. These species may experience increased mortality rates due to increased access as a result of new and improved roads (Holbrook and Vaughan 1985). Construction traffic may injure or kill individuals, and local populations may experience higher levels of hunting and poaching pressure, due to improved access from additional access roads (Holbrook and Vaughan 1985). Alternatives A and D would result in improved access below The Notch, but access would be limited since the access would begin on private land without public access. Alternative C would result in improved access to areas along Pole Hill Road above Meadowdale Hills subdivision, which would increase human access on National Forest System land near The Notch. Alternative B would not result in improved access to the project area. In most instances, suitable habitat adjacent to disturbance areas would be available for use by these small game species, and therefore, impacts from the project would be anticipated to be minor.

Short-term and long-term impacts to other mammal species would result from the loss or alteration of habitat and could result in displacement of these species into adjacent habitats. These impacts are anticipated to be minor.

The road network may impact other mammal species to varying degrees depending on the geographical location, type of habitat disturbed, and wildlife species potentially impacted. Impacts to other mammal species from the construction and maintenance of construction and access roads would be similar to direct and indirect impacts from power line construction. Long-term effects to other mammal species due to impacts from operations are similar to short-term effects due to construction; however, they would be less intensive and longer in duration. These impacts generally would be minor.

Upland Game Birds

Impacts to upland game birds as a result of Alternatives A, B, C, and D or Variant A1 would be similar to those discussed for other mammals. Acres of habitat affected under these alternatives are included in **Tables 4.7-1, 4.7-3, 4.7-4,** and **4.7-6**. In addition, a portion of the project is located in wild turkey overall range (NDIS 2012) and a portion (structure numbers 7-4 to 9-4, E-LS, and 7-5 to 9-6, E-PH) of the analysis area is within a wild turkey production area (NDIS 2012). Construction of the proposed project would result in direct impacts to upland game birds through the incremental loss of potentially suitable habitat, and displacement from the disturbance areas, which would continue until reclamation was completed and vegetation re-established. Potential impacts also could include nest abandonment or loss of eggs or young. These temporary losses would reduce productivity for that breeding season, given the linear nature of the project and duration of construction activities in a specific area.

Indirect impacts to upland game birds associated with human activity and noise would be similar to impacts discussed for other mammals (Holbrook and Vaughan 1985).

Short-term and long-term impacts to upland game birds generally would be minor or negligible. Short-term effects due to construction of these aboveground alternatives would result in the incremental loss or alteration of upland game bird habitat. Habitat loss or alteration would result in the displacement of species into adjacent habitats. Surface disturbance also would result in an incremental increase in habitat fragmentation along the project, which would continue until reclamation has been completed and vegetation is re-established. Construction within the wild turkey production areas during the period of March 15 to August 15 could potentially disrupt nesting birds, and impacts to wild turkey in production areas could be moderate during this period.

Long-term impacts from operations to upland game birds would be similar to the short-term disturbance effects due to construction; however, impacts would be less intensive due to the infrequent nature of helicopter flyovers and maintenance visits to structure sites.

<u>Raptors</u>

Special status raptor species are addressed in Section 4.10, Special Status Wildlife Species. Potential direct impacts to raptors from the construction and operation of Alternatives A, B, C, and D and Variant A1 are included in **Tables 4.7-1 , 4.7-3, 4.7-4,** and **4.7-6**, and would include the incremental loss or alteration of potentially suitable breeding, roosting, and foraging habitat, and could include reduction in prey base and increased human disturbance. Impacts would be greater if activities occur during the breeding season. The loss of native habitat to human development has resulted in declines of hawks and eagles throughout the West (Boeker and Ray 1971; Schmutz 1984). In some cases, habitat changes have not reduced numbers of raptors, but have resulted in shifts in species composition (Harlow and Bloom 1987). Impacts to small mammal populations due to habitat loss can result in a reduced prey base for raptors, causing lower raptor densities. Thompson et al. (1982) and Woffinden and Murphy (1989) found that golden eagles and ferruginous hawks had reduced nesting success where native vegetation had been lost and the habitat was unable to support jackrabbit (prey) populations. Furthermore, raptors have a high potential of being disturbed from nests and roosts, which contributes to displacement and reduced nesting success (Holmes et al. 1993; Postovit and Postovit 1987; Stalmaster and Newman 1978).

If construction of these aboveground alternatives was to occur during the raptor breeding season, impacts to breeding raptors could include the possible loss of nests or nest abandonment due to increased noise and human activity in proximity to an active nest site. This would result in a significant impact. However, with the project-specific design criteria for avian wildlife (Section 2.5.1), breeding raptors would not be impacted by these alternatives.

The primary short-term impact to raptors would be due to the incremental loss of foraging, breeding, and nesting habitat due to construction activities. However, these short-term impacts would be minor. The primary long-term effects to raptors from project operation would be mortalities as a result of electrocution and collision with transmission line components. Maintenance activities (vegetation management, ground or air inspections, and repair work) would cause indirect impacts, but would be less intense and shorter in duration than long-term impacts. Transmission lines do not pose an electrocution hazard for bird species because the conductor spacing is too wide to allow contact. Configurations over 69 kV typically do not present a high electrocution potential, based on conductor placement and orientation (APLIC 2006). The proposed structure types for all action alternatives would be conformant with APLIC 2012 and utilize larger span widths between charged components than those of the existing towers. Therefore the electrocution potential for all alternatives, Alternative D excluded, would be reduced relative to the existing tower configuration. Electrocution potential for Alternative D would remain the same as that of the existing transmission line.

Avian predators, particularly raptors, are attracted to overhead utility lines because they provide perches for various activities, including hunting (APLIC 2006). Power poles increase a raptor's range of vision, allow for greater speed during attacks on prey, and serve as territorial markers (APLIC 2006; Manville 2002; Steenhof et al. 1993). Transmission line structures can impact small game, nongame, migratory bird, reptile, and amphibian populations by enhancing raptor and corvid populations. Raptors and corvids nest and perch on transmission structures, which create vertical structure in generally treeless shrub-steppe habitats (Knight and Kawashima 1993; Steenhof et al. 1993). Raptors and corvids are not expected to occur at higher densities than the situation with the existing lines since, depending on the alternative. The number of nesting and perching locations would remain the same or be greatly reduced.

Operation of the transmission lines also could incrementally increase the collision potential for migrating and foraging bird species. Collision potential typically is dependent on variables such as the location in relation to high use habitat areas (e.g., nesting, foraging, and roosting); line orientation to flight patterns and movement corridors; species composition; visibility; and line design (APLIC 2006). Avian mortality from collisions with power lines is well documented (Brown and Drewien 1995). Although rarely impacting healthy populations with good reproductive potential, collision mortality can be biologically significant to small local populations (Beer and Ogilvie 1972) and endangered species (Faanes 1987; APLIC 1994). Avian loss is often greatest where power lines cross migratory paths, bisect feeding and nesting-roosting sites, or occur adjacent to major avian use areas (Savereno et al. 1996). Higher risk also exists when land topography funnels birds through power line corridors (Bevanger 1990; Faanes 1987). Highest collision probabilities appear to occur where birds typically fly between foraging and loafing habitats bisected with overhead lines (SAIC 2001).

Factors that influence the risk of collision to individual birds as they encounter power lines are varied and include flight characteristics, previous experience with power lines (typically a function of age), weather, topography, and power line structural characteristics (APLIC 2006, 1994; Thompson 1978). The static wire, also referred to as the shield or groundwire, has posed the greatest collision danger to birds (APLIC 1994; Faanes 1987). Research has indicated that most collisions occur with static wires when birds increased their altitude in apparent attempts to avoid conductor wires. Birds maneuvering to avoid the conductor wires actually increased collision risk, and in the absence of static wires most collisions could have been avoided. If power lines must be placed aboveground, the risk of colliding would probably be reduced if all wires were in a single horizontal plane and tower height was reduced to that of the trees, reducing above-canopy exposure (Bevanger 1994; Thompson 1978).

Project alternatives include the replacement of existing transmission structures with updated towers that conform to APLIC 2012 guidelines. This improvement would reduce the amount of available perching and nesting sites along the transmission line and reduce the potential for avian mortality associated with collision. Therefore, operation of the project would result in negligible long-term impacts to raptors and could potentially be beneficial due to the fact that installation of new APLIC 2012 compliant tower structures would reduce the potential for avian mortality from collision.

Other Birds

Migratory bird species that could be impacted by construction activities include nesting passerines, or songbirds, that utilize the various habitats found within the analysis area for wildlife. Songbirds in the analysis area include open-country species associated with grassland and shrubland habitats and woodland species associated with coniferous forests.

Potential direct impacts resulting from construction and operation of the aboveground alternatives to migratory bird species would include the incremental loss of potentially suitable breeding, roosting, and foraging habitat, reduction in forage base, and avoidance due to increased human disturbance, especially during the breeding season. Acres of habitat affected under Alternatives A, B, C, and D and Variant A1 are included in **Tables 4.7-1, 4.7-3, 4.7-4,** and **4.7-6**. If construction occurred during the migratory bird breeding season (approximately March 1 to July 31), impacts to breeding birds could include the loss of nests or nest abandonment caused by increased noise and human activity in proximity to an active nest site. During this period, the proposed project could cause adverse impacts to migratory bird species. However, implementation of project specific design criteria (Section 2.5.1.1) would alleviate this impact.

Noise levels associated with construction could directly impact migratory bird species that occupy habitats impacted by the project. Studies have shown that reductions in bird population densities in both open grasslands and woodlands may be attributed to a reduction in habitat quality produced by elevated noise levels (Reijnen et al. 1997, 1995). Although visual stimuli in open landscapes may contribute to reduced bird densities at relatively short distances, the impacts of noise appear to be the most critical factor since breeding birds of open grasslands (threshold noise range of 43 to 60 dBA) and woodlands (threshold noise range of 36 to 58 dBA) respond very similarly to disturbance by traffic volume (Reijnen et al. 1997). Reijnen et al. (1996) determined a threshold effect for bird species to be 47 dBA, while a New Mexico study in a piñon-juniper community found that impacts of gas well compressor noise on bird populations were strongest in areas where noise levels were greater than 50 dBA. However, moderate noise levels (40 to 50 dBA) also have shown some effect on bird densities (LaGory et al. 2001), but anticipated impacts would be negligible.

Short-term and long-term impacts to migratory bird species would be similar to those discussed for other species. Short-term effects due to the construction of the proposed project would result in the incremental loss of habitat. Recovery times of the various vegetation communities that provide habitat for the species within the wildlife analysis area are discussed in Section 3.7, Vegetation. Habitat loss or alteration would result in the displacement of species into adjacent habitats. Surface disturbance also would result in an incremental increase in habitat fragmentation along the project until reclamation has been completed and vegetation is re-established. Impacts to other bird species from the construction and maintenance of access roads would be similar to those discussed for construction and operation of the power lines. These impacts would be minor or negligible within project ROWs.

Long-term effects due to impacts from operations to other bird species would be similar to those discussed for other species, and would continue until after the end of the project's design life.

BCC species that could potentially be impacted by project construction and operation include the Lewis' woodpecker and Cassin's finch. Impacts to Lewis woodpecker are discussed in Section 4.10.5.2, Forest Service Sensitive and Management Indicator Species. Potential direct impacts resulting from project alternatives or variants to the Cassin's finch would include the incremental loss, conversion, and fragmentation of potentially suitable breeding, roosting, and foraging habitat as a result of construction and operation activities. Although direct impacts to this species preferred habitat of coniferous forest within the project area would be greatest under Alternative D, this impact is anticipated to be minor and not result in the decline of local populations due to the abundance of available habitat within the project vicinity. The effects of fragmentation from project construction would be limited in nature as completion of the project for Alternatives A, B, and C, including the variants, would result in the consolidation of existing the ROWs into a single ROW. Overall, the consolidation of ROWs and the removal of tall vegetation within the newly created ROW would likely result in increased foraging opportunity as these species typically forage in open areas.

Short-term effects due to the construction of the project alternatives or variants would result in the incremental loss of habitat, of which a percentage would be immediately reclaimed following construction of the facilities. Loss of habitat could result in the displacement of species into adjacent habitats. Surface disturbance also would cause an incremental increase in habitat fragmentation in the analysis area until reclamation has been completed and vegetation is re-established. These impacts would be a minor or negligible within project ROWs.

Long-term impacts from operations could result from habitat disturbance in areas where facilities would be sited and periodic vegetation management activities, and could include wildlife mortalities resulting from collisions with maintenance vehicles or with transmission lines, and displacement due to habitat degradation from increased noise and human activity in and along the transmission line.

Amphibians and Reptiles

Three special status amphibian and reptile species could occur within the project vicinity. These amphibian and reptile species are discussed in Section 4.10. Potential impacts to other non-special status amphibian and reptile species are discussed below.

Potential direct impacts resulting from construction and operation of Alternatives A, B, C, and D, or Variant A1 to amphibian and reptile species would include the incremental loss and disturbance of potentially suitable seasonal breeding and foraging habitat located adjacent to and upland of riparian areas and mortalities resulting from collisions with vehicles or construction equipment. Details regarding the drainages and wetlands crossed by Alternatives A, B, C, and D are listed in **Tables 3.5-2** and **3.6-1.** Construction traffic within the ROW could result in amphibian mortalities during spring and summer breeding migrations to and from flooded areas, wetlands, streams, ponds, or lakes. Vehicle use within or adjacent to drainages and wetlands with existing roads (**Table 3.6-1**) could cause amphibian mortalities as they use these habitats throughout the year. Potential indirect impacts include vehicle activity causing increased sediment on a temporary basis in stream or riparian areas. Because the frequency of stream crossings during wet periods would be low, impacts would be minor.

Short-term effects would include the temporary loss and disturbance of amphibian and reptile habitat due to construction activities. Long-term impacts would include those resulting from operations and maintenance of the transmission line, such as mortalities resulting from collisions of individuals with maintenance vehicles and disturbance from the presence of maintenance personnel. Because the frequency of stream crossings during wet periods is low, impacts would be minor.

4.9.5.2 Variants A2 and C1

Variants A2 and C1 would differ from Alternatives A and C at the western-most segments where the alternatives would be constructed underground following a new alignment (see **Figure 2.2-2**), and would be buried. Construction of buried lines would impact greater continuous surface area during construction compared to aboveground construction, as a trench would be dug to bury the conductors in conduits. Avoidance of specific species and habitats may not be feasible for these alternatives.

Big Game

The types of direct and indirect impacts to big game species under Variants A2 or C1, compared to Alternatives A, B, C, and D or Variant A1, would be greater. The types of short-term and long-term impacts to big game species under Variants A2 or C1 would generally be the same as under Alternatives A, B, C, and D or Variant A1.

Other Mammals

The types of direct and indirect impacts to other mammal species under Variants A2 or C1 would generally be the same as described under Alternatives A, B, C, and D or Variant A1.

The types of short-term and long-term impacts to other mammal species under Variants A2 or C1 would generally be the same as described under Alternatives A, B, C, and D or Variant A1, but potential for predation by raptors would be reduced in areas where the project was buried.

Upland Game Birds

The types of direct and indirect impacts to upland game birds under Variants A2 or C1 would generally be the same as described under Alternatives A, B, C, and D or Variant A1, but the amount of potential habitat disturbed would be greater.

The types of short-term and long-term impacts to upland game birds under Variants A2 or C1 would generally be the same as described under Alternatives A, B, C, and D or Variant A1, but the potential for predation by raptors would be reduced in areas where the project was buried.

Raptors

The primary short-term impact to raptors would be the incremental loss of foraging, breeding, and nesting habitat due to construction activities. The primary long-term effects to raptors from project operation would be mortalities as a result of electrocution and collision with transmission line components. These long-term impacts would be reduced relative to Alternatives A, B, C, and D or Variant A1, as a portion of the project would be buried. The types of short-term and long-term impacts to raptors under Variants A2 or C1 would generally be the same as described under Alternatives A, B, C, and D or Variant A1. As with Alternatives A, B, C, and D or Variant A1, the avian wildlife project specific design criteria (per Section 2.5.1.1, Avian Wildlife) would be conducted.

Other Birds

The types of direct and indirect impacts to other bird species under Variants A2 or C1 would generally be the same as described under Alternatives A, B, C, and D or Variant A1, but the amount of potential habitat disturbed would be greater.

Short-term and long-term impacts to other bird species under Variants A2 or C1 would generally be the same as described under Alternatives A, B, C, and D or Variant A1, but the potential for predation by raptors would be reduced in areas where the project was buried.

Amphibians and Reptiles

The types of direct and indirect impacts from Variants A2 or C1 would be similar to Alternatives A, B, C, and D or Variant A1, but the amount of disturbance within stream crossings would be greater in areas where the project was buried. Disturbance within wetlands and aquatic habitats would not be avoided; direct mortalities and loss of habitat could occur in these areas. There is the potential for significant impacts at these locations.

4.9.6 Mitigation

Based on the project specific design criteria and the applicable SCPs, no additional mitigation measures have been recommended.

4.9.7 Residual Impacts

Short-term residual impacts to big game, other mammal species, raptors, and other birds from the construction of any project alternative would be minimized by the application of mitigation measures, SCPs, and design criteria, and are not anticipated to be significant (i.e., would not result in the loss of individuals of a population of wildlife to a degree that would result in species being listed or proposed for listing as threatened or endangered). Short-term residual impacts to wild turkey would be possible if construction occurs within a wild turkey production area during the nesting period between March 15 and August 15. Short-term impacts to amphibians would be minimized within identified and avoided riparian areas; however individuals could be impacted in adjacent upland areas during wet seasons.

Long-term residual impacts to wildlife would include the loss of vegetation related to the permanent placement of facilities, and access roads for the life of the project. Wildlife injuries and mortalities are expected to occur as a result of collisions with transmission structures, guy wires, transmission conductors, and vehicles. Quantification of these impacts is not presented in this analysis due to the lack of available data and the variability of wildlife populations. These residual impacts are anticipated to be minor and not result in the loss of individuals of a population of wildlife to a degree that would result in species being listed or proposed for listing as threatened or endangered. Additional residual impacts would be the increase in habitat should an alternative be selected where ROWs would be consolidated and one would be allowed to return to a natural state.

It is anticipated that reclamation efforts would be successful and no permanent residual impacts to habitats would occur. Timeframes for successful reclamation can vary by habitat type and initial impact intensity. During extended periods of reclamation, it is expected that habitat function may be reduced until reclamation is complete.

Acres of wildlife habitat affected under Alternatives A, B, C, and D and Variant A1 are included in **Tables 4.7-1**, **4.7-3**, **4.7-4**, and **4.7-6**. Based on total disturbance, short-term and long-term residual impacts would be greatest under Alternative D. Variants A2 and C1 would generally have the same short-term and long-term residual impacts as Alternatives A, B, and C, and Variant A1, except for greater impacts to big game and lower potential for impacts to birds.

4.9.8 Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitments would be anticipated for wildlife resources. During project operation, vegetation posing operational or safety challenges would be removed from a portion of the ROW to facilitate maintenance for the life of the project; however, this loss would be countered by the establishment of new vegetation more compatible with transmission line operations until the end of the project life, as well as the return of a ROW to natural condition should a combined alternative be selected.

4.9.9 Relationship between Short-term Uses and Long-term Productivity

Long-term impacts could include the reduction of wildlife use within the analysis area. Additionally, short-term impacts associated with increased human presence and noise associated with construction could displace animals from suitable cover, foraging, and breeding sites. However, because most species would be able to relocate to adjacent suitable habitats for the short-term, populations would continue to persist and utilize available habitat in the long term.

4.10 Special Status and Sensitive Wildlife Species

Special status species are those species for which state or Federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are federally listed species that are protected under the ESA and species designated as sensitive by the USFS. In addition, the State of Colorado maintains a list of state-protected and sensitive species (CRS 33-2-105) that includes many of the USFS sensitive species as well as ESA-listed species. In accordance with the ESA, Western and the USFS, in coordination with the USFWS, must ensure that any action that they authorize, fund, or carry out would not adversely affect a federally listed species. The FSM 2670 describes regulatory requirements for USFS sensitive species.

The impact analysis area for wildlife resources includes a 100-foot area along each side of linear features (transmission lines and access roads), a 300-foot-wide area centered along the new routing options, and a 75-foot area centered on the underground variants. As discussed in Section 4.9, no impacts from the project or alternatives are expected to occur to aquatic wildlife or their habitats; therefore, impacts to aquatic wildlife are not further discussed in this section.

Issues considered in assessing the environmental consequences of the project and alternatives on special status species were identified by Western through internal scoping, consultation with cooperating agencies, and through comments provided during public scoping. Those issues include:

- The loss or decline of special status species (i.e., federally listed, proposed or candidate species for listing under the ESA); USFS MIS, USFS sensitive species, and species protected by Colorado state law and their associated habitats.
- Collision of special status or sensitive bird species with transmission lines.

4.10.1 Methodology

Impacts to special status and sensitive wildlife species from the project are based on the locations of the resources in relation to the proposed surface disturbance areas. SCPs are taken into account in addressing the severity of the impact. The acres of disturbed areas were estimated based on the extent of disturbance for construction and operation activities.

4.10.2 Significance Criteria

A significant impact on special status species or their critical habitats would result if any of the following were to occur from constructing and operating the project:

- Jeopardizing the continued existence of a special status species.
- Loss of individuals of a population of species that would result in a change in species status.
- Adversely modifying Critical Habitat to the degree it would no longer support the species for which it was designated.
- Violation of any Federal or other applicable statutes or regulations pertaining to special status species.
- Causing adverse impacts to habitat used by special status species for spawning or rearing and mussel species for attachment to bottom substrates.

4.10.3 Impacts Common to All Alternatives

Direct and indirect impacts to special status wildlife species and their habitats would occur from surface disturbance associated with construction and operation activities in the ROW. If impacts occur within specific sensitive species habitat, direct impacts could include trampling/crushing of special status species individuals, the removal or conversion of habitat, the potential for mortalities resulting from collision with transmission lines, and avoidance of the project area due to the increased noise and disturbance resulting from the increased presence of humans.

Indirect effects to special status species would result from increased erosion, sedimentation, fugitive dust generation, the spread and establishment of noxious and invasive weed species, disturbance from human presence during construction and maintenance activities, noise, and habitat fragmentation.

Any potential impacts to special status wildlife species individuals or habitat are likely to be adverse, minor, and short-term given that limited surface disturbance is anticipated and Western's commitment to reclaim disturbed areas. Long-term impacts would include loss or conversion of habitat associated with the permanent facilities and access roads during the life of the project, and the loss of woody vegetation habitat that is removed from the ROW for the life of the project. These negative impacts would be minor and long-term considering that maintenance activities will occur over the life of the project.

4.10.4 No Action Alternative

The No Action Alternative, including the small segment involving the re-location of the line at the Newell Lake View subdivision, would pose impacts similar to the other alternatives, except potential impacts would occur over a longer span of time.

Short-term and long-term effects under the No Action Alternative would be similar to current levels described in Section 4.10.3. Minor impacts from general maintenance would be anticipated to increase with a general increase in maintenance activities. Short-term and long-term effects in the area of the Newell Lake View subdivision re-route would be similar to those described for all action alternatives in Section 4.10.5, but would be reduced in total acreage.

4.10.5 Impacts Unique to Specific Action Alternatives

As described in Section 4.9.5, the types of direct and indirect impacts to wildlife species resulting from any action alternative or variant would be the same as those discussed in Section 4.10.3. Additional impacts to special status and sensitive wildlife are described in the following sections. Avoidance of specific species and habitats may not be feasible for Variants A2 or C1. Acres of habitat disturbance for each alternative are summarized in **Tables 4.7-1** through **4.7-6**. The number of streams and drainages crossed by each alternative where impacts could occur to reptiles, amphibians, and river otters is listed in **Table 3.5-2**.

The effects of habitat conversion and fragmentation from project construction would be limited in nature and could potentially benefit some wildlife species as completion of the project with Alternatives A, B, or C or their variants would result in the consolidation of multiple existing ROWs and transmission lines into a single ROW and a single transmission line. Overall, the consolidation of ROWs, and the removal of tall vegetation within the newly created ROW would likely result in increased foraging opportunity for those species that typically forage in open areas.

4.10.5.1 Colorado State Threatened, Endangered, and Special Concern Species

<u>Townsend's Big-eared Bat</u>

Potential direct effects to this species as a result of project alternatives or variants include the short-term incremental reduction of potential foraging habitat during construction and avoidance of the project area due to increased human presence and noise. These impacts would be limited in nature as construction and maintenance activities in the project area would occur during daylight hours only, areas temporarily disturbed by construction would be revegetated, and conversion of the existing power line ROW to open areas of native shrub vegetation communities would benefit this species through the expansion of available foraging area.

The potential for mortalities resulting from collision with transmission lines is considered to be low due to project compliance with APLIC guidelines. The potential for mortalities of individuals resulting from collisions with construction equipment and vehicles on access roads also would exist under project alternatives or variants. However, because this species is nocturnal and construction activities in the impact analysis area would only occur during daylight hours, the potential for this impact to occur is considered to be low; therefore the impact would be negligible.

Alternative D would result in the greatest amount of direct impacts to the preferred habitat of this species as shown in **Tables 4.7-1** through **4.7-6**. Conversely, Alternative C would result in the least amount of direct impacts to this species habitat.

<u>Bald Eagle, American Peregrine Falcon</u>

Potential direct impacts resulting from project alternatives or variants to these species would include the incremental loss and disturbance of potentially suitable breeding and foraging habitat and mortalities resulting from collisions with the transmission lines and structures, vehicles, or construction equipment.

Potential indirect impacts to these species as a result of project alternatives or variants would include the short-term avoidance of otherwise suitable habitat (Pinewood Reservoir) by these species due to increased noise and human activity. Although no nests for either of these species have been documented within the project area, if project construction was to occur during the raptor breeding season, a migratory bird nesting survey would be conducted prior to any construction activities in order to avoid potential impacts to active nests as stated in Section 2.5.1, Project Specific Design Criteria.

Long-term impacts from operations could result from habitat disturbance and fragmentation in areas where facilities would be sited and periodic vegetation management activities, including wildlife mortalities that occur as a result of maintenance activities and displacement due to habitat degradation from increased noise and human activity in and along the transmission line ROW. Due to the limited nature of foraging habitat for these species within the project area, the probability of adverse impacts is considered to be negligible.

<u>Boreal Toad, Northern Leopard Frog, Common Garter Snake</u>

Potential direct impacts, resulting from project alternatives or variants to these species would include the incremental loss and disturbance of potentially suitable breeding and foraging habitat and mortalities resulting from collisions with vehicles or construction equipment. Vehicle and equipment crossings of streams or suitable seasonal upland habitat could cause amphibian mortalities during spring and summer breeding migrations to and from flooded areas, wetlands, streams, ponds, or lakes. The potential for these adverse impacts to occur would be reduced by the implementation of SCPs 32 through 35, as discussed in **Table 2.5.1**. Because construction of overhead transmission lines would span, and therefore, avoid, construction in this habitat, impacts would be negligible for Alternatives A, B, C, D, and Variant A1.

A greater potential for adverse impacts would exist for Variants A2 or C1. These variants have not been surveyed for suitable habitat. Per SCPs, the specific design criteria, and the mitigation recommended for addressing wetland habitat in Section 4.6.6, any disturbance within wetlands and aquatic habitats would be avoided, if practical (it is possible that the underground cables could be installed by boring rather than direct burial). Impacts would include direct mortalities and loss of habitat within these areas.

Potential indirect impacts would include vehicle activity causing increased sediment on a temporary basis in streams or suitable upland seasonal habitat crossed by project vehicles. Impacts would be negligible for routes other than Variants A2 and C1, where impacts could be minor.

Short-term effects would result from the temporary loss and disturbance of habitat for these species due to construction activities of which a percentage would be immediately reclaimed following construction of the facilities. Impacts would be negligible for routes other than Variants A2 and C1, with the implementation of the SCPs, the specific design criteria, and the recommended mitigation.

Long-term impacts could include individual mortalities resulting from collisions with maintenance vehicles, or migration due to disturbance from the presence of maintenance personnel. Because the frequency of stream crossings during wet periods would be low, impacts to these species would be minor.

4.10.5.2 Forest Service Sensitive and Management Indicator Species

The following impact discussions include those species determined to potentially occur in the project area as noted in Section 3.10.3, Forest Service Sensitive and Management Indicator Species.

<u>American Marten</u>

Impacts to this species from surface disturbance activities would include the loss of habitat potentially resulting in the displacement of species into adjacent habitats. Surface disturbance also would result in an incremental increase in habitat fragmentation along the project until reclamation has been completed and vegetation is re-established.

The road network, which would be constructed or upgraded to fulfill the construction requirements of the project, may impact this species to varying degrees depending on the geographical location and the type of habitat disturbed. Impacts to this species from the construction and maintenance of construction and access roads would be similar to those discussed for other mammal species discussed in Section 4.9. These impacts generally would be minor and are not anticipated to have a significant effect upon local populations.

The primary potential direct adverse impact to this species would be avoidance (displacement) of otherwise suitable habitat in the vicinity of project disturbance areas due to noise and human activity. This impact would have minor effects on marten, a species that is wide-ranging and relatively tolerant of human presence. Indirect impacts resulting from construction of project alternatives or variants would result in increased human activity and noise in the vicinity of the terminal locations and the transmission line ROW. Avoidance would result in displacement of animals from an area larger than the actual disturbance area. Following avoidance of human activity and noise-producing areas during construction, this species may acclimate to the activity and begin to return to areas that were formerly avoided. These impacts generally would be minor.

Effects due to the construction of the project alternatives or variants would result from the incremental loss of habitat (**Tables 4.7-1** through **4.7-6**), of which a percentage would be immediately reclaimed following construction of the facilities. This species does not typically inhabit areas that have been burned or recently cleared of vegetation. Although direct impacts to this species preferred habitat would be greatest under Alternative D, these impacts are anticipated to be minor due to the relative abundance of forested habitat types in the project vicinity.

Long-term effects to these species due to operations would be similar to short-term effects due to construction; however, they would be less intensive and longer in duration. Potential long-term effects include wildlife mortalities that occur as a result of maintenance activities, increased risk of predation by raptor species which may perch on transmission lines and structures, and habitat degradation resulting from increased noise and human activity in, and along, the transmission line ROW. The potential for predation by raptors would be reduced in areas where the project was buried. Long-term effects also would include added habitat for the alternatives that consolidate two ROWs into one.

<u>Fringed Myotis</u>

Potential direct effects to this species as a result of project alternatives or variants would include the incremental habitat fragmentation from vegetation removal, avoidance of otherwise suitable habitat due to increased noise and human activity, and the potential for mortalities resulting from collision with transmission lines. The effects of fragmentation from project construction would be limited in nature as completion of the project with Alternatives A, B, and C or their variants would result in the consolidation of existing ROWs into a single ROW. Overall, the consolidation of ROWs and the removal of tall vegetation within the newly created ROW would likely result in increased foraging opportunity as the fringed myotis typically forages in open areas. Although direct impacts to this species preferred habitat would be greatest under Alternative D, these impacts are anticipated to be minor due to the relative abundance of forested habitat types in the project vicinity.

The potential for mortalities of individuals resulting from collisions with construction equipment and vehicles on access roads also would exist under all project alternatives or variants. However, because this species is nocturnal and construction activities in the analysis area would only occur during daylight hours, the potential for this impact to occur is considered to be low; therefore the impact would be negligible.

<u>Townsend's Big-eared Bat</u>

The Townsend's big-eared bat is discussed in Section 4.10.5.1, Colorado State Threatened, Endangered, and Special Concern Species.

<u>Hoary Bat</u>

Potential foraging impacts to this species would be similar to those described for the fringed myotis above. In addition, the potential for impacts to roost or maternity sites due to the removal of more mature, larger trees with the expansion of the ROW also would exist for this species. Loss of trees could result in a minor reduction of possible roost or maternity sites for individual bats, but this loss would be negligible compared to possible roost or maternity site trees available outside of the ROW. Although individual bats could be displaced from roost or maternity sites with expansion of the ROW, direct mortality is not likely for this highly mobile species because it roosts in the foliage at the ends of branches. It is likely that a bat roosting on a tree would be able to fly away before potential injury from tree felling occurred.

Flammulated Owl

Potential direct effects to this species as a result of project alternatives or variants would include the incremental habitat fragmentation from vegetation removal (**Tables 4.7-1** through **4.7-6**), avoidance of otherwise suitable habitat due to increased noise and human activity, and the potential for mortalities resulting from collision with transmission lines. The effects of fragmentation from project construction with Alternative A, B, C, or their variants would be limited in nature as completion of the project would result in the consolidation of existing ROWs into a single ROW. Additionally, trees removed by maintenance activities and expansion of the existing ROW would be relatively young and would not likely support cavity nesting activity by flammulated owl. However, there are areas of mature forest where taller trees and snags could be removed during ROW expansion; leading to there is a relatively small risk for the potential loss of a nest tree. Direct impacts to this species preferred habitat within the project area would be greatest under Alternative D. This potential impact is anticipated to be minor in significance and not result in long-term declines of local populations.

Based on the project design criteria, no project construction would occur during the raptor breeding season, and there would be no direct or indirect impacts to the flammulated owl due to loss of nests or nest abandonment due to increased noise and human activity in proximity to an active nest site.

Long-term impacts from operations could result from habitat disturbance and fragmentation in areas where facilities would be sited and periodic vegetation management activities, and could include wildlife mortalities occurring as a result of maintenance activities and displacement due to habitat degradation resulting from increased noise and human activity in and along the transmission line ROW. This would be a minor impact.

Lewis' Woodpecker and Olive-sided Flycatcher

Potential direct impacts resulting from project alternatives or variants to these species would include the incremental loss, conversion, and fragmentation of potentially suitable breeding, roosting, and foraging habitat as a result of construction and operation activities. Although direct impacts to these species preferred habitat of coniferous forest within the project area would be greatest under Alternative D, this impact is anticipated to be minor in significance and not result in the decline of local populations due to the abundance of available habitat within the project vicinity. The effects of fragmentation from project construction would be limited in nature as completion of the project would result in the consolidation of existing ROWs into a single ROW. Overall, the consolidation of ROWs and the removal of tall vegetation within the newly created ROW would likely result in increased foraging opportunity as these species typically forage in open areas.

Per the project-specific design criteria, avian nesting surveys would be conducted prior to construction to ensure ground disturbing activities do not result in the "take" of an active nest or migratory bird protected under the MBTA. If construction occurs during the avian breeding season (roughly between March 15 and September 1), surveys would be conducted no earlier than 72 hours prior to any ground disturbing activities to ensure the project complies with the MBTA. Thus, no impacts to nesting migratory birds are anticipated.

Short-term effects due to the construction of the project alternatives or variants would result in the incremental loss of habitat, of which a percentage would be immediately reclaimed following construction of the facilities. Loss of habitat could result in the displacement of species into adjacent habitats. Surface disturbance also would cause an incremental increase in habitat fragmentation in the analysis area until reclamation has been completed and vegetation is re-established. These impacts would be a minor or negligible within project ROWs.

Long-term impacts from operations could result from habitat disturbance in areas where facilities would be sited and periodic vegetation management activities, and could include wildlife mortalities resulting from collisions with maintenance vehicles or with transmission lines, and displacement due to habitat degradation from increased noise and human activity in and along the transmission line ROW.

Northern Goshawk

The potential for adverse impacts to this species is considered low due to the limited availability of mature old-growth coniferous forest habitat within the project area. Occurrences of the northern goshawk would be limited to areas of coniferous forest. Potential direct effects to this species as a result of project alternatives or variants would include the incremental habitat fragmentation from vegetation removal (**Tables 4.7-1** through **4.7-6**), avoidance of otherwise suitable habitat due to increased noise and human activity, and the potential for mortalities resulting from collision with transmission lines. The effects of fragmentation from project construction with Alternative A, B, C, or their variants would be limited in nature as completion of the project would result in the consolidation of existing ROWs into a single ROW. Direct impacts to this species preferred habitat within the project area would be greatest under Alternative D. This potential impact is anticipated to be minor in significance and not result in long-term declines of local populations.

Based on the project design criteria, a 0.5-mile radius around active Northern goshawk nests would be maintenance and if not possible, no project construction would occur during the raptor breeding season March 1 through September 15, and there would be no direct or indirect impacts to the northern goshawk due to loss of nests or nest abandonment due to increased noise and human activity in proximity to an active nest site.

Long-term impacts from operations could result from habitat disturbance and fragmentation in areas where facilities would be sited and periodic vegetation management activities, and could include wildlife mortalities occurring as a result of maintenance activities and displacement due to habitat degradation resulting from increased noise and human activity in and along the transmission line ROW. This would be a minor impact.

American Peregrine Falcon

The American peregrine falcon is discussed in Section 4.10.5.1, Colorado State Threatened, Endangered, and Special Concern Species.

Boreal Toad and Northern Leopard Frog

The Boreal toad and Northern leopard frog are discussed in Section 4.10.5.1, Colorado State Threatened, Endangered, and Special Concern Species.

Arapahoe Snowfly and Hudsonian Emerald Dragonfly

The potential for adverse impacts to these species is considered low due to the limited availability of suitable habitat within the project area. Based on the project design, no direct impacts to these species are anticipated. The Solitude Creek wetland between poles 4-6 and 4-7 (E-PH) would be avoided during construction. In accessing the existing E-PH Structure 4-7, Western would avoid the fen by assessing the structure from an existing two-track road located south of the fen. For Alternatives A, A1, and A2 Western would only need to access the Structure 4-7 to disassemble and cut up the structure. Road improvements for this alternative are not anticipated. For Alternatives B, C, and D, Western would need to improve roads to accommodate construction and maintenance vehicles. Solitude Creek beneath the E-PH line does not represent potential habitat for Arapahoe snowfly. Therefore, it is unlikely there would be any direct or indirect impacts to possible Apraphoe snowfly from Alternatives B and C.

Potential indirect effects include the degradation of water quality during construction activities. However, the use of best management practices to minimize sediment discharge, as well as the broad vegetative filter strip that occurs between the project area and any nearby watercourses or wetlands, would preclude sediment contribution to potential Arapahoe snowfly habitat. No aspect of the project would affect water volume downgradient from the project area. Since no road construction would occur across Solitude Creek, the area is not likely to directly or indirectly affect flows or water quality in downstream portions of the creek.

4.10.5.3 Forest Service Management Indicator Species

Elk and Mule Deer

Direct and indirect impacts to elk and mule deer are described in Section 4.9, Wildlife.

Golden-crowned Kinglet and Hairy Woodpecker

Potential direct impacts, resulting from project alternatives or variants to these species would result from the incremental loss of potentially suitable breeding, roosting, and foraging habitat. Because of the existing forest types within the project area, it is unlikely that golden-crowned kinglets are present. Implementation of the project alternatives would result in some minor losses of tree cover to expand the ROW and construction activities could result in some minor and short-term disruption of individual golden-crowned kinglets. Overall, project alternatives would likely have a neutral effect on populations of golden-crowned kinglets and changes populations trends at the planning unit level would not occur.

Hairy Woodpecker

Adverse impacts to this species could result from trees removed by maintenance activities and expansion of the existing ROW. The majority of trees designated for removal would be relatively young and could include trees likely to support foraging and cavity nesting activity by hairy woodpecker. Therefore, the potential loss of a nest tree does exist under the project action alternatives. Because of the extensive amount of beetle-killed or dying trees in the analysis area and adjacent areas of forest, the loss of a few potential forage trees or a nest cavity tree would be inconsequential for local populations of hairy woodpecker. However, if nesting hairy woodpeckers are discovered during preconstruction surveys or during construction, actions would be taken to avoid the nesting activity in accordance the project specific design criteria.

Construction and maintenance activities could result in hairy woodpecker's short-term avoidance of the immediate area of activity should this species be present at the time of this activity. The possible short-term avoidance of construction and maintenance activities would not have any adverse effects on local populations of hairy woodpecker since the analysis area is relatively small in relation to available adjacent habitats, and any avoidance would be for a relatively short time period.

Mountain Bluebird

Expansion of the ROW is unlikely to create grassland openings large enough to create preferred habitat areas for mountain bluebird. Because of the lack of larger openings within the analysis area, it is unlikely that mountain bluebirds are present. Implementation of the any of the action alternatives would result in some minor losses of tree cover to expand the ROW and construction activities could result in some minor and short-term disruption of individual mountain bluebirds if they are present. Overall, project construction and operation would likely have a neutral effect on populations of mountain bluebird and changes in populations trends at the planning unit level would not occur.

Pygmy Nuthatch

Adverse impacts to this species could result from trees removed by maintenance activities and expansion of the existing ROW. The majority of trees designated for removal would be relatively young and could include trees likely to support foraging and cavity nesting activity by pygmy nuthatch. Therefore, the potential loss of a nest tree does exist under the project action alternatives. Because of the extensive amount of beetle-killed or dying trees in the analysis area and adjacent areas of forest, the loss of a few potential forage trees or a nest cavity tree would be inconsequential for local populations of pygmy nuthatch.

Construction and maintenance activities could result in pygmy nuthatch's short-term avoidance of the immediate area of activity should this species be present at the time of this activity. The possible short-term avoidance of construction and maintenance activities would not have any adverse effects on local populations of pygmy nuthatch since the analysis area is relatively small in relation to available adjacent habitats, and any avoidance would be for a relatively short time period.

<u>Wilson's Warbler</u>

Under Alternatives A, A1, and A2, potential direct impacts to this species habitat could occur at the crossing of Solitude Creek during the removal of existing Structure 4-7. Impacts would be short-term and limited to the removal of the existing structure. Road improvements for this alternative are not anticipated at this location as access to the site is available via an existing two-track road.

Potential impacts under the other project action alternatives would be limited to the short-term avoidance of construction and maintenance activities by foraging Wilson's warblers. This impacts would not have any adverse effects on local populations of Wilson's warbler since the analysis area is relatively small in relation to available habitat on the planning unit area, and any avoidance would be for a relatively short time period. Therefore, the project action alternatives may adversely impact foraging birds, but changes to Wilson's warbler populations or trends at the planning unit level would not occur.

<u>Boreal Toad</u>

The Boreal toad is discussed in Section 4.10.5.1, Colorado State Threatened, Endangered, and Special Concern Species.

4.10.6 Mitigation

Based on the project specific design criteria and the applicable SCPs, no additional mitigation measures have been recommended.

4.10.7 Residual Impacts

Short-term residual impacts are those impacts to special status wildlife species from the construction of any project alternative that would remain after the application of mitigation measures, SCPs, and design criteria. Residual impacts to special status wildlife species, if any, are anticipated to be negligible.

Long-term residual impacts to special status wildlife species would include the loss of vegetation related to the permanent placement of facilities, and access roads for the life of the project, and fragmentation of native habitats. Limited wildlife injuries and mortalities are expected to occur as a result of collisions with transmission towers, transmission lines, and vehicles. Quantification of these impacts is not presented in this analysis due to the lack of available data and the variability of wildlife populations. These residual impacts are anticipated to be negligible and not result in the decline of any special status wildlife species potentially occurring within the project area. It is anticipated that reclamation efforts would be successful and no permanent residual impacts to habitats would occur. Timeframes for successful reclamation can vary by habitat type and initial impact intensity. During extended periods of reclamation, it is expected that habitat function may be reduced until reclamation is complete.

Based on total disturbance, short-term and long-term residual impacts would be greatest under Alternative D. After implementation of the project-specific design criteria and the SCPs there would not be any significant impacts to special status wildlife species from any of the alternatives.

4.10.8 Irreversible and Irretrievable Commitment of Resources

No irreversible commitments would be anticipated for special status and sensitive wildlife species. Woody vegetation would be removed from a portion of the ROW to facilitate maintenance for the life of the project; which would be an irretrievable loss of this habitat contributing to habitat fragmentation. This loss would continue until reclamation has been completed and the vegetation re-established.

4.10.9 Relationship between Short-term Uses and Long-term Productivity

Short-term impacts could include the reduction of wildlife use within the analysis area. Additionally, short-term impacts associated with increased human presence and noise associated with construction could displace animals from suitable cover, foraging, and breeding sites. However, because most species would be able to relocate to adjacent suitable habitats for the short-term, populations would continue to persist and utilize available habitat in the long term.

4.11 Land Use and Recreation

The analysis area for land use includes the transmission line ROWs and the immediate surrounding area, up to 1 mile on either side of the proposed transmission line alternatives.

The analysis area for recreation consists of all recreation uses/areas within or adjacent to the transmission line alternatives, as well as any recreation uses/areas accessed from roads or trails that intersect the transmission line alignments.

The main issues related to land use and recreation include conflicts with land use plans and policies; long-term loss or conflicts with current land uses; conflicts with special use areas, recreational uses and outdoor activities; and loss of agricultural productivity. Other key issues related to land use and recreation as presented in Section 1.6.3.2, include:

- Effects of new ROW acquisition on land uses and property owners where an adequate ROW had not been previously acquired.

- Effects of the proposed project on recreational uses and experiences in the vicinity of Estes Park and Pinewood Reservoir, and on National Forest System lands accessed by USFS Road 122 (Pole Hill Road).

- Effects of the proposed project on protected areas, including county open space, lands protected by conservation easement, lands within the Stewardship Trust Program, and State Wildlife Areas.

- Effects of ROW expansion or new ROW acquisition on existing infrastructure (e.g., Upper Thompson Sanitation District's treatment plant) and other structures.

4.11.1 Methodology

4.11.1.1 Land Use

Rebuilding and operating the transmission lines and the associated effects resulting from construction activities and ROW restrictions were compared against existing land uses, including recreational uses, to determine if they would result in conflicts with these uses. Similarly, land use plans and zoning were reviewed in the areas that would be influenced by the project to determine if the project was consistent with planned land uses.

To determine if an action would cause a significant impact, the context of the project was considered in conjunction with the intensity of the impact. The context of the project is the locally affected area. Significance depends upon the effects in the local area.

Alternatives are compared with regard to the identified key issues by comparing: 1) acres of new ROW acquisition, 2) acres or length of land ownership type crossed, 3) number of landowners burdened by ROW acquisition, for new or widened ROW, 4) number of open space and protected lands crossed, and 5) effects of ROW expansion on existing infrastructure.

4.11.1.2 Recreation

Potential direct and indirect effects to recreation caused by construction, operation, and maintenance of the project were assessed by examining potential changes in recreational access, opportunities, and experiences that would result from implementation of the various alternatives. Consistency with current ROS designation(s) on National Forest System lands also is assessed.

4.11.2 Significance Criteria

4.11.2.1 Land Use

A significant impact on land use would result if any of the following were to occur from constructing or operating the project:

- Major conflict with an existing use, such as the removal of a building, or restrictions that result in direct, readily identifiable conflicts with planned uses by Federal, state, or local governments, or the ability to expand an existing public utility.
- Conflict with applicable land use plans, policies, goals or regulations.
- Conflict with state or federally established, designated or reasonable foreseeable planned special use areas (e.g., recreation, wildlife management area, wilderness areas, etc.).

4.11.2.2 Recreation

A significant impact on recreation would result if any of the following were to occur from constructing or operating the proposed project:

- Permanent loss of access to a locally important recreation site/area.
- Loss/degradation of a recreation site/area of regional/national importance.
- Conflict with formally established recreation uses/opportunities (e.g., ROS class or limit/restrict a specific type of allowable activity or use at the site/area).

4.11.3 Impacts Common to all Alternatives

4.11.3.1 Land Use

Direct and indirect impacts would include disruptions to current land uses from project construction and operation, including short-term disturbance during the construction phase, and to a lower degree, on-going activities associated with maintenance of the ROW and transmission structures. Maintenance activities currently occur along both of the existing lines, but the timing, frequency and location of these activities would be modified by the project, diminishing in some locations and increasing in others. New or expanded ROW required for project construction and operation would be acquired by negotiating easements with private landowners and/or with local, state or Federal agencies. Land uses within new or expanded easements would be limited by ROW restrictions that prevent the construction of buildings or other incompatible uses. There would be beneficial impacts to the Newell Lake View subdivision as a result of removing the existing line that traverses through several developed lots where homes have been built immediately adjacent to the existing transmission line ROW. Overall, direct and indirect impacts to land use resulting from constructing and operating the proposed transmission lines would be minor to moderate and adverse in both the short- and long-term.

During construction activities, short-term disturbance would be associated with establishing access, removing the existing H-frame structures, establishing staging areas and conductor stringing sites, and constructing new steel monopole or H-frame structures. The impacts to current land uses during construction would be short-term, decreasing when construction activities are completed. Long-term impacts would result from installation of permanent structures and transmission line, and ROW maintenance. The long-term loss resulting from transmission line structures would be very small (less than 0.1 acre), would mostly occur within the existing ROWs, and for Alternatives A, B, and C, including the variants, would involve replacing existing structures with a smaller number of taller structures. This would result in negligible impacts. Long-term adverse impacts to land use from the acquisition of new or expanded ROW would range from negligible to moderate depending on the location and ownership of the acquired ROW. Acreage of new ROW where land use restrictions would apply are described in Section 4.11.5 below.

None of the alternatives would result in conflicts with adopted land use plans or policies. Those portions of the alignments located on National Forest System lands are within a designated utility corridor (USFS 2012a).

4.11.3.2 Recreation

Impacts to recreation could occur from establishment of new access roads, road improvements, or overland access depending on the location of these activities. Construction activities within a recreation area would result in adverse impacts from noise, visual disturbances and potential delays or temporary inability to reach a recreation destination. Short-term impacts to recreation could range from negligible to moderate depending on location and timing of construction activities. New permanent access roads that are not designated for public use could become an attractive nuisance and lead to unauthorized OHV use and associated resource damage, noise, etc. The miles of new permanent access proposed on National Forest System land under each of the alternatives is summarized in Section 4.16, Transportation. Staging areas would not be located within developed recreation or concentrated use areas.

Operations and maintenance activities could cause minor adverse impacts to recreation access, opportunities, and experiences due to delays in accessing a recreation site, noise and visual disturbances, and disturbances to wildlife. These activities are already occurring but their distribution and frequency would change depending on the alternative implemented.

Impacts to recreation from general construction activities and staging areas would be short-term. Impacts from operations and maintenance would be short in duration, but would occur periodically over the long-term life of the project. Impacts to recreation from access road building, improvements, overland access, and temporary access roads would be short-term. Impacts to recreation from permanent access roads would be long-term. It is assumed that temporary access roads would be restored and thus, there would be no long-term impacts from these roads.

4.11.4 No Action Alternative

Under the No Action Alternative, both existing transmission line ROWs would continue to be utilized and on-going maintenance activities would continue, possibly with increased frequency. The benefits to land use and recreation from decommissioning one of the lines would not be realized. Existing ROWs would be expanded as needed and minor adjustments would be made to the alignments where necessary in order to comply with NERC and NESC requirements. At one location, specifically a segment through the Newell Lake View subdivision, the existing line would be relocated and a new ROW acquired due to the presence of several residences adjacent to the existing ROW.

4.11.4.1 Land Use

Under the No Action Alternative, impacts associated with land use would result from the acquisition of new ROW at selected locations. In order to comply with applicable standards and maintain an acceptable level of reliability, Western would acquire additional ROW at all locations on private land where the current ROW width is less than 75 feet, and depending on maintenance requirements, additional ROW may need to be acquired at some locations where the existing ROW width is less than 110 feet.

The South Line has a ROW width of 75 feet or more over its entire length. Conversely, the North Line has inadequate ROW width over nearly its entire length, the only exceptions being short segments near Mall Road in Estes Park and near the Flatiron Substation.

Where there is inadequate ROW on private land, Western would acquire the additional ROW needed to meet applicable standards. For much of the North Line, this would require acquisition of an additional 45 to 55 feet of ROW. At one location, specifically a segment through the Newell Lake View subdivision, the existing line would be relocated to follow Pole Hill Road near Pinewood Reservoir and a new ROW acquired due to the fact that several homes have built immediately adjacent to the existing transmission line ROW. The new line segment would parallel Pole Hill Road. Existing land uses would be disrupted by noise and activities involved with construction, but these impacts would cease once construction was completed. Western would relinquish its rights to the ROW through Newell Lake View subdivision following decommissioning of the existing line and the overall effect on the Newell Lake View subdivision would be beneficial.

In total, 40 landowners would be burdened by ROW acquisition under the No Action Alternative, which would be required to meet current standards. Acquisition of new ROW would affect five landowners while ROW expansion would affect 35 landowners. Seven landowners would have ROW decommissioned on their properties. Western would not seek authorization for new or expanded ROW on National Forest System land.

4.11.4.2 Recreation

Impacts to recreation from the No Action Alternative would result from new transmission line structures and general maintenance and replacement activities along the transmission line alignments and in areas where new ROW would be acquired. New transmission line structures would affect the recreation setting in a portion of Pinewood Reservoir County Park; however, these actions would involve replacing an existing transmission line and expansion of an existing ROW, which reduces the degree of change to the setting. See Section 4.12 for a discussion of visual impacts.

Additional clearing activities within any expanded ROWs would have a negligible to minor adverse impact on the recreation setting at recreation areas along the northern alignment where additional new ROW would be acquired in the Roosevelt National Forest, Ramsay-Shockey Open Space, and Chimney Hollow Open Space. Impacts to recreation from the new structures in the long term would be negligible as the new structures would consist of the same type of H-frame structures currently in place, and, with the exception of the Newel Lake View subdivision, would be replaced in the same locations.

4.11.5 Impacts Unique to Specific Action Alternatives

4.11.5.1 Land Use

<u>Alternatives A, B, C, and D and Variants</u>

Land Ownership

Private landowners make-up the largest percentage of landownership along the action alternatives, followed by the USFS, Larimer County and SLB (**Table 4.11-1**).

Table 4.11-1 Comparison of Land Ownership Crossed

Alternative	Total Length (miles)	Within Existing ROW (miles)	Within New ROW (miles)	Land Ownership Crossed (miles)					
				County	SLB	NCWCD	USFS	DOI	Private/ Other
No Action	28.6	27.6	1	2.5	1	0.2	3.8	1.0	20.0
A	15.0	12.6	2.4	0.8	-	-	1.7	0.6	12.0
A1	15.1	11.4	3.7	0.6	-	-	1.7	0.6	12.0
A2	15.3	11.3	4.0	0.6	-	-	1.7	0.6	12.1
B	14.8	13.8	1.0	1.6	1	0.2	2.2	0.4	9.4
C	15.5	12.1	3.4	1.8	-	0.1	2.2	1.0	10.6
C1	15.7	11.7	4.0	1.8	-	0.1	2.2	1.0	10.6
D	28.6	27.6	1	2.5	1	0.2	3.8	1.0	20.0

SLB = State Land Board (Colorado), NCWCD = Northern Colorado Water Conservancy District, DOI = U.S. Department of Interior

Protected Lands

Protected lands crossed by all action alternatives include the Flatiron Reservoir County Park and Chimney Hollow Open Space. Alternatives A, C, and D also cross the Pinewood Reservoir County Park and Ramsay Shockey Open Space, while Alternatives B and D would cross the Blue Mountain Bison Ranch and a SLB Stewardship Trust parcel. The effects of crossing these protected areas would be minimized by the fact that they are already crossed by existing transmission lines that would be rebuilt using an existing or expanded ROW. None of the protected lands would be crossed at a location that required the acquisition of new ROW following a new alignment. Some alternatives would result in beneficial impacts to protected areas through the removal of an existing transmission line and decommissioning of the ROW. Specifically, Alternatives A and C would remove the South Line through the Blue Mountain Bison Ranch and Pinewood Reservoir Stewardship Trust property. Alternative C also would decommission the North Line where it crosses the Chimney Hollow Open Space. Alternative B would decommission the North Line where it crosses the Ramsay Shockey Open Space and Pinewood Reservoir County Park. At these locations, the existing ROW would be allowed to return to natural conditions, resulting in long-term beneficial effects to these properties. Among the action alternatives, only Alternative D would not result in beneficial impacts to protected areas due to the fact that it would maintain both existing lines in place.

ROW Expansion and New ROW Acquisition

The number of acres of land to be acquired for new or expanded ROWs under each of the action alternatives is estimated as follows: Alternative A (153 acres); Alternative B (42 acres); Alternative C (117 acres); and Alternative D (177 acres). However, these totals do not account for the fact that all action alternatives other than Alternative D would result in a substantial amount of ROW being abandoned through consolidation of the two existing lines. This is discussed further in the descriptions of each alternative below. None of the alternatives conflict with zoning or land use management plans.

Alternative A would deviate from the existing alignment at several locations, including a segment north of the Newell Lake View subdivision, a new segment connecting to the Pole Hill Substation, and a segment at the far western end of the alternative where a new alignment near Mall Road is proposed to avoid a conflict with the Upper Thompson Sanitation District wastewater treatment plant. The amount of new and expanded ROW required for Alternative A is 153 acres, which accounts for both new segments of the alignment where a new ROW would be acquired as well as expansion of the existing ROW to a width of

110 feet from the 30-foot width that presently exists at most locations. In total, 46 landowners would be burdened by ROW acquisition under Alternative A. Acquisition of new ROW would affect 8 landowners while ROW expansion would affect 38 landowners. No existing residences would be directly affected by a new or expanded ROW and its associated restrictions.

Implementing Alternative A also would result in the removal of the existing South Line and the abandonment of its ROW, which varies in width from 75 to 130 feet. In total, approximately 150 acres of existing ROW would be abandoned, including segments through developed areas such as the Meadowdale Hills subdivision. This would result in a beneficial effect to property owners located along the alignment of the existing South Line. Thirty-six landowners would have ROW decommissioned on their properties under Alternative A.

Alternative B, which is typically located within an existing ROW with a width of 75 to 130 feet would require the acquisition of less new ROW than Alternative A, approximately 42 acres, some of which is located along a new alignment needed to connect the rebuilt line to the Pole Hill Substation. Similar to Alternative A, the existing ROW would be abandoned along one of the existing transmission lines, in this case the North Line. In total, approximately 50 acres of ROW would be abandoned along the existing North Line, including segments through developed areas such as the Park Hill and Newell Lake View subdivisions. In total, 19 landowners would be burdened by ROW acquisition under Alternative B. Acquisition of new ROW would affect four landowners while ROW expansion would affect 15 landowners. An expanded ROW would not be required through the Meadowdale Hills subdivision and no existing residences would be directly affected by a new or expanded ROW. Fifty-one landowners would have ROW decommissioned on their properties.

Alternative C would rebuild the transmission line on a single ROW using a combination of the existing North and South lines. New ROW would be required through Crocker Ranch on the western end of the proposed project; to connect to the Pole Hill Substation from the North Line; and for the re-route around and to the south of Newell Lake View subdivision. In total, Alternative C would require the acquisition of 117 acres of new or expanded ROW. Similar to Alternatives A and B, portions of the ROW along the existing lines would be abandoned. In total, approximately 139 acres of existing ROW would be abandoned. Thirty-six landowners would be burdened by ROW acquisition under Alternative C. Acquisition of new ROW would affect nine landowners while ROW expansion would affect 27 landowners. An expanded ROW would not be required through the Meadowdale Hills subdivision and no existing residences would be directly affected by a new or expanded ROW. Thirty-three landowners would have ROW decommissioned on their properties.

Alternative D would rebuild both existing lines, expanding the ROWs where needed. As a result, this alternative would require the greatest amount of new ROW, a total of 177 acres. Of this amount, the great majority would result from an expansion of the existing ROWs with only one mile of new alignment requiring additional ROW. Most of the new ROW is along the segment where the North Line would be relocated around and to the south of Newell Lake View subdivision. Alternative D also would relocate one structure on the north side of the Upper Thompson Sanitation District parcel in Estes Park to accommodate expansion of their facility. No existing residences would be directly affected by either an expanded ROW or by the new ROW. Unlike the other action alternatives, Alternative D would result in the abandonment of very little existing ROW and this would be limited to the two short segments where the line would be relocated. In total, 40 landowners would be burdened by ROW acquisition under Alternative D. Acquisition of new ROW would affect 5 landowners while ROW expansion would affect 35 landowners. Seven landowners would have ROW decommissioned on their properties.

Implementation of SCPs 1 and 18 would minimize the effects of construction activities by limiting the movement of construction crews and equipment to the ROW, including access routes, and requiring that all waste materials from the construction areas and ROW that cannot be eliminated onsite, be removed, allowing disturbed areas to revert to previous land uses.

Short-term impacts to land use as a result of construction activities would occur from temporary interruption of activities due to the presence of heavy equipment and line stringing activities. Any loss of the use of agricultural land during construction activities would be compensated. Short-term impacts would be minor to moderate and would be temporary, ending when construction would be completed. Long-term impacts to land use would result from the inclusion of land use restrictions in ROW easements for new or expanded ROWs, to prevent incompatible uses. Under Alternatives A, B, and C positive long-term impacts would result from the decommissioning of one of the two existing transmission lines, and subsequent return of ROW easements to landowners. These positive long-term impacts would not apply to Alternative D.

Variant A1

Variant A1 would have similar impacts to those described for Alternative A. The only difference is an approximately two mile segment that would be located on a new alignment near the western edge of the project area. Variant A1 would avoid most of the Park Hill subdivision and the Upper Thompson Sanitation District wastewater treatment plant by traversing Crocker Ranch on an alignment just south of the existing North Line and generally parallel to U.S. Highway 36. Approximately 28 acres of new ROW would be required for the new alignment, bringing the total amount of new ROW acquired under Variant A1 to 157 acres. The existing 30-foot ROW along the North Line would be abandoned west of the point where Variant A1 departs from the existing line. In total, 48 landowners would be burdened by ROW acquisition under Variant A1. Acquisition of new ROW would affect ten landowners while ROW expansion would affect 38 landowners. Thirty-six landowners would have ROW decommissioned on their properties.

Variant A2

The great majority (12.6 miles) of Variant A2 would be built aboveground and impacts for this segment would be the same as was described for Alternative A. The westernmost 2.7 miles of this alternative would be constructed underground following a new alignment generally located between the existing North Line and U.S. Highway 36. The longer duration and greater disturbance associated with construction of an underground transmission line would result in moderate, short-term impacts to residential and other uses in the Park Hill subdivision and vicinity. In the long term, Variant A2 would minimize conflicts with land use by burying the line along Mall Road through the developed area near Park Hill subdivision. However, the cables for the underground transmission lines would need to be replaced within 40 years of installation, resulting in subsequent short-term impacts. In total, approximately 152 acres of new ROW would be acquired under Variant A2. Forty-two landowners would be burdened by ROW acquisition under Variant A2. Acquisition of new ROW would affect 7 landowners while ROW expansion would affect 35 landowners. Thirty-six landowners would have ROW decommissioned on their properties.

Variant C1

The great majority (12.7 miles) of Variant C1 would be built aboveground and impacts for this segment would be the same as was described for Alternative C. The westernmost 2.7 miles of this alternative would be constructed underground following a new alignment. Variant C1, from Mall Road to the USFS boundary adjacent to the Meadowdale Hills subdivision, would be constructed underground. The longer duration and greater disturbance associated with construction of an underground transmission line would result in moderate, short-term impacts to residential and other uses in the Park Hill and Meadowdale Hills subdivisions and vicinity. In the long term, Variant C1 would minimize conflicts with land use by burying the line along Mall Road through the developed area near Park Hill subdivision and along the existing transmission line ROW through the Meadowdale Hills subdivision. However, the cables for the underground transmission lines would need to be replaced within 40 years of installation, resulting in subsequent short-term impacts. Burial of the transmission line would minimize conflicts with land uses adjacent to this variant. A total of approximately 110 acres of new ROW would be acquired under Variant C1. In total, 36 landowners would be burdened by ROW acquisition under Variant C1.

Acquisition of new ROW would affect 9 landowners while ROW expansion would affect 27 landowners. Thirty-three landowners would have ROW decommissioned on their properties.

4.11.5.2 Recreation

Alternatives A, B, C, and D and Variants

Impacts to recreation from these action alternatives would result from establishing access, removing existing transmission line facilities, installing new transmission structures, and general construction activities along the transmission line alignment. With the exception of Alternative D, which would use wood pole structures, new, taller, less natural-looking (i.e., metal not wood pole) transmission line structures associated with Alternatives A and C would affect the recreation setting along the transmission line within the Roosevelt National Forest, Flatiron Reservoir County Park, Ramsay-Shockey Open Space, through a small portion of Pinewood Reservoir County Park, and through the northern tip of Chimney Hollow Open Space. Alternative B would rebuild the transmission line within the Roosevelt National Forest, Flatiron Reservoir County Park, Chimney Hollow Open Space, and Pinewood Reservoir Stewardship Trust. Rebuilding the transmission lines within existing ROW would have a minor adverse effect on the recreation setting due to increased structure height and the replacement of wood H-frame structures with steel monopoles. Construction activities within the alignment would affect recreation opportunities on the Besant Point Trail within Pinewood Reservoir County Park, particularly if it occurred in the summer when recreation use is highest. Under Alternative C, new ROW would be acquired west of the Meadowdale Hills subdivision, where the transmission line would generally parallel U.S. Highway 36 to the intersection of U.S. Highway 36 and Mall Road. This new ROW would be intended to reduce visibility from U.S. Highway 36. The use of structures with a lower height and shorter span also would be considered along this segment to further reduce visibility. Adverse impacts to recreation from the altered setting would be minor because transmission structures are already present.

The proposed transmission line rebuild would not conflict with the “Roaded Natural” ROS class through the Roosevelt National Forest.

Alternatives A, B, and D propose either no improvements to USFS roads or limited reconditioning (blading) to remove ruts created by construction vehicles. Alternative A proposes to leave the greatest length of USFS road unimproved (1.4 miles); limited reconditioning following construction would occur on up to 2.2 miles of USFS roads. Alternatives B and D would leave 0.4 mile of USFS road unimproved; limited reconditioning following construction would occur on up to 3.2 miles of USFS road. Alternatives A, B, and D would all leave a 0.4-mile four-wheel drive portion of Pole Hill Road near the western boundary of the Roosevelt National Forest unimproved. Effects to the OHV recreation experience would be negligible under Alternative A, and minor under Alternatives B and D due to the greater length of road where reconditioning would be permitted.

Alternative C would reconstruct sections of USFS Roads 122 (Pole Hill Road) and 247.D, to allow for passage of semi-trailer trucks to structure locations. Under this alternative, grinding, chipping, or blasting could be used to level the grade on the west end of Pole Hill Road. Pole Hill Road would not be returned to its previous condition, resulting in the probability of increased recreational traffic after construction due to increased accessibility. Reconstruction of Pole Hill Road would improve access for recreational users accessing National Forest System lands for hunting, dispersed camping, and other non-motorized recreational uses. Some recreational users may identify improved access as a beneficial effect, if it opens up areas for their recreational use that were previously inaccessible. Other users may identify improved access as an adverse effect if it leads to a diminished experience of solitude. Whether beneficial or adverse, the effect would be readily apparent and measurable and, therefore, would be of moderate intensity.

Pole Hill Rd (USFS Road 122) is one of the most popular four-wheel drive roads in the Estes Park area for OHV recreationists. There are limited OHV opportunities in the Estes Park area resulting in increased demand for this particular road. OHV use on USFS Road 122 ranges from moderate to high in the summer months. Due to its popularity with OHV users, Big Thompson 4 Wheel Drive Club has adopted USFS Road 122 and assists with annual maintenance. Rocky Mountain Rush runs tours in the Pole Hill area and has authorized permanent facilities (observation tower, picnic shelter with cooking facilities, toilet/washing/generator building, storage building) at the top of Panorama Peak. Tours are advertised as four-wheel drive/off-road tours with the most challenging four-wheel drive section of the entire route being the steep, rock section just east of the road closure gate on Pole Hill Rd. Alternative C would level Pole Hill Road, removing the best and most challenging terrain for OHV use. This effect on OHV recreation would be significant and long-term.

Removal of transmission line facilities would result in minor adverse impacts to recreation opportunities and experiences due to possible delays in accessing a site, noise and visual disturbances to the recreation setting, surface disturbance that results in vegetation removal and bare ground, or disturbance to wildlife. However, beneficial impacts to the recreation setting also would occur due to line decommissioning under Alternatives A, B, and C. Under Alternatives A and C, the South Line would be removed from ROW crossing the Blue Mountain Bison Ranch and Pinewood Reservoir Stewardship Trust, and the ROW would be allowed to return to natural conditions, resulting in long-term beneficial effects to those properties. Alternative C also would decommission the North Line where it crosses the Chimney Hollow Open Space. Alternative B would decommission the North Line where it crosses the Ramsay Shockey Open Space and Pinewood Reservoir County Park. Alternatives A, B, and C would all decommission one of the existing transmission lines and 0.2 to 0.3 mile of existing access on the Roosevelt National Forest, thus enhancing recreation experiences for visitors to these areas.

General construction activities associated with building a new double circuit line would affect recreation opportunities and experiences within the Roosevelt National Forest, Flatiron Reservoir County Park, Ramsay-Shockey Open Space, Pinewood Reservoir County Park, Chimney Hollow Open Space, and Pinewood Reservoir Stewardship Trust. Minor adverse impacts to recreation opportunities and experiences may occur due to delays in accessing a site, noise and visual disturbances to the recreation setting, or disturbances to wildlife. At this time, Chimney Hollow Open Space is not open to the public though public tours were offered in 2012. Hunting use also would be affected along Pole Hill Road; however, other portions of Game Management Unit 20 would be available for hunting during construction. Alternate locations for recreation activities within Roosevelt National Forest would be available during construction for any displaced users.

Construction and operation of the transmission line along a new alignment around the Newell Lake View subdivision and to the Pole Hill Substation would not affect recreation areas or opportunities.

Impacts to recreation from the new structures would be long-term as the recreation setting would be permanently altered from the new structures. Adverse impacts to recreation from the removal of structures would be short-term, while beneficial impacts to recreation would be long-term. Impacts to recreation from general construction activities would be short-term.

Variant A1

The alignment for Variant A1 differs from Alternative A on the western end of the project area only. Both Alternative A and Variant A1 cross the western end of the project area on privately held land without public recreation opportunities. Therefore, the impacts of Variant A1 on recreation would be the same as described for Alternative A.

Variant A2

The alignment for Variant A2 differs from Alternative A on the western end of the project area only. Both Alternative A and Variant A2 cross the western end of the project area on privately held land without public recreation opportunities. Therefore, the impacts of Variant A1 on recreation would be the same as described for Alternative A.

Variant C1

The alignment for Variant C1 differs from Alternative C on the western end of the project area only. Both Alternative C and Variant C1 cross the western end of the project area on privately held land without public recreation opportunities. Therefore the impacts of Variant C1 on recreation would be similar to impacts described for Alternative C. One notable difference would be impacts to the recreation setting at the entrance to National Forest System lands east of Meadowdale Hills subdivision. The transmission line would be constructed underground up to this point with beneficial effects to the recreational setting at the entrance to National Forest System land. However, this benefit would be offset by the requirement for two transition structures (that would be approximately 100 feet tall and 5 feet wide at the base) where the line would change from underground to overhead construction.

4.11.6 Mitigation

After implementing SCPs 1 and 18 described in Section 2.5, there would be no significant impacts to land use in terms of conflicts with land use plans, zoning or with special management areas. Western will coordinate with the USFS to identify access spur roads that should be gated to discourage the creation of unauthorized user-created trails on National Forest System lands.

4.11.7 Residual Impacts

Residual effects would consist of temporary disruption of land uses and recreational activities by construction activities. Direct impacts associated with construction activities, such as potential access delays and disruption to land uses and the recreational setting, are expected to be adverse, but short-term and minor in intensity, ending when construction activities cease. Direct adverse impacts from the acquisition of ROW and subsequent restriction of landowner use and rights would be long-term and moderate in intensity. Western's approach to acquiring land access is detailed in Section 2.3.1.

Alternative D would rebuild the transmission line on both ROWs, and has the greatest requirement for new ROW acquisition (177 acres), followed by Variant A1 (157 acres), Alternative A (153 acres), Variant A2 (152 acres), Alternative C (117 acres), Variant C1 (110 acres), and Alternative B (42 acres). Acres of ROW to be authorized on National Forest System land for each alternative is as follows: 55 acres (Alternative D); 31 acres (Alternatives B, C, and C1); and 23 acres (Alternatives A, A1, and A2). Acres of ROW to be decommissioned under each of the alternatives are as follows: Alternative A (143 acres), Variant A1 (151acres), Variant A2 (150 acres), Alternative B (42), Alternative C (139 acres), Variant C1 (143 acres), and Alternative D (4 acres). Seven parcels identified as protected lands are crossed by the project alternatives. Alternative D crosses all seven of the parcels, compared to five parcels being crossed by Alternative B, and four parcels being crossed by Alternatives A and C.

Long-term adverse impacts to the recreational setting from the taller steel structures for Alternatives A, B, and C, or the variants, would be minor to moderate; however, under all alternatives except for Alternative D and No Action, there also would be long-term beneficial minor to moderate recreational and land use impacts due to ROW consolidation and decommissioning. Alternative C and Variant C1 would have significant impacts to OHV recreation on National Forest System land, due to reconstruction of Pole Hill Road.

All action alternatives are compatible with existing land use plans and policies and USFS ROS classifications, and avoid adverse effects to the Upper Thompson Sanitation District.

4.11.8 Irreversible and Irretrievable Commitment of Resources

It is anticipated that there would be no irreversible or irretrievable impacts associated with the action alternatives.

4.11.9 Relationship Between Short-term Uses and Long-term Productivity

Recreational and land use access may be disrupted during construction activities, particularly along portions of Pole Hill Road; however, in the long term access would be restored. Long-term productivity also would be enhanced in areas where existing transmission line would be removed.

4.12 Visual

This section provides an assessment of the direct and indirect potential impacts to visual resources from the construction and operation of the proposed project. The impacts study area, impact assessment methodology, scoping issues, and significance criteria are summarized below, followed by the potential impacts of the proposed project.

4.12.1 Methodology

The direct, indirect, and cumulative visual resources analysis area is the visible area (viewshed) affected by the project and surrounding lands. Visual effects resulting from the removal of the existing single-circuit 115-kV lines and the installation of new 115-kV line structures would be most pronounced within the 0.5 mile (the foreground distance zone) though individual transmission facilities can be seen by the unaided eye at miles from the project (outer extent of the middleground distance zone) where not screened. Beyond 4 miles, individual facilities are generally difficult to discern. Landscape changes, such as ROW maintenance, may be discernible up to 12 miles away during optimal viewing conditions.

The analysis area encompasses major roadways, recreation sites, protected areas, mountain communities and neighborhoods whose tourism economy and quality of life are based in large measure on scenic quality. The area is a popular destination for developed and dispersed recreational opportunities with residents and draws visitors from the surrounding region and world-wide. Recreational uses and land uses in the area are described in Section 3.11. Key issues of concern, as presented in Section 1.6.3.2, include:

- Visual impacts to scenic travel corridors (e.g., U.S. Highway 36), residential areas, rural aesthetics, and recreational viewsheds in the vicinity of Estes Park, Rocky Mountain National Park, Meadowdale Hills subdivision, Pinewood Lake, and National Forest System land.
- Potential incompatibility with the SIO of Moderate on National Forest System lands.

Other issues of concern include:

- Visual impacts from a new 115-kV double-circuit transmission line compared to two 115-kV single-circuit transmission lines.
- Visual benefits of removing old power lines.
- Visual effects of underground versus overhead transmission lines

As a cooperating agency under NEPA, the USFS provided guidance on the scope of analysis and methodology for visual resources (USFS 2013). Short- and long-term visual impacts were assessed qualitatively utilizing public and agency scoping, field observations, construction design details, viewshed analyses, photographic simulations (see **Appendix C**), sections and elevations, and KOPs per the USFS's SMS process and significance criteria, as described below. The analysis includes a comparison of the alternatives compatibility with the USFS's SIOs.

Mitigation measures were developed to minimize or eliminate adverse impacts to the extent feasible.

4.12.1.1 Computer-Generated Photographic Simulations

From the total list of KOPs, representative sites (primarily those representing locations with high viewer sensitivity and high potential for visual impacts to existing visual resources) were selected for development of photographic simulations, or photo-realistic renderings, in consultation with the USFS and in response to scoping comments. Visual simulations are an important tool in estimating the degree of visual change each alternative may cause to landscape scenery as seen from travel ways and use areas, taking into consideration viewing distance, angle of view, season, time of day, and the type of project changes proposed. The simulations provide documentation regarding both adverse and beneficial structure contrasts and landscape contrasts, which are expected to occur with project implementation.

Visual simulations of the project are presented in **Appendix C**, and are based on Western's SCPs, project-specific design criteria described in Chapter 2.0, and preliminary engineering. All simulations simulate the removal of the existing transmission lines, installing a double-circuit 115-kV transmission line, and implementing proposed vegetation management practices within the expanded ROW. New or improved access roads were not simulated since the exact locations would not be determined until the design phase for the proposed project. In most case, existing roads or overland travel would be utilized, except for currently inaccessible areas with steep slopes.

The simulations are fundamentally similar: all simulations for Alternatives A, B, and C and the variants show an average structure height of 105 feet for the new double double-circuit 115-kV transmission line structures and long-term vegetation management of the ROW (except where noted in **Appendix C**). No simulations for Alternative D were included since new H-frame wood-pole structures would be similar to the existing wood-pole structures. The degree and type of vegetation cover that might be expected to recover over the short-term was estimated by comparing before and after photographs of ROW vegetation treatments completed in 2009. Sample photographs showing ROW vegetation management are contained in **Appendix C**. Simulation methods and metadata for each KOP (photograph date, time, coordinates, camera model, focal lens length) can be found in **Appendix C**.

4.12.1.2 Key Observation Point Analyses

Beneficial and adverse effects from each alternative by KOP are described in **Table 4.12-1** with respect to landscape character, scenic attractiveness and existing scenic integrity.

4.12.1.3 Viewshed Analyses

Viewshed analyses for each alternative were conducted using a geographic information system to quantify the number of transmission structures that would be visible within the analysis area (see **Figures 4.12-1** through **4.12-8**). Traditional viewshed analyses rely on a 10-meter (or about 33 feet) digital elevation model and do not take into account the screening effect of vegetation; they are a "bare-ground" scenario of views limited solely by terrain. To better represent existing tree screening, 35-foot-tall trees were incorporated into the viewshed analyses at a conservative height using the ESRI BUMP mapping tool (Nighbert 2010). As described in Section 4.7, the proposed project crosses two types of timber stands: Mixed Conifer forests on north facing slopes, and Ponderosa Pine woodlands on south, east, and west-facing slopes. An average stand density was determined by analyzing aerial photography. Timber stand data from SWReGAP was converted to a random 35-foot-tall cone pattern based on the average stand density and added to the 10-meter digital elevation model. The resulting viewshed analyses show the number of poles that would be visible from a particular location accounting for timber screening.

The No Action alternative and Alternative D were modeled at 65 feet high. Alternatives A, B, and C and the overhead portions of Variants A1, A2, and C1 were modeled at 105 feet high, the average anticipated height. Viewshed analyses are one indicator of visual impact, however, they do not take into account viewer sensitivity, scenic quality, scenic integrity, or the degree of change over distance (i.e., visual contrast decreases substantially as distance from the project increases).

4.12.1.4 Field Observations

The impact analysis takes into account differences between photographic simulations, viewshed analyses and the actual appearance of a transmission line in the landscape. Photographic simulations cannot depict 360-degree views and ever-changing environmental conditions. The human eye sees differently than a camera lens: human vision is binocular and dynamic, compared to a camera that tends to flatten an image. A photographic simulation portrays a single atmospheric, lighting, and seasonal condition. Field observations of comparable Western and Platte River Power Authority 115-kV double-circuit overhead steel monopole and underground projects in the Fort Collins, and Loveland, Colorado area in 2012 aided in preparing a comprehensive evaluation.

4.12.1.5 Compliance with Management Objectives

Where alternatives cross National Forest System lands, the predicted structure and landscape contrasts and impacts to viewers were compared to Forest Plan management objectives and standards for that area. Forest Plan objectives and standards are designed to maintain a specific visual experience, and are used to determine whether alternatives are within or exceed the allowable degree of visual change for the area. The SIO that would result from implementation of each of the alternatives on National Forest System land is compared to the existing SIO of Moderate.

4.12.1.6 Assumptions

The following assumptions were used in the impacts analysis for visual resources:

- All action alternatives would result in visual change to the area because aboveground facilities and surface disturbance would be visible from some location, however remote.
- Viewshed impacts to the recreational experience are of a visual nature; they are, therefore, addressed in the visual resource section.
- Visual impacts to context-sensitive cultural sites are addressed in Section 4.15.
- For purposes of this analysis, potential effects or impacts are considered either construction or operation and maintenance related. Construction-related impacts are assumed to be short-term and visible during construction activities of 1 year; operation and maintenance-related impacts are assumed to be long-term and visible for the duration of the operation/maintenance phase of the project.
- The evaluation takes into account the SCPs and the special design features included in Chapter 2.0.
- There is a wide and diverse range of opinions on the visual significance of transmission projects. A goal of the USFS SMS is to objectively quantify the changes introduced by a project compared to existing conditions and management objectives, with the commonly held perception that natural-appearing landscapes are more attractive to viewers.

Figure 4.12-1 Existing Transmission Lines Viewshed

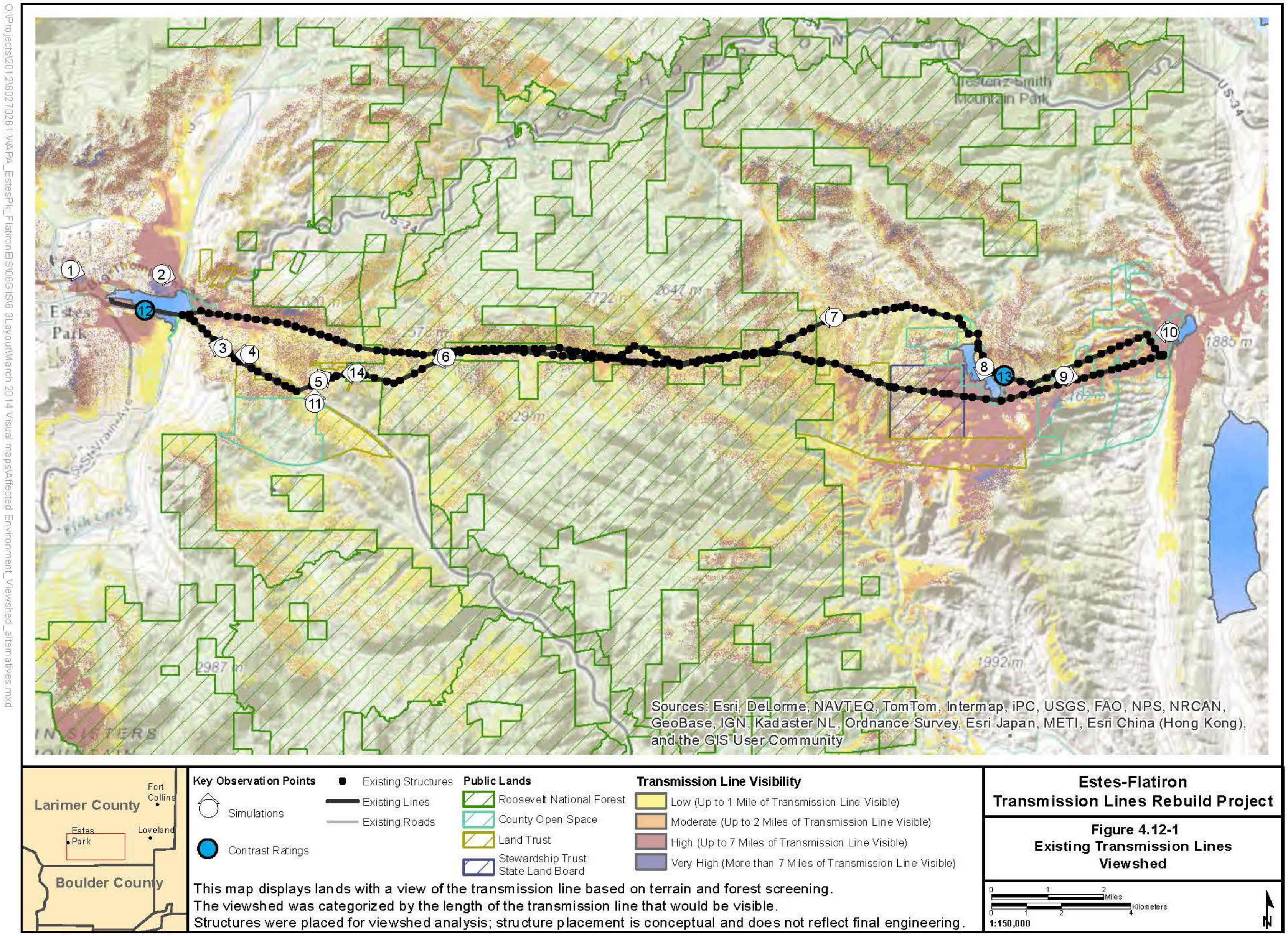


Figure 4.12-2 Alternative A Viewshed

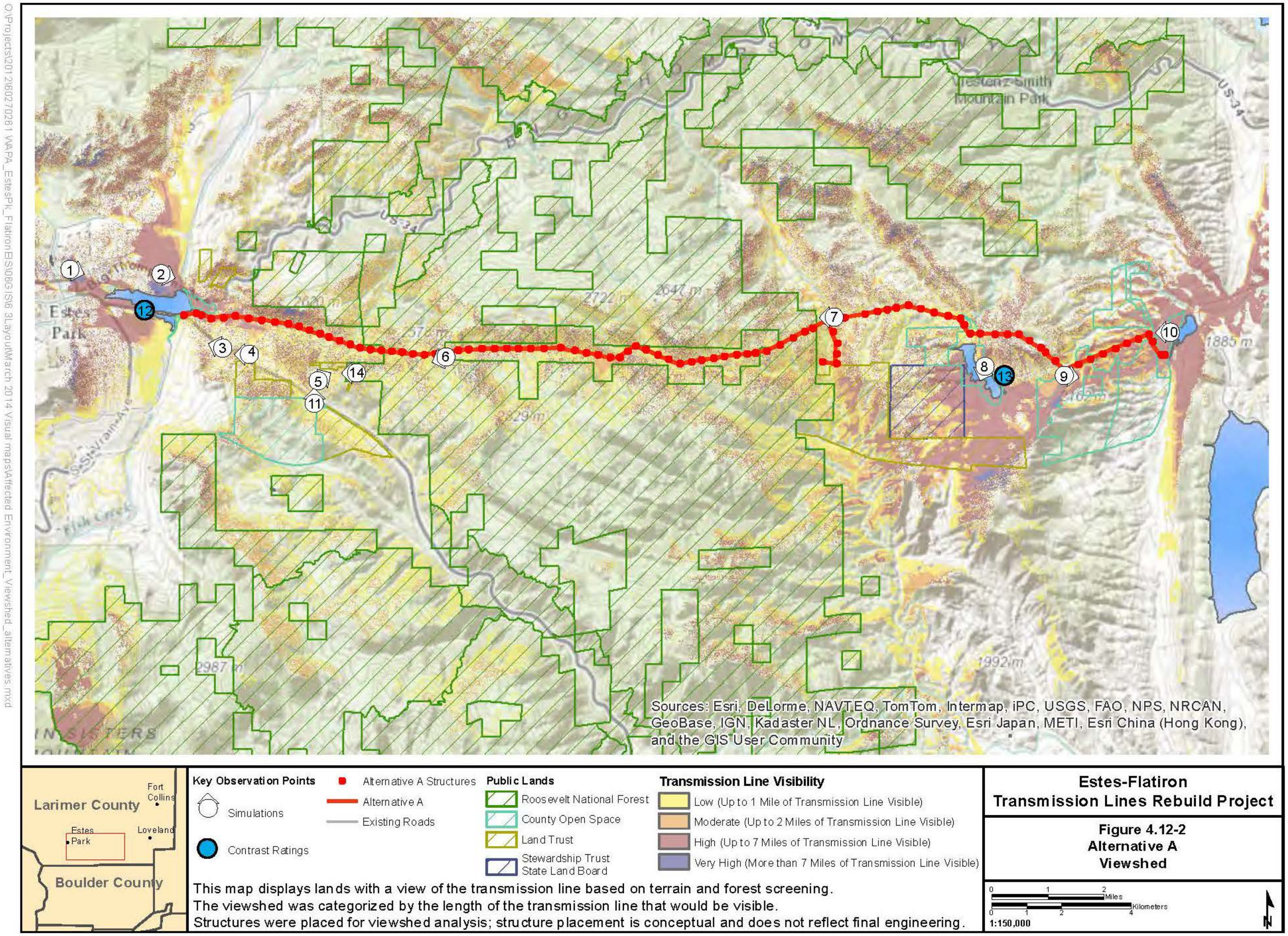


Figure 4.12-3 Variant A1 Viewshed

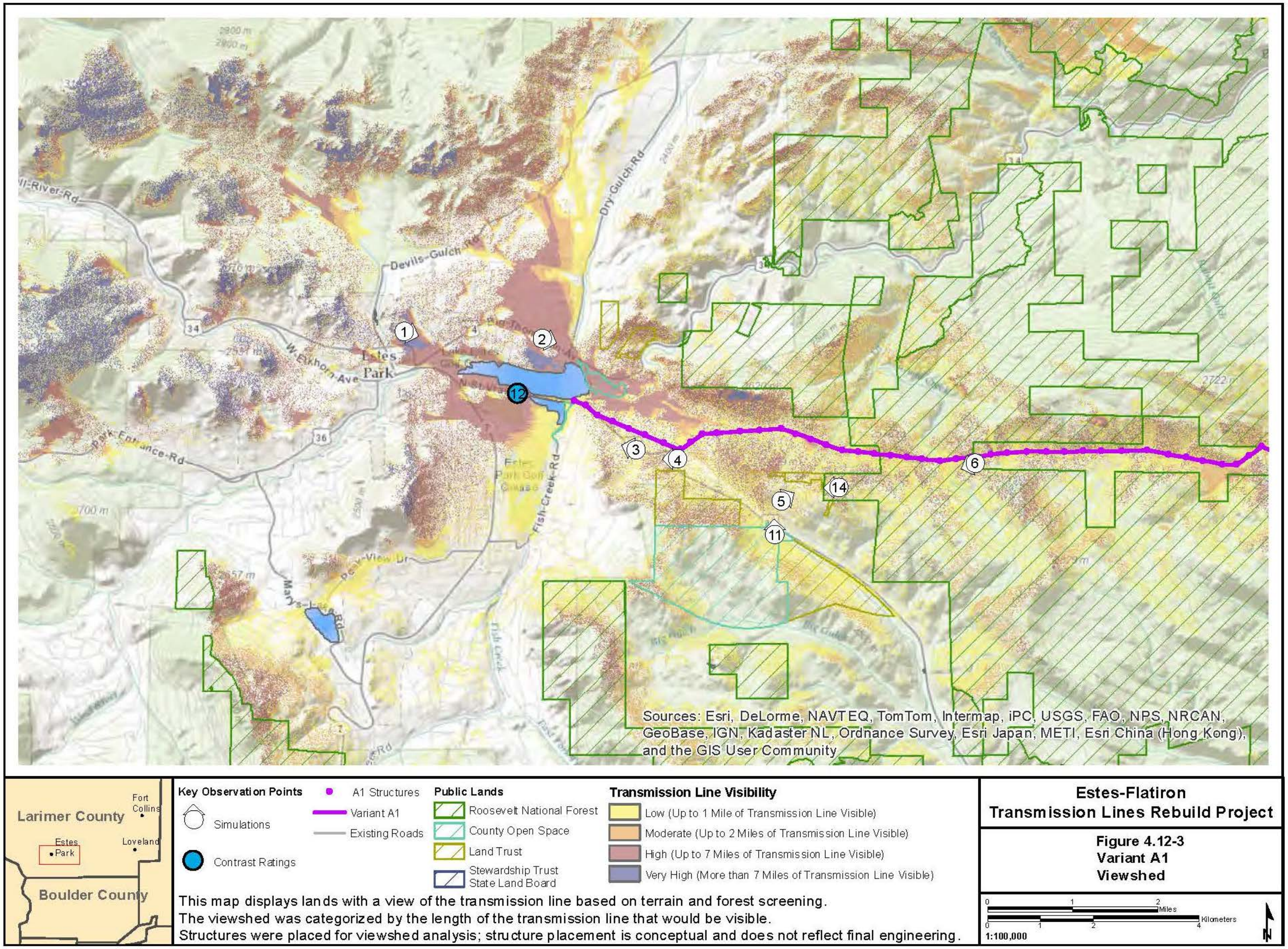


Figure 4.12-4   Variant A2 Viewshed

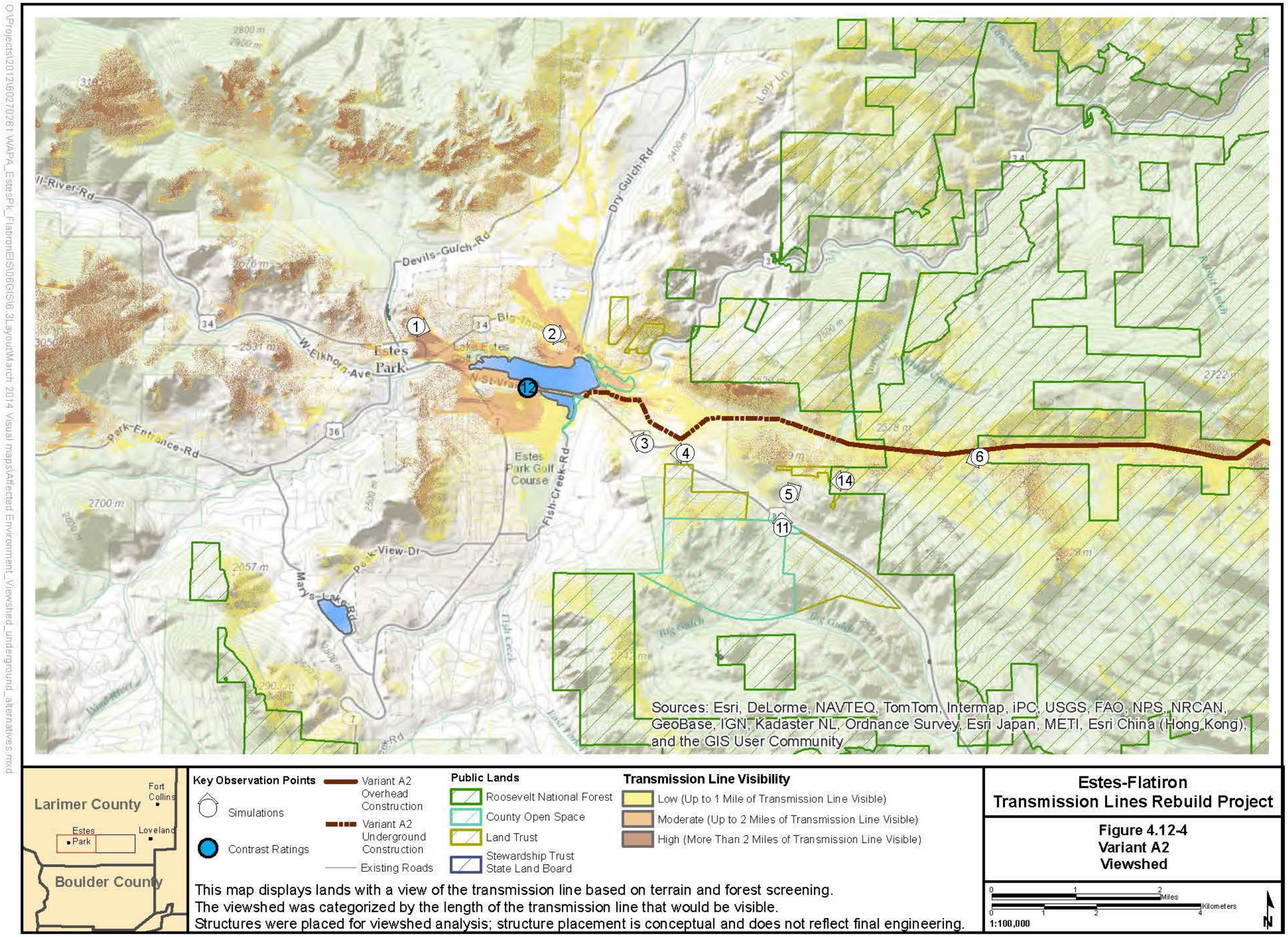


Figure 4.12-5 Alternative B Viewshed

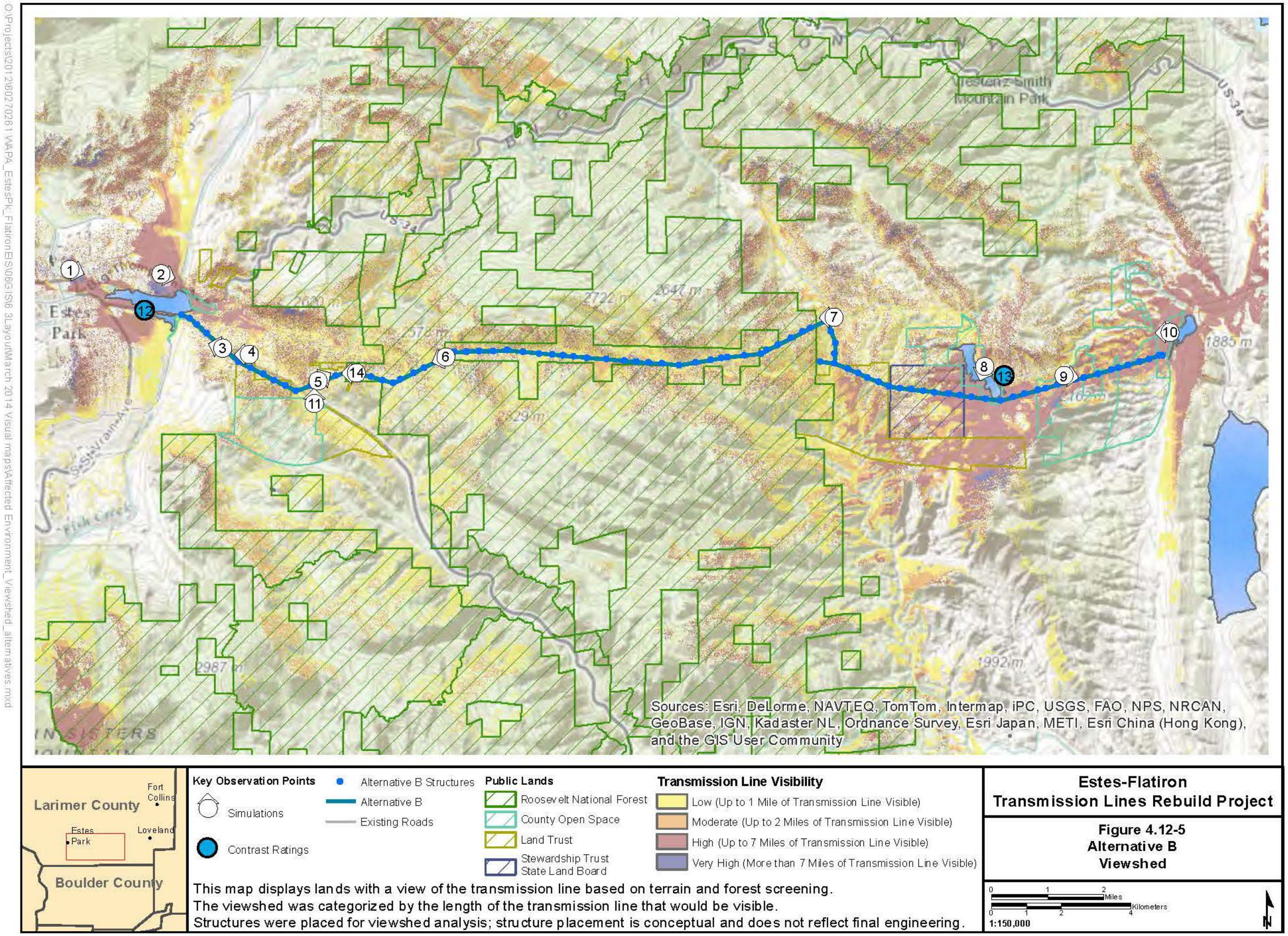


Figure 4.12-6 Alternative C Viewshed

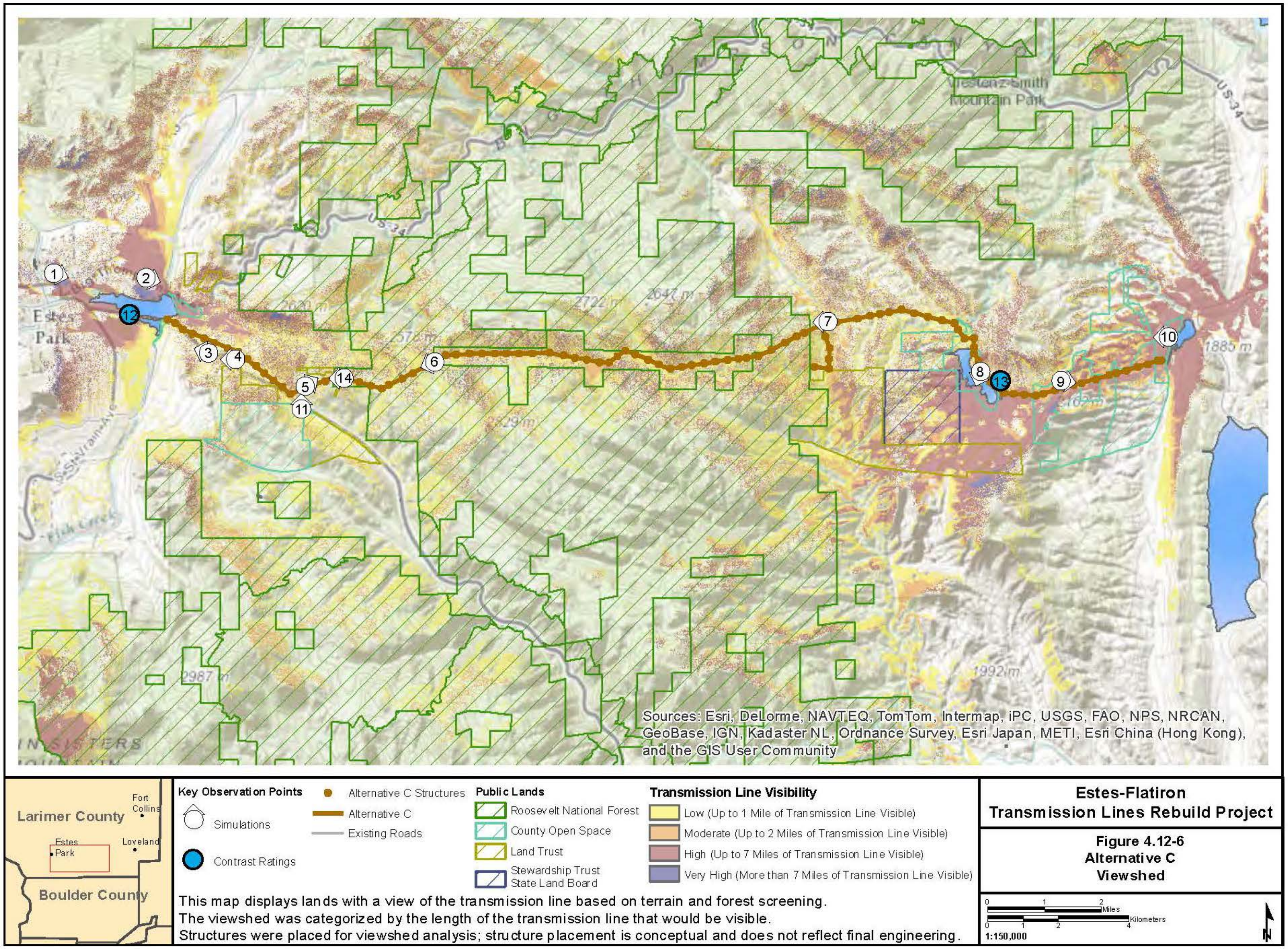


Figure 4.12-7 Variant C1 Viewshed

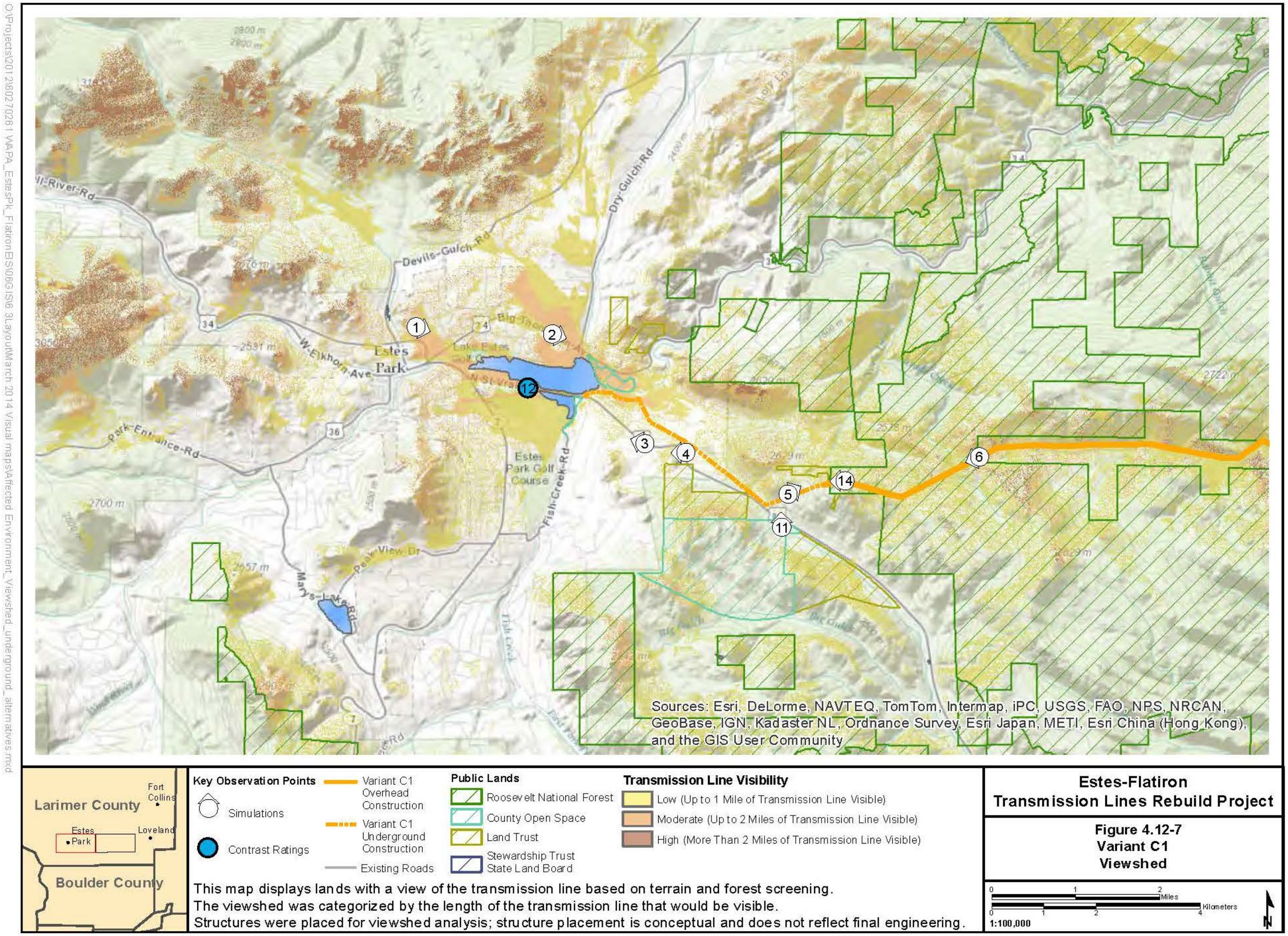
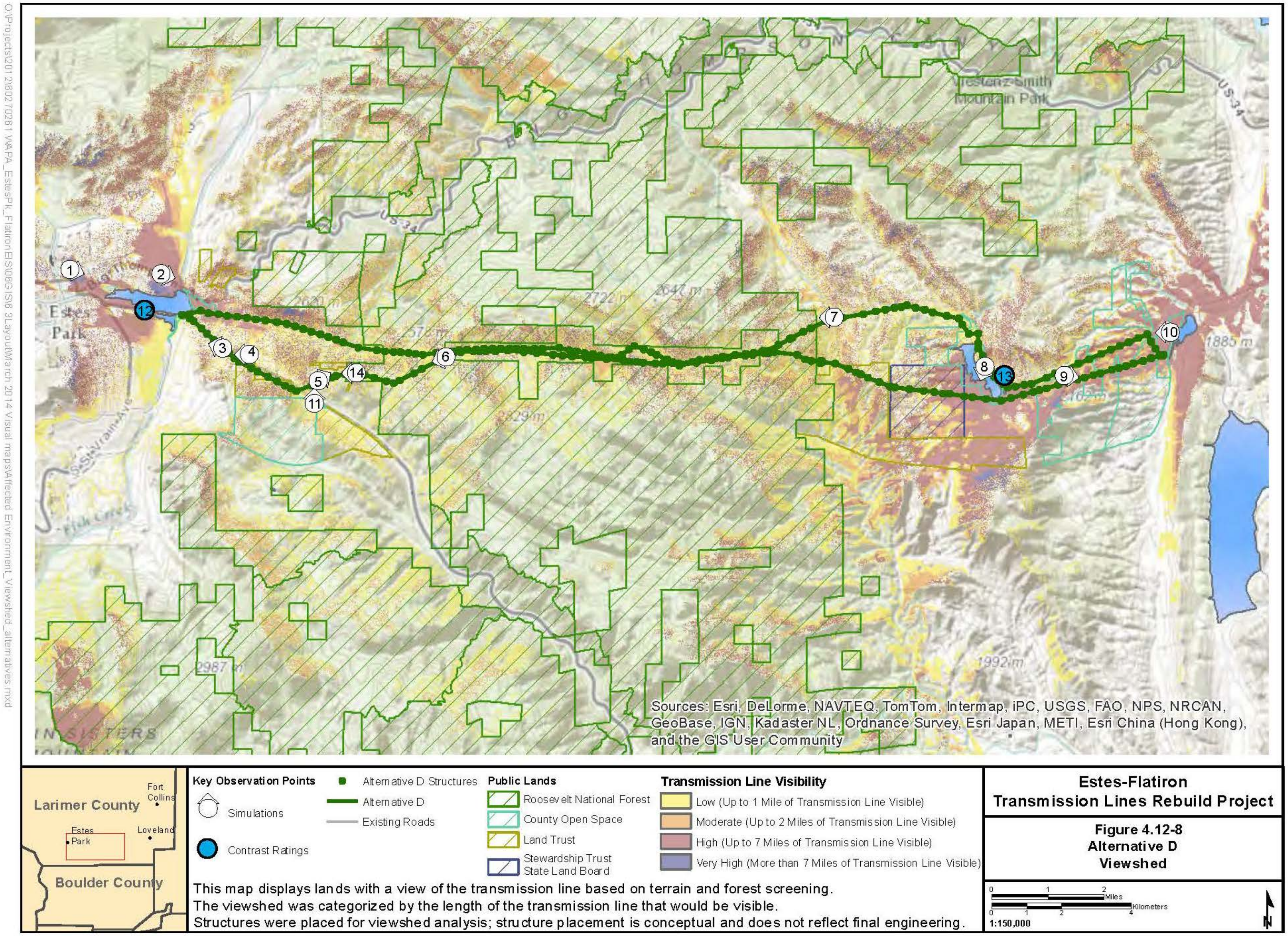


Figure 4.12-8 Alternative D Viewshed



4.12.2 Significance Criteria

A significant impact on visual resources would result if any of the following were to occur from constructing or operating the proposed project:

- Unresolved conflicts with the visual resource goals and policies of Larimer County or Town of Estes Park on County-owned or private land, or state policies for state stewardship trust lands.
- Substantial dominant visual changes in the landscape that are seen from highly sensitive viewer locations (e.g., community gateways, roadside parks, viewpoints, and historic markers) or locations with special scenic, historic, recreational, cultural, archaeological, or natural qualities that have been recognized in adopted plans or some other official declaration.

4.12.3 Impacts Common to All Alternatives

As large-scale forms and lines, transmission lines create long-term changes to the visual setting and can be visible from many locations. Adverse or beneficial visual changes would occur from the following short- and long-term activities consistent with Chapter 2.0 and implementation of Western's SCPs and special design criteria. Short-term effects consider ROW construction activities, clearing, grading, and vehicular traffic; new and/or improved temporary and permanent access roads; and construction staging areas. Long-term effects consider new and/or expanded ROWs; and operations and maintenance activities. All short-term and long-term effects for visual resources are direct effects. Therefore, discussion of indirect effects is not carried forward through each of the impact sections that follow.

<u>Right-of-Way Construction Activities, Clearing, Grading and Vehicular Traffic</u>

Clearing and grading to remove trees and shrubs from structure locations and along access roads would occur. Viewers would see structure excavation, assembly, placement, cuts and fill from structure sites, and conductor installation with heavy equipment at the structure sites and staging areas. Boom trucks and cranes would be seen raising structures. Conductor pulling, sagging, and clipping by ground vehicle or helicopter would be visible. Construction activities, as well as the associated work force and dust would be most visible in the Estes Valley and Flatiron Reservoir areas. Direct short-term adverse visual impacts would occur in these locations.

At the conclusion of construction, site cleanup and restoration activities would remove debris, recontour, reseed, and mulch disturbed areas to re-establish vegetative cover. The reclaimed areas would have a noticeably smoother and more uniform texture, color, and form than adjacent undisturbed areas. When the construction is complete, there would be no more movement of equipment, therefore the level of impact would decrease.

<u>New and/or Improved Temporary and Permanent Access Roads</u>

Where existing roads are not available and overland access is not feasible, access roads would be improved or created to structures sites within the ROW. New access roads would create a strong line and color contrast on the landscape, as shown in **Figure 4.12-9**. In steep terrain, roads may need to switchback to maintain an acceptable grade, increasing their length. Cuts and side-casted fill from improved roads in steep terrain would increase contrasts.

<u>Construction Staging Areas</u>

Two temporary staging areas of approximately 1.5 acres each would be required for temporary equipment staging, material laydown, and storage facilities. Locations have not been established and could potentially be visible from sensitive viewing areas. Direct, adverse impacts would occur during the construction period from the presence of equipment, materials, and associated dust, as well as a work force. Short-term soil disturbance in the ROW would be visible until the areas have been successfully revegetated.

Figure 4.12-9 Photograph of a 115-kV line rebuilt by Platte River Power Authority in 2012 near Horsetooth Reservoir.

Note: Visual impacts seen immediately following construction of the roads, structure erection pads, weathered steel transmission lines and reclamation on steep rangeland would be similar to this photo, taken October 2012.

New and/or Expanded Rights-of-Way and Vegetation Management

All alternatives and the variants use an existing ROW for the majority of their route, expanded as needed primarily for alternatives that would utilize the North Line. In general, utilizing the existing ROW would have lower effects on visual resources than siting a line on new ROW for several reasons: access roads exist, vegetation has been continually maintained for decades, and viewers are accustomed to seeing the existing transmission line. However, in some cases – namely where crossing major roads and residential areas – the existing ROW would have greater impacts than a new ROW that avoided sensitive viewing areas. The maintained ROWs of all alternatives would be visible from eastern portions of Rocky Mountain National Park near Estes Park, where urban development and other structures also are visible. While comprising part of background views from the Park, the maintained ROW would be somewhat visible from higher viewpoints on trails and roads.

In very visually sensitive areas, incorporating the design criteria of softening the straight line of ROW edges, leaving some low-growing trees within the ROW, and/or implementing a less-aggressive treatment of the ROW would lessen the visual contrast.

Operations and Maintenance Activities

Long-term routine activities include aerial inspections, ground inspections, maintenance and repair of project components, and vegetation management. Maintenance operations would include aerial and ground patrols for monitoring, tree trimming, and equipment repair. Viewers in the vicinity of the route would be able to see ground inspections. These annual maintenance activities would result in a negligible change to the visual environment.

4.12.4 No Action Alternative

The No Action Alternative keeps the two existing transmission lines in service through continuing structure replacement and maintenance.

The height of the existing H-frame structures varies from 50 feet to 75 feet high, with an average of 40 feet shorter than the 105-foot standard steel monopole used in Alternatives A-C and 20 feet shorter than the 85-foot shortened steel monopole proposed as an option in special situations. The lower height and use of wood materials that match with the colors and textures of the forest in the analysis area results in the H-frame structure having the least visual impact relative to the typical structures for Alternatives A-C described in Chapter 2.0. Further, since their construction 60 and 75 years ago, viewers have become accustomed to the presence of the existing transmission lines, lessening their visual impact compared to a single, taller steel transmission line.

Ponderosa pine, aspen, and mixed conifer stands, which are adjacent to approximately 70 percent of the existing ROWs and sensitive viewing locations, are highly effective at screening and/or providing a backdrop for the No Action Alternative (see KOPs 1, 2, 11, 12, and Section 3.7). The existing tree canopy is estimated at an average height of 45 feet and generally screens the (Collaborative Forest Landscape Restoration Program 2010) lower two-thirds of the H-frame structures when seen from ground level. The effectiveness of tree screening is directly proportional to tree species and stand density. Conifers provide year-round screening, while aspens provide seasonal screening. Where they cross open mountain shrub and upland meadows, the existing lines attract attention in the foreground. The visual impact of individual wood H-frames decreases substantially with distance as the lower profile structures blend with the background.

Short-term impacts associated with maintenance operations to incrementally repair and replace deteriorating structures would occur sporadically and with increasing frequency over several years across the extent of the project, compared to a defined timeframe of 8 to 12 months for the action alternatives. The mismatched materials would increase the lines' visibility and attract viewer attention, thus increasing adverse effects. New temporary and permanent access roads and structure sites would be required, creating linear contrasts.

Because vegetation management has been occurring continually on the existing lines – as recently as 2009 – the long-term appearance of the maintained ROW would be similar to existing conditions. Selective trees would be removed for safety during construction or long-term operations if they are capable of growing within 22 feet of the transmission line conductors.

The two transmission lines are frequently within the same viewshed for the majority of their extent, which increases the level of impact at these locations. Two transmission lines can be seen the entire extent along Pole Hill Road, except for within the Meadowdale Hills subdivision and north of Pinewood Reservoir. The dual transmission lines decrease the area’s scenic attractiveness and fragment its scenic integrity.

Table 4-12-1 and **Figure 4.12-1** display the impacts by KOP for the No Action Alternative. Visual contrasts occur and would continue to occur most prominently from the existing transmission lines in the following conditions:

- Where immediately adjacent to viewers (see KOPs 3, 5, 8, 13, and 14);
- Where skylined, which increases the intensity and distance of contrasts (see KOPs 2, 10, 12, and 13);

Table 4.12-1a Impacts by Key Observation Points (KOPs 1–2)

	KOP 1	KOP 2
Location & View Direction	**Stanley Hotel: View looking southeast from the Stanley Hotel, 1.7 miles from the project end point.** The Stanley Hotel is on the NRHP and a significant historic and scenic resource in Estes Park. Also representative of tourism and residential views from Estes Park. Landscape visibility is High, due to the high volume of use and high scenic concern levels associated with visitors. Scenic attractiveness includes Class B Estes Park and Rocky Mountains. Existing scenic integrity ranges from Moderate to Low.	**U.S. Highway 34: View looking southeast from U.S. Highway 34 at Lone Tree Drive, 0.6 mile from the project end point.** Representative of tourism and views from Estes Park. The southeast view looks toward Mount Olympus, Mount Pisgah and mixed commercial and hotel land uses along the highway Scenic attractiveness is Class B, with views of the mountains being typical of the Southern Rocky Mountains Steppe ecoregion. Landscape visibility and sensitivity is High, due to the high volume of traffic, and high viewer interests in scenery. The existing scenic integrity ranges from Moderate to Low.
Visualization of Alternative	A, A1, B, C	A, A1, A2, B, C, C1
No Action	While most of the mountains appear natural and unaltered, existing roads, community developments in Estes Park, and the two existing transmission ROWs on the mountain slopes to the north and south of U.S. Highway 36 have noticeably altered the natural landscape character to the east. The project's transmission structures, conductors, and ROW vegetation management practices have created moderately contrasting form and line on elevated west-facing, forested slopes.	While most of the mountains appear natural and unaltered, existing roads, community development in Estes Park, and the two existing transmission ROWs on the mountain slopes to the north and south of U.S. Highway 36 have noticeably altered the natural landscape character in views to the east. The South Line is more visible than the North Line, which is screened by Mount Olympus. The South Line is parallel with side slope contours, reducing contrasts from ROW maintenance, until above the U.S. Highway 36 overlook where the ROW's steep slope attracts attention. Existing transmission structures are not evident in forested areas, but would be where located above the U.S. Highway 36 overlook and approaching the Lake Estes Causeway (outside of the photograph frame).
Alternative A	The existing moderately contrasting ROW to the north would appear similar to existing conditions, though with stronger vertical structure contrasts from taller and wider monopoles. Structures would be skylined at The Notch and extend 50 percent above the tree canopy. Low contrast in non-forested areas. The abandoned ROW south of U.S. Highway 36 would revegetate in 20 years.	ROW maintenance is screened by Mount Pisgah; three structures would be visible in the meadow above the Big Thompson River. Additional structures would be visible south of Lake Estes dam when not screened by highway commercial uses (outside of the photograph frame). The abandoned ROW south of U.S. Highway 36 would revegetate in 20 years.
Variant A1	At The Notch and in open non-forested areas, contrasts would be the same as Alternative A. On lower slopes, Alternative A creates a new southwest ROW towards U.S. Highway 36, which would be screened by trees when parallel to contours. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.	On lower slopes, Alternative A creates a new southwest ROW towards U.S. Highway 36, which would be screened by trees when parallel to contours. New monopoles would extend 50 percent above the existing canopy. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.
Variant A2	The upper alignment would be similar to Variant A1, though no transmission structures would be installed and the ROW would appear slightly narrower and devoid of small trees and shrubs. Below the Estes Park overlook, the underground ROW would turn northwest. The ROW would be screened by trees when parallel to contours. At this distance, no ROW would be evident when crossing meadows once reclamation is complete. A pair of transition structures would be visible connecting to the existing lattice structures at Lake Estes. No other segments of Variant A2 would be visible. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.	The upper alignment would be similar to Variant A1, though no transmission structures would be installed and the ROW would appear slightly narrower and devoid of small trees and shrubs. Below the Estes Park overlook, the underground ROW would turn northwest. The ROW would be screened by trees when parallel to contours. At this distance, no ROW would be evident when crossing meadows once reclamation is complete. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.
Alternative B	The existing moderately contrasting ROW south of and along U.S. Highway 36 would appear similar to existing conditions, though with stronger vertical structure contrasts from taller and wider monopoles, especially above the U.S. Highway 36 overlook. Where parallel to U.S. Highway 36, adverse impacts from the new structures would be less than a new ROW because it would follow the existing highway corridor as seen from KOP 1. The abandoned ROW north of U.S. Highway 36 would revegetate in 20 years.	On the southern ROW, three structures would be skylined. ROW maintenance would create more contrast than the No Action. Contrasts would increase above the U.S. Highway 36 overlook. Where parallel to U.S. Highway 36, adverse impacts from the new structures would be less than a new ROW because it would follow the existing highway corridor as seen from KOP 2. The abandoned ROW north of U.S. Highway 36 would revegetate in 20 years.
Alternative C	A new ROW would follow a drainage north of and below U.S. Highway 34, widening the natural clearings and creating moderate contrasts in form, color, texture, and structures. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.	East of Mount Pisgah two structures would be skylined. A new ROW would follow a drainage north of and below U.S. Highway 34, widening the natural clearings and creating highly visible contrasts in form, color, texture, and structures. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.
Variant C1	The upper alignment would be similar to Alternative C, and would attract less attention at this distance as no transmission structures would be installed and the ROW would appear slightly narrower and devoid of small trees and shrubs. The ROW would be screened by trees when parallel to contours. No ROW would be evident when crossing meadows once reclamation is complete. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.	The upper alignment would be similar to Alternative C, and would attract less attention as no transmission structures would be installed and the ROW would appear slightly narrower and devoid of small trees and shrubs. The ROW would be screened by trees when parallel to contours. No ROW would be evident when crossing meadows once reclamation is complete. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.
Alternative D	Similar to No Action. Stronger contrasts from ROW clearing, though ROW width would be similar to existing conditions.	Similar to No Action. Stronger contrasts from ROW clearing, though ROW width would be similar to existing conditions.

1 See **Appendix C** for visualizations of the noted alternatives.

Table 4.12-1b Impacts by Key Observation Points (KOPs 3–5)

	KOP 3	KOP 4	KOP 5
Location & View Direction	**U.S. Highway 36: View Looking Northwest towards South Transmission Line.** Westerly views entering Estes Park and of adjacent mountains. Scenic attractiveness is Class B, with spectacular and unique views of the Rocky Mountains dominating the viewer's attention above Estes Park. Landscape visibility and sensitivity is High, due to the high volume of traffic, and high viewer interests in scenery.	**U.S. Highway 36, Estes Park Overlook / Entrance Sign: View looking west towards Estes Park.** Representative of tourism, views entering Estes Park on U.S. Highway 36. This popular tourist overlook allows for pedestrian views and photography. Views are directed toward rock outcroppings, Mount Olympus and Rocky Mountain National Park above the 'Estes Park' sign. Background views to Rocky Mountain National Park are Class A, and foreground and middleground views are Class B. Landscape visibility and sensitivity is High.	**Meadowdale Hills Subdivision: View Looking Northeast Towards South Transmission Line.** Residential views. Scenic attractiveness is Class B. Scenery is typical of rural residential subdivisions, located near Estes Park in the Southern Rocky Mountains. Landscape visibility and sensitivity is High for northwestern Meadowdale Hills and Ravencrest residents, with partial visibility from U.S. Highway 36.
Visualization of Alternative	A1, B, C	A1, C	B, C
No Action	The existing scenic integrity of the view is Low. While the mountains beyond Lake Estes appear predominantly natural and unaltered, the existing southern transmission structures and conductors are clearly visible and have noticeably altered the natural landscape character for 0.75 mile adjacent to the highway.	The existing scenic integrity of the view is Moderate and is negligibly impacted by the existing lines. The view appears predominantly natural and unaltered, except for the existing roadway and distant developments in Estes Valley. The primary view towards the sign appears predominantly natural and unaltered. Secondary views upslope towards the South Line are screened. Downslope from the pedestrian overlook, the North Line lies in a drainage and is partially screened 0.5 mile below the viewer by terrain and trees surrounding the overlook. No vegetation management can be seen.	The existing scenic integrity of the view is Low. The natural vegetation, landforms and rock forms are dominant aspects of the seen environment, although these co-exist with the existing South Line, residential homes, distribution lines, and roads, which have noticeably altered the landscape setting. Immediately south, traffic along U.S. Highway 36 is ever present. Existing moderate to strong contrasts line and form are attributable to the existing transmission facility.
Alternative A	The South Line adjacent to U.S. Highway 36 would be removed, beneficially improving the scenic integrity. Alternative A would not be noticeably visible to the north through conifer stands.	The North Line would be rebuilt and not visible when looking towards the sign. From the pedestrian overlook, the top of the taller structures would be partially visible, with ground disturbance at the base of Mount Pisgah not visible.	Alternative A would not be visible from Meadowdale Hills subdivision, as it is screened to the north by Mount Pisgah. The South Line would be removed and be a moderate to major beneficial effect.
Variant A1	Both the North Line and South Line adjacent to U.S. Highway 36 would be removed, beneficially improving the scenic integrity. Alternative A1 would be visible approaching and then running parallel to the highway, 0.05 mile downhill from KOP 3. Two angle structures would be adjacent to the roadside resulting in a minor adverse impact to scenic integrity and viewer sensitivity.	From the base of Mount Pisgah, the North Line would turn southwest and approach the overlook until 0.1 mile downslope, then turn northwest towards Estes Park. Structure bases would be located on elevations between 7,580 and 7,600 feet. The elevation of the overlook is 7,725 feet, a difference of 125 to 145 feet. Neither the 85 nor the 105-foot-tall structure would extend above the overlook. The tops of the structures would be partially visible (screened by trees and the highway embankment) when looking downward from the highway, near the Estes Park sign, and pedestrian overlook.	Same as Alternative A.
Variant A2	A pair of transition structures would be visible connecting to the existing lattice structures at Lake Estes. Their height would be similar to structures in Alternative A through C, though the unique configuration would attract attention. No other segments of Variant A2 would be visible.	The upper alignment would be similar to Variant A1, and would be partially visible. The ROW would attract less attention as no transmission structures would be installed and the ROW would appear slightly narrower. In the foreground, greater contrast would result from the ROW devoid of small trees and shrubs compared to overhead alternatives where small trees and shrubs would be present. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.	Same as Alternative A.
Alternative B	The North Line, which is screened by trees, would be removed. Alternative B would replace the South Line along U.S. Highway 36 for 0.75 mile. The scale of the taller structures and immediate proximity to vehicles would have a major adverse impact across this segment to scenic integrity and viewer sensitivity.	The North Line would be removed, and Alternative B would be partially visible to the south above the forest canopy. Alternative B is not aligned in the direction of highway or overlook views and would be a minor beneficial effect.	The rebuilt South Line would attract the attention of residents and be a moderate to major adverse impact to travelers and homes along Pole Hill Road. Intensity and magnitude of the rebuild would depend on proximity and view orientation. Vegetation management would be similar to existing conditions on south slopes.
Alternative C	Same as Alternative A1.	The North and South lines would be removed. Alternative C generally parallels U.S. Highway 36 in a drainage 0.1 mile downslope of the highway and overlook. At the overlook, pedestrians would see only the structures immediately below, as east-west views are screened by trees. Structure bases would be located at elevations between 7,580 and 7,600 feet. The elevation of overlook is 7,725 feet, a difference of 125 to 145 feet. Neither the 85 nor the 105-foot-tall structure would extend above the overlook. The tops of the structures would be partially visible (screened by trees and the highway embankment) when looking downward from the highway, near the Estes Park sign, and pedestrian overlook.	Same as Alternative B.
Variant C1	Same as Variant A2.	The upper alignment would be similar to Alternative C, and would be partially visible. The ROW would attract less attention as no transmission structures would be installed and the ROW would appear slightly narrower. In forested areas in the foreground, greater contrast would result from the maintained ROW devoid of small trees and shrubs compared to overhead alternatives where small trees and shrubs would be present. Residual contrasts in abandoned ROWs to the north and south of U.S. Highway 36 would revegetate in 20 years.	Underground construction of Variant C1 would attract less attention than Alternatives B or C. The disturbed ROW would create minor to moderate adverse impact to views from residences and travelers along U.S. Highway 36 and Pole Hill Road. Upon completion of reclamation, greater contrast would result over the life of the project from the maintained ROW devoid of small trees and shrubs compared to overhead alternatives where small trees and shrubs would be present.
Alternative D	Similar to No Action. Stronger contrasts from ROW clearing, though ROW width would be similar to existing conditions.	Same as No Action.	Same as No Action.

Table 4.12-1c Impacts by Key Observation Points (KOPs 6–8)

	KOP 6	KOP 7	KOP 8
Location & View Direction	Pole Hill Road: View from USFS Lands near Pole Hill Road and Microwave Station, Looking Southwest Towards South Transmission Line. National Forest System lands, residential, dispersed recreation. Pole Hill Road is used by for access to National Forest System lands and private residences. Views are of the Southern Rocky Mountains oriented towards the snow-capped Rocky Mountain National Park mountains. Scenic attractiveness is Class A in the background and Class B in the foreground. Adjacent scenery strongly influences the overall scenic attractiveness. Landscape visibility is Moderate, viewer volume is Low, and viewer interests in scenery is considered Moderate based on scoping comments.	Pole Hill Road: View from Quillan Gulch Road, Looking West Towards the North Transmission Line and National Forest System lands. National Forest System lands, residential. Pole Hill Road is used for access to National Forest System lands and private residences. Foreground views are typical of the scenery in the southern Rocky Mountains. Scenic attractiveness is Class B. Landscape visibility is Moderate, as viewer volume is Low, and viewer interests in scenery are considered Moderate.	Pinewood Reservoir: Day Use Area View looking South/Southwest. Wide panoramic views across Pinewood Reservoir and conserved lands that provide hiking, fishing, camping and 'non-wake' boating opportunities. Views are directed towards the water and shoreline to the south and southwest. Scenic attractiveness is Class B. Landscape visibility and sensitivity is High towards the reservoir, due to the open water and grassland/shrub vegetation, residential, recreation, and protected area concerns: Larimer County Open Space (Pinewood Reservoir, Ramsay Shockey, Blue Mountain Bison Ranch), and State Stewardship Trust. Landscape visibility is Moderate east of Pinewood Reservoir due to ponderosa pines and residential uses.
Visualization of Alternative	B, C	A, B, C	A, B, C
No Action	The existing scenic integrity of the view is Moderate. The view appears predominantly natural and unaltered, except for a segment of the existing southern transmission line and ROW, which is visible in the foreground. Danger trees were removed between 2009 and 2011. When views are oriented down the ROW, moderate contrasts result from the texture, color, and lines of ROW maintenance and H-frame structures. Corridor impacts decrease substantially when views do not align parallel with the ROW.	The view appears predominantly natural and unaltered, except for a segment of the existing southern transmission line and ROW, which is visible in the foreground. Danger trees were removed between 2009 and 2011. When views are oriented down the ROW, moderate contrasts result from the texture, color, and lines of ROW maintenance and H-frame structures. Corridor impacts decrease substantially when views do not align parallel with the ROW.	The existing scenic integrity across the lake is Moderate. The view appears predominantly natural, except for Newell Lake View subdivision to the east, scattered residential uses to the south, distribution lines, and the two existing transmission lines. The South Line is a focus of viewer attention and is visible in views to the south and west of the reservoir and from the Newell Lake View subdivision. One existing structure is skylined on a knoll. Further west, the South Line becomes backdropped then screened by the natural terrain and conifers. The North Line that currently crosses through the Newell Lake View subdivision would be re-routed along Pole Hill Road. Effects from the re-routed line would appear similar to existing conditions from the day use area, as recreational views are oriented towards the lake (opposite the re-routed line). The majority of Newell Lake View subdivision residents would then look over the top of the re-routed line, except for those residences adjacent to Pole Hill Road.
Alternative A	Alternative A would be partially visible to the north, through and above the forest canopy. The South Line would be removed and be a moderate beneficial effect.	Vegetation maintenance would create more contrast than the existing conditions. Taller, heavier-appearing structures would result in moderate adverse impacts to scenic integrity that would be visible above the tree canopy.	The North and South lines would be removed, with major beneficial effects. Alternative A would not be visible north of Pinewood Dam.
Variant A1	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Variant A2	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Alternative B	Vegetation maintenance contrasts would be stronger than existing conditions. Taller, heavier-appearing structures would result in moderate adverse impacts to scenic integrity that would be visible above the tree canopy.	Same as Alternative A.	The North Line through Newell Lake View subdivision and along Pole Hill Road would be removed with moderate beneficial effects. New structures on South Line would dominate attention, with two skylined structures seen from the day use area, resulting in major adverse effects. The net effect would be moderate adverse effects as recreational and residential views are directed south across the lake.
Alternative C	Same as Alternative B.	Same as Alternative A.	The South Line near the reservoir and the North Line through Newell Lake View subdivision would be removed, with major beneficial effects. Alternative C would follow Pole Hill Road around Newell Lake View subdivision east of Pinewood Reservoir. Negligible effects would occur to day use area users, as recreational views are oriented towards the lake. From the lake looking east, Alternative C would be backdropped by a mountain and residential area with Low scenic integrity. The majority of Newell Lake View subdivision residents would look over the top of Alternative C, except for those at the base of the mountain adjacent to Pole Hill Road. The net effect would be minor adverse as the alternative would not directly impact the majority of recreational and residential views.
Variant C1	Same as Alternative B.	Same as Alternative A.	Same as Alternative C.
Alternative D	Similar to No Action. Stronger contrasts from ROW clearing, though ROW width would be similar to existing conditions.	Similar to No Action. Stronger contrasts from ROW clearing, though ROW width would be similar to existing conditions.	Same as No Action.

Table 4.12-1d Impacts by Key Observation Points (KOPs 9–11)

	KOP 9	KOP 10	KOP 11
Location & View Direction	W County Road 18E: View Looking Southeast Towards both Transmission Lines. West County Road 18 W provides residential access to the area and to Pinewood Reservoir, and is used extensively for biking. Views of the Great Plains are in the background; foreground views are to Bald Mountain with Chimney Hollow and Flatiron in the middleground. Scenic attractiveness is Class B. Landscape visibility is Moderate, high visual absorption capability and moderate volume of use.	Pole Hill Rd / County Road 18E at Flatiron Picnic and Day Use Area: View Looking at North and South Transmission Lines. Residential, recreation, and Larimer County Open Space (Chimney Hollow, Flatiron Reservoir) uses. Flatiron Reservoir is a 47-acre reservoir, which is part of the CBT project, and provides fishing, picnicking and camping opportunities. Scenic attractiveness to the west is Class B. Landscape visibility is Moderate, due to the viewing distance, moderate volume of use, and high viewer interests in scenery.	Hermit Park: Looking towards South Line through Meadowdale Hills. Larimer County Open Space (Hermit Park), U.S. Highway 36 and residential uses. This KOP is taken at the entrance station of Hermit Park, a popular County open space providing camping, hiking, and wildlife viewing opportunities. Scenic attractiveness to the south across U.S. Highway 36 to the Meadowdale Hills/Ravencrest subdivision is Class B. Landscape visibility is High, due to the viewing distance, high volume of use, and high viewer interests in scenery.
Visualization of Alternative	B, C	A, B, C	None
No Action	Bald Mountain is characterized by a mosaic of low-profile grey/green shrub and grassland vegetation colors and textures, which contrast with the steeper slopes and reddish soils and rocks of Flatiron. The existing scenic integrity of the view is Low. The natural scenery has previously been altered by the presence of crisscrossing roads and transmission lines, residential uses, Flatiron substation, aboveground pipelines from the CBT project, as well as a radio tower stations. The two transmission lines cross Pole Hill Road six times. Radio towers are visible on Bald Mountain to the south and on a mountain to the north.	Views are directed east towards Flatiron Reservoir and secondly to steep slopes and ridgelines in every direction. East-facing slopes are covered with grasses and sagebrush at lower elevations, with dark evergreens predominating on higher mountain slopes. The existing scenic integrity looking west is Low. The natural scenery has previously been altered by the predominance of roads and three transmission lines heading to the Flatiron substation, residential uses, aboveground pipelines from the CBT project, as well as a radio tower stations. Radio towers are visible on Bald Mountain to the south and on a mountain to the north.	The existing scenic integrity of the view is Low. The rocky mountainside and ponderosa trees are dominant aspects of the seen environment, although these co-exist with traffic, U.S. Highway 36, the existing South Line, residential homes, distribution lines, and roads which have moderately altered the landscape setting. The South Line descends along a major ridgeline crossing U.S. Highway 36. Here the highway crests a pass near Mount Pisgah, unveiling the first westbound view of the Estes Valley. Scenic integrity improves looking west towards Mount Pisgah and background views of Rocky Mountain National Park due to the absence of residential development and the highway. Strong contrasts line and form are attributable to the existing transmission facility, which has three skylined structures.
Alternative A	The North Line would be rebuilt and visible to the northeast, as it ascends north of the Newell Lake View subdivision. The taller structures would cross W County Road 18E four times attracting more attention than the existing line, resulting in moderate adverse effects. The South Line would be removed, resulting in moderate beneficial effects. The net effect would be a minor adverse effect due to the taller structures.	The North Line would be rebuilt and visible to the northwest. From an inferior position (compared to KOP 9), the taller structures would be sited on minor ridgelines and cross W County Road 18E four times attracting more attention than the existing line, resulting in moderate adverse effects. The South Line would be removed, resulting in moderate beneficial effects. The net effect would be moderate adverse.	Alternative A would not be visible from Meadowdale Hills subdivision, as it is screened to the north by Mount Pisgah. The South Line would be removed and be a moderate to major beneficial effect.
Variant A1	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Variant A2	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Alternative B	The South Line would be rebuilt and visible to the east. The taller structures would cross W County Road 18E two times attracting more attention than the existing line, resulting in moderate adverse effects. The North Line would be removed, resulting in moderate beneficial effect. The net effect would be a minor adverse effect due to the taller structures.	The South Line would be rebuilt and visible to the west. The taller structures would attract more attention than the existing line, resulting in moderate adverse effects. Alternative B lies lower than Alternative A in a drainage and is removed from residential uses along Pole Hill Road, resulting in less contrast than Alternative A. The North Line would be removed, resulting in moderate beneficial effects. The net effect would be minor adverse.	Alternative B would attract the attention and be a major adverse impact to tourists, recreationists, and travelers as the six conductors cross U.S. Highway 36. Three taller structures would be skylined from this view. Vegetation management and roads would be similar to existing conditions. Rebuilding through this altered rural residential area with mountainside roads and distribution lines lessens impacts to tourists and recreationists at Hermit Park and U.S. Highway 36 than if the line crossed through a natural-appearing scene.
Alternative C	Same as Alternative B.	Same as Alternative B.	Same as Alternative B.
Variant C1	Same as Alternative B.	Same as Alternative B.	Underground construction of Variant C1 would attract less attention than Alternatives B or C. The disturbed ROW would create minor to moderate adverse impact to views from residences and travelers along U.S. Highway 36 and Pole Hill Road. Upon completion of reclamation, greater contrast would result over the life of the project from the maintained ROW devoid of small trees and shrubs compared to overhead alternatives where small trees and shrubs would be present.
Alternative D	Same as No Action.	Same as No Action.	Same as No Action.

Table 4.12-1e Impacts by Key Observation Points (KOPs 12–14)

	KOP 12	KOP 13	KOP 14
Location & View Direction	Lake Estes Causeway / U.S. Highway 36: View looking east towards project end point. Residential, tourism, Lake Estes, and U.S. Highway 36 uses. The eastward view is dominated by Lake Estes in the foreground and the forested and rocky backdrop of Mount Olympus and Mount Pisgah. Scenic attractiveness is Class B. Landscape visibility and sensitivity is High, due to the high volume of traffic, and high viewer interests in scenery.	Newell Lake View Subdivision: View looking east. Residential uses in the Newell Lake View subdivision have encroached on the existing northern ROW, creating hazardous conditions. Scenery is typical of rural residential subdivisions in the foothills transition zone. Scenic attractiveness is Class B. Landscape visibility and sensitivity is High for southern residents along Pole Hill Road. Homes to the north are elevated, with views looking well above the North Line.	Pole Hill Road: View looking west from Pole Hill Road on National Forest System Lands towards Mount Pisgah, east of Meadowdale Hills Subdivision. The South Line crosses Pole Hill Road (USFS Road 122) seven times over two miles. Uses include National Forest System land activities, residential, and OHV. Views are of Mount Pisgah, Mount Olympus, and the southern Rocky Mountains oriented towards the snow-capped Rocky Mountain National Park mountains. Scenic attractiveness is Class A in the background and Class B in the foreground. Adjacent scenery strongly influences the overall scenic attractiveness. Landscape visibility is Moderate, viewer volume is Low, and viewer interests in scenery is considered Moderate based on scoping comments.
Visualization of Alternative	A2, C1	None	None
No Action	While the dominant mountains appear natural and unaltered, lattice transmission Structures along the Estes Lake Causeway have a major impact on the arrival/exit experience along U.S. Highway 36. The E-LS (north) and E-PH (south) transmission lines terminate at the lattice transmission lines prior to crossing the causeway. On the North Line, one structure in the Park Hill subdivision and the ROW at the foot of Mount Olympus and The Notch beyond are visible. Three structures can be seen on the South Line, including one that is skylined. The contrast attributable to the No Action is minor in context with other transmission, highway, and residential facilities.	The existing scenic integrity of the view is Low. The natural vegetation and landforms are influential, but compromised by residential homes, distribution lines, roads, and radio towers which have noticeably altered the landscape setting. Under the No Action, the North Line would be relocated to skirt the southern boundary of Newell Lake View subdivision along Pole Hill Road, substantially benefitting residential views from this KOP. The number of residences with an immediate view of the relocated line would be approximately half that of the existing conditions. More views oriented towards Pinewood Reservoir would look above the line rather than directly at it. The South Line across from Pinewood Reservoir would appear the same as current conditions.	The existing scenic integrity of the view is Low. Human alterations are evident and somewhat dominate the natural landscape's character in the foreground. The existing South Line is visible in the foreground. Danger trees were removed between 2009 and 2011, and no discernable ROW is evident. When views are oriented down the ROW, moderate contrasts result from the texture, color, and lines of ROW maintenance and H-frame structures. ROW impacts decrease substantially when views do not align parallel with the ROW.
Alternative A	One structure would be visible in the Park Hill subdivision at a height 10 feet shorter than the 115-foot lattice structures. Structures could potentially be visible in the ROW at the foot of Mount Olympus and The Notch. The width of the ROW from vegetation maintenance would be similar to existing conditions, though few immature trees would remain the ROW. The South Line would be removed along U.S. Highway 36. Combined with the beneficial removal of the South Line, the adverse contrast attributable to Alternative A in context with other built features in this view would be minor.	The North and South lines would be removed, with major beneficial effects. Alternative A would not be visible from the Newell Lake View subdivision.	Alternative A would be partially visible to the north, through and above the forest canopy. The South Line would be removed and be a moderate beneficial effect.
Variant A1	Alternative A1 would be similar to Alternative A, except that the ROW at the foot of Mount Olympus would be revegetated over time. A ROW at The Notch and one structure in the Park Hill subdivision would be visible, resulting in minor adverse impacts.	Same as Alternative A.	Same as Alternative A.
Variant A2	A pair of transition structures would be visible connecting to the existing lattice structures at Lake Estes. Their height would be similar to structures in Alternatives A through C, though the unique configuration would attract attention. No other segments of Variant A2 would be visible.	Same as Alternative A.	Same as Alternative A.
Alternative B	The North Line would be removed and the ROW in the view would revegetate over time. The south ROW along U.S. Highway 36 would be screened similar to existing conditions, though up to two taller structures would be skylined above the U.S. Highway 36 overlook. Combined with the beneficial removal of the North Line, the adverse contrast attributable to Alternative B in context with other built features in this view would be moderate.	The North Line through Newell Lake View subdivision would be removed. Two taller structures on the South Line would be partially visible in the middleground and would not be skylined. Combined with the beneficial removal of the North Line, the adverse contrast attributable to Alternative B in context with other built features in this view would be negligible.	Vegetation maintenance contrasts would be stronger than existing conditions. Taller, heavier-appearing structures in the foreground generally paralleling Pole Hill Road would dominate the setting, adversely impact scenic integrity, and would be visible above the tree canopy.
Alternative C	Alternative C would be similar to Alternative B, except that only one structure would be visible in the Park Hill subdivision, with no structures skylined since the ROW would be screened in a low drainage. Alternative C would have the least adverse impact compared to all alternatives from this KOP.	Same as Alternative B within the frame of this KOP. Alternative C would follow Pole Hill Road. The majority of residential views would look above the new line. No transmission lines would be seen south of Pinewood Reservoir, a focal point that most homes are oriented towards.	Same as Alternative B.
Variant C1	Same as Variant A2.	Same as Alternative C.	Same as Alternative B.
Alternative D	Similar to No Action. Stronger contrasts from ROW clearing, though ROW width would be similar to existing conditions.	Same as No Action.	Similar to No Action. Stronger contrasts from ROW clearing, though the ROW width and height of H-frame structures would be slightly higher.

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- Where maintained ROWs through forest stands result in a “corridor effect” with cross-beamed structures in the center, especially when the ROW is parallel to the line of sight (see KOPs 1, 2, 3, 6, 7, and 12); and
- Where both ROWs are seen in the same view (see KOPs 1, 2, 3, 8, 9, 10, 12, and 13).

Views immediately adjacent to the existing transmission lines would continue to be adversely affected. These include 1 mile along U.S. Highway 36, 0.5 mile along Mall Road, and along much of Pole Hill Road.

Visual impacts to private residences would be highly variable and localized due to building and window orientation, tree screening, and the large number of existing built structures and overhead electric distribution lines within these subdivisions. Residences immediately adjacent to the ROW in the Park Hill, Meadowdale Hills, Vogel, and Ravencrest subdivisions would continue to be affected in a manner similar to current project conditions. Beneficial effects would occur in the central and southwestern portion of the Newel Lake View subdivision where the existing transmission line would be removed; conversely residents at the southern perimeter of Newell Lake View subdivision along Pole Hill Road would be adversely affected by the relocated alignment (see KOP 8).

Over the long-term, annual operations and maintenance activities would be similar to those that have occurred for decades, though with increased frequency, until all incremental replacements have been accomplished. Maintenance operations would include aerial and ground patrols for monitoring, tree trimming, and equipment repair. Residents and visitors in the vicinity of the routes would be able to see ground and helicopter inspections. Western’s vegetation maintenance regime would maintain and expand the existing width of the cleared ROW through densely timbered areas. Therefore, existing adverse visual effects would continue from the presence of two H-frame transmission lines, maintained ROWs, and permanent access roads, especially as seen from residential, recreation, and highway areas.

<u>Effects on Visual Resource Objectives</u>

The existing transmission lines cross National Forest System lands with an SIO of Moderate.

National Forest System lands in T5N, R72W, Sections 26, 34, and 35 are crossed by the North Line and South Line. These sections comprise a major ridgeline between the Estes Valley and private portion of Pole Hill Road along the North Fork starting at T5N, R72W, Sections 25 and 26. National Forest System lands are used for seasonal motorized recreation, hiking, cross country skiing, and dispersed hunting and camping on a network of USFS roads, including USFS Roads 122 and 247, which are open between June and November. This is the highest elevation crossed by the transmission lines. The landscape character is heavily forested with foreground and middleground views representative of southern Rocky Mountain scenery, which is strongly influenced by views of the snow-capped mountains of Rocky Mountain National Park in the background. Though within 0.5 mile of each other, the lines are typically not seen together due to the steep terrain and dense forest stands that screen long-distance views from roads. Views of the line are typically limited to the immediate foreground (one to two structures), which are often located at high points in the mountainous terrain. The valued landscape character appears intact, with the separated lines screened and repeating the color and form of forest stands. The lower profile scales of the existing structures do not attract attention above the tree canopy. The Adopted SIO of Moderate is achieved with the line subordinate to the overall landscape character and long-distance views of the Front Range.

National Forest System lands in T5N, R71W, Section 27 also are crossed by the North Line and South Line. The existing North Line can be seen from KOP 7 visible east-west along Pole Hill Road. This section of Pole Hill Road is used by property owners and the adjacent National Forest System lands are used for dispersed recreation, including hunting and camping. The North Line ascends a steep section of National Forest System land below The Notch and the structures are heavily screened by tree stands, rock outcrops, and terrain bordered by residential and forestry uses. Where not partially screened, North Line structures can be seen along Pole Hill Road at three crossings. The majority of the South Line is not visible from public roads across National Forest System lands, except for structures crossing Pole Hill Road. In the immediate foreground of the existing lines and BOR facilities, views appear moderately altered. View oriented away from or more than 300 feet from these facilities appear intact and predominantly natural. Overall, the valued landscape character appears intact across the majority of this section, with the separated lines partially screened and repeating the color and form of forest stands and at a lower profile scale that does not attract attention above the tree canopy. Where the two lines converge, the character appears moderately altered because each line straddles Pole Hill Road to the north and south within 0.25 mile of one another. Deviations attract the most attention when views of the ROW are oriented parallel to the line of sight and where typical screening is absent. The Adopted SIO of Moderate is met as the lines remain subordinate to the overall landscape character and long-distance views of the Front Range.

4.12.5 Impacts Unique to Specific Action Alternatives

4.12.5.1 Alternative A

Short- and long-term direct effects within the analysis area from Alternative A would be very similar to the effects described under Impacts Common to All Alternatives. **Table 4.12-1** and **Figures 4.12-2** display the impacts by KOP and viewshed analysis of Alternative A. Simulations of Alternative A can be found in **Appendix C**.

One 115-kV double-circuit transmission line would be constructed with single-column steel poles in the existing ROW. Structures would consist of steel monopoles and would range from 75 to 105 feet tall, constructed of self-weathering steel or galvanized steel. The typical span between poles would be approximately 850 feet, with a maximum span of 1,300 feet. The solid surfaces of monopoles can be highly reflective if the surfaces are light in color and do not employ low-reflectivity coatings. The solid form, heavier width, strong vertical lines, and metallic colors, and smooth textures of these vertical structures would be discernible to the viewer, particularly within open landscapes in the foreground and middleground viewshed distances. Visual contrasts would increase during periods of snow cover with a self-weathering steel finish because it would not blend with the ground plane. Visual contrasts with galvanized structures during periods of snow would be less. Depending on viewer position, ROW maintenance would be visible up to 12 miles from the transmission line. Impacts at this distance would be negligible.

New, taller, less natural-looking (i.e., metal not wood poles) structures and associated disturbance would result in short- and long-term localized adverse effects ranging from minor to moderate. Adverse effects are increased where transmission lines are skylined or where the ROW is visible parallel to the line of sight. For example, two structures would occur on private land in T5N, R72W, Section 27 where they would be seen skylined from the Estes Valley adjacent to a communication tower above a major ridgeline. Also in T5N, R72W, Sections 26 and 27, Alternative A descends a steep ravine and rocky outcrop below The Notch where access roads are limited to non-existent. Road construction would occur, and would include cut and fill grading along a series of switchbacks. In summary, the skylined structures, new permanent access roads, and the loss of tree screening from ROW maintenance, would increase the color and line contrasts of Alternative A seen from Estes Valley in the vicinity of The Notch.

Prior to and during the 8- to 12-month construction period, surveying, engineering, construction employees would be seen in the area at a rate similar to existing vehicular traffic. Construction activities would occur continuously along the ROW for all action alternatives. Conductor pulling, sagging, and clipping by ground vehicle would be visible every 2 to 3 miles, or approximately at 5 locations along the alternative ROWs for Alternatives A-C and at approximately 10 locations for Alternatives D.

Although Alternative A was sited to avoid most residential homes whenever possible, the taller transmission line would create strong, indirect contrasts in the immediate foreground of residences in

Crocker Ranch; recreational use areas, residences, and businesses along Mall Road; and along Pole Hill Road east of Pole Hill Substation. Within 150 feet, the visual dominance of the structures increases, and most residents would perceive the proposed project as strongly degrading the scenic quality of the existing landscape over the long-term. In most residential areas, viewers would see Alternative A in context with smaller, existing electric distribution lines in the immediate foreground.

As noted in Section 2.2.2, Description of Transmission Facilities, structures with a shorter average height of 85 feet and shorter average span of 700 feet, would be considered where visibility from sensitive viewpoints is a major concern, including from Park Hill and Newell Lake View subdivisions and some segments of USFS lands. The shorter structures would be approximately 20 feet shorter on average than the taller 105-foot structures, with the trade-off that the use of shorter structures would result in roughly twice the number of structures in a given length of ROW due to the shorter span.

Long-term, moderate beneficial effects would occur where the existing lines would be removed at Chimney Hollow Open Space, Pinewood Reservoir, along U.S. Highway 36, the Big Thompson River below Lake Estes, and the Newell Lake View, Meadowdale Hills, and Ravencrest subdivisions. West of The Notch along Pole Hill Road, Alternative A would have less visual impact than Alternative B because it is closer to Pole Hill Road, is backdropped at a lower elevation, and further from the majority of residences.

Vegetation management has been occurring continually on the existing lines to remove danger trees. In certain areas with inadequate ROW, Western has obtained landowner permission to remove danger trees beyond the ROW. Immature trees have been left in the ROW until they pose a threat to the transmission line. Under all action alternatives, Western proposes to remove undesirable vegetation during construction that at mature height would interfere with transmission line safety and reliability as described in **Appendix B**. The desired condition would be a ROW dominated by grasses, forbs, shrubs, and lower-growth tree species that, at maturity, would not interfere with the transmission line. For all action alternatives, project-specific design criteria in Chapter 2.0 would screen views of the ROW, soften the straight line of ROW edges, or implement a less-aggressive treatment of the ROW in visually sensitive areas (views from Estes Park, U.S. Highways 34 and 36, residential subdivisions, and from public recreation areas) to maintain a more natural-appearing landscape mosaic pattern. In visually sensitive areas, the long-term appearance of vegetation in the existing ROWs would be similar to existing conditions. Outside of these visually sensitive areas, the long-term appearance of vegetation in existing ROWs would create a stronger contrast in color, texture, line, and form than the No Action Alternative.

Along the new routing north of Newell Lake View subdivision, the new ROW would result in an open, linear feature in an area currently characterized by a closed canopy. The edges of clearings and cuts through trees, shrubbery, or other vegetation would be irregularly shaped to soften the undesirable visual impact of straight lines. However, the ROW would draw attention as the scale of the irregular edges would not fully mimic the natural feathering and scalloping found in meadows along the line. Removing most tree species would result in the new ROW having a mix of shrub, herbaceous, slow growing tree species, and young trees over the long-term. The new ROW would attract attention long-term compared to existing conditions, especially when parallel with the line of sight.

Removal of Existing Transmission Line

Alternatives A, B, and C would remove existing transmission structures and lines at or below ground level. Major beneficial effects would occur with the South ROW, or a combination of the two, being abandoned. The abandoned ROW would revegetate naturally and in 20 years the existing visual effects of a maintained ROW, pads, and access roads would diminish, substantially, increasing the scenic quality and scenic integrity of the analysis area.

Effects on Forest Service Visual Resource Objectives

The USFS SIO of Moderate applies only to National Forest System lands. Alternative A crosses National Forest System lands in T5N, R72W, Section 26 along the North Line ROW. Views of the taller line would be limited to the immediate foreground (one structure) and up to four structures when looking parallel to the ROW. In T5N, R72W, Section 26, Alternative A descends a steep rock outcrop below The Notch on National Forest System land where access roads are non-existent. Road construction to meet safety requirements would occur, and would include cut and fill grading along a series of switchbacks. While the ROW through this area is not generally visible from USFS roads, it would potentially be seen from by dispersed recreation users and from other viewpoints in the analysis area. The new double-circuit transmission line structures and conductors would be seen above the trees and somewhat dominate the desired landscape character. The new structures and ROW maintenance would equate to a Very Low SIO on National Forest System Lands as seen from Pole Hill Road in the foreground (0 to 0.5 mile) and some middleground (0.5 to 4 miles) locations. Long-term beneficial effects would result from removal and abandonment of the South Line and ROW that parallel Pole Hill Road for approximately 1 mile. The long-term beneficial effect of removing and abandoning the South Line and ROW would partially offset the visual impact of rebuilding the North Line. Selection of this alternative would require lowering the SIO from Moderate to Very Low and documentation of the change of SIO in MA 8.3 - Utility Corridor for this project area, in accordance with Forest Plan Standard 154 and also documentation in the USFS ROD.

Alternative A crosses National Forest System lands in T5N, R71W, Section 27 along the existing north ROW (see KOP 7). The ROW and up to three structures would be visible east-west at three crossings along Pole Hill Road. The landscape character would appear altered at these crossings where views are oriented parallel to the line of sight and where the typical screening is absent. The eastern two crossings would be located at recent CBT improvements in an area where the existing landscape character already appears moderately altered. Long-term beneficial effects would result from removal and abandonment of the South Line and ROW that parallel Pole Hill Road for 0.3 mile. Overall, the valued landscape character would appear altered across the majority of this section, with the structures and the ROW partially screened when not adjacent to Pole Hill Road. Alternative A would equate to a Very Low SIO as seen from Pole Hill Road in the foreground (0 to 0.5 mile) and some middleground (0.5 to 4 miles) locations. Long-term beneficial effects would result from removal and abandonment of the South Line and ROW that parallel Pole Hill Road for approximately 1 mile. The long-term beneficial effect of removing and abandoning the South Line and ROW would partially offset the visual impact of rebuilding the North Line. Selection of this alternative would require lowering the SIO from Moderate to Very Low and documentation of the change of SIO in MA 8.3 - Utility Corridor for this project area, in accordance with Forest Plan Standard 154 and also documentation in the USFS ROD.

4.12.5.2 Variant A1

Variant A1 is identical to Alternative A except for the westernmost segment where the route would depart from the existing North Line and traverse along the base of Mount Pisgah and then parallel U.S. Highway 36. Variant A1 would be most frequently seen from the Estes Valley. Impacts for Variant A1 would be less than Alternative A, as Variant A1 crosses at an angle where the lower, new ROW would be screened from view, thereby reducing the "corridor effect" (see KOPs 1 and 2).

As noted in Section 2.2.2, Description of Transmission Facilities, structures with a shorter average height of 85 feet and shorter average span of 700 feet, would be considered where visibility from sensitive viewpoints is a major concern, including from Park Hill and Newell Lake View subdivisions and some segments of USFS lands. The shorter structures would be approximately 20 feet shorter on average than the taller 105-foot structures, with the trade-off that the use of shorter structures would result in roughly twice the number of structures in a given length of ROW due to the shorter span. Long-term beneficial effects would occur where the existing lines would be removed along Mall Road and the Big Thompson River below Lake Estes. The abandoned portion of the existing ROW at the foot (tallus slope) of Mount Olympus would be revegetated over time. **Table 4.12-1** and **Figure 4.12-3** display the impacts by KOP and viewshed analysis of Variant A1. Simulations of Alternative A1 can be found in **Appendix C**. Effects on USFS visual resource objectives would be as described for Alternative A.

4.12.5.3 Variant A2

Variant A2 is similar to Alternative A except for the westernmost segment where the route would be constructed underground following a new alignment that avoids forested areas. Impacts for Alternative Variant A2 for would result from surface disturbance associated with burying the transmission line. Short-term visual impacts from underground construction activities would be more intense compared to overhead construction. During operations, vegetation management for the underground route would require a 75-foot ROW where trees and large shrubs would not be allowed. The maintained ROW would have substantially different color, texture, and forms than the adjacent undisturbed areas. Because no woody trees or shrubs would be permitted to grow in the ROW, the ground plane of this underground ROW would attract more attention than the ground plane of an overhead ROW since up to one mile of forested private land in T5N, R72W, Sections 28 and 29 and to a lesser extent across shrub mosaics (see Section 4.7, Vegetation). Where the ROW ground plane is screened from view, impacts would be not be seen. Impacts would exist where the ROW ground plane is open to view. These effects can be moderated by implementing the vegetation management strategies in Section 2.5.1.2. Compared to overhead construction in the same vicinity, Variant A2 would have less impacts.

A pair of transition structures, approximately 100 feet tall and 5 feet wide at the base, would be constructed at each termination site. The eastern transition structures on private land at the USFS boundary would not be visible from public roads, though potentially from dispersed USFS users. The western transition structures at the intersection Mall Road and U.S. Highway 36 would attract the attention of viewers at Lake Estes, U.S. Highway 36, and Mall Road to a greater degree than the existing lattice tower that they would connect to.

Following construction, roadways, landscaped areas, and undeveloped areas would be restored to their original condition and topography, except for access ways to the underground service vaults that would be installed along the buried cable conduits. Rocks, rock outcroppings, and debris would be replaced similar to pre-construction conditions to blend with the surrounding landscape. Infrastructure impacted by the construction would be restored to their previous function, and yards and pastures vegetated per landowner easements. Vaults would be visible on the ground plane at intervals along the underground segment. Permanent surface monuments installed to mark the easement centerline would be visible but would not attract attention.

Figure 4.12-4 displays the viewshed analysis of Variant A2. Simulations of Variant A2 can be found in **Appendix C**. The transmission line would be constructed overhead on National Forest System lands and the effects on USFS visual resource objectives would be as described for Alternative A.

4.12.5.4 Alternative B

Short- and long-term direct effects to the analysis area from Alternative B would be similar to the effects described under Impacts Common to All Alternatives and Alternative A. **Table 4.12-1** and **Figures 4.12-5** display the impacts by KOP and viewshed analysis of Alternative B. Simulations of Alternative B can be found in Appendix C.

Long-term adverse effects would occur to Chimney Hollow Open Space; views of Pinewood Reservoir and the Ramsay-Shockey Open Space; Park Hill, Meadowdale Hills and Ravencrest subdivisions, and 0.75-mile of U.S. Highway 36 entering Estes Park. West of The Notch along Pole Hill Road, Alternative B would cross higher elevations and be skylined at several locations compared to Alternative A.

As noted in Section 2.2.2, Description of Transmission Facilities, structures with a shorter average height of 85 feet and shorter average span of 700 feet, would be considered where visibility from sensitive viewpoints is a major concern, including from Meadowdale Hills and Newell Lake View subdivisions and some segments of USFS lands. The shorter structures would be approximately 20 feet shorter on average than the taller 105-foot structures, with the trade-off that the use of shorter structures would result in roughly twice the number of structures in a given length of ROW due to the shorter span. Removal and abandonment of the North Line would result in long-term, moderate beneficial effects to the valley between Mount Pisgah and Mount Olympus as seen throughout the Estes Valley, and to the residential and recreation settings of Pole Hill Road east of Pole Hill Substation and the Big Thompson River below Lake Estes.

Effects on USFS Visual Resource Objectives

Effects from Alternative B on National Forest System lands in T5N, R71W, Section 27 would be the same as Alternative A.

Along the south ROW on National Forest System lands in T5N, R72W, Sections 34 and 35, Alternative B would be similar to Alternative A. Alternative B generally parallels one mile of Pole Hill Road and crosses it at five locations. These crossings would allow for longer distance views of the ROW (see KOP 6 and KOP 14). While views of the taller structures would be limited to the immediate foreground, Alternative B's proximity to high volumes of traffic on Pole Hill Road would impact sensitive viewers more than Alternative A.

Long-term, moderate beneficial effects would occur by removing the North Line and abandoning the ROW because it would eliminate the ROW below The Notch. To the south, the landscape character would appear moderately altered in the foreground and some middleground views of Alternative B and meet a Very Low SIO. The long-term beneficial effect of removing and abandoning the North Line and ROW would partially offset the visual impact of rebuilding the South Line. Selection of this alternative would require lowering the SIO from Moderate to Very Low and documentation of the change of SIO in MA 8.3 - Utility Corridor for this project area, in accordance with Forest Plan Standard 154 and also documentation in the USFS ROD.

4.12.5.5 Alternative C

Short- and long-term direct effects to the analysis area from Alternative C would be very similar to the effects described under Impacts Common to All Alternatives and Alternative A. **Table 4.12-1** and **Figures 4.12-6** display the impacts by KOP and viewshed analysis of Alternative C. Simulations of Alternative C can be found in **Appendix C**.

From The Notch to U.S. Highway 36, impacts from Alternative C would be the same as Alternative B. Alternative C would create strong, localized contrasts in the immediate foreground of residences of the Meadowdale Hills, Ravencrest, and Park Hill subdivisions, and along Pole Hill Road east of Pole Hill Substation. Adjacent to U.S. Highway 36 at the Ravencrest Heights subdivision, an angle structure would be skylined before Alternative C descends in a drainage 0.1 mile downslope of the highway. At the Estes Park overlook along U.S. Highway 36, the top of Alternative C would be located below the overlook and partially to fully screened by trees and the highway embankment.

As noted in Section 2.2.2, Description of Transmission Facilities, structures with a shorter average height of 85 feet and shorter average span of 700 feet, would be considered where visibility from sensitive viewpoints is a major concern, including from Park Hill subdivision, Meadowdale Hills subdivision, and/or Newell Lake View subdivision and some segments of USFS lands. The shorter structures would be approximately 20 feet shorter on average than the taller 105-foot structures, with the trade-off that the use of shorter structures would result in roughly twice the number of structures in a given length of ROW due to the shorter span.

Long-term, moderate beneficial effects would occur where the existing lines would be removed at Pinewood Reservoir, U.S. Highway 36, the Big Thompson River below Lake Estes, and along Mall Road. Recreationist views of Pinewood Reservoir and Ramsay-Shockey Open Space would benefit from the South Line's removal. ; Residences at Newel Lake View subdivision would be both beneficially and adversely impacted. Beneficial effects would occur in the central and southwestern portion of the Newel Lake View subdivision where the existing transmission line would be removed; conversely residents at the southern perimeter of Newell Lake View subdivision along Pole Hill Road would be adversely affected by the relocated alignment (see KOP 8). Views of the valley between Mount Olympus and Mount Pisgah from Estes Park and National Forest System lands would be improved.

Effects on Forest Service Visual Resource Objectives

Effects from Alternative C on National Forest System lands in T5N, R71W, Section 27 would be the same as Alternative A. On National Forest System lands in T5N, R72W, Sections 34 and 35, effects from Alternative C would be the same as Alternative B. Selection of this alternative would require lowering the SIO from Moderate to Very Low and documentation of the change of SIO in MA 8.3 - Utility Corridor for this project area, in accordance with Forest Plan Standard 154 and also documentation in the USFS ROD.

4.12.5.6 Variant C1

Variant C1 is similar to Alternative C except for the westernmost segment where the route would be constructed underground following a new alignment from the intersection of U.S. Highway 36 and Mall Road to the USFS boundary adjacent to the Meadowdale Hills subdivision. The short- and long-term ROW of Variant C1 would have a visual appearance similar to Variant A2; however, it crosses 1 mile more of Ponderosa Pine woodland more than Variant A2. Variants A2 and C1 follow the same alignment to the intersection of a Crocker Ranch access road. Adverse effects from transition structures above Meadowdale Hills subdivision near the USFS boundary would not be visible from the majority of Meadowdale Hills subdivision and U.S. Highway 36, but visible to Pole Hill Road users, recreationists, and homeowners above Meadowdale Hills near the USFS boundary. Because no woody trees or shrubs would be permitted to grow in the ROW, the ground plane of the underground ROW would attract more attention than the ground plane of an overhead ROW. Where the ROW ground plane is screened from view, impacts would be not be seen. Impacts would exist where the ROW ground plane is open to view. For example, beneficial effects would occur to Meadowdale Hills residents adjacent to the ROW, however, the absence of trees and shrubs in the ROW would be noticeable from residences and from U.S. Highway 36. The net effect would be moderate beneficial effects from removal of the existing transmission line.

Figure 4.12-7 displays the viewshed analysis of Variant C1. Simulations of Variant C1 can be found in **Appendix C**. The transmission line would be constructed overhead on National Forest System lands and the effects on USFS visual resource objectives would be as described for Alternative C.

4.12.5.7 Alternative D

Alternative D would rebuild the two existing single-circuit 115-kV transmission lines using wood H-frame structures, new hardware and conductors – essentially identical in appearance to the existing conditions though potentially 5 to 10 feet taller where needed to meet safety requirements. The existing, adverse visual effects and visibility of Alternative D shown in **Figures 4.12-8** would continue to be the same as the No Action Alternative, except as noted below.

Visual changes during construction would be more intensive but of shorter duration than No Action. All facilities would be replaced in a definite time period of less than one year rather than gradually over an extended period of time.

Western would remove all undesirable vegetation and trees during construction that at mature height would interfere with transmission line safety and reliability as described under Impacts Common to All Alternatives, project-specific design criteria in Chapter 2.0, and in **Appendix B**. Road construction would occur in very steep terrain to meet safety requirements in locations where no access roads appear to be presently feasible, such as west of Pole Hill Substation in T5N, R71W, Sections 26 and 27 along the

South Line; below The Notch in T5N, R72W, Sections 26 and 27 along the North Line; and near Pole Hill Road in T5N, R72W, Section 34 along the South Line. The grading, cut and fill would attract attention. Also, new conductors and overhead groundwires would be installed with Alternative D, initially creating additional visual contrasts until the conductors become oxidized with time. With the No Action Alternative, the conductors would only be replaced following failure, and then only in segments. Therefore, the long-term appearance of Alternative D would create a stronger contrast in color, texture, line, and form than the No Action Alternative.

Over the long-term, annual operations and maintenance activities would be similar to those that have occurred for decades, though less frequent with fully rebuilt transmission lines and new vegetation management standards.

Rebuilding the North or South Lines as a single-circuit H-frame would have less adverse visual impact than Alternatives A, A1, B, and C because viewers are accustomed to seeing the existing transmission lines. When seen in the same view (i.e., when the two lines are in proximity to each other) the adverse visual effects of two rebuilt single-circuit transmission lines would be similar to the long-term effects of a consolidated Alternative A, A1, B, or C. There are several reasons: non-existent access roads would need to be constructed in steep terrain, some structures would be 5 to 10 feet taller, Western would clear immature trees to meet the new vegetation management standard, once implemented, and two transmission lines and ROWs would be visible in multiple directions in many views. **Figures 4.12-8** show that the visibility of two lower-profile transmission lines would be similar to a consolidated line, even when accounting for screening by the average height of the forest canopy. For example, nearly twice the miles of maintained ROW would be seen from Estes Park and Rocky Mountain National Park than for a consolidated route.

<u>Effects on Visual Resource Objectives</u>

The rebuilt transmission lines would meet the USFS Adopted SIO of Moderate on National Forest System lands, similar to the No Action Alternative.

4.12.6 Mitigation

The most effective mitigating strategy for scenic resources is proper siting and structure design. Visual considerations identified though public scoping and field observations were a major factor in refinement of the alternatives and selection of a transmission structure during the EIS processes. The following mitigation measures, if adopted and when combined with the SCPs and project-specific design criteria, would further reduce the visual contrast created by the action alternatives:

VR-1: Rocks, brush, and woody debris will be salvaged and replaced to approximate pre-project visual conditions on graded structure pads, staging areas, and temporary access routes that are decommissioned post-construction, to re-establish the pre-disturbance surface character and aid in revegetation.

Implementation of VR-1, if adopted, would re-establish the pre-disturbance surface character following construction and accelerate long-term reclamation of graded pads, staging areas, and temporary access routes.

VR-2: Western will utilize non-specular conductors and non-reflective coatings on insulators.

Implementation of VR-2, if adopted, would reduce glare from transmission conductors and insulators.

VR-3: The large height, size, and solid form of steel monopoles combined with the strong vertical line contrasts they introduce into landscapes makes the use of appropriate color treatment particularly important for monopole transmission towers. Surface treatments for transmission structures should repeat and/or blend with the existing colors of the surrounding landscape. A rust-colored, weathered finish would be applied to transmission structures from Bald Mountain west to Estes Park where Alternative A would be viewed against a conifer background to help blend structures with the brown and forest green backdrop. Grey, galvanized steel would be utilized east of Bald Mountain to Flatiron substation where they would be seen against an olive-colored sagebrush and mountain mahogany backdrop. Also, where transmission structures would be silhouetted against the sky from most viewpoints, such as above The Notch, galvanized structures would be selected to minimize color contrasts. Galvanized steel monopoles poles and davit arms would receive a non-specular treatment to dull their reflectivity and reduce glare.

Implementation of VR-3, if adopted, would reduce color contrasts and glare from transmission structures.

4.12.7 Residual Impacts

Residual impacts would continue but to a lesser degree with implementation of visual resource mitigation measures described in Section 4.12.6. All transmission alternatives (including reduced glare and color contrast from conductors, insulators, and structures) would result in minor to moderate to major adverse impacts by reducing scenic quality and scenic integrity throughout the operational life of the proposed project. Abandoned ROWs would continue to attract attention until successful reclamation has occurred. Implementation of Alternatives A, B and C, and Variants A1, A2, and C1 would all result in an SIO of Very Low on National Forest System lands. Implementation of Alternative D or the No Action Alternative would result in an SIO of Moderate on National Forest System lands. Selection of any of the alternatives that would result in a Very Low SIO on National Forest System lands would require lowering of the SIO and documentation of the change in SIO in Management Area 8.3 - Utility Corridor for this project area, in accordance with Forest Plan Standard 154, and also documentation in the USFS ROD.

4.12.8 Irreversible and Irretrievable Commitment of Resources

Although scenic quality would continue to be diminished by the No Action Alternative, and further diminished by Alternatives A, B, C, and the variants, these impacts are not considered irreversible or irretrievable. Project effects would likely persist for many years but could be reversed by removal of the structures and rehabilitation of the ROW.

4.12.9 Relationship between Short-term Uses and Long-term Productivity

The project would result in the long term incremental degradation of scenic resources within the project area, which would be partially offset by removal and consolidation of the two existing lines. Short-term productivity would be affected with greater intensity than long-term productivity, until reclamation occurs and sensitive viewers become accustomed to the project's visibility. For areas with low reclamation potential or slow revegetation rates, long-term productivity losses to scenic character would continue beyond the period of construction, operation, and maintenance activities. The decrease in scenic quality through direct impacts (i.e., ROW clearing and maintenance) could adversely affect recreation activities and land uses in and around the project over the long-term.

4.13 Socioeconomics and Environmental Justice

The analysis area for socioeconomics and environmental justice is Larimer County and more specifically, Estes Park and Loveland where applicable.

Social and Economic Values

Primary issues associated with social and economic value impacts are effects on economic activity as measured by changes in employment and earnings, changes in populations, and changes in the demand for housing and community services.

The following additional issues related to socioeconomics were identified during the scoping process:

- Maintenance of aesthetic values.
- Effects of the proposed project on property values.
- Effects of the proposed project on sources of revenue from tourism and outdoor recreation.

Environmental Justice

Issues regarding environmental justice involve having disproportionately high and adverse impacts on minority or low-income populations caused by constructing and operating the proposed project.

4.13.1 Methodology

4.13.1.1 Social and Economic Values

Socioeconomic impacts of the project were evaluated by examining the availability of labor, potential changes in local population and property values, and changes in demand for housing and community services. In addition, the number of homes within 100 feet of the alternative ROWs is reported to provide a basis for comparison of the number of properties that may be affected by changes to their property value.

4.13.1.2 Environmental Justice

Census data were collected at the census block group, county, and state levels. A comparison of affected census block groups (race) and census tracts (income) was made to determine whether minority or low income populations would experience disproportionately high and adverse effects from the construction and/or operation of the project.

4.13.2 Significance Criteria

A significant impact on socioeconomics values would result if any of the following were to occur from constructing or operating the project:

- An increase in population that would create shortages of housing and place an excessive burden on local services.
- Permanent displacement of an existing residence or business.
- Long-term loss of economic viability of a ranch or other business.
- Permanent and irreversible loss of work for a major sector of a community.
- Substantial economic benefit (a positive economic impact could be considered significant).
- A substantial disproportionate effect on minority or low-income populations in the area.

4.13.3 Impacts Common to All Alternatives

The primary socioeconomic and environmental justice impacts that would occur would apply to all alternatives. Direct and indirect impacts would include slight, short-term increases to the local population from construction crews. The influx of construction crews would have a beneficial impact on the economic base of local communities such as Loveland and Estes Park, as construction workers would spend some income on lodging and other local services (maintenance under the No Action Alternative would be conducted by Western's local maintenance team in lieu of a contract work force).

Long-term effects would be associated with property values and would vary by alternative.

4.13.3.1 Population

Direct and indirect economic benefits to the surrounding area from construction expenditures would be a beneficial impact, creating temporary and jobs within the community.

The transmission lines rebuild would temporarily employ approximately 10 to 15 construction personnel. Construction personnel would primarily use temporary housing at local motels in the area, although some may be local and would utilize their own residence. The number of construction employees would be negligible and would have a less than significant impact on the local population or housing in the analysis area.

4.13.3.2 Economic Base

Construction of the transmission lines rebuild would provide some additional incremental employment opportunities in the region. It is anticipated that workers would spend a portion of their income in local communities on lodging and meals, resulting in an incremental beneficial effect to local businesses during construction activities. In accordance with SCP 38, ROW would be purchased at fair market value and payment made for any agriculture or other property damages during construction or maintenance.

Short-term effects under the action alternatives would occur primarily during construction and would be mostly limited to a slight increase in the construction work force and beneficial impacts from associated spending in the local community. These impacts would be short-term and end after construction is completed. The presence of construction vehicles and construction personnel along the transmission line ROWs would result in minor short-term impacts to aesthetic values, recreation, and tourism activities during construction.

Long-term effects would be associated with property values. A review in the Journal of Real Estate Literature examined empirical studies on the effects of electric transmission lines on property values (Journal of Real Estate 2010). These published studies ranged from 1964 to 2009. Most studies found no effect to property values, which was attributed to the addition of open space contributed by the transmission line easement. Additionally, in the case of this project, many of the residences have property values that have taken into account the presence of the transmission lines because they have been built near or against the easements of the existing transmission lines. Aesthetic values and recreation-based tourism would be positively impacted from line decommissioning under all action alternatives that consolidate two ROWs by constructing a double-circuit transmission line. Additional long-term effects would include more reliable electrical transmission to the Estes Park area with a decreased risk of power outages and a decrease in maintenance costs. Under Alternative D, long-term effects would include the continued use of two ROWs and lack of socioeconomic benefits that would accrue from consolidating two ROWs into one.

No significant adverse impacts are anticipated from permanent displacement of an existing residence or business, long-term loss of economic viability of a ranch or other business, or permanent and irreversible loss of work for a major sector of the community.

4.13.3.3 Environmental Justice

The poverty rates and minority population percentages for the census tracts affected by the proposed project are shown in **Table 3.13-9**. The poverty rates and minority population percentages for the analysis area are less than or comparable to rates for the state, as is reflected by the amount of second homes within the project area. Therefore, it has been determined that environmental justice populations are not present within the project area and the proposed project would not have a disproportionately high and adverse effect on minority or low-income populations.

4.13.4 No Action Alternative

Under the No Action Alternative, impacts would include increased maintenance costs as replacement of the existing structures would be accelerated. There would be no direct or indirect effects on population, economic base, property values, aesthetic values, recreation or tourism-based sources of revenue, or environmental justice. The exception would be the potential for a slight increase in property values within the Newell Lake View subdivision where the line would be removed, easement rights released, and the ROW would be rerouted to Pole Hill Road. Conversely, those areas of the Newell Lake View subdivision near Pole Hill Road where the ROW would be rerouted might see a slight reduction to property values, however compensation for the ROW easement should offset any impact. **Table 4.13-1** depicts the number of landowners affected by new ROW, widened ROW, and ROW removal for each alternative.

Under the No Action Alternative, short and long-term effects would include both an increase in maintenance costs as well as an increasingly unreliable electrical service because the existing line would become more intensive to maintain. There would be no short-term or long-term effects on population, economic base, aesthetic values, recreation or tourism-based sources of revenue, and environmental justice. Long-term effects include potential changes to property values within the Newell Lake View subdivision where the ROW would be rerouted to Pole Hill Road, as noted above. Short-term effects would include negligible increases in population and economic input to the local economy from construction expenditures and employment to reroute the transmission line out of Newell Lake View subdivision. This increase in population and economic input into the local economy would diminish as maintenance activities are completed.

Table 4.13-1 Landowners Affected by Each Alternative

Resource	Alternative A	Variant A1	Variant A2	Alternative B	Alternative C	Variant C1	Alternative D	No Action Alternative
Total number of. landowners burdened by ROW acquisition	46	48	42	19	36	36	40	40
New ROW	8	10 (*1)	7 (*1)	4 (*2)	9	9	5 (*2)	5 (*2)
Widened ROW	38	38	35	15	27	27	35	35
Number of landowners where ROW removed (*3)	36	36	36	51	33	33	7	7

*1-Includes new road ROW/construction on Crocker through Noels Draw.

*2-Includes new Road ROW on southwest side of U.S. Highway 36.

*3-Some landowners benefit by the removal of one line but are still burdened by the other line.

4.13.5 Impacts Unique to Specific Action Alternatives

Property Values

While no studies have been done in the specific analysis area, various studies have been conducted to determine the effect of transmission lines on the value of single family residences in residential subdivisions. As previously noted, based on research of a compilation of studies regarding the effects of transmission lines on property values, estimates of the decrease in property values can range from 2 to 9 percent (Real Estate Journal 2010). Property owners are compensated for the ROW easement at fair market value which should offset impacts to property values. Any real property value impact generally fades after a few years as a new line becomes a part of the landscape of human development. A number of the studies found no effect, while in some cases a slight increase was observed. Increases were attributed to the additional open space usually behind the residences created by the transmission line easement. Impacts to property values would vary by alternative, but would generally be negligible where the transmission line would be rebuilt within an existing transmission line easement that has been in place for over 60 years.

Alternative A

Under Alternative A, the existing transmission line would be removed from the ROW and the ROW decommissioned through the Meadowdale Hills, Ravencrest, and Newell Lake View subdivisions, resulting in the release of easement rights thereby causing a potentially slight increase in property values at those locations. The new structures through the Park Hill subdivision on the western end of the alternative are anticipated to be 10 to 20 feet higher than the existing structures within an existing easement. Impacts to property values crossed by Alternative A would be decreased because the new transmission line would rebuild within an existing transmission line that has been in place for over 80 years. **Table 4.13-1** depicts the number of landowners affected by new ROW, widened ROW, and ROW removal. Residences whose property is encumbered by existing easements within the Meadowdale Hills, Ravencrest, and Newell Lake View subdivisions, where the existing line would be removed, potentially would experience a slight increase in property value as the existing lines would be removed, the easement rights would be released, and the ROW would return to natural vegetation patterns.

In addition, if construction activities were to occur during the primary recreational use period (May 15 to October 15), there would be short-term, adverse effects to the operations of an outfitter authorized to provide four-wheel drive tours in the Pole Hill Area. American Wilderness Tours, which now operates as Rocky Mountain Rush, holds a Priority Outfitter/Guide special use authorization allowing 3,575 service days annually with an average use of 1,800 to 2,000 service days/year. A service day constitutes a day or any part of a day on National Forest System lands for which an outfitter or guide provides services to a client. The number is calculated by multiplying each service day by the number of clients on a trip. They offer morning and afternoon tours daily and evening tours 4 days a week. Although difficult to quantify until the construction schedule is more specifically defined, conflicts between construction activities associated with removal of the existing south South Line and outfitter use of Pole Hill Road may emerge. Structure removal activities would utilize smaller vehicles than construction installation activities; however, use of Pole Hill Road would still result in minor short-term impacts.

Alternative B

Under Alternative B, the existing transmission line would be removed from the north ROW through the north and west sides of the Park Hill subdivision and the existing ROW through Newell Lake View subdivision, resulting in the potential for a slight increase of property values at those locations. In the Meadowdale Hills and Ravencrest subdivisions, the existing H-frame wood pole structures would be replaced by steel monopole structures that would be 10 to 30 feet higher within an existing ROW, depending on the span length designed for the transmission line. **Table 4.13-1** depicts the number of landowners affected by new ROW, widened ROW, and ROW removal. The taller structures along U.S. Highway 36 would incrementally increase impacts on aesthetic values, recreation, and tourism activities. However, these impacts would be lessened as a result of the long-term presence of H-frame structures that have been within the existing ROW for over 60 years.

If construction activities were to occur during the primary recreational use period (May 15 to October 15) there would be adverse effects to Rocky Mountain Rush, which is authorized to provide four-wheel drive tours in the Pole Hill area. As noted in Alternative A, these effects would be minor and short-term.

Alternative C

Under Alternative C, the existing transmission line would be removed from the North Line ROW through the Park Hill subdivision and the ROW would be decommissioned. At Newell Lake View subdivision, the ROW through the subdivision would be relocated to follow Pole Hill Road. Property values could increase slightly within the north and west sides of the Park Hill subdivision and the Newell Lake View subdivision where the existing line would be removed. Where new ROW would be required, property owners impacted by the new ROW would be compensated. In the Meadowdale Hills and Ravencrest subdivisions, the existing H-frame wood pole structures would be replaced by steel monopole structures that would be 10 to 30 feet higher within an existing ROW, depending on the span length designed for the transmission line. **Table 4.13-1** depicts the number of landowners affected by new ROW, widened ROW, and ROW removal. The taller structures would incrementally increase impacts on aesthetic values, recreation, and tourism activities as a result of the taller structures along U.S. Highway 36; however, these impacts would be lessened as a result of the long-term presence of H-frame structures that have been within the ROW for over 60 years.

Alternative C would reconstruct sections of USFS Roads 122 (Pole Hill Road) and 247.D, to allow for passage of semi-trailer trucks to structure locations. Under this alternative, grinding, chipping, or blasting could be used to level the grade on the west end of Pole Hill Road. Reconstruction of Pole Hill Road would diminish the OHV recreation experience on USFS Road 122, particularly on the most challenging four-wheel drive section just east of the road closure gate accessed from Meadowdale Hills subdivision.

Rocky Mountain Rush runs tours in the Pole Hill area and has authorized permanent facilities (observation tower, picnic shelter with cooking facilities, toilet/washing/generator building, storage building) at the top of Panorama Peak. Tours are advertised as four-wheel drive/off-road tours with the most challenging four-wheel drive section of the entire route being the steep, rock section just east of the road closure gate on Pole Hill Rd. Alternative C would degrade the OHV experience on a key road used for four-wheel drive activities, USFS Road 122, but would not completely displace the outfitter, who would continue to have access to a network of unimproved roads in the Pole Hill area. Although, there would be no direct effects to the company's permanent facilities and other USFS roads in the Pole Hill area (e.g., USFS Roads 122A, 247, 247A, 247B, and portions of 247D) would remain unimproved and accessible for four-wheel drive use, overall, the economic effects to this business are anticipated to be significant and long-term.

<u>Alternative D</u>

Under Alternative D, the rebuild of the existing lines would not affect property values. Property values could increase slightly within the Newell Lake View subdivision where the existing line would be removed, and easement rights released. However, property owners impacted by the new ROW along the southern boundary of the subdivision where the new line would be constructed near Pole Hill Road may experience a slight decrease in property values. **Table 4.13-1** depicts the number of landowners affected by new ROW, widened ROW, and ROW removal.

Alternative D would have similar impacts on a four-wheel drive outfitter (Rocky Mountain Rush) as were described for Alternative B; however, to a lesser degree since the transmission line would be rebuilt on existing ROW rather than being rerouted to Pole Hill Road.

<u>Variant A1</u>

Variant A1 represents an alternate route through private ranch land on the western end of the project area. The routing variant rejoins existing ROW on the south side of Park Hill subdivision. **Table 4.13-1** depicts the number of landowners affected by new ROW, widened ROW, and ROW removal. Impacts would be similar to those described for the Action Alternatives and Impacts Common to All Alternatives. The new structures would incrementally increase impacts on aesthetic values, recreation, and tourism activities; however, these impacts would be lessened as a result of the long-term presence of H-frame structures that have been within the existing ROW for over 80 years.

<u>Variant A2</u>

Variant A2 would follow the same alignment as described for Alternative A and build the line aboveground over most of this distance. The westernmost portion of this alternative would be constructed underground following a new alignment that heads south from the existing transmission line to the intersection of Mall Road and U.S. Highway 36. Preliminary construction cost estimates of Variant A2 are approximately $37.9 million. This is roughly 80 percent greater than alternatives that do not have an underground option. Further costs are detailed in **Table 2.4-1**, Section 2.4.

Variant C1

Variant C1, from Mall Road to the USFS boundary adjacent to the Meadowdale Hills subdivision, would be constructed underground to lessen visual concerns. This section would run slightly less than three miles in length. Preliminary construction cost estimates of Variant C1 are approximately $39.6 million. This is roughly 89 percent greater than alternatives that do not have an underground option. Impacts to Rocky Mountain Rush would be similar as stated in Alternative C.

4.13.6 Mitigation

After implementing SCP 38, there would be no significant impacts to socioeconomics or environmental justice as a result of landowner loss of revenue. No mitigation measures have been proposed.

4.13.7 Residual Impacts

From a social and economic perspective, any residual effects would primarily be long-term in nature and very localized. Residual long-term socioeconomic impacts would mostly include effects on property values. However, many of the residences have property values that have taken into account the presence of the transmission lines because they have been built near or against the easements of the existing transmission lines. Residual social effects would be associated with the change in character of the landscape in and near the analysis area, which could be viewed as adverse and beneficial to different local residents and other users of the land. Direct long-term impacts pertain mostly to property values. These impacts would be beneficial in areas where transmission line easements and structures would be removed and adverse where new easements are added, although property owners would be compensated for new easements. As a result of the historical long-term presence of transmission structures within the ROWs, these impacts are anticipated to be minor. **Table 4.13-1** depicts the total number of landowners affected by new ROW, widened ROW, and ROW removal. Residual direct long-term socioeconomic impacts also would include effects to the private outfitter, Rocky Mountain Rush, as four-wheel drive portions of Pole Hill Road under Alternative B would be improved, degrading the OHV experience. The economic effects to this business are anticipated to be significant and long-term.

4.13.8 Irreversible and Irretrievable Commitment of Resources

Implementation of the project would require the commitment of natural, human, engineered, and monetary resources. After completed, most of the resource investments would be irretrievable and their use/application for this project would preclude their use for other purposes; however, some project components such as poles, conductors, and ground wire may be recycled into other uses.

4.13.9 Relationship Between Short-term Uses and Long-term Productivity

Implementation of the project would involve a series of temporary use of land and other resources, as well as long-term influences on land use, economic activity, and social setting along the alternatives. The application of reliable energy transmission would contribute to long-term productivity gains.

4.14 Electrical Effects and Human Health

The impact analysis area for electrical effects and human health includes the alternative ROWs and areas immediately adjacent to the ROW.

Issues or concerns regarding public health and safety identified by Western through internal scoping, consultation with coordinating agencies, or through comments provided during public scoping include:

- Adverse health impacts from EMF, as noted in Section 1.6.2.2 as an issue selected for detailed analysis, and stray voltage associated with transmission lines.
- Safety issues associated with transmission lines acting as a lightning rod.

- Safety issues associated with low flying helicopters.
- Risks to public safety from the application of pesticides to the ROW.
- Serious injuries to transmission line workers.
- Safety issues from the potential increase in wildfires, along with indirect health effects from fire suppression chemicals.

Methods to reduce impacts from wildfire are discussed in Section 4.7.5. The following discussion is related to potential impacts associated with the remaining identified issues.

4.14.1 Methodology

Existing regulations, safety standards, operational procedures and literature were reviewed. Industry practices are required to be protective of worker and public safety and health. Impacts associated with the proposed alternatives that could occur were assessed by comparing projected activities and impacts with existing safety standards and regulations to protect public health. The analysis includes a comparison of the alternatives based on modeling using the Electric Power Research Institute Transmission Line Workstation Design Tool of the electric fields at the proposed edge of ROW (55 feet from centerline) measured in kilovolts/meter and magnetic fields at the edge of the ROW measured in mG.

4.14.2 Significance Criteria

A significant impact on public health or safety would result if any of the following were to occur from constructing and operating the project:

- Interference with emergency response capabilities or resources.
- Serious injuries to: 1) workers, 2) visitors to the area, or 3) area land users.
- Creation of EMFs near an existing or proposed sensitive land use, such as schools or hospitals, which would pose a plausible risk to human health.
- Creation of a substantial interference and disruption of emergency communications and electronic health/safety devices that results in substandard performance.
- Changes in traffic patterns that result in hazardous situations for motorists or pedestrians.

4.14.3 Impacts Common to All Alternatives

Potential direct and indirect impacts to human health could include effects from noise, radio and television interference, shocks, induced current and voltage, cardiac pacemakers, and EMF. Impacts also could occur from the use of helicopters to patrol the line. The impacts for all alternatives would be localized. With the exception of Variants A1, A2, and C1, and parts of Alternative A, these impacts would occur mostly within existing transmission line ROWs.

Radio and television interference as well as induced current and voltage also may be experienced, but would generally be at levels low enough not to cause adverse effects to communication sources, including emergency communications. Effects would be lessened through application of SCPs 20 and 39. SCP 20 would apply applicable mitigation to eliminate problems of induced currents and voltages onto objects within the ROW, while SCP 39 would ensure the power line would be designed to minimize noise and other effects from energized conductors. EMF effects on sensitive cardiac pacemakers and other sensitive receptors are rare, as a result of low levels of EMF and the lack of sensitive receptors within the ROW.

Primary shocks could result from direct contact with the transmission line conductors if trucks with booms or other tall equipment were operated near the transmission line. Caution would be exercised to avoid primary shocks resulting from line strikes with equipment. Furthermore, the transmission lines would be constructed and operated according to the NESC, which would minimize the risk for shock. Therefore, the risk of electrocution during construction as well as operation would be negligible. Primary shocks also can result from direct contact with objects installed by homeowners, such as radio masts or TV antennas; however, the risk has decreased markedly over the past decades with the advent of cable and digital TV.

Potential adverse human health effects associated with lightning strikes would be minimized by the presence of the overhead ground wire and optical ground wire that shield the conductors; however, when current is discharged from the structure base to the surrounding ground, voltage can momentarily exist on the ground near the structure, thus presenting an electrocution hazard. Generally accepted safety measures regarding the dangers of close proximity to elevated structures during an electrical storm would apply. When corona is present, the air surrounding the conductors is ionized and many chemical reactions take place, producing small amounts of ozone and other oxidants. The NAAQS for photochemical oxidants, of which ozone is the principal component, is 235 $\mu g/m^3$ or 120 ppb. The maximum incremental ozone levels at ground level calculated for the proposed line would be less than 0.02 ppb for a 0.5-mile-per-hour perpendicular wind and a .03-inch-per-hour rain.

Direct and indirect impacts also could occur from aerial line patrol utilizing helicopters. Western operates its aircraft under Federal Aviation Regulations Parts 135, 133, and 91 and is a member of the Helicopter Association International as well as an active member of Helicopter Association International's Utilities, Patrol, and Construction Committee, the organization that sets international guidelines for power line patrol and construction. Western would strictly follow these guidelines when performing aerial line patrol to minimize human health concerns. Traffic patterns and subsequent effects to emergency response, motorists, or pedestrians are expected to be less than significant as a result of what would be only a minor increase in construction truck traffic, well within the capacity of the existing road network. Direct and indirect impacts to human health resulting from constructing and operating the proposed transmission lines would not be significant.

Short-term noise impacts would occur during construction activities. Short-term primary shock risks would be associated with potential contact of construction vehicles with the energized transmission line conductors. Long-term effects are addressed under each subheading below.

4.14.3.1 Audible Noise

The average noise level during wet weather at the edge of the ROW for the aboveground alternatives and variants is anticipated to be 15 dBA at 115 kV (Enterprise Park to Crooked Lane Environmental Assessment 2012). A soft whisper at 15 feet would be approximately 30 dBA, while a broadcasting studio would be near 20 dBA. It is anticipated that noise of 15 dBA at the edge of the ROW would constitute a negligible effect. Additionally, SCP 39 would be implemented to further lesson the effects from noise by implementing modern power line design. SCP 17 would limit noise effects during construction or maintenance by requiring internal combustion engines be fitted with an approved muffler and spark arrester.

4.14.3.2 Radio and Television Interference

An acceptable level of maximum fair-weather radio interference at the edge of a ROW is 40 to 45 decibels above 1 microvolt per meter. Average levels during foul weather are typically 16 to 22 decibels higher than average fair-weather levels. The predicted fair-weather level for aboveground alternatives and variants is 36 decibels above 1 microvolt per meter. This is approximately 15 percent less than the maximum level considered acceptable resulting in negligible effects.

Television interference due to corona effects occurs during periods of foul weather and generally is caused by aboveground transmission lines with voltage of more than 345 kV. The level of corona-operated television interference expected from the proposed rebuild is 16 decibels above one microvolt per meter at the edge of the ROW. This is a lower level than occurs on many existing lines and effects would be considered negligible. Newer more modern transmission line equipment also would assist in limiting the likelihood of radio and television interference, as would the consolidation from two ROWs to one. Additionally, various techniques, such as shielding for various electronic equipment, exist for eliminating adverse impacts on radio and television reception. Western would address individual complaints concerning radio and television interference, as needed.

4.14.3.3 Shocks

Primary shocks can occur from direct electrical contact with energized transmission line conductors. Caution should be exercised to avoid primary shocks resulting from direct contact with aboveground or buried lines with equipment (e.g., drill rigs, farm equipment, and electrical service equipment). The newer higher lines would present much less of a threat of primary shocks, than the existing lines which are nearer to the ground and utilize older conductors. Steady-state current shocks occur when a person touches an ungrounded object. Potential steady-state current shocks from vehicles under transmission lines would be at or below secondary shock levels. These secondary shocks could cause an involuntary and potentially harmful movement, but causes no direct physiological harm. Steady-state current shocks are infrequent and represent a nuisance rather than a hazard. Proper grounding would greatly reduce the risk of steady-state current shocks.

4.14.3.4 Induced Current and Voltage

Induced currents and voltages near ungrounded objects represent a potential source of nuisance shocks near a high voltage transmission line. Even under worst case conditions, the short-circuit current resulting from induced voltage of the aboveground transmission line to the largest anticipated vehicle would be less than the NESC criterion of 5 mA. SCP 20 would be implemented to eliminate problems of induced currents and voltages onto conductive objects sharing the ROW.

4.14.3.5 Cardiac Pacemaker Effects

The interference threshold for the most sensitive pacemaker is estimated at 3.4-kV/m. The maximum induced electrical field of any of the proposed alternatives is estimated at 0.5 kV/m. Therefore, with operation at 115-kV capacity, the proposed project would not pose a risk to pacemaker wearers.

4.14.4 No Action Alternative

Under the No Action Alternative, impacts from new construction would be similar to those discussed under Section 4.14.3. In addition, impacts under the No Action Alternative would include continued impacts from existing power lines. **Tables 4.14-1** and **4.14-2** detail the existing EMF from the H-frame structures. Although the strength of the field decreases rapidly after 30 feet, there are some areas within the Newell Lake View subdivision where the ROW does not exceed 20 feet. Although at these distances electromagnetic fields would still be within recommended thresholds, these fields would stay in place until the existing line is relocated south of the subdivision near Pole Hill Road. Low EMF levels and the lack of sensitive receptors within transmission line ROWs would result in negligible effects. Noise impacts would result from maintenance activities as well as operation of the transmission lines, but effects would be lessened as a result of the transitory nature of construction.

Radio and television interference and induced current voltage are not expected to be affected as a result of implementation of SCPs 20 and 39 and the relatively low voltage of the transmission line. Short-term impacts to human health would be similar to those described under Impacts Common to All Alternatives. The majority of short-term impacts would result from maintenance activities as H-frame structures are replaced and maintenance activities near the Newell Lake View subdivision where the ROW would be re-routed along Pole Hill Road. Short-term impacts would include increased noise levels from maintenance activities.

Long-term effects would be associated with mostly radio and television interference, shocks, induced current and voltage, cardiac pacemaker effects, and EMF; however, low levels of EMF, implementation of SCPs, and lack of sensitive receptors within the ROW contribute to a negligible long-term effect. Under the No Action Alternative, long-term effects also would include the continued use of two ROWs and subsequent potential for human health risks spread across two ROWs as the need for maintenance would increase.

4.14.5 Impacts Unique to Specific Action Alternatives

Unless noted otherwise, impacts in areas where the line would be buried on Variants A2 or C1 would be negligible.

4.14.5.1 Electric and Magnetic Fields

Transmission lines would be designed to minimize EMF and would have EMF levels similar to other existing transmission lines. EMF strength depends on conductor capacity loads, voltage load and distance from source. The strength of the field decreases rapidly with distance. EMFs that are applicable to the 115-kV transmission lines that would be installed for the project are provided in **Tables 4.14-1** and **4.14-2**, and are depicted in **Figures 4.14-1** and **4.14-2**. Electric fields for the double-circuit single pole transmission line alternatives (Alternatives A, B, and C and variants) would be approximately 70 percent less at the edge of the 110-foot ROW than the existing H-frame lines. Magnetic field levels would be similar to the field levels of the existing H-frame at the edge of the ROW; however, the new double-circuit line would reduce magnetic field levels to less than the existing H-frame line within the 110-foot ROW. Note that EMF levels differ in strength on both sides of single-pole structures due to the configuration of conductors. Based on predicted estimates, EMFs are both expected to diminish rapidly beyond 30 feet from the centerline. Magnetic fields within transmission line ROWs constantly increase and decrease, with the highest fields resulting when the electrical demands are the greatest, typically in the winter months.

Typical homes produce background magnetic field levels (away from appliances and wiring) that range from 0.5 mG to 4 mG (EPA 1992). Natural static magnetic fields from the earth are near 0.6 mG. At a distance of 55 feet from the centerline, magnetic fields produced by the proposed double-circuit transmission line would equal the magnetic field levels encountered from typical household appliances. The Colorado Public Utilities Commission states that magnetic field levels of less than 150 mG at the edge of the transmission line ROW are reasonable. The proposed double-circuit aboveground transmission lines would emit magnetic fields at the edge of the ROW at levels well below those noted by the Colorado Public Utilities Commission.

Table 4.14-1 Predicted Electric Fields from Proposed Aboveground Transmission Lines, Operated at Maximum Capacity (kilovolts per meter)

	Distance (feet) from Centerline												
Pole Type	**-160**	**-130**	**-100**	**-70**	**-55**	**-30**	**0**	**+30**	**+55**	**+70**	**+100**	**+130**	**+160**
H-frame, 115-kV[1]	0.02	0.05	0.08	0.25	0.34	0.70	0.50	0.70	0.34	0.25	0.08	0.05	0.02
Single-pole double circuit, 115-kV[2,3]	0.02	0.02	0.02	0.07	0.12	0.27	0.3	0.27	0.12	0.07	0.02	0.02	0.02

[1] Applicable to the No Action Alternative and Alternative D.

[2] Applicable to Alternatives A, A1, B, and C.

[3] Single-pole structures differ in EMF strength due to conductor orientation.

Table 4.14-2 Predicted Magnetic Field from Proposed Aboveground Transmission Lines, Operated at Maximum Capacity (mG)

Pole Type	Distance (feet) from Centerline										
	-160	**-100**	**-70**	**-55**	**-30**	**0**	**+30**	**+55**	**+70**	**+100**	**+160**
H-frame, 115-kV[1]	1	2	4	5.2	12	23	12	5.3	4	2	1
Single-pole double circuit, 115-kV[2]	2	2	4	5.2	7	8	3	1.8	2	2	2

[1] Applicable to the No Action Alternative and Alternative D.

[2] Applicable to Alternatives A, A1, B, and C.

For a 115-kV line double-circuit design, an electric field of less than 0.4-kV per meter would result at the point of maximum strength within the ROW. This would decrease to less than 0.07-kV per meter near the edge of the ROW. There are no Federal standards for transmission line electric fields; however, the International Committee on Non-ionizing Radiation Protection has set a voluntary protection level for electrical fields for the general public of 4.2-kV per meter (International Committee on Non-ionizing Radiation Protection [ICNRP] 1998). The proposed double-circuit aboveground transmission line would emit magnetic fields at the edge of the ROW at levels well below the level recommended by the ICNRP resulting in a negligible long-term effect.

The health effects associated with the upgraded aboveground transmission line would be similar or less than those for the existing line. The edge of the ROW would mark the beginning of the long-term residential exposure levels at the root of the present health concern.

As detailed in **Tables 4.14-1** and **4.14-2**, and **Figures 4.14-1** and **4.14-2,** EMF levels associated with the wooden H-frame structures would be higher than the single-pole double circuit structures; however, these levels reduce greatly at 30 feet from the centerline. Under Alternative A, there would be one residence in the Park Hill subdivision that would be within 100 feet of the centerline. Under Alternatives B, C, and D, three residences in the Meadowdale Hills subdivision would be within 100 feet of the centerline. One additional residence, in the Newell Lake View subdivision, would be within 100 feet of the centerline under Alternatives C and D. At a distance of 30 feet from the transmission line centerline EMF levels would be approximately 40 to 60 percent lower than current EMF levels and would diminish rapidly beyond 30 feet. This would lead to a negligible long-term effect. A positive long-term effect would result from the removal of the existing H-frame structures from the north transmission line ROW.

Electric fields for locations where the power line would be buried (Variants A2 and C1) would be blocked by soil and would not be a concern. Magnetic field levels would be near 0.21 mG near the centerline at the surface and 0.05 mG approximately 50 feet from the centerline near the edge of the ROW. These levels are well below the guidelines set by the Colorado Public Utilities Commission resulting in a negligible effect.

Long-term effects would be associated mostly with aboveground power lines, and would include radio and television interference, shocks, induced current and voltage, cardiac pacemaker effects, and EMF. Low levels of EMF relative to naturally occurring levels and ICNRP levels, implementation of SCPs, and lack of sensitive receptors within the ROW contribute to a negligible long-term effect. A positive long-term effect would result from the removal of the existing H-frame structures from the south transmission line ROW.

4.14.6 Mitigation

After implementing SCPs 20 and 39, there would be no significant impacts to human health in terms of electrical effects. Because electrical effects or impacts to human health would not be significant for any alternative or variant, no additional mitigation measures to avoid, minimize, or mitigate impacts would be required.

4.14.7 Residual Impacts

No mitigation has been identified; therefore the residual effects would be the same as impacts described previously. Direct effects associated with construction activities, such as construction equipment noise, are expected to be adverse, but short-term and minor in intensity, ending when construction activities cease. Direct long-term effects would be adverse, but negligible, as a result of the lack of sensitive receptors within the ROW and EMF levels below Colorado Public Utilities Commission guidance. The EMFs 55 feet from the proposed centerline would be lowest for the underground variants, A2 and C1. As noted in **Tables 4.14-1** and **4.14-2**, the EMFs for the aboveground alternatives at 55 feet from centerline would be lower for Alternatives, A, A1, B, and C (single-pole double circuit structures) than Alternative D and the No Action Alternative (H-frame single circuit structures). There would be no significant impacts to human health from any of the alternatives.

4.14.8 Irreversible and Irretrievable Commitment of Resources

Because the potential to cause electrical effects or impact human health resources is low or nil, no irreversible and irretrievable commitment of resources is anticipated.

4.14.9 Relationship between Short-term Uses and Long-term Productivity

Short-term impacts associated with construction of the alternatives would not adversely cause long-term electrical effects or impact the long-term human health in the area.

4.15 Cultural Resources and Native American Traditional Values

The analysis area for cultural resources is referred to as the APE for consistency with terminology used in the NHPA. Under Section 106 of the NHPA, the APE is defined as “those areas in which impacts are planned or are likely to occur. Specifically, the APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. Additionally, the APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (36 CFR 800.16[d]).”

For purposes of this EIS, the analysis area or APE for cultural resources and Native American traditional values is a 110-foot-wide ROW centered on the transmission line alternatives, and a 100-foot-wide area centered on all newly proposed access roads and any existing access road requiring upgrades, and the footprint of all proposed substations including a 200-foot buffer. For all other proposed locations or temporary construction sites, the APE includes the footprint plus a 200-foot buffer. The APE for visual effects includes a 2-mile-wide area centered on the transmission line alternatives. Some sites or features immediately adjacent to the APE also may be included at the discretion of the cultural resources specialists.

Figure 4.14-1 Pole Hill 115-kV Electric Field Profile at 6 feet Aboveground

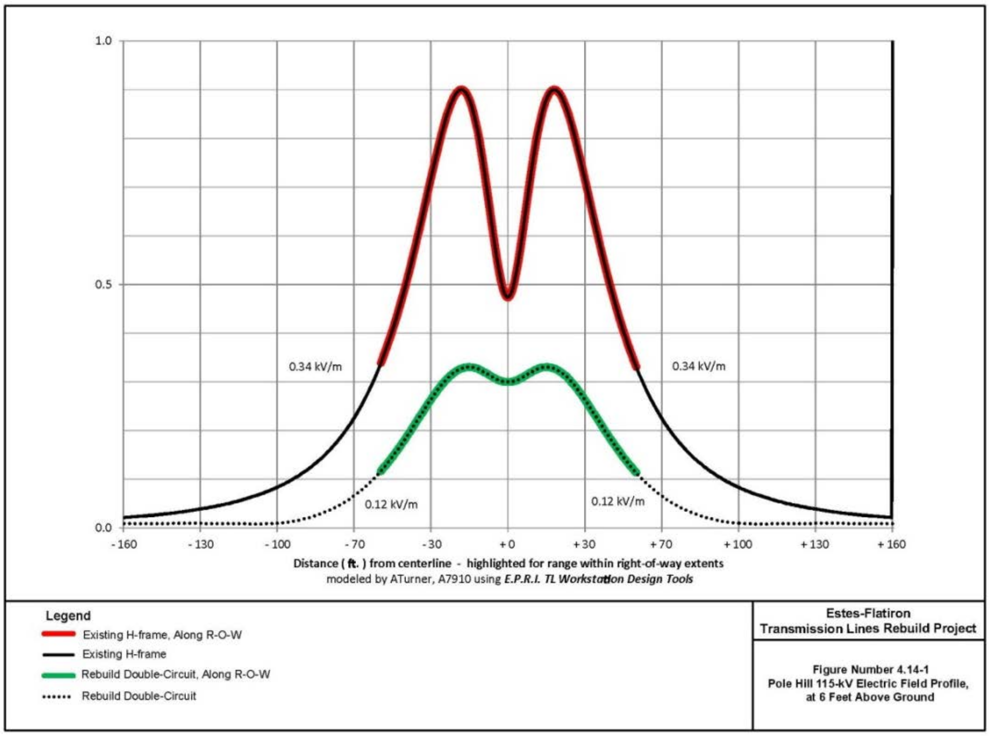
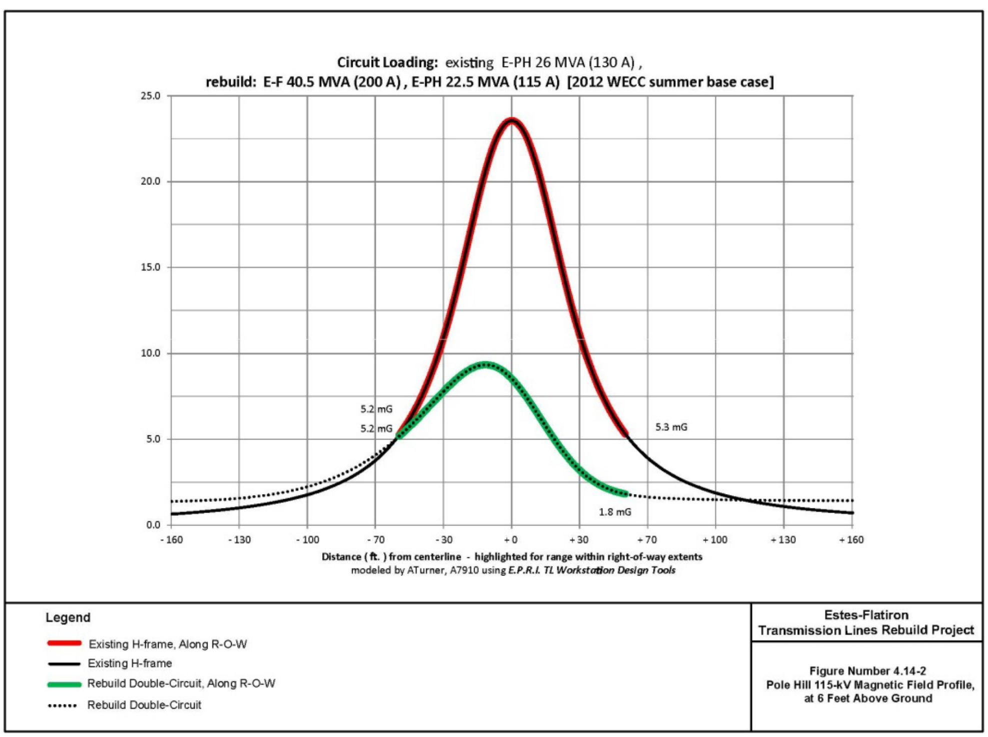


Figure 4.14-2 Pole Hill 115-kV Magnetic Field Profile at 6 feet Aboveground



As noted in Section 1.6.3.2, an issue selected for detailed analysis is the effects of the proposed action on cultural resources, including ground disturbance for access roads, pole removal, and new structure installation. No other major issues of concern were identified by Western through internal scoping, consultation with coordinating agencies, or through comments provided during public scoping. To date, no traditional cultural properties (TCPs) or other areas of tribal importance have been identified either by the tribes participating in the government-to-government consultation process or as a result of the Class III inventories. With the exception of portions of the underground variants and areas where rights-of-entry were not granted, the alternative ROWs have been inventoried for cultural resources. In the event a portion of an alternative that has not been previously inventoried is selected, additional inventories would be completed prior to project construction. Development of the project could affect NRHP-eligible cultural resources (i.e., historic properties), if they are present in the APE.

The following impacts were considered as a result of constructing and operating the proposed project:

- Potential impacts resulting from surface-disturbing activities, such as access to construction areas by large machinery, improvement of existing access roads, use of staging areas for storage of equipment and supplies, and future maintenance activities. These physical impacts could occur to both known sites and subsurface sites that could be discovered and disturbed during ground-disturbing activities.
- Potential construction impacts that include changes in erosion patterns.
- Potential impacts to historic properties related to off-road vehicle traffic associated with construction or maintenance.
- Potential impacts to historic properties from increased access to areas or increased numbers of people during construction resulting in vandalism and illegal artifact collection.
- Potential impacts resulting from introducing visual or auditory elements associated with new structures and auditory emissions in an otherwise rural or natural setting that is out of character with a resource.

Potential effects to TCPs or other areas of tribal importance to Native Americans will continue to be addressed in the context of the NHPA, American Indian Religious Freedom Act of 1978, and other regulations that provide for Federal protection of these types of sites and consideration of religious practices that might be impacted as a result of the project. Potential adverse effects to areas of tribal importance considered in this analysis could include:

- Impacts related to physical damage to cultural, traditional, religious, or sacred sites.
- Visual impacts resulting from project development.
- Noise impacts resulting from project construction and operation.
- Loss of access.
- Infringement on the practice of religion by traditional practitioners.

4.15.1 Methodology

Surface disturbance impacts were evaluated for each alternative using the following method:

- Review of potential impacts to historic properties is based on review of the existing literature and site information collected during the Class III pedestrian inventories conducted by Alpine (Section 3.15.1), including a comparison of the number of historic properties for each alternative.
- Review of existing literature and site information collected during the Class III inventories, as well as the government-to-government consultation efforts for potential impacts to Native American traditional values.

With the exception of portions of the underground variants and areas where rights-of-entry were not granted, all of the existing transmission lines, proposed reroutes, and existing access roads have been inventoried to Class III standards. Class III inventories would be conducted for any new access roads identified during the design phase. All built environments that are 45 years or older would be recorded at a level adequate to determine project effects. Any information on the location of cultural resources would be treated in accordance with Section 304 of the NHPA and Section 9 of the Archaeological Resources Protection Act of 1979.

4.15.2 Significance Criteria

A significant impact on cultural resources and Native American traditional values would result if any of the following were to occur from construction or operation of the proposed project:

- Damage to, or loss of, a site of archaeological, tribal, or historical value that is listed, or eligible for listing, on the NRHP.
- Loss or degradation of a TCP or sacred site, or if the TCP or site is made inaccessible for future use.

Impacts are considered significant if actions result in effects to properties listed or determined eligible for inclusion in the NRHP or considered important to Native American groups as measured by:

- Physical destruction or alteration of a property or relocation from its historic location;
- Isolation or restriction of access;
- Change in the character of the property's use or of physical features within the property's setting, or the introduction of visible, audible, or atmospheric elements that are out of character with the significant historic features of the property;
- Neglect that leads to deterioration or vandalism; and
- Transfer, sale, or lease from Federal to non-Federal control, without adequate and legally enforceable restrictions or conditions to ensure the preservation of the historic significance of the property.

Significance, under NEPA, is detailed in 40 CFR 1508.27 and is distinct from archaeological significance. Archaeological significance is measured by four categories defined by 36 CFR 60.4:

"The quality of significance in American history, architecture, archaeology, and culture present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that:

A. Are associated with events that have made a significant contribution to the broad patterns of our history;
B. Are associated with the lives of persons significant in our past;
C. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D. Have yielded, or may be likely to yield information important in prehistory or history" (36 CFR 60.4).

4.15.3 Impacts Common to All Alternatives

Development of the project could directly or indirectly affect historic properties or sites of importance to Native Americans. **Table 4.15-1** lists all cultural resources, including historic properties, documented along each project alternative. Ground-disturbing activities associated with installation of the transmission line structures, including foundations, improvement of existing access roads, establishment of new spur roads, demolition activities, use of temporary work areas and staging areas for storing equipment and supplies, and future maintenance activities would have the potential to directly impact historic properties or sites of importance to Native Americans. These physical impacts could occur to both known sites and subsurface sites and could result in the vertical and horizontal displacement of soil containing cultural materials, damage to or destruction of artifacts and features, and loss of archaeological data.

Potential indirect effects associated with the project could include changes in erosion patterns due to construction activities, soil compaction, or vegetation removal; off-road construction and maintenance vehicle traffic; or, vandalism, inadvertent damage, or illegal artifact collection as a result of increased numbers of people in the APE during project construction and maintenance. Other potential indirect effects could include visual impacts to historic properties, TCPs, or other sites of tribal importance where setting is an aspect of the site's integrity.

Table 4.15-1 Sites Documented during the Class III Inventories

Site Number	Site Type	NRHP-Eligibility Determination by Western		Alternative						
			No Action	A	A1	A2	B	C	C1	D
5LR827	Pinewood School (along Alternatives C & D reroute)	Recommended not eligible						X	X	X
5LR801	Rowe Cabin (along access road)	Determined not eligible	X	X	X	X				X
5LR2148	Log cabin	Determined not eligible	X				X	X	X	X
5LR3992\ 5LR9390	Pole Hill Power Plant and Switchyard	Within existing CBT project Historic District; contributing element – determined as eligible	X	X	X	X	X	X	X	X
5LR3994	Pole Hill Afterbay Dam	Within existing CBT project Historic District; contributing element – determined as eligible	X	X	X	X	X	X	X	X
5LR3995	Little Hell Creek Diversion Dam	Within existing CBT project Historic District; contributing element – determined as eligible	X							X
5LR4003	Pole Hill Canal	Within existing CBT project Historic District; contributing element – determined as eligible	X	X	X	X	X	X		X
5LR9388	F-PH Transmission Line	Determined not eligible	X				X	X	X	X
5LR12920	Ranch complex	Determined eligible	X	X	X	X		X	X	X
5LR12921	Mine adit	Determined not eligible	X				X	X	X	X

Table 4.15-1 Sites Documented during the Class III Inventories

Site Number	Site Type	NRHP-Eligibility Determination by Western	Alternative							
			No Action	A	A1	A2	B	C	C1	D
5LR12922	Log cabin and associated features	Determined eligible	X	X	X	X				X
5LR12923	Can scatter	Determined not eligible	X				X	X	X	X
5LR12924	Isolated find	Determined not eligible	X	X	X	X		X	X	X
5LR12925	Isolated find	Determined not eligible	X				X			X
5LR12926	Isolated find (along access road)	Determined not eligible; SHPO did not agree with eligibility determination – recommends additional work	X	X	X	X				X
5LR12927	Isolated find	Determined not eligible						X	X	
5LR12928	Isolated find	Determined not eligible	X				X	X	X	X
5LR13201	John Grieg Homestead	Recommended as eligible							X	
5LR13202	Isolated find	Recommended as not eligible			X					

Source: Satterwhite 2012.

In consultation with the Colorado SHPO and interested Tribes, Western would determine whether construction of the project would affect any historic properties, TCPs, or other sites considered important to Native American groups. If these types of sites would be adversely affected, mitigation would be proposed to minimize or mitigate those effects. Mitigation may include, but not be limited to, one or more of the following measures: 1) avoidance through siting of the transmission structures and access roads or the use of realignment of the transmission line, relocation of staging areas, or changes in the construction and/or operational design; 2) data recovery, which may include the systematic professional excavation of an archaeological site or the preparation of photographic and/or measured drawings documenting standing structures; or 3) the use of landscaping or other techniques that would minimize or eliminate effects on the historic setting or ambience of standing structures. Western anticipates that by following the procedures outlined in Section 106 of the NHPA, adverse impacts to historic properties, TCPs, or other sites of tribal importance would be avoided or mitigated.

Western's SCPs would help prevent other impacts to historic properties, TCPs, or other sites of tribal importance during construction and maintenance activities. To minimize vandalism and unauthorized collecting of archaeological material during construction, all construction personnel would be educated on the significance of cultural resources and the relevant Federal regulations intended to protect them (SCP 4). Access to the construction area would be limited to the ROW, existing roads, and any newly designated routes to reduce the potential effects to historic properties and sites of tribal importance as a result of off-road driving by project personnel (SCP 1). To reduce impacts related to changes in erosion patterns caused by construction, ground surface restoration and reclamation techniques would be carried out to minimize erosion and facilitate natural revegetation (SCP 3, SCP 6, and SCP 26). If previously unknown cultural resources are discovered during construction, all ground-disturbing activities at the location of the discovery would be suspended until the provisions of the NHPA have been carried out (SCP 46).

In those instances where site avoidance is the agreed mitigation, construction activities would be monitored or sites flagged to prevent inadvertent destruction of historic properties or sites of tribal importance (SCP 44). Additionally, construction crews would be monitored to the extent possible to prevent vandalism or unauthorized removal or disturbance of cultural artifacts or materials (SCP 45). Where site avoidance is the agreed mitigation, there would be no effect from any project alternative.

To reduce the potential for visual effects, the contractor would exercise care to preserve the natural landscape, and would conduct its construction operations to prevent any unnecessary destruction, scarring, or defacing of the natural surroundings in the vicinity of the work (SCP 5). In addition, construction staging areas would be located and arranged in a manner to preserve trees and vegetation to the maximum practicable extent (SCP 7).

Increased maintenance activities, expansion of the ROW, and acquisition of new ROW could result in direct and indirect effects to historic properties or sites of Tribal importance located within or adjacent to the transmission line ROW and access roads. SCPs would be employed to minimize potential adverse effects during maintenance activities; therefore, Western anticipates that no adverse direct or indirect effects to historic properties or sites considered important to Native American groups would occur.

Short-term impacts include direct disturbance to historic properties or sites of Tribal importance as a result of project-related construction activities or illegal collecting and vandalism related to increased numbers of people in the APE during construction activities. These types of impacts would be avoided or mitigated through implementation of Western's SCPs. Therefore, no short-term impacts would be anticipated as a result of project alternatives.

Long-term impacts could include indirect disturbance due to changes in erosion patterns as a result of expanding the ROW or acquiring new ROW. Vandalism or illegal collecting of artifacts as a result of increased numbers of people in the APE during maintenance activities most likely would continue to occur at current levels. Erosion impacts would be minimized through implementing Western's SCPs, and impacts would be negligible or minor.

4.15.4 No Action Alternative

Class III inventories have been conducted along the No Action Alternative and associated access roads. As a result of the inventories, 13 historic sites and four historic isolated finds were documented along the No Action Alternative and associated access roads (**Table 4.15-1**).

Direct and indirect impacts for areas of new construction would be the same as those described in Section 4.15.3. Short-term and long-term effects would be the same as those described in Section 4.15.3.

4.15.5 Impacts Unique to Specific Action Alternatives

A summary of historic sites documented along project alternatives is included in **Table 4.15-1**.

A total of six historic sites and two historic isolated finds were documented along Alternative A and associated access roads during the Class III inventories.

A total of six historic sites and three historic isolated finds were documented along Alternative A with Variant A1 and associated access roads during the Class III inventories.

A total of six historic sites and two historic isolated finds were documented along Alternative A with Variant A2 and associated access roads during the Class III inventories.

As a result of the Class III inventories, eight historic sites and two historic isolated finds were documented along Alternative B.

A total of nine historic sites and four isolated finds were documented along Alternative C and associated access roads during the Class III inventories.

A total of nine historic sites and four historic isolated finds were documented along Alternative C with Variant C1 and associated access roads during the Class III inventories.

As a result of the inventories, 12 historic sites and four historic isolated finds were documented along Alternative D and associated access roads.

Direct and indirect impacts for Alternatives A, B, C, and D would be the same as those described in Section 4.15.3. Short-term and long-term effects for these alternatives would be the same as those described in Section 4.15.3.

Impacts to historic properties or sites considered important to Native American groups located in the APE would be avoided or mitigated through implementation of a historic properties treatment plan and Western’s SCPs. Impacts to previously unknown historic properties or sites of Tribal importance that may be discovered during maintenance activities would be mitigated under Western’s SCPs.

4.15.6 Mitigation

Impacts to historic properties or sites of Tribal importance located in the APE would be avoided or mitigated through implementation of a historic properties treatment plan and Western’s SCPs. Impacts to previously unknown historic properties or sites of Tribal importance that may be discovered during construction activities would be mitigated under Western’s SCPs. Therefore, no additional mitigation is recommended.

4.15.7 Residual Impacts

Per Section 4.15.5 above, and considering Alternative D would involve construction along both existing transmission lines, Alternative D has the greatest number of historic properties encountered per literature review and pedestrian surveys. Residual impacts to historic properties or sites considered important to Native American groups are anticipated to be negligible or minor. There would be no significant impacts to cultural resources or Native American traditional values from any of the alternatives.

4.15.8 Irreversible and Irretrievable Commitment of Resources

Historic properties could be irreversibly and irretrievably lost if inventory, avoidance, and/or mitigation efforts are not sufficient to identify and protect these properties. However, all potential ground disturbing site activities would have Class I and Class III inventories of them prior to construction. Western would locate structures and access to avoid known cultural sites.

4.15.9 Relationship between Short-term Uses and Long-term Productivity

The project would result in the loss of short-term use and long-term productivity of cultural resources not eligible for the NRHP and located in proposed disturbance areas. Currently, there are no known historic properties that cannot be avoided by the project. However, if an historic property is located in proposed disturbance areas and cannot be avoided, data recovery or other types of mitigation would be conducted prior to project construction in accordance with NHPA regulations and Western’s SCPs. The scientific information obtained through mitigation would be preserved for the long-term. However, the property itself ultimately would be lost. There could be a long-term loss of cultural resources due to illegal collecting of artifacts and vandalism associated with project construction and operation.

4.16 Transportation

The analysis area for transportation resources includes roads that transect the alternatives as well as the local road network that would be utilized to directly access the proposed alternatives. Issues associated with transportation are congestion, travel impediments and adequate emergency access. Key issues as defined in Section 1.6.3.1, Key Issues, include effects of new road construction in inaccessible areas with difficult constructability in solid rock outcrops. Other issues selected for detailed analysis related to transportation as presented in Section 1.6.3.2, include effects of road construction, road reconstruction, road reconditioning and ongoing maintenance on wetlands, soils, and water quality.

4.16.1 Methodology

Impacts to transportation were assessed by comparing projected additional travel demand due to project activities to existing daily traffic counts. Construction labor and operational staff projections for the proposed transmission line rebuilds were used as a basis for identifying impacts that may occur during construction and operations. Construction of transmission lines could be carried out using multiple work crews over wide-ranging time periods.

In addition, a quantitative comparison of the alternatives is presented on the differences for issues including the number of miles that require construction within areas that are presently not accessible with difficult constructability in rock outcrops, as well as, the length and disturbance areas for temporary and permanent access roads; and length of USFS road to be reconstructed or reconditioned.

4.16.2 Significance Criteria

A significant impact on transportation resources would result if any of the following were to occur from constructing or operating the proposed project:

- A decrease of long-term roadway or intersection effectiveness below present service level.
- Creation of permanent impediments to traffic.
- Creation of road conditions that would require frequent and recurring roadway repair or maintenance.

4.16.3 Impacts Common to All Alternatives

The primary transportation impacts that would occur would apply to all alternatives. Western would utilize access roads already in service for the existing transmission lines; however, where existing access roads are not available, Western would acquire additional easement and follow USFS road construction requirements and Western's SCPs to gain access. Direct and indirect impacts to transportation resources would come from increases in traffic due to increased vehicle trips during construction activities. Increases in project traffic would occur along the local road network including existing access roads. These increases would not exceed the service level of any roadway. Roads subject to interference by construction or maintenance work would be kept open without unreasonable delays or suitable detours would be provided and maintained. Protection of the public would be provided as required by OSHA 1926, Subpart G (Signs, Signals, and Barricades) and by the public agency having law enforcement jurisdiction for the roadway. Direct and indirect impacts to transportation resulting from constructing and operating the proposed transmission lines rebuild would be moderate but not be significant.

During construction activities, short-term impacts would occur from increased vehicle trips associated with equipment and material delivery and worker transportation. An increase in vehicle trips would result in additional truck volume along the local road network. The resulting increase in traffic volume is projected to fall within the capacity of roads within the project area. Construction vehicles and equipment would be staged at either staging areas (i.e., vehicles such as concrete trucks, semi-trailers), at structure locations (i.e., cranes, bulldozers, augers), or on USFS administrative roads constructed to new structure sites. Construction traffic on USFS ML2 roads would be intermittent and short-term, and would not close existing ML2 roads. In the absence of construction pull-outs, high clearance vehicles would likely need to find a place to pull off a road if they meet construction traffic traveling in the opposite direction. The impacts from the projected increase in traffic volume would be short-term, decreasing when construction activities are completed. Long-term impacts would be associated with traffic generated by periodic maintenance trips utilizing the local road network and maintenance roads. USFS ML2 roads would need to be temporarily closed for short periods of time during clearing, augering, and structure installation activities where these activities occur in proximity to the road. The periodic maintenance would include road maintenance to sustain road conditions. These visits would be intermittent and would result in a negligible impact.

4.16.4 No Action Alternative

Under the No Action Alternative, the existing transmission lines would remain in service through continuing structure replacement and maintenance. Maintenance requirements on the existing lines would increase with as much as 70 to 80 percent of all structures in need of replacement as a result of age and subsequent deterioration. At one location, specifically a segment through the Newell Lake View subdivision, the existing line would have to be relocated on a new ROW due to several residences being adjacent to the existing ROW.

Direct and indirect impacts associated with the No Action Alternative and the relocation of the transmission line at the Newell Lake View subdivision would be similar to those described in Impacts Common to All Alternatives. Direct and indirect impacts to transportation resulting from the No Action Alternative would be minor as a result of the low level of project generated traffic having a slight but detectable effect on local roadway traffic levels.

Short-term and long-term impacts associated with the No Action Alternative would be similar to those described in Impacts Common to All Alternatives.

4.16.5 Impacts Unique to Specific Action Alternatives

It is estimated that constructing the transmission lines would require 10 to 15 construction workers devoted to transmission line construction. Given the small number of workers and construction vehicles it is anticipated that direct and indirect traffic disruptions on existing roads would be minimal and localized, resulting in no significant impacts.

New access roads would be required to access new structures sites that are not accessible from existing access roads. Areas where new access would be acquired would experience increased levels of truck traffic during construction. Direct and indirect impacts to transportation resulting from the action alternatives would be minor due to the low level of project-generated traffic.

Incremental lower levels of truck traffic would result from Alternative D due to less concrete truck trips associated with differing construction techniques on wood H-frame poles vs. the single pole structures, although auguring and other construction activities would still require an increased number of trips relative to baseline conditions. This decrease in truck trips relative to the other action alternatives would be negligible. An elevated level of traffic would result from Variants A2 and C1 as an increased level of concrete would be needed during construction for the cable trenches. Even with an increased level of traffic associated with these variants, the overall increase in traffic levels are expected to result in minor impacts.

Temporary short-term disturbances would result from construction traffic along the ROW and local road network as noted in **Table 4.16-1**, but would subside when construction is completed. Long-term disturbance for permanent new access roads by alternative is provided in **Table 4.16-1**. Alternative D would have the greatest long-term disturbance due to the need to provide access to two transmission lines.

Site-specific access requirements off National Forest System land cannot be determined until final design and engineering. However, on National Forest System land an assumption of pole-for-pole replacement was made. Based on this assumption, access requirements for each of the alternatives were determined.

Table 4.16-1 Summary of Short-term and Long-term Surface Disturbance for Access Routes

Disturbance Type	A	A1	A2	B	C	C1	D
Short-term disturbance for temporary access (acres)	7	7	7	7	8	8	0
Long-term disturbance for permanent access (acres)	10	10	11	13	10	9	21

* Assumes 8-foot-wide access route for temporary access and 15-foot-wide access route for permanent access. Permanent access would be 12 feet wide on roads on National Forest System land.

The miles of system roads, permanent access, and temporary access needed for removal of existing line and new construction under each of the action alternatives is summarized in **Table 4.16-2**. Alternative D requires the most permanent access (2.5 miles), followed by Alternatives A, A1, and A2 (1.3 miles) and Alternatives B, C, and C1 (0.8 mile). Areas with difficult constructability due to rock outcrops include The Notch and an area west of Pole Hill Substation along the penstocks on National Forest System land. Alternative D requires more construction of permanent access in inaccessible areas with difficult constructability (1.0 mile) than Alternative A, A1, and A2 (0.6 mile) or Alternatives B, C, and C1 (0 miles). Construction of permanent access in areas with steep topography and solid rock outcrops would require extensive excavation and blasting.

Changes in classification are not anticipated for any USFS road. However, under Alternatives C and C1, Western proposes to reconstruct sections of USFS Roads 122 and 247.D, to allow for passage of semi-trailer trucks to structure locations. Under this alternative, grinding, chipping, or blasting could be used to level the grade on the west end of Pole Hill Road. Imported aggregate would be limited and used only when needed to achieve proper road grades for haul. Alternatives A, A1, A2, B, and D propose either no improvements to USFS roads or limited reconditioning to remove ruts post-construction.

Under Alternative C and Variant C1, a specific four-wheel drive section of Pole Hill Road would be reconstructed to allow for passage of heavy construction vehicles. This section would not be returned to its previous condition, resulting in the possibility of increased recreational traffic after construction due to increased accessibility.

4.16.6 Mitigation

No mitigation measures have been proposed.

4.16.7 Residual Impacts

Residual impacts would be limited to the possibility of increased recreational traffic on Pole Hill Road under Alternative C and Variant C1 after construction as a result of improvements to a portion of a four-wheel drive segment. Direct impacts associated with construction activities, such as traffic delays, are expected to be adverse, but short-term and minor in intensity, ending when construction activities cease. Direct long-term effects from periodic maintenance trips would be adverse, and the greatest for Alternative D, resulting in 21 acres of permanent disturbance. As noted in **Table 4.16-2**, Access Requirements on National Forest System land by Alternative, Alternative D requires more construction of permanent access in inaccessible areas with difficult constructability (1.0 miles) than Alternative A, A1, and A2 (0.6 mile) or Alternatives B, C, and C1 (0 miles).

Table 4.16-2 Access Requirements on National Forest System Land by Alternative

Road Category	Alternative			
	A, A1, & A2	B	C & C1	D
System Roads				
Unimproved USFS System Road (miles)	1.4	0.4	0.0	0.4
Limited reconditioning of existing Maintenance Level 2 system road post-construction (miles)	2.2	3.2	0.2	3.2
Existing Maintenance Level 2 system road reconstructed to high Maintenance Level 2 for construction (miles)	0	0	3.4	0
Permanent Access (Administrative Designation)				
Existing Western access designated for administrative use (miles)	0.4	0.2	0.2	0.6
New administrative road for permanent access (miles)	0.9	0.6	0.6	1.9
Temporary Access				
New temporary road for line decommissioning (miles)	0.4	0.9	0.9	0.0
Temporary access by non-system two-track (miles)	0.6	0.5	0.5	0.0
Temporary access by overland travel (miles)	0.3	0.3	0.3	0.0
Roads Proposed for Decommissioning				
Existing Western access to be decommissioned (miles)	0.2	0.3	0.3	0.00

There would be no significant impacts to transportation from any of the alternatives.

4.16.8 Irreversible and Irretrievable Commitment of Resources

It is anticipated that there would be no irreversible or irretrievable impacts associated with the action alternatives.

4.16.9 Relationship Between Local Short-term Uses and Long-term Productivity

The action alternatives may reduce short-term uses of local access roads during construction activities. The project would not result in any long-term loss or enhancement of productivity.

4.17 Accidents and Intentional Acts of Destruction

Transmission line projects may be the subject of intentional destructive acts ranging from random vandalism and theft to sabotage and acts of terrorism intended to disable the facility. Acts of vandalism and theft are more likely to occur than acts of sabotage and terrorism especially in remote areas. Vandalism often includes shooting of insulators. Sabotage and terrorism would most likely include destruction of key transmission line components with the intent of interrupting the electrical grid. Facilities also could become disabled from accidents, such as tree limbs falling on transmission lines as the result of storms or unauthorized trimming activities.

Estes Park is currently served by three high voltage lines. Under Alternatives A, B, and C where two single-circuit lines are combined into one double-circuit line, an intentional destructive act or an accident to the transmission line would be more likely to have a widespread effect on the local population. A widespread effect on the local population would be slightly less likely to occur under Alternative D. Under Alternative D, which would maintain two single-circuit lines, both transmission lines would have to undergo an intentional destructive act or succumb to multiple accidents simultaneously to result in a widespread effect. However, the new steel poles would be stronger than the H-frame poles they would be replacing and more resistant to intentional destructive acts, sabotage, and catastrophic events such as ice storms, wind, and fires, including intentionally set fires. Their greater height also may be a deterrent to intentional destructive acts and sabotage. Variants A2 and C1 would be built underground on the far western end of each variant. The increased difficulty of accessibility associated with Variants A2 and C1 would result in a lessened chance impact from an intentional act of destruction.

Intentional destructive acts and accidents can result in financial and environmental impacts as well as impacts to consumers and businesses who rely on power. Financial impacts are ultimately passed on to rate payers. Environmental impacts related to accidents and intentional destructive acts could include damage from electrocution of perpetrators, line crews, or the public; wildfire ignition from downed lines; and oil contamination from damaged equipment. Adverse impacts to consumers and businesses may range from minor annoyance to economic hardship.

Little or no preventive measures are available to protect the transmission line from vandalism or sabotage. However, the threat from a single act of sabotage resulting in widespread power outage would be reduced as multiple transmission lines serve the project area. Furthermore, this part of the power system is not a key facility impacting a large number of people, so it is not a likely target for terrorist activities.

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5.0 Cumulative Impacts

5.1 Introduction

This chapter describes the anticipated unique incremental impacts to the region for each resource with direct and indirect impacts. The analysis of the potentially affected resources is based on the professional judgment and experience of Western, USFS, and EIS contractor resource specialists; discussions with other agency resource experts and professionals; literature reviews; and field trips to the study area by resource personnel.

The goal of this chapter is to disclose, to the greatest extent possible, the incremental effects of the project on the resources in the cumulative impacts study areas. The cumulative impacts study areas are determined and described individually for each resource. If quantitative data are not available, qualitative estimates are provided to facilitate the comparison of alternatives by the public and decision makers.

Potential past and present actions and reasonably foreseeable future actions in the project vicinity that may have environmental impacts on resources assessed in this EIS include:

- Big Thompson Fuel Reduction Project – USFS;
- Big Thompson to Flatiron – Line Structure Replacements;
- Canal Lining Replacement, Pole Hill Canal, Colorado-Big Thompson Project;
- Proposed Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department;
- Flatiron to Valley and Estes to Lyons – Line Structure Replacements;
- Hazardous Fuels Treatment Project – USFS;
- Vegetation Management Projects and yearly hazard tree maintenance – Western.
- Residential/subdivision development and home construction on private lands primarily along the main roadways along the valley bottoms and in the North Fork Little Thompson River Drainage, including associated infrastructure (roads, power lines, etc.);
- Livestock grazing in the one active grazing allotment;
- Timber harvest over the last 100 years for homesteads and ranches;
- Recreational motorized use;
- Disturbance from recreational hunting pressure; and
- Wildfire fuels reduction activities. These activities are anticipated to continue in the future. No project plans submitted to state or federal agencies have been identified as reasonably foreseeable for the purposes of this analysis.

5.2 Air Quality

The cumulative impacts study area for air quality includes the area within 62 miles (100 km) of project boundaries. Visibility impacts to Class I areas are often analyzed at much greater distances. Past and present actions and reasonably foreseeable future actions that may have environmental consequences on air quality include:

- Canal Lining Replacement, Pole Hill Canal, Colorado-Big Thompson Project;
- Hazardous Fuels Treatment Project – USFS; and
- Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department.

All of these projects have had or would have the potential to generate criteria pollutants and GHG, mostly from vehicle exhaust and fugitive dust from disturbed soil. The potential air impacts would be temporary, and if the projects were not constructed concurrently any impacts would be additive. These projects would undergo NEPA analyses, be constructed and maintained according their respective agency Best Management Practices, and/or be conducted according to other local, state, and federal regulatory approvals and provisions.

Construction and operation of the project would cause incremental increases in some pollutants which in combination with past and present actions and reasonably foreseeable future actions, produce a cumulative impact. However, because the proposed project alternatives are not anticipated to cause impacts above current air quality criteria, the incremental increase in cumulative impacts to air quality would be short-term and minor or insignificant in intensity. Any of the cumulative project-related emissions would be minute compared to the current vehicle output of 10,000 vehicles that use U.S. Highways 34 and 36 create on a daily basis on either side of the project.

5.3 Geology

No project alternative is anticipated to cause significant impacts to geology, mineral resources, or paleontology. Therefore, there would be no incremental increase in cumulative impacts to geology, mineral resources, or paleontology.

5.4 Soil Resources

The cumulative impacts study area for soil resources is the same as the analysis area described in Section 4.4. The past and present actions and reasonably foreseeable future actions that may have environmental consequences on soil resources include:

- Canal Lining Replacement, Pole Hill Canal, Colorado-Big Thompson Project;
- Thompson River Fuel Reduction Project
- Hazardous Fuels Treatment Project – USFS; and
- Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department.

All of these projects have had or would have the potential to create surface disturbance to soil resources, thus increasing the potential for soil compaction, accelerated runoff, erosion, and sedimentation. In general, cumulative impacts to soil resources would result in short-term impacts to soil resources. An exception would be the Chimney Hollow Reservoir project, which would result in long-term impacts to soil resources.

In general, incremental increases in cumulative impacts to soil resources in the cumulative impacts study area from the proposed project alternatives would be limited based on the proposed SPCs.

5.5 Water Resources and Floodplains

The cumulative impacts study area for water resources and floodplains are the four hydrologic units transected by the project (Lake Estes/Big Thompson, Headwaters Little Thompson River, North Fork Little Thompson River, and Dry Creek – OBTR). The past and present actions and reasonably foreseeable future actions that may have environmental consequences on surface water, groundwater, or floodplains that would be similar to those of the project alternatives include:

- Flatiron to Valley and Estes to Lyons – Line Structure Replacements;
- Canal Lining Replacement, Pole Hill Canal, Colorado-Big Thompson Project;
- Hazardous Fuels Treatment Project – USFS;
- Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department;
- Big Thompson to Flatiron – Line Structure Replacements; and
- Big Thompson Flooding 2013.

All of these projects or events have had or would have the potential to create accelerated runoff and sedimentation, cuts-and-fills or other disturbance at stream crossings, or impacts to groundwater supplies or quality from excavation or discharge. Additional effects from the proposed Chimney Hollow Reservoir may include greater evaporation losses from the reservoir surface, dam seepage and water table effects, and impacts from water rights considerations and trans-mountain flows needed to fill the reservoir.

In general, incremental increase in cumulative impacts to water resources from the proposed project alternatives would be short-term, minor increases in runoff and sediment yield, resulting in a temporary degradation of water quality in the receiving streams. The cumulative impacts of this project and those listed above would be primarily short-term adverse changes in water quality that would dissipate when construction ends. There would be no incremental increase in cumulative impacts to groundwater or floodplains.

5.6 Wetlands and Waters of the U.S.

The cumulative impacts study area for wetland and waters of the U.S. resources is defined as the HUC 12 watersheds crossed by the proposed project alternatives. The cumulative analysis for wetland and waters of the U.S. focuses on five past and present actions and reasonably foreseeable future actions that are likely to affect wetland and waters of the U.S. resources:

- Big Thompson to Flatiron – Line Structure Replacements;
- Canal Lining Replacement, Pole Hill Canal, Colorado-Big Thompson Project;
- Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department;
- Flatiron to Valley and Estes to Lyons – Line Structure Replacements; and
- Thompson River Fuel Reduction Project; Hazardous Fuels Treatment Project – USFS.

Depending on when the past projects were constructed, jurisdictional wetland and waters of the U.S. impacts may have been impacted without consultation with the USACE. Mitigation for impacts may or may not have occurred.

Incremental losses for wetland and waters of the U.S. from the proposed project alternatives potentially would include the reduction of numerous wetland and riparian functions, including soil stability, erosion control, and species biodiversity due to surface disturbance for all alternatives. Incremental increases in cumulative impacts from this project would be minor and related to wetland and waters of U.S crossing that could not be avoided. Western’s standard operating procedure is into avoid any wetland area unless there is no option available. If avoidance is possible, Western will adhere to SCPs and USACE 404 permit requirements.

5.7 Vegetation

The cumulative impacts study area for vegetation resources is the same as the analysis area. The cumulative analysis for vegetation resources, including noxious weeds and wildland fires focuses on five past and present actions and reasonably foreseeable future actions that are likely to affect vegetation resources, noxious weeds, and wildland fire:

- Residential/subdivision development and home construction on private lands primarily along the main roadways along the valley bottoms and in the North Fork Little Thompson River Drainage, including associated infrastructure (roads, power lines, etc.);
- Flatiron to Valley and Estes to Lyons – Line Structure Replacements and yearly hazard tree maintenance;
- Canal Lining Replacement, Pole Hill Canal, Colorado-Big Thompson Project;
- Hazardous Fuels Treatment Project – USFS; and
- Big Thompson to Flatiron – Line Structure Replacements.

Depending when the past projects were constructed, some type of mitigation may have been required to minimize the impacts to less than significant. Past and present actions and reasonably foreseeable future actions would cumulatively reduce available vegetation cover types in the cumulative impacts study area until such time that reclamation is deemed successful. Successful reclamation is defined as re-establishing a sustainable vegetation community that has similar species diversity and vegetative cover compared to similar undisturbed native vegetative communities.

Incremental increases in cumulative impacts associated with the No Action Alternative would be related to acquisition of additional ROW, and additional maintenance activities associated with the existing line. Minor incremental increases in cumulative impacts to vegetation resources from the proposed project alternatives potentially would include the changes in numerous habitat functions including soil stability, erosion control, species biodiversity, acreage of woodlands, wildlife forage and habitat, and available forage for livestock grazing operations. The spread of new noxious weed species into the project area, or existing species into previously native habitats would be a significant cumulative impact if it occurred, however SCPs are in place to minimize the spread and establishment of noxious weeds.

5.8 Special Status Plant Species

The cumulative impacts study area for special status species is the same as the analysis area. The cumulative analysis focuses on past and present actions and reasonably foreseeable future actions that are likely to affect special status species:

- Flatiron to Valley and Estes to Lyons – Line Structure Replacements;
- Canal Lining Replacement, Pole Hill Canal, Colorado-Big Thompson Project;
- Hazardous Fuels Treatment Project – USFS;
- Big Thompson to Flatiron – Line Structure Replacements; and
- Range Fuels Treatment Partnership Implementation Strategy.

Incremental increases in cumulative impacts associated with the No Action Alternative would be related to acquisition of additional ROW, and additional maintenance activities associated with the existing line. Past and present actions and reasonably foreseeable future actions would incrementally reduce available special status species habitat until such time that reclamation is deemed successful.

Cumulative losses or special status species for all action alternatives potentially would include the reduction of available special status habitat, fragmentation of forest canopy, and losses of woody habitat species. The project incremental impacts would be minor based on the small amount of surface disturbance associated with the proposed project.

5.9 Wildlife

The cumulative impacts study area is contained within the Elk Ridge Geographic Area (GA), located east of U.S. Highway 36 and south of U.S. Highway 34. This area has excellent year-round habitat for wildlife. It is a mix of foothills shrub-grass communities, juniper-ponderosa pine communities on south slopes, and Douglas-fir on north slopes. Some lodgepole pine occurs at higher elevations. Remnants of old growth ponderosa pine occur in the area. Elevations vary from 6,200 to 9,284 feet. The goal of the GA is to manage vegetation to achieve a mix needed for wildlife habitat and to reduce fuel loading, especially near subdivisions.

The Elk Ridge GA contains a mixture of homes situated between wildlife areas. These wildland-urban interface zones are the focus of the Range Fuels Treatment Partnership Implementation Strategy. The partnership is comprised of federal, state, and local governments, land management agencies, private landowners, conservation organizations and other stakeholders. The purpose of the partnership is to reduce wildland fire risks through sustained fuels treatment along Colorado’s Front Range to work to enhance community sustainability and restore fire-adapted ecosystems over a 10-year period. The partnership assessed areas and activities that were of greatest concern.

Activities within these areas includes timber harvest to increase habitat potential and control fuel buildups; manage lodgepole pine to reduce fuels, create openings and maintain thermal and hiding cover; increase the amount of aspen represented in the landscape; and manage ponderosa pine to emulate conditions representative of a nonlethal understory fire regime, to emphasize old-growth recruitment and retention and to reduce fuels.

Primary past and present actions and reasonably foreseeable future actions within the cumulative impacts study area for wildlife that can have appreciable impacts on habitat include:

- Residential/subdivision development and home construction on private lands primarily along the main roadways along the valley bottoms and in the North Fork Little Thompson River Drainage, including associated infrastructure (roads, power lines, etc.);
- Past livestock grazing in the one vacant grazing allotment;
- Timber harvest over the last 100 years for homesteads and ranches;
- Recreational motorized use;
- Disturbance from recreational hunting pressure; and
- Wildfire fuels reduction and vegetation management activities within the Thompson Valley and Estes Valley Fuels Treatment Areas (FTAs).

Residential development on private lands is expected to continue, but it would likely be confined primarily to the immediate valley bottoms on or near the main roads, as currently exists, due to steep slopes and because National Forest System lands are prevalent on upper slopes and higher elevations. Private and other lands not under USFS jurisdiction comprise 8,023 acres of the Elk Ridge GA or about 28 percent of the 28,726-acre GA. However, the large majority of this acreage would not likely be developed for homes due to steep slopes or ownership patterns, and therefore would continue to provide habitat with little permanent human disturbance. This lack of development generally provides habitat conditions with limited and infrequent disturbance.

Within the Thompson Valley and Estes Valley FTAs, vegetation management activities include clear cuts, aspen enhancement, and forest thinning practices. Impacts to wildlife habitat based on the two USFS FTAs within the study area are detailed in **Table 5.9-1**. These activities are anticipated to continue in the future. No project plans submitted to state or federal agencies have been identified as additional reasonably foreseeable for the purposes of this analysis.

Table 5.9-1 Affected Vegetation within the Thompson Valley and Estes Park Fuel Treatment Areas

Cover Type	Acres
Forested	70.59
Grassland	314.35
Barren	1.44
Shrub	61.43
Shrub - Riparian	0.18
Aspen	244.15
Douglas-fir	816.24
Lodgepole Pine	1,995.84
Ponderosa Pine	1,832.69
Subalpine Fir / Engelmann Spruce	148.30
Surface Water	5.64
Grand Total	**5,490.84**

Cumulative impacts from any action alternative or variants would incrementally increase in the cumulative impacts study area during the project construction, but would gradually decrease during operation of the proposed project alternatives as reclamation occurs. Cumulative impacts from past and present activities within the cumulative impacts study area common to all wildlife species and whether the proposed project alternatives would create incrementally increases in cumulative impacts are discussed below:

- Reduction of suitable wildlife habitat and increased habitat fragmentation: While surface disturbance generally corresponds to associated wildlife habitat loss, accurate calculations of cumulative wildlife habitat loss cannot be determined because the direct impacts of habitat disturbance are species-specific and dependent upon: 1) the status and condition of the population(s) or individual animals being affected; 2) seasonal timing of the disturbances; 3) value or quality of the disturbed sites; 4) physical parameters of the affected and nearby habitats (e.g., extent of topographical relief and vegetative cover); 5) value or quality of adjacent habitats; 6) the type of surface disturbance; and 7) other variables that are difficult to quantify (e.g., increased noise and human presence. As foraging, hunting, breeding, nesting, and rearing habitats are removed, overall quality of wildlife habitat also would decrease. In areas where development has previously occurred, habitat fragmentation may have resulted in the disruption of seasonal patterns or migration routes. Current or previous surface disturbance in the cumulative impacts study area primarily results from residential/subdivision development and home construction as well as construction and operation of associated infrastructure. Other activities such as livestock grazing also contribute to cumulative impacts on wildlife habitat (e.g., reduction of available forage/biomass). The incremental reduction of suitable wildlife habitat and increased habitat fragmentation would be minor considering the SPCs and the utilization of existing ROWs for the action alternatives.
- Temporary Animal displacement: Displaced individuals of any species could be forced into less suitable habitats, possibly resulting in subsequent potential effects of deteriorated physical condition, reproductive failure, mortality, and general distress as important habitat is reduced and animals are displaced. Loss of habitat/forage consequently could result in increased competition between and among species for available resources. Some wildlife

species, such as raptors and big game, would be susceptible to these cumulative impacts because encroaching human activities in the cumulative impacts study area has resulted, or would result, in animal displacement in areas that may be at their relative carrying capacity for these resident species.

Many of the local wildlife populations (e.g., small game, migratory birds) that occur in the cumulative impacts study area likely would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development. Displacement of individuals also could reduce hunting success in the area. The incremental animal displacement caused by the proposed rebuild alternatives and the No Action alternative would be temporary during construction. Based on design criteria proposed for breeding raptors and avian species, displacements are not expected to occur from the proposed project alternatives.

- Decreased reproductive success: A decrease in reproductive success and physical condition from increased energy expenditure due to physical responses to disturbance could lead to increased mortality. Incremental decreases due to the proposed project alternatives would be low considering the short duration of construction and maintenance activities.
- Increased vehicle/wildlife collisions: An increase in traffic levels within the cumulative impacts study area during construction has the potential to incrementally increase vehicle/wildlife collisions. Potential increased human utilization of resources through hunting and other recreational activities that would expose wildlife to potential human harassment, either inadvertent or purposeful, would increase wildlife collisions. However, because the proposed project would utilize existing ROWs and vehicle speeds would be low due to road types and conditions, the incremental increases in wildlife collisions would be minor.

Details regarding specific cumulative effects to wildlife species identified as potentially occurring within the project area are discussed below.

Big Game

Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, power lines, etc.) and recreation have the most potential to affect these species by encroaching on their range, altering habitat use patterns, and increasing hunting pressure due primarily to increased public access. However, this increase in access for the proposed project is anticipated to be minor and is likely to result in a negligible increase in overall hunting pressure.

Big game species within the project area utilize all habitats impacted by the project. Impacts to riparian habitats important to black bear and moose would be negligible. Approximately 6 acres of surface water and less than 0.5 acre of shrub riparian areas are located within the FTAs.

Vegetation management within the FTAs may impact forage quality for deer and elk. Forage conditions are likely to remain the same or improve slightly in the FTAs, as most canopy cover would be retained, resulting in a similar amount of light and moisture reaching the forest floor. Hiding and thermal cover and migration corridors would likely be degraded as removal of ladder fuels and the crushing of understory plants with machinery would result in temporarily reduced amounts of horizontal cover. However, impacts to foraging habitat is anticipated to be minor in significance and not result in the decline of local populations due to the abundance of available habitat within the project vicinity.

None of the past, present, and reasonably foreseeable future activities discussed above would have appreciable impacts to preferred mountain lion habitat within the study area because they generally do not occur within steep, rocky terrain. Recreational activities within the study area would have the most potential to create avoidance of otherwise suitable habitat. Additional impacts to mountain lion populations would directly correlate with the effects of actions on deer populations. However, impacts to deer habitat is anticipated to be minor and not result in the decline of local populations due to the abundance of available habitat within the project vicinity.

Therefore, the project is not expected to lead to or contribute to appreciable cumulative effects for big game species when added to impacts from past, present, and reasonably foreseeable future activities.

Raptors, Game Birds, and Other Bird Species

As discussed in Section 3.9, a variety of raptor and songbird species utilize the project vicinity. Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, power lines, etc.) and recreation have the most potential to affect these species by encroaching on their range, altering habitat use patterns, and increasing hunting pressure on upland game birds due primarily to increased public access. However, this increase in access for the proposed project is anticipated to be minor and is likely to result in a negligible increase in overall hunting pressure.

Within FTAs, the amount of suitable habitat impacted is detailed above in **Table 5.9-1**. Species associated with forested habitats generally would be more susceptible to cumulative effects due to the long-term nature for these habitats to re-establish. Within the FTAs, approximately 4,864 forested acres may be subject to timber management practices. However, Forest Plan goals and desired conditions generally would lead to the maintenance or improvement over time of forest habitat for these species, which are associated with or forage around mature forested habitats. For these species, the FTAs should lead to improved habitat conditions over time by maintaining and developing more rapidly (than without thinning activities) mature and old-growth forest habitat conditions, which would benefit potential nesting and roosting habitat. Given this and the Forest Plan direction for the analysis area, the project is not expected to lead to or contribute to appreciable cumulative effects for these species, when added to impacts from past, present, and reasonably foreseeable future activities.

Special status or sensitive bird species are discussed in Section 5.10.

Amphibians and Reptiles

The majority of common amphibians and reptile species found in Colorado have life history requirements linked to the presence of aquatic habitats. Cumulative impacts to surface waters are discussed in Section 5.5. Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, power lines, etc.) and recreation have the most potential to affect these species by encroaching on their range and altering habitat use patterns. The two FTAs would have minimal impacts to suitable habitat for these species. Approximately 6 acres of surface water and less than 0.5 acre of shrub riparian areas are located within the FTAs. Therefore, the project would not result in or contribute to appreciable cumulative impacts for these species.

Special status or sensitive amphibian species are discussed in Section 5.10.

The incremental impacts from this project and ongoing and future development in the cumulative impacts study area would cumulatively reduce the ability of wildlife habitats in the cumulative impacts study area to support wildlife populations at their current levels for the lifetime of the anticipated project-related development, production, and reclamation. Cumulative impacts would continue until such time that reclamation is deemed successful. Successful reclamation is assumed to re-establish wildlife habitats to pre-disturbance conditions.

Based on the large amount of available habitat and minimal amount of past, present, and foreseeable actions within our CESA, no impacts to genetic diversity or biodiversity would be expected. It is anticipated that cumulative impacts to wildlife would not be significant.

5.10 Special Status and Sensitive Wildlife Species

The cumulative impacts study area, as well as past and present actions and reasonably foreseeable future actions reviewed for special status species is the same as described in Section 5.9, Wildlife. As discussed in Section 5.9, wildlife species have been cumulatively impacted by past and present activities and would be incrementally impacted from any action alternative. The impacts generally would be the same as discussed above in Section 5.9, Wildlife. Species associated with forested habitats generally would be more susceptible to cumulative effects due to the long-term nature for these habitats to re-establish. In general, the severity of the cumulative effects would depend on factors such as the sensitivity of the species impacted, seasonal intensity of use, type of action, and physical parameters (e.g., topography, forage, and cover availability). Details regarding specific cumulative effects to special status and sensitive species identified as potentially occurring within the study area are discussed below.

Townsend's Big-eared Bat

Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, power lines, etc.) and recreation have the most potential to affect these species by encroaching on their range and altering habitat use patterns. Within the FTAs, approximately 4,864 acres of forested acres may be subject to timber management practices. However, vegetation management activities associated with the designated FTAs in the study area would result in beneficial impacts for the Townsend's big-eared bat. The proposed thinning treatments would treat primarily understory trees, and leave most of the mature overstory trees within potential foraging habitat. FTA treatments would have a long-term positive effect on foraging habitat due to maintaining and restoring more open forest conditions of ponderosa pine and mixed Douglas-fir/ponderosa stands in the treatment units. The thinning also would reduce the risk of wildfire. The clearcut treatment units may create foraging habitat by creating openings and edge habitat in what currently is dense single-story lodgepole pine stands. Consequently, there is low potential for adverse cumulative impacts to occur for this species from implementation of the FTA treatments or the Project.

Fringed Myotis, Hoary Bat, Northern Goshawk, Flammulated Owl, Lewis' Woodpecker, Olive-sided Flycatcher, Golden-crowned Kinglet, and Pygmy Nuthatch

Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, powerlines, etc.) and recreation have the most potential to affect these species by encroaching on their range and altering habitat use patterns. Within the FTAs, approximately 4,864 acres of forested acres may be subject to timber management practices. However, with regard to these USFS sensitive species, Forest Plan goals and desired conditions generally would lead to the maintenance or improvement over time of forest habitat for these species, which are associated with or forage around mature forested habitats. For these species, the FTAs should lead to improved habitat conditions over time by maintaining and developing more rapidly (than without thinning activities) mature and old-growth forest habitat conditions, which would benefit potential nesting and roosting habitat. Given this and the Forest Plan direction for the analysis area, the project is not expected to lead to or contribute to appreciable cumulative effects for these species, when added to impacts from past, present, and reasonably foreseeable future activities.

American Marten

None of the past, present, and reasonably foreseeable future activities discussed above would have appreciable impacts to marten habitat within the analysis area because they generally do not occur within potential marten habitat. The activities have occurred or would occur at lower elevations outside of higher-elevation potential marten habitat. Within the FTAs, approximately 150 acres of spruce-fir and 2,000 acres of lodgepole pine may be subject to timber management practices. However, the habitat quality for marten in these stands is low because of the predominantly small size class (dbh) of lodgepole pine, lack of multi-story structure, and lack of down wood. These stands generally are single-story stands with little down wood or horizontal structure, which is prevalent in preferred or high-quality marten habitat, such as late-successional spruce-fir forests. Because only a limited amount of low-quality potential marten habitat would be impacted by the FTAs, the project would not result in or contribute to appreciable cumulative impacts for marten.

Bald Eagle, Wilson's Warbler, Boreal Toad, Northern Leopard Frog, Common Gartner Snake, Arapahoe Snowfly, and Hudsonian Emerald Dragonfly

Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, powerlines, etc.) and recreation have the most potential to affect these species by encroaching on their range and altering habitat use patterns. The two FTAs would have minimal impacts to suitable habitat for these species. Approximately 6 acres of surface water and less than 0.5 acre of shrub riparian areas are located within the FTAs. Additionally, regarding bald eagle nesting and roosting trees, typically large mature trees are not targeted for removal. Therefore, neither the FTAs nor the project would result in or contribute to appreciable cumulative impacts for these species.

Peregrine Falcon

None of the past, present, and reasonably foreseeable future activities discussed above would have appreciable impacts to peregrine falcon habitat within the study area because they generally do not occur within potential peregrine falcon nesting habitat. Recreational activities within the study area would have the most potential to create avoidance of otherwise suitable habitat. Nesting habitat for peregrines does not exist within the two FTAs, but the use of ponderosa pine forests for foraging may be impacted by the reduction of approximately 2,000 acres. However, impacts to foraging habitat is anticipated to be minor in significance and not result in the decline of local populations due to the abundance of available habitat within the project vicinity. Therefore, neither the project nor the FTAs would result in or contribute to appreciable cumulative impacts for these species.

Elk and Mule Deer

Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, powerlines, etc.) and recreation have the most potential to affect these species by encroaching on their range and altering habitat use patterns. Forage conditions are likely to remain the same or improve slightly in the FTAs, as most canopy cover will be retained, resulting in a similar amount of light and moisture reaching the forest floor. Hiding, thermal cover, and migration corridors would likely be degraded because removal of ladder fuels and the crushing of understory plants with machinery would result in reduced amounts of horizontal cover. However, impacts to foraging habitat is anticipated to be minor in significance and not result in the decline of local populations due to the abundance of available habitat within the project vicinity. Therefore, neither the project nor the FTAs would result in or contribute to appreciable cumulative impacts for these species.

Mountain Bluebird

Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, powerlines, etc.) have the most potential to affect this species by encroaching on their range and altering habitat use patterns. The treatments proposed would occur primarily within stands and therefore are not likely to influence primary habitat for mountain bluebirds. The FTAs would impact approximately 375 acres of open grasslands and shrub land habitats utilized by this species. However, the current vegetation in the study area is underrepresented in mature stand types which provide the larger trees and snags with suitable cavities for bluebird nesting. Treatments within the FTAs are expected to create opportunities for stands to develop into mature structure and maintain existing snags unless they are a safety concern. Existing nest trees and the structure associated with them should still be available to provide nesting opportunities, as well as prey habitat. The clearcut treatment within the FTAs may create openings and edge habitat in what currently is dense single-story lodgepole pine stands. Therefore, neither the FTAs nor the project would result in or contribute to appreciable cumulative impacts for these species.

Hairy Woodpecker

None of the past, present, and reasonably foreseeable future activities discussed above would have appreciable impacts to woodpecker habitat within the analysis area because this species is considered secure in Colorado. Cumulatively, on-going activities on private lands such as continued home building and its associated activities (infrastructure, power lines, etc.) have the most potential to affect this species by encroaching on their range and altering habitat use patterns. Within the FTAs, approximately 4,864 acres of forested acres may be subject to timber management practices. However, the habitat quality for the hairy woodpecker in these stands is low because of the predominantly small size class (dbh) of lodgepole pine, lack of multi-story structure, and lack of down wood. The FTAs represent a variety of proposed activities that would likely move to balance young to mature forested habitats. Mature stands and grasses are currently underrepresented in these areas. Treatments are expected to create opportunities for stands to develop into mature structure. Design criteria maintain existing snags unless they become a safety concern. Reduction of the extent and intensity of wildfire may harm this species, because they are an abundant post-fire species. Neither the project nor the FTAs would not result in or contribute to appreciable cumulative impacts for these species.

In summary, no cumulative impacts to special status wildlife species are anticipated under the No Action Alternative. Incremental impacts to special status wildlife species from any action alternative would be minor. The cumulative impacts to special status wildlife species would be additional losses of habitat and habitat degradation over the lifetime of this project and other actions. On federally managed lands (and in many cases, on State of Colorado lands and private lands), operators/ proponents are typically required to conduct pre-construction surveys in potential or known habitats of threatened, endangered, or otherwise special status wildlife species. These surveys would help determine the presence of any special status wildlife species or extent of habitat. Protective measures then would be developed in consultation with the USFS, DOI, CPW, and USFWS to avoid or minimize direct disturbance in these habitats.

5.11 Land Use and Recreation

The cumulative impacts study area for land use and recreation is the same as the direct effects study area, and includes a 1-mile buffer around the project centerline. Past and present actions and reasonably foreseeable future actions may have environmental consequences on land use activities. These actions have had or would have the potential to create short-term disruptions to land uses as a result of surface disturbances. In general, cumulative impacts to land uses would result in short-term impacts to land uses during construction activities and long-term benefits after construction because land uses would either resume or be enhanced due to more available acreage.

The past and present actions and reasonably foreseeable future actions within the cumulative impacts study area that may have cumulative impacts on recreation include:

- Big Thompson Fuel Reduction Project – USFS;
- Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department;
- Vegetation Management Projects – Western; and
- Private development.

All of these projects have had or would have the potential to result in impacts to recreation opportunities and experiences due to delays in accessing a site, noise and visual disturbances to the recreation setting, surface disturbance that results in vegetation removal and bare ground, or disturbance to wildlife. Effects from the proposed Chimney Hollow Reservoir would include additional recreation opportunities provided at the reservoir. Effects to the recreation setting from creation of the reservoir would be long-term.

In general, incremental impacts from this project to recreation would affect recreational resources, particularly hunting, depending on the timing and location of the use relative to the project construction schedule. In general, cumulative impacts from all action alternatives would be moderate or less in intensity and would be short-term, except for transmission line relocations near Pinewood Reservoir, which would have long-term effects on the recreation setting as a result of the higher more visible towers. Impacts on OHV use on Pole Hill Road would remain significant, unaffected by other past, present, or reasonably foreseeable actions.

5.12 Visual Resources

All of the past and present actions and reasonably foreseeable future actions described in Section 5.1 may have environmental consequences on scenic resources. Overall impacts will be significant, but the proposed project is not contributing much to the total, and is not pushing the impacts to a new level. In addition, other electric transmission and distribution lines within or near the project area contribute to cumulative visual effects. The lattice transmission structures along the Lake Estes Causeway dominate foreground views near Lake Estes and have greater visibility from KOP 12 than the steel monopoles proposed for the transmission line rebuild. Wood and steel pole distribution lines present in residential subdivisions crossed by the proposed project also contribute to cumulative visual effects.

The existing landscape character is defined by a combination of dense conifer stands in mountainous areas and open, shrub and grass covered foothills fragmented by small towns and rural subdivisions. Until recently, the forested areas provided limited, visibility is limited to the immediate foreground due to mature mixed conifer and ponderosa stands. However, extensive mountain pine beetle infestations have and are presently affecting large portions of these stands, resulting in a brown hue to the forest and pockets of die-off throughout the analysis area. Mechanical and prescribed burn forest treatments are and would continue to be implemented in response to mountain pine beetle infestations. As a result of large-scale forest succession and planned treatments, the existing landscape character would likely transition from a densely forested, uniform-aged evergreen condition to a mosaic of open patches of grasses, shrubs, aspen, and evergreen forests of varying age classes. Although forest management including wildfires may have short-term adverse effects, the resulting long-term condition would have negligible to beneficial effects on scenic quality and scenic integrity. As tree mortality, wildfires, and tree clearing activities related to mountain pine beetle continue to increase, the proposed project alternatives would become more visible. Adverse impacts to sensitive viewers would increase until regrowth occurs to screen the transmission line(s) in forested areas.

Past actions also have modified the landscape character, including reservoir development and water conveyance infrastructure, transmission and distribution electrical infrastructure, state highway and local transportation networks, and residential and commercial land development. Past actions have been concentrated in the Estes Valley and, to a lesser extent, near Flatiron Reservoir. The existing scenic values and recreational opportunities continue to attract recreational and residential development. Land conversion from ranching and natural open space landscapes to more intensive recreational resorts and residential and commercial subdivisions with requisite electric utilities would likely continue in the foreseeable future. Land development and forest fragmentation would result in a loss in scenic quality and scenic integrity.

Present and reasonably foreseeable transmission replacement, maintenance, and vegetation management activities by Western in the analysis area would result in similar adverse effects as the project. In combination with past and present actions and reasonably foreseeable future actions, the project's continuation of vegetation maintenance and structure replacement would incrementally contribute to adverse visual character changes in the region. Further, openings within forested areas from large-scale die-off, wildfires, forest succession, planned treatments, and new residential and commercial uses would potentially increase visibility of the proposed project. Because the project repairs an existing transmission line, effects are reduced relative to a new ROW in an area without an existing transmission line. The incremental contribution to long-term adverse cumulative effects would be minor and adverse.

5.13 Socioeconomics and Environmental Justice

The cumulative impacts study area for socioeconomic resources is the same as the direct effects study area with an emphasis on the Town of Estes Park.

Past and present actions and reasonably foreseeable future actions that may have environmental consequences on socioeconomics and environmental justice include the following projects:

- Big Thompson Fuel Reduction Project – USFS;
- Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department;
- Vegetation Management Projects – WAPA; and
- Continuing residential development.

These actions have had or would have the potential to create short-term benefits to the local economy as a result of construction activities. Past and present actions and reasonably foreseeable future actions would not permanently displace an existing residence or business, result in an increase in population that would create shortages of housing and place an excessive burden on local resources, reduce economic viability of a major sector of a community, ranch, or other business, or impact environmental justice populations. Incremental impacts to socioeconomics and environmental justice from this project would include minor effects on property values adjacent to the proposed project alternatives, and an incremental increase in reliable energy transmission.

5.14 Electrical Effects and Human Health

The cumulative impacts study area for electrical effects and human health is the same as the direct effects study area. No project alternative is anticipated to cause significant electrical effects or impacts to human health. Therefore, there would be no incremental impacts on human health.

5.15 Cultural Resources and Native American Traditional Values

The cumulative impacts study area includes the APE described in Section 4.15, plus a 2-mile buffer. Currently, past and present actions and reasonably foreseeable future actions in this area are limited to:

- Residential/subdivision development and home construction on private lands primarily along the main roadways along the valley bottoms and in the North Fork Little Thompson River Drainage, including associated infrastructure (roads, power lines, etc.);
- Livestock grazing in the one active grazing allotment;
- Timber harvest over the last 100 years for homesteads and ranches;
- Recreational motorized use; and
- Disturbance from recreational hunting pressure.

This project is not anticipated to appreciably contribute to unavoidable adverse cumulative impacts. Indirect effects, such as illegal collecting of artifacts, most likely would continue to occur at current levels in the cumulative impacts study area as a result of increased access and continued development in the area.

5.16 Transportation Resources

The cumulative impacts study area for transportation resources is the same as the direct effects study area. Past and present actions and reasonably foreseeable future actions that may have environmental consequences on transportation resources include the following projects:

- Big Thompson Fuel Reduction Project – USFS;
- Chimney Hollow Reservoir – NCWCD and Larimer County Natural Resources Department; and
- Vegetation Management Projects – WAPA.

These actions have had or would have the potential to create localized congestion on the regional road network through increased vehicle trips. In general, the proposed project alternatives would incrementally increase cumulative impacts to transportation resources, creating short-term delays during construction activities, particularly if several projects were implemented at the same time. These possible delays would cease after completion of construction activities. As a result, only minor contributions to cumulative impacts from this project are anticipated.

5.17 Accidents and Intentional Acts of Destruction

The cumulative impacts study area for accidents and intentional acts of destruction includes the analysis area and the surrounding electrical transmission network. No project alternative is anticipated to cause significant effects or impacts. Therefore, there would be no incremental impacts contributing to cumulative impacts.

6.0 Preparers, Agencies and Persons Consulted, and Distribution List

6.1 List of Preparers

The individuals listed in **Table 6.1-1** and **Table 6.1-2** were actively involved with the preparation of this EIS.

Table 6.1-1 Lead and Cooperating Agency Staff

Name	Agency	Project Role
Mark Wieringa	Western	NEPA Document Manager
Tim Snowden	Western	NEPA Document Manager
Dave Swanson	Western	Contract Environmental Specialist/NEPA
Travis Anderson	Western	Project Manager
Carey Ashton	Western	Land and Realty Specialist
Allen Turner	Western	Electrical Engineer
Ron Turley	Western	Vegetation Management
Claire Douthit	Western	General Counsel/Legal Sufficiency Review
Ree Rodgers	Western	Archaeologist
Kevin Atchley	U.S. Forest Service	District Ranger
Sue Greenley	U.S. Forest Service	NEPA Document Manager/Lands Staff
Karen Roth	U.S. Forest Service	Forest Environmental Coordinator/NEPA
Reghan Cloudman	U.S. Forest Service	Public Affairs
Kevin Colby	U.S. Forest Service	Landscape Architect/Visual Resources
Andrea Van der Ohe	U.S. Forest Service	Recreation
Dick Edwards	U.S. Forest Service	Fire, Fuels, & Timber Management
Dale Oberlag	U.S. Forest Service	District Wildlife Biologist
Steve Popovich	U.S. Forest Service	Forest Botanist
Deb Entwistle	U.S. Forest Service	North Zone Hydrologist
Lizandra Nieves-Rivera	U.S. Forest Service	Soils
Sue Struthers	U.S. Forest Service	Forest Archeologist
Kipp Klein	U.S. Forest Service	Engineer
Janice Naylor	U.S. Forest Service	GIS

Table 6.1-2 EIS Contractors

Name	Firm	Project Role	Academic Credentials
Anne Doud	AECOM	Project Manager/NEPA	MS, Ecology
Jim Paulson	AECOM	Senior Reviewer	BS, Civil Engineering
Steve Graber	AECOM	Land Use, Socioeconomics, Public Health & Safety, Noise	BS, Natural Resources Management; BA, Economics
Terra Mascareñas	AECOM	Soils	BS, Soil and Crop Science
Bill Berg	AECOM	Geology & Paleontology	MS, Geology
Anne Ferguson	AECOM	Recreation	MS, Environmental Sustainability BS, Natural Resource Recreation and Tourism
Kim Munson	AECOM	Cultural Resources	MA, Anthropology
Andrew Newman	AECOM	Wildlife Biology	BS, Conservation Biology/Wildlife Management
Erin Bergquist	AECOM	Vegetation & Wetlands	MS, Ecology
Jim Burrell	AECOM	Water Resources	MS, Civil Engineering BS, Forest Management
Paul Swartzinski	AECOM	Forestry & Fire Management	MS, Restoration Ecology BS, Rangeland Ecology
Vince Scheetz	AECOM	Air Quality	Graduate Studies, Atmospheric Science MS, Systems Management
Brian Taylor	AECOM	GIS Analyst	BA, Geography
Bruce Meighen	Logan Simpson Design	Principal, Public Involvement	Master of City Planning
Tom Keith	Logan Simpson Design	Principal, Senior Reviewer	MS, Regional Resource Planning
Tanya Copeland	Logan Simpson Design	Project Manager/NEPA	MS, Ecology and Evolution
Jeremy Call	Logan Simpson Design	Visual Resources	Master of Landscape Architecture
Jeremy Palmer	Logan Simpson Design	Visual Simulation	AAS, Computer Animation
Ryan McClain	Logan Simpson Design	Visual Simulation	BS, Landscape Architecture
Casey Smith	Logan Simpson Design	GIS Analyst	BS, Natural Resources Management and GIS
Kristy Bruce	Logan Simpson Design	GIS Analyst	Master of Landscape Architecture

6.2 List of Agencies and Persons Consulted

Individuals consulted during preparation of the EIS are listed in **Table 6.2-1** below. These individuals were interviewed at the onset of the EIS process to help define issues and develop the public participation plan for the EIS.

Table 6.2-1 List of Agencies and Persons Consulted

Name	Agency or Organization	Role or Title
Edward Nichols	Office of Archaeology and Historic Preservation	State Historic Preservation Officer
Susan Linner	U.S. Fish and Wildlife Service	Colorado Field Supervisor
Larry Gamble	National Park Service, Rocky Mountain National Park	Chief, Branch of Planning and Compliance
Lara Rozzell	National Park Service, Intermountain Region	Ecologist/Renewable Energy Specialist
Pam Shaddock	U.S. Senator Mark Udall, Northeast Office	Regional Director
James Thompson	U.S. Senator Michael Bennet	Regional Director
Dan Betts	U.S. Representative Cory Gardner	Aid to Congressman Cory Gardner
Jeffrey Boring	Larimer County Natural Resources Department	Resource Specialist II
Robert Helmick	Larimer County Planning	Senior Planner
Frank Lancaster	Town of Estes Park	Town Administrator
Reuben Bergsten	Town of Estes Park	Utilities Director
Chris Bieker	Upper Thompson Sanitation District	District Manager

6.3 Draft EIS Distribution List

6.3.1 Federal, State, and Local Agencies and Officials, and Project Partners

An electronic or printed copy of the Draft EIS was distributed to the elected officials, tribal representatives, agencies, and other organizations identified in **Table 6.3-1** below.

Table 6.3-1 Draft EIS Distribution List

Name/Title	Organization
Federal Elected Officials	
Senator Mark Udall	U.S. Senate
Senator Michael Bennet	U.S. Senate
Congressman Jared Polis (District 2)	U.S. House of Representatives
Congressman Cory Gardner (District 4)	U.S. House of Representatives
Tribal Representatives	
The Honorable Janice Prairie Chief Boswell, Governor	Cheyenne and Arapaho Tribes of Oklahoma
Ms. Karen Little Coyote, Cheyenne Director, Culture and Heritage	Cheyenne and Arapaho Tribes of Oklahoma
Mr. Dale Hamilton, Arapaho Director, Culture and Heritage	Cheyenne and Arapaho Tribes of Oklahoma
Mr. William C'Hair	Northern Arapaho Culture Commission
Ms. Darlene Conrad, Tribal Historic Preservation Officer	Northern Arapahoe Tribe of The Wind River
Mr. Linwood Tallbull, Tribal Historic Preservation Officer	Northern Cheyenne Tribe
The Honorable Pearl Casias, Chairman	Southern Ute Indian Tribe
Mr. Neil Cloud, NAGPRA Representative	Southern Ute Indian Tribe
The Honorable Ronald Wopsock, Chairman	Ute Indian Tribe
Ms. Betsy Chapoose, Director of Cultural Rights and Protection	Ute Indian Tribe
State Elected Officials	
Governor John Hickenlooper	Governor of Colorado
Senator Kevin Lundberg (15th District)	Colorado General Assembly
Representative Perry Buck (49th District)	Colorado General Assembly
Federal Agencies	
Ms. Suzanne Bohan, Program Director	NEPA Compliance and Review Program, EPA Region 8
Ms. Sue Greenley, Lands Staff	USDA Forest Service, Arapaho-Roosevelt National Forests and Pawnee National Grasslands
Dr. Willie R. Taylor, Director	Office of Environmental Policy and Compliance, Department of the Interior
Mr. Mike Collins, Eastern Colorado Area Manager	U.S. Bureau of Reclamation
Ms. Lucy Maldonado, Environmental Specialist	U.S. Bureau of Reclamation
Mr. Larry Gamble, Chief	Branch of Planning and Compliance, Rocky Mountain National Park

Name/Title	Organization
State Agencies	
Mr. Mike King, Executive Director	Colorado Department of Natural Resources
Mr. Bill Ryan, Director	State Land Board
Mr. Bob Broscheid, Director	Colorado Parks and Wildlife
Mr. Christopher Urbina, Executive Director	Colorado Department of Public Health and Environment
Local Agencies/Officials	
Mr. Tom Donnelly, County Commissioner (District 3)	Larimer County Commissioners Office
Mr. Terry Gilbert, Community Development Director	Larimer County Planning & Building Services
Mr. Robert Helmick, Senior Planner	Larimer County Planning & Building Services
Mr. Gary Buffington, Director	Larimer County Natural Resources Department
Mr. Jeffrey Boring, Resource Specialist II	Larimer County Natural Resources Department
Mr. Frank Lancaster, Town Administrator	Town of Estes Park
Mr. Reuben Bergsten, Director	Town of Estes Park Utilities Department
Mr. Chris Bieker, District Manager	Upper Thompson Sanitation District
Mr. John Collins, System Planning Manager	Platte River Power Authority
Other Organizations & Stakeholders	
Mr. Thomas Gootz, Director	Association for Responsible Development
Mr. Kirk Cunningham	Sierra Club, Rocky Mountain Chapter
Mr. Christopher Jones and Ms. Kimberly Krohmer	Responsible Lines
Mr. Frank Morgan	Horsetooth Four Wheelers
Mr. Tom Adams, Ranch Manager	Crocker Ranch
Interested Party	Estes Park Baptist Church

6.3.2 Individuals Receiving Copies of the Draft EIS

The Draft EIS is available on the project website at http://go.usa.gov/rvtP. In addition, a printed copy of the Draft EIS Summary and a transmittal letter containing a link to download the full Draft EIS was mailed to approximately 400 individuals on the project mailing list. The project mailing list includes affected landowners, individuals that provided comments during the public scoping period, individuals on the notification list maintained by the USFS, and other stakeholders.

The following individuals also received a printed or compact disk (CD) copy of the full Draft EIS, per their request.

Name	Name	Name	Name
Michael Aldridge	Jean & Ingrid Drouin	Ron & Joann Nicholson	Harry V. Thomas
George & Melinda Archey	Audrey Elens	Judy Nystrom	Andrea Thorne
Craig C. Axtell	Trent Forrister	Larry Olson	Roger Waldfogel
Thomas Beck	Diane Hackett Carlton	Gordon M. Pederson	Edward Wheeler
Leon & Valentine Berberian	Steven K. Imig	Thomas & Cheryl Poff	Zeke Williams
Craig Burke	Larry Lawson	Thomas Reed	Linda Wilson
Karen Chionio	Rodger & Erika Libby	Barbara Sax	James Wiegand & Janet Collins
Terry Chiplin	Linda Poppe	Pamela Shaddock	
Kevan & Roberta Davidson	Helen Miller	Reggie & Mary Elizabeth Smith	
Carol Dreselly	Albert J & Anna Mary Moresco	Elliot Sproul	

A printed copy of the Draft EIS is available for public review at Western's Corporate Services Office (12155 West Alameda Parkway, Lakewood, Colorado), the Loveland Public Library (500 East Third Street, Loveland, Colorado) and the Estes Park Public Library (335 East Elkhorn Avenue, Estes Park, Colorado).

6.4 Contractor Disclosure Statement

Pursuant to 40 CFR 1506.5(c), AECOM, Inc., headquartered at 555 South Flower Street, 4th Floor, Los Angeles, CA 90071-2201, has certified that AECOM and their subcontractors have no financial or other interests in the outcome of this project. A copy of the signed Conflict of Interest Disclosure is on file with Western's Contracting Officer.

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8.0 INDEX

Appendix A

Notice of Intent to Prepare an EIS

The Commission encourages electronic submission of protests and interventions in lieu of paper, using the FERC Online links at *http://www.ferc.gov.* To facilitate electronic service, persons with Internet access who will eFile a document and/or be listed as a contact for an intervenor must create and validate an eRegistration account using the eRegistration link. Select the eFiling link to log on and submit the intervention or protests.

Persons unable to file electronically should submit an original and 14 copies of the intervention or protest to the Federal Energy Regulatory Commission, 888 First St. NE., Washington, DC 20426.

The filings in the above proceedings are accessible in the Commission's eLibrary system by clicking on the appropriate link in the above list. They are also available for review in the Commission's Public Reference Room in Washington, DC. There is an eSubscription link on the web site that enables subscribers to receive email notification when a document is added to a subscribed docket(s). For assistance with any FERC Online service, please email *FERCOnlineSupport@ferc.gov.* or call (866) 208–3676 (toll free). For TTY, call (202) 502–8659.

Comment Date: 5 p.m. Eastern time on Wednesday, April 18, 2012.

Dated: April 10, 2012.

Kimberly D. Bose,

Secretary.

[FR Doc. 2012–9121 Filed 4–16–12; 8:45 am]

BILLING CODE 6717–01–P

DEPARTMENT OF ENERGY

Western Area Power Administration

[DOE/EIS–0483]

Estes to Flatiron Substation Transmission Lines Rebuild Project, Larimer County, CO

AGENCY: Western Area Power Administration, DOE.

ACTION: Notice of Intent To Prepare an Environmental Impact Statement and To Conduct Scoping Meetings; Notice of Floodplain and Wetlands Involvement.

SUMMARY: Western Area Power Administration currently owns and operates two 115-kilovolt transmission lines on two separate rights-of-way (ROW) located between Flatiron Reservoir (near Loveland, Colorado) and the town of Estes Park, Colorado. Each transmission line is approximately 16 miles long. Western is proposing to remove one transmission line and abandon the ROW. The remaining transmission line would be rebuilt along the existing ROW with taller steel monopoles and would be double-circuited (i.e., six conductors per pole).

Western determined that an environmental impact statement (EIS) is the appropriate level of NEPA review. Therefore, Western will prepare an EIS on its proposal to upgrade and co-locate two existing separate transmission lines on a double-circuit transmission line on one ROW in accordance with NEPA, the DOE NEPA Implementing Procedures, and the Council on Environmental Quality (CEQ) regulations for implementing NEPA. Portions of Western's proposal may affect floodplains and wetlands, so this Notice of Intent (NOI) also serves as a notice of proposed floodplain or wetland action in accordance with DOE floodplain and wetland environmental review requirements.

DATES: This notice initiates a 90-day public scoping process to solicit public comments and identify issues, opportunities, and concerns that should be considered in the preparation of a Draft EIS. The scoping period will end on July 16, 2012, or 15 days after the date of the last public scoping meeting, whichever is later. In order to ensure consideration in the Draft EIS, all comments must be received prior to the close of the scoping period. Western will provide additional opportunities for public participation upon publication of the Draft EIS. The public will be notified in advance of future opportunities for participation as the EIS is prepared.

To provide the public with an opportunity to review the proposal and project information, Western expects to hold two public meetings: One meeting in Estes Park, Colorado and one meeting in Loveland, Colorado during the public scoping period. Western will announce the dates and locations of the public scoping meetings through local news media, newsletters, and posting on the Western Web site at *http://ww2.wapa.gov/sites/western/transmission/infrastruct/Pages/Estes-Flatiron.aspx,* at least 15 days prior to each meeting. Western will consider all comments on the scope of the EIS received or postmarked by the end of scoping. The public is invited to submit comments on the proposal at any time during the EIS process.

ADDRESSES: Comments related to the proposed Project may be submitted by mail to Tim Snowden, Western Area Power Administration, 5555 E. Crossroads Blvd., P.O. Box 3700, Loveland, CO 80539–3003, fax (970) 461–7213, or email, *RMR_estesflatironeis@wapa.gov.*

FOR FURTHER INFORMATION CONTACT: For additional information on the proposed project, the EIS process, or to receive a copy of the Draft EIS when it is published, contact Tim Snowden by the methods noted above. For general information on the DOE's NEPA review process, contact Carol M. Borgstrom, Director of NEPA Policy and Compliance, GC–54, U.S. Department of Energy, 1000 Independence Avenue SW., Washington, DC 20585–0119, telephone (202) 586–4600 or (800) 472–2756, fax (202) 586–7031.

SUPPLEMENTARY INFORMATION: Western is a Federal power marketing agency within the DOE that markets and delivers Federal wholesale electric power (principally hydroelectric power) to municipalities, rural electric cooperatives, public utilities, irrigation districts, Federal and State agencies, and Native American tribes in 15 western and central states.

Western initially began preparation of an environmental assessment (EA) for the Project. Western's proposal was under a class of actions in the DOE NEPA Implementing Procedures (10 CFR part 1021) that normally requires the preparation of an EA. Subsequent to the EA determination, Western held public meetings and received many written and oral comments from the public and agencies on the proposal during the scoping period. The public expressed several concerns regarding the impacts of the proposal and some of the stakeholders requested evaluation of additional alternatives. Based on these factors, Western determined that an EIS is the more appropriate level of NEPA review.[1] Therefore, Western will prepare an EIS on its proposal to upgrade and co-locate two existing separate transmission lines on a double-circuit transmission line on one ROW.

Western will coordinate with appropriate Federal, State, and local agencies and potentially affected Native American tribes during the preparation of the EIS. The U.S. Department of Agriculture, Forest Service, Arapaho and Roosevelt National Forest (Forest Service) will be a cooperating agency on the EIS since it requires NEPA review to support its decision on whether or not to grant a Special Use Permit for parts of the transmission line located on National Forest Service System lands. Western will invite other Federal, State, local, and tribal agencies with

[1] On November 16, 2011, DOE's Acting General Counsel delegated to Western's Administrator all EIS authorities.

jurisdiction by law or special expertise, with respect to environmental issues, to be cooperating agencies on the EIS, as defined in 40 CFR 1501.6. Such agencies also may make a request to Western to be a cooperating agency. Designated cooperating agencies have certain responsibilities to support the NEPA process, as specified in 40 CFR 1501.6(b).

Purpose and Need for Agency Action

Western's purpose and need for agency action is to ensure its facilities are up to current safety and reliability standards, accessible for maintenance and emergencies, protected from wildfire, and cost effective for its customers.

Proposed Action

Presently there are two transmission lines on two separate ROWs located between Flatiron Reservoir (near Loveland) and the town of Estes Park. The Estes-Lyons line segment is approximately 16 miles long and was built in 1938. The Estes-Pole Hill and Flatiron-Pole Hill line segments combined are approximately 16 miles long and were built in 1952 as part of the Colorado-Big Thompson Project. The vast majority of wood pole structures on both transmission lines are the original poles and are 60 to 72 years old.

Western's proposed Federal action (proposal) is to combine portions of both transmission lines onto a single ROW between Flatiron Reservoir and Estes Park, Colorado. Portions of both transmission lines would be removed and those portions of the ROWs abandoned. In the remaining ROW, the transmission line would be rebuilt with steel monopole structures replacing the existing wood H-frame structures, in a double-circuit configuration (i.e., six conductors per structure). In some areas, the ROW would be slightly wider than it is at present to accommodate the double circuit transmission line. There would be two short segments of new ROW, located on private land, to connect portions of the existing transmission line segments into a single ROW. There are no new substations or proposed changes to existing substations.

Presently, vehicle access is required along the entire 32 miles of existing ROW for maintenance and wood pole replacement. Most of the existing wood pole structures would need replacement in the near future and some are in need of replacement at this time. With Western's proposal, approximately 16 miles of the existing ROW would be eliminated along with the associated access roads.

Currently, the two transmission lines cross Roosevelt National Forest System lands. Approximately 1.65 miles of transmission line and ROW would be removed and 2.16 miles of transmission line would be rebuilt on National Forest System lands, under Western's proposal.

Alternatives

Under the No-Action (i.e., baseline) alternative, the two transmission lines would continue to operate on the existing and separate ROWs. Records indicate that 70 to 80 percent of the 32 miles of transmission lines would require replacement within the near future. This would require replacing transmission line structures along both existing ROWs. Access to the transmission lines is limited and replacement of structures would require additional or improved access on both ROWs. The No-Action alternative would require that the existing 30-foot ROW on the Estes-Lyons section be widened to meet current safety standards. Other alternatives may be identified through the EIS scoping process. Comments received during the EA scoping process and comments provided in response to this NOI and the EIS scoping meetings will be considered in defining the scope of the EIS.

Floodplain or Wetland Involvement

Floodplains and wetlands are in the project area. Since the proposal may involve action in floodplains or wetlands, this NOI also serves as a notice of proposed floodplain or wetland action. The EIS will include an assessment of impacts to floodplains and wetlands, and, if required, a floodplain statement of findings following DOE regulations for compliance with floodplain and wetlands environmental review (10 CFR part 1022).

Environmental Issues

Western's proposed Project area is located between Flatiron Reservoir and Estes Park, Colorado in a fairly mountainous territory and crosses open and developed areas. The area is characterized by rugged terrain with scattered developments set against the backdrop of Rocky Mountain National Park. The EIS will review relevant environmental information and will analyze the potential impacts on the full range of potentially affected environmental resources.

Public Participation

Interested parties are invited to participate in the scoping process to help define the scope of the EIS, significant resources, and issues to be analyzed in depth, and to eliminate from detailed study issues that are not pertinent. The EIS scoping process will involve all interested agencies (Federal, State, county, and local), Native American tribes, public interest groups, businesses, affected landowners, and individual members of the public.

Western has previously consulted with potentially affected or interested tribes to jointly evaluate and address the potential effects on cultural resources, traditional cultural properties, or other resources important to the tribes in the proposed Project area. Western will contact previously identified interested tribes and inform them that an EIS is planned. Any government-to-government consultations will be conducted in accordance with Executive Order 13175, Consultation and Coordination with Indian Tribal Governments (65 FR 67249), the President's memorandum of April 29, 1994, *Government-to-Government Relations with Native American Tribal Governments* (59 FR 22951), DOE-specific guidance on tribal interactions, and applicable natural and cultural resources laws and regulations.

Western will announce public EIS scoping meetings through local news media, newsletters, and posting on the Western Web site at *http://ww2.wapa.gov/sites/western/transmission/infrastruct/Pages/Estes-Flatiron.aspx,* at least 15 days prior to each meeting. Attendees will be able to speak directly with Western and the Forest Service at the EIS scoping meetings about Western's proposal. The public is encouraged to provide information and comments on issues it believes Western should address in the EIS. Comments may be broad in nature or restricted to specific areas of concern. After gathering comments on the scope of the EIS, Western will address those issues raised in the EIS. In addition, Western will use the results of the EA scoping process to help define the scope of the EIS. Comments on Western's proposal will be accepted at any time during the EIS process, and may be directed to Western as described under ADDRESSES above. Comments received outside of the designated comment periods may be addressed in the Draft EIS, otherwise they will be addressed later in the process, such as in the Final EIS, if practicable.

The EIS process will include this NOI, local EIS scoping meeting notifications, public scoping meetings; consultation and coordination with appropriate Federal, State, county, and local agencies and tribal governments; involvement with affected landowners; distribution of and public review and comment on the Draft EIS; a formal public hearing or hearings on the Draft EIS; distribution of a published Final EIS; and publication of separate Records of Decision in the **Federal Register** by Western and the Forest Service.

Dated: April 6, 2012.

Timothy J. Meeks,

Administrator.

[FR Doc. 2012–9179 Filed 4–16–12; 8:45 am]

BILLING CODE 6450–01–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–9514–9]

Agency Information Collection Activities OMB Responses

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: This document announces the Office of Management and Budget (OMB) responses to Agency Clearance requests, in compliance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*). An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA regulations are listed in 40 CFR part 9 and 48 CFR chapter 15.

FOR FURTHER INFORMATION CONTACT: Rick Westlund (202) 566–1682, or email at *westlund.rick@epa.gov* and please refer to the appropriate EPA Information Collection Request (ICR) Number.

SUPPLEMENTARY INFORMATION:

OMB Responses to Agency Clearance Requests

OMB Approvals

EPA ICR Number 1686.09; NESHAP for the Secondary Lead Smelter Industry; 40 CFR part 63, subparts A and X; was approved on 03/02/2012; OMB Number 2060–0296; expires on 03/31/2015; Approved without change.

Comment Filed

EPA ICR Number 2452.01; NESHAP for Pulp and Paper Production; in 40 CFR part 63 subparts A and S; OMB filed comment on 03/02/2012.

EPA ICR Number 2457.01; NESHAP for Group IV Polymers and Resins; in 40 CFR part 63 subparts A and JJJ; OMB filed comment on 03/02/2012.

EPA ICR Number 1811.08; NESHAP for Polyether Polyol Production; in 40 CFR part 63, subparts A and PPP; OMB filed comment on 03/06/2012.

Withdrawn and Continue

EPA ICR Number 2258.02; $PM_{2.5}$ NAAQS Implementation Rule (Renewal); Withdrawn from OMB on 03/22/2012.

EPA ICR Number 2313.02; Ambient Ozone Monitoring Regulations: Revisions to Network Design Requirements (Final Rule); Withdrawn from OMB on 03/20/2012.

John Moses,

Director, Collections Strategies Division.

[FR Doc. 2012–9107 Filed 4–16–12; 8:45 am]

BILLING CODE P

ENVIRONMENTAL PROTECTION AGENCY

[EPA–HQ–OECA–2011–0250; FRL–9515–8]

Agency Information Collection Activities; Submission to OMB for Review and Approval; Comment Request; NESHAP for Wet-Formed Fiberglass Mat Production (Renewal)

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: In compliance with the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*), this document announces that an Information Collection Request (ICR) has been forwarded to the Office of Management and Budget (OMB) for review and approval. This is a request to renew an existing approved collection. The ICR which is abstracted below describes the nature of the collection and the estimated burden and cost.

DATES: Additional comments may be submitted on or before May 17, 2012.

ADDRESSES: Submit your comments, referencing docket ID number EPA–HQ–OECA–2011–0250, to: (1) EPA online using *www.regulations.gov* (our preferred method), or by email to: *docket.oeca@epa.gov,* or by mail to: EPA Docket Center (EPA/DC), Environmental Protection Agency, Enforcement and Compliance Docket and Information Center, mail code 28221T, 1200 Pennsylvania Avenue NW., Washington, DC 20460; and (2) OMB at: Office of Information and Regulatory Affairs, Office of Management and Budget (OMB), Attention: Desk Officer for EPA, 725 17th Street NW., Washington, DC 20503.

FOR FURTHER INFORMATION CONTACT: Learia Williams, Monitoring, Assistance, and Media Programs Division, Office of Compliance, Mail Code 2223A, Environmental Protection Agency, 1200 Pennsylvania Avenue NW., Washington, DC 20460; telephone number: (202) 564–4113; fax number: (202) 564–0050; email address: *williams.learia@epa.gov.*

SUPPLEMENTARY INFORMATION: EPA has submitted the following ICR to OMB for review and approval according to the procedures prescribed in 5 CFR 1320.12. On May 9, 2011 (76 *FR* 26900), EPA sought comments on this ICR pursuant to 5 CFR 1320.8(d). EPA received no comments. Any additional comments on this ICR should be submitted to both EPA and OMB within 30 days of this notice.

EPA has established a public docket for this ICR under docket ID number EPA–HQ–OECA–2011–0250, which is available for public viewing online at *http://www.regulations.gov,* or in person viewing at the Enforcement and Compliance Docket in the EPA Docket Center (EPA/DC), EPA West, Room 3334, 1301 Constitution Avenue NW., Washington, DC. The EPA Docket Center Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Reading Room is (202) 566–1744, and the telephone number for the Enforcement and Compliance Docket is (202) 566–1752.

Use EPA's electronic docket and comment system at *http://www.regulations.gov* to either submit or view public comments, access the index listing of the contents of the docket, and to access those documents in the docket that are available electronically. Once in the system, select ''docket search,'' then key in the docket ID number identified above. Please note that EPA's policy is that public comments, whether submitted electronically or in paper, will be made available for public viewing at *http://www.regulations.gov* as EPA receives them and without change, unless the comment contains copyrighted material, Confidential Business Information (CBI), or other information whose public disclosure is restricted by statute. For further information about the electronic docket, go to *www.regulations.gov.*

Title: NESHAP for Wet-formed Fiberglass Mat Production (Renewal).

ICR Numbers: EPA ICR Number 1964.05, OMB Control Number 2060–0496.

ICR Status: This ICR is scheduled to expire on June 30, 2012. Under OMB

Appendix B

Proposed Vegetation Management for Estes to Flatiron Transmission Lines Rebuild

Vegetation Management for Estes to Flatiron Transmission Lines Rebuild

No Action Alternative (Continue Past Practices)

Under the No Action Alternative, Western would continue its infrastructure, ROW, and access road maintenance practices as they are currently defined under existing authorizations and other agreements, and treatments used during the construction of the transmission lines. The current management approach to controlling vegetation, ensuring access, and maintaining equipment is largely reactive and responds to maintenance problems when they occur. Methods to control vegetation are manual, mechanical, and chemical (herbicides). As new practices are required due to new regulatory requirements and internal program requirement changes, Western would propose, review and adopt these changes.

Under the No Action Alternative, Western would continue its management approach for ROW and transmission line maintenance. Because Western addresses primarily danger trees, as defined in its authorization[1], it must review the ROWs at least once a year to ensure that no new danger trees have appeared and remove them. This focus requires annual reentries, and in some areas more frequent reentries, into the ROW to address vegetation problems that were identified during periodic line patrols or when maintenance forces are in the ROW for other activities. Western manages vegetation using the mix of manual, mechanical, and chemical methods to control vegetation in transmission line and access route ROWs. The No Action Alternative also includes the practice of spot application of approved herbicides. Western also performs access route repairs, as needed. Transmission system maintenance activities would consist of regular aerial and ground patrols to find problems, scheduling and performing repairs to correct problems, and preventative maintenance.

The primary difference between the No Action Alternative and the Proposed Action is the proposal to change the way Western manages vegetation in ROWs. The following sections describe activities under the proposed action, including methods of vegetation management.

Proposed Vegetation Management for All Rebuild Alternatives

Western is currently authorized to use a reactive management approach for ROW and transmission line maintenance. Because current practices primarily focus on managing danger trees, the ROWs must be reviewed at least once a year to ensure that no new danger trees have appeared and remove them. This focus requires annual reentries, and in some areas more frequent reentries, into the ROW to address danger trees that were identified during periodic line patrols or when maintenance forces were in the ROW for other activities. Western manages vegetation using the mix of manual, mechanical, and chemical methods to control vegetation in transmission line and access route ROWs. Vegetation Management includes the practice of spot application of approved herbicides. Western would perform access route repairs as needed. Transmission system maintenance activities consist of regular aerial

[1] Danger trees are trees located within or adjacent to the easement or permit area that present a hazard to employees, the public, or power system facilities. Characteristics used in identifying a danger tree include but are not limited to the following: encroachment within the safe distance to the conductor as a result of the tree bending, growing, swinging, or falling toward the conductor; deterioration or physical damage to the root system, trunk, stem or limbs and/or the direction and lean of the tree; vertical or horizontal conductor movement and increased sag as a result of thermal, wind and ice loading; exceeding facility design specifications; fire risk; other threats to the electric power system facilities or worker/public safety (WAPA O 430.1A, dated 03-18-2008).

and ground patrols to find problems, scheduling and performing repairs to correct problems, and maintenance.

As part of the Estes-Flatiron Transmission Lines Rebuild, Western proposes to change the way it manages vegetation in the ROWs to a more proactive approach. This applies to each alternative for the proposed transmission lines rebuild. Western proposes manage its transmission line ROWs to better ensure the reliability and safety of the transmission lines, ensure adequate access for maintenance, protect the public and ensure worker safety, and manage risk from fire, all while ensuring the protection of environmental resources. For Forest Service-managed lands, Western proposes to acquire new authorization along with the development of a new operation and maintenance plan to include a more proactive approach for managing vegetation along Western ROWs on Forest Service-managed lands using an integrated vegetation management (IVM) approach. This approach is based on the American National Standard Institute Tree, Shrub and Other Woody Plant Maintenance-Standard Practices (Integrated Vegetation Management, a. Electric Utility ROW (ANSI A300 (Part 7)-2006 IVM). Western would proactively control vegetation growth and fuel conditions that threaten its transmission lines. For private lands, where new easements are needed for the proposed transmission lines rebuild, Western proposes to include provisions in new easements to include a more proactive approach for managing vegetation using an IVM approach. Depending on the rebuild alternative and where existing easements are adequate for proposed transmission line rebuild, Western would implement a more proactive approach for managing vegetation within the ROW to the extent allowed by any restrictions included with the existing easements.

Proposed Inspection and Transmission System Management

Western does aerial (usually by helicopter), ground, and climbing inspections of its transmission infrastructure in compliance with its internal policies, guidance, and general mandatory regulatory requirements. These inspections would continue with maintenance of the proposed transmission lines rebuild. The requirements are updated as needed. Western does the following inspections:

<u>Aerial Inspections</u>

At a minimum, Western does aerial inspections every 6 months, usually by helicopter, to monitor vegetation, and to find damaged or malfunctioning equipment. Western does aerial patrols between 50 and 300 feet above the transmission line, depending on land use, topography, and weather, and the objective of the patrol. The helicopter generally passes quickly (less than 1 minute) over a span (the area between two structures), but can circle back or hover if issues are found or more documentation is needed.

<u>Ground Inspections</u>

Annual ground-based inspections check access to the structures, vegetation conditions, fences, gates, locks, and tower hardware, and ensure that each structure would be readily accessible in an emergency. They allow for the inspection of hardware that is more difficult to inspect by air, and find access road issues such as erosion and vegetation encroachment. Ground inspections are typically done using pickup trucks, all-terrain vehicles, or by foot. Access would by existing routes and routes established during construction of the proposed transmission lines rebuild and along the transmission line ROW.

<u>Climbing Inspections</u>

Western does climbing inspections on transmission line structures if aerial or ground inspections find problems. Typically these inspections involve accessing the structures via existing access routes, or travel along the ROW in pickup trucks or all-terrain vehicles, and could require bucket trucks.

Proposed Vegetation Management Practices

The existing transmission lines are in various conditions concerning vegetation management and fuel loading. For example, there are areas that need relatively little treatment, areas that need significant treatment to bring them to a desirable condition that could then be managed efficiently, and areas with mixed conditions. This is the result of a variety of past actions, including the extent of vegetation clearing along the ROWs when transmission lines were constructed and how these areas were subsequently managed over the years; maintenance practices over many years in a variety of vegetation types that could have contributed to excessive fuel loading in the ROWs; past danger-tree cutting; site conditions (e.g., slope, soil types, rainfall, pine beetle and other beetle attacks, and diseases); tree species distribution; topography; and other variables.

Western identified six categories of existing conditions in the ROWs to help describe how Western proposes to manage vegetation. **Table B-1** summarizes the six categories of existing conditions. For Alternatives A, B, C, and D, the ROW would be treated during construction based on the conditions defined for each category. For the No Action Alternative, Western would continue to treat vegetation as currently authorized until more current management options are proposed, reviewed and adopted. All work under the proposed No Action Alternative are always subject to several considerations; including the availability of resources, both human and financial; competing priorities; relative risk of the condition to the transmission line; and sensitive or protected species or other sensitive resources. The following definitions help readers understand the descriptions of the six categories of existing conditions.

- **Threshold.** Synonyms: action threshold, trigger. The condition of vegetation or fuel load in the ROW that would initiate the need to control it. Factors include maximum desired levels of plant density or height of undesirable vegetation (also called incompatible vegetation), fuel loads, public and worker safety, and the availability of funding and crews.
- **Maintenance treatments.** Vegetation or fuel management methods and activities selected to keep vegetation or fuel in a desirable condition or to restore a desirable condition.
- **Reentry interval.** The estimated length of time to the next vegetation or fuel management treatment following construction. Several variables affect the length of the interval, such as growth rates of undesirable species, availability of human resources to do the treatments, budget constraints, and project priorities.
- **Initial treatment.** The first round of vegetation management activities used to establish a desired condition in the ROW would occur during construction. The initial treatment is typically more equipment- and resource-intensive than maintenance treatments.
- **Fast-growing undesirable vegetation.** A relatively fast-growing species that at mature height typically threatens the transmission line. The species and the site conditions determine growth rate. For example, aspen and lodgepole pine are often fast-growing undesirable species. In less-than-ideal site conditions they might grow more slowly. Conversely, normally slow growing species can be fast growing on high-quality sites.
- **Slow-growing undesirable vegetation.** A species that at mature height typically threatens the transmission line, but it is typically slow growing. Examples are spruce and fir. The growth rate might be a characteristic of the species, or it might be due to a typically faster-growing species on a marginal site, where its growth is much slower.
- **Fuel load.** The amount of fuel, whether dead or alive (green), in the ROW. Undesirable fuel loads could contribute to unacceptable risks to the transmission line from fires. Characteristics that make fuel load undesirable include how easily ignited it is, how hot it burns, how well it

sustains fire, how rapidly it burns, how long it will burn, flame lengths, and how much smoke the burn will generate.

- **Desired vegetation condition.** The acceptable or optimal condition of native vegetation in the ROW, which is generally defined by a lack of undesirable species. The species makeup of a desired vegetation condition varies depending on ROW conditions. For example, if a transmission line spans deep ravines high above trees, the desired condition might include tall-growing tree species. In other areas with less power-line-to-ground clearance, the desired vegetation condition would include lower-growth plant species.
- **Undesirable vegetation.** Synonyms: target vegetation, incompatible vegetation, unacceptable vegetation. Vegetation species that present a safety hazard and are unsuitable for the intended use of the ROW, or that at mature height would typically threaten transmission line reliability, operations, or maintenance.
- **Desirable vegetation.** Synonyms: compatible vegetation, acceptable vegetation. Vegetation species that do not present a safety hazard, and are suitable for the intended use of the ROW.

Categories of Right-of-Way Conditions and Vegetation Treatment Methods

Western identified six broad categories of ROW conditions along the existing transmission lines. The condition of the vegetation in the ROW determines whether the ROW would need to be treated soon; needs treatment over the longer term, or is unlikely to need treatment for some time. Western would routinely monitor ROWs to determine vegetation conditions. Western would manage fuel loads as needed when it treats vegetation in the ROWs as described under Category 6. **Table B-1** lists the six categories of ROW conditions and their proposed treatment methods. Photos provided in **Figure B-1** below show areas of the existing transmission line ROWs corresponding to the six categories described in **Table B-1.** These photos illustrate the types of ROW conditions associated with each category, and represent typical ROW conditions present along the existing transmission lines.

Table B-1 Categories of Right-of-way Conditions and Vegetation Treatment Methods

Category	Vegetation	Examples	Frequency of Treatment	Treatment Methods
1	ROW vegetation is compatible with the transmission line based on topography and/or presence of natural, stable, low-growing vegetation communities.	1) Where the line spans canyons, there is usually adequate clearance between vegetation and the transmission line conductors – even when larger mature trees are present; 2) a vegetation community that is already a stable, low-growth one (e.g., grasses, forbs, bushes, and shrubs) so that vegetation at mature height is not a threat to the transmission line.	None expected, but ROW monitoring would be needed to ensure conditions have not changed.	None expected.
2	Fast-growing incompatible species that are currently not acceptable, and require treatment.	Mature lodgepole pine, mature aspen, and other species on high-quality growth sites.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively frequent (expected 2- to 6-year return intervals).	Accessible sites would favor use of mechanized equipment and removal of salvageable material. Inaccessible sites would favor use of hand felling.
3	Fast growing incompatible species of trees that currently do not present an immediate problem, but over the long-term would be incompatible.	Immature lodgepole pine and aspen. Other species on high-quality growth sites.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively frequent (expected 2- to 6-year year return intervals, but this would vary depending on site conditions).	Accessible sites would favor mechanized equipment, with removal of salvageable material. Inaccessible sites would favor use of hand felling.

Table B-1 Categories of Right-of-way Conditions and Vegetation Treatment Methods

Category	Vegetation	Examples	Frequency of Treatment	Treatment Methods
4	Slow-growing incompatible species of mature vegetation that are currently not acceptable, and require treatment.	Mature ponderosa pine, spruce and fir. Other species on harsh sites. The Ponderosa Pine Woodland community is the dominant vegetation community, comprising about 57 percent of the project area. The Mixed Conifer Forest community comprises 11 percent of the project area.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively infrequent on sites with incompatible species with slow growth rates, perhaps 5 or more years, depending on site conditions.	On sites with good access, mechanized equipment would be favored and salvageable material would be removed. On sites with poor access, hand felling and other manual methods would typically be used.
5	These sites have slow-growing incompatible species that currently do not present an immediate problem, but, over the long term would be incompatible.	Immature ponderosa pine, spruce and fir. Other incompatible species on harsh sites.	Initial treatment would occur with construction of the line. Maintenance treatments are expected to be relatively infrequent, perhaps 5 years or longer, depending on site conditions.	On sites with good access, mechanized equipment would be favored and salvageable material would be removed. On sites with poor access, hand felling and other manual methods would typically be used.
6	Treatments in these areas of ROW are driven largely by the conditions of the fuel load. Typically, they include areas with low-growing vegetation types characterized by having high fuel loads. Sites are characterized by dense, woody vegetation capable of high-intensity fire, with transmission lines having relatively low conductor-to-ground clearances.	Mountain Shrub Mosaic community that covers 15 percent of the project area, including dense lodgepole regeneration, juniper, mountain mahogany, and cliffbrush.	Initial treatment would occur with construction of the line. This could include mechanical removal of vegetation near structures and from areas of the ROW. Maintenance treatments as needed. Need is determined from ROW monitoring.	In areas with good access, mechanized treatment such as mowing would be favored. In areas with poor access, manual treatments would typically be used.

Category 1 Conditions

ROW near Structure 7-3 on the Estes-Pole Hill line with natural, low-growing vegetation outside the coniferous stand that is compatible with the transmission line. This area would be crossed with Alternative B, D, and the No Action Alternative.

Category 2 Conditions

ROW on Estes-Lyons line near Structure 8-5 with incompatible lodgepole pine that would require treatment during construction to establish a low-growth condition, which Western would then maintain. This area would be traversed by Alternatives A, C, and D and the No Action Alternative.

Category 3 Conditions

ROW on the Estes-Pole Hill line near Structure 6-2 with aspen, a fast-growing incompatible species, encroaching upon the ROW. The aspen would need to be treated during construction and then maintained in a low-growth condition. The photo also illustrates that there can be different types of vegetation conditions in a small section, and underscores the need for routine monitoring of ROWs. This area would be traversed by Alternative B and D and the No Action Alternative.

Category 4 Conditions

The trees on this site near Structure 4-6 on the Estes-Pole Hill line are slower growing, but at maturity would interfere with the transmission line. Western would need to treat the area during construction to establish a lower growth condition, which Western would monitor and maintain as needed. This area would be traversed by Alternatives B, C, D, and the No Action Alternative.

Category 5 Conditions

Although this ROW is generally acceptable near E-LS Structure 8-6 in the foreground, the larger trees under the transmission line would be removed during construction to ensure they do not present a hazard to the line. The same would apply to the trees within the ROW on the right near E-PH Structure 8-5. Ahead on line for both existing transmission lines, the trees within the drainages may not require treatment during construction as they would be well below the transmission line conductors, even at maturity.

Category 6 Conditions

These structures on the Flatiron-Pole Hill transmission line traverse stands of mountain mahogany. This dense vegetation around structures and under the conductors could present a fuel problem. This photo also includes ponderosa pine within the ROW that would be removed during construction. Alternatives B and D and the No Action Alternative would traverse this area west of Pinewood Reservoir.

Figure B-1 Examples of the Six Condition Categories Along Existing Right-of Way

Establishing the Desired ROW Vegetation Condition during Construction

Western would assess current conditions in the ROW to identify areas that need initial treatments during construction based on the categories described above. Treatment of ROW vegetation during construction of new line would emphasize the following activities:

- Cut danger trees if any are present
- Manage slash that has built up in the ROW to reduce fuels density
- Grind or crush regeneration that has grown in the ROW to reduce the density of live, green fuels
- Cut tree species that at mature height would threaten safe, reliable transmission-line operation.

During construction of the transmission line, Western proposes to remove undesirable vegetation (typically trees) that at mature height would interfere with transmission line safety and reliability. The desired condition would be to establish and maintain stable vegetation communities on the ROW dominated by appropriately sized plant species, such as grasses, forbs, shrubs, and lower-growth tree species that, at maturity, would not interfere with the transmission line.

Maintaining Desired ROW Condition

Western's proposal includes monitoring and retreating ROW areas at appropriate intervals based on the results of reviews of ROW conditions during line patrols to maintain the desired conditions. In ROW areas with relatively low conductor-to-ground clearances, Western would typically retain lower-growth native plant species to maintain the desired vegetation condition. Western would do this through active management to remove tall-growth species. Depending on the specific site conditions, desirable native species could include grasses, forbs, and shrubs, through appropriately sized small or lower-growing tree species. Generally, more selective control methods can be used to maintain this condition along the ROW. ROW maintenance activities and treatment intervals would vary in the ROW depending on the success of previous treatments, vegetation type, rates of vegetation re-growth, environmental protection requirements, and risks to the transmission line.

An important component of ROW maintenance is fuels management to mitigate the risk of damage from wildfires. Western would evaluate the risk to transmission line operations and security from wildfire and manage fuels in the ROWs. ROW fuel loads associated with vegetation re-growth or control treatments must be evaluated and controlled as needed. All vegetation (dead or live) can be considered fuel because it can contribute to fire intensity and duration. In addition to reducing the risk of incompatible vegetation in a ROW, Western's proposed ROW reclamation and long-term maintenance strategies would address areas where accumulated fuel poses an unacceptable risk. Western would reduce fuel density in ROWs using mechanical and manual treatment approaches, as described below.

There could be areas along the existing transmission lines that need no or minimal vegetation management – for example, some areas in canyons and drainages or other steep topography in which trees might not grow to heights or densities that would threaten the transmission line that crosses high above (see Category 1). In some of these areas few if any control methods would be needed for years. In other vegetation communities, occasional mowing of vegetation around structures could be needed to ensure access to the structures and to reduce the risk of fire to the transmission line structures (e.g., mowing mountain mahogany around wooden structures proposed for Alternative D). Regardless, Western would need to monitor all ROWs to continuously evaluate vegetation conditions and ensure they meet the management objectives, and that changed conditions have not resulted in unacceptable threats.

<u>Vegetation Control Methods</u>

Western proposes several general control methods, individually or in combination, to manage vegetation. These methods include a variety of control methods utilities typically use to manage their ROWs. Western would use the techniques to alter the vegetation condition so that it can be maintained more efficiently and effectively. The following paragraphs describe the general vegetation-control methods.

Manual Control Methods

Manual vegetation control includes the use of hand-operated powered tools and non-powered hand tools. Manual techniques – mainly using chainsaws – can be used where equipment access is limited by terrain, soil conditions, or other environmental conditions. One or two trucks carrying equipment and workers drive along the access road to the appropriate site. Crews of two or more with chainsaws then hike along the ROW and cut target vegetation. Crews often use ATVs instead of trucks. Crew sizes for this type of activity usually range from two to four.

Mechanical Control Methods

Mechanical vegetation control uses machine platforms with various interchangeable treatment-head attachments to remove or control target vegetation along transmission line and authorized access route ROWs. Rubber-tired mechanical equipment platforms are generally limited to operating on slopes less than 30 to 35 percent. Specialized tracked equipment platforms, with articulating control cabins, are typically used on slopes up to 60 percent. Both types of specialized equipment platforms can operate with very low ground pressures. However, site-specific obstacles such as rocks or other extreme terrain conditions can reduce their efficiency. Mechanical operations usually involve a crew of two to three.

- **Feller bunchers**. These machines grab trees, cut them at the base, pick them up, and move them to a windrow or onto the back of a truck. The tree is under the machine's control.
- **Skidders and forwarders**. Skidders are tracked or four-wheel drive tractors with winches. They have articulated steering and usually a small, adjustable, push-blade on the front. They are one of the few logging machines capable of thinning or selective logging in larger timber. Forwarders can also haul smaller log lengths than a skidder, but this sometimes limits their range of operation. However, forwarders cause relatively little ground disturbance because material is carried on the back of the forwarder instead of being dragged behind, as with a skidder. Site conditions (e.g., soil moisture and terrain), presence of sensitive environmental resources, and forest conditions dictate the appropriate combination and use of this type of equipment.
- **Roller-choppers**. This technique uses rotating drums towed by a variety of vehicles that roll and chop vegetation and forest debris. A series of blades, steel chains, or other devices attached to the drum chop the vegetation.
- **Walking brush controllers**. These machines have booms, dippers, and other means to manipulate cutting equipment and control vegetation with minimal soil disturbance.
- **Mowing/grinding**. Mechanized heavy equipment with high-speed rotary blades can be used to cut, chop, or shred woody vegetation in ROWs. Target vegetation is typically cut off at ground level, encouraging the selection and recovery of low-growing plant communities consisting of grasses, forbs, and other herbaceous plants. Examples of this type of mowing equipment are Fecon, brush-hog, Track-Mack, and Hydro-Ax.

Herbicides and Growth Regulators

Western would use spot application of herbicides approved for use to treat undesirable, mostly herbaceous vegetation. Western applies herbicides to invasive species. Herbicides are applied directly to the vegetation using a hand or powered sprayer. Herbicides are used on incompatible vegetation that sprouts after initial treatment by cutting or mowing. Herbicide applications typically involve a crew of one to two.

Western uses herbicides that are approved for use in ROW maintenance and by the Forest Service. Western uses Environmental Protection Agency and state-registered herbicides, and appropriately licensed or certified applicators apply the herbicides following the label requirements.

Herbicides can be applied in different ways, depending on the targeted plants, vegetation density, and site circumstances. Western proposes herbicide treatment either by spot application or localized (site-specific) application.

When making decisions about the use of these methods, Western considers the area being treated, the presence of sensitive plants and other environmental resources, the herbicide label requirements, and whether the method is cost effective and efficient.

Site-Specific Herbicide Application

Site-specific or localized herbicide application is the treatment of individual or small groupings of plants. Western typically uses this application method only in areas of low to medium target-plant density. The application techniques include, but are not limited to, the following:

- **Basal treatment.** Appropriately licensed or certified applicators apply the herbicides using handsprayers or by backpack sprayers. They apply herbicides at the base of the plant (the bark or stem) from the ground up to knee height. The herbicide is usually mixed with an oil carrier to enhance penetration through the bark, and applied to the point short of run-off. These treatments can be done during the dormant season or growing season.

- **Low-volume foliar treatment.** Applicators apply herbicides using a backpack sprayer, or ATVs or tractors with a spray gun. They apply herbicides to the foliage of individual or clumps of plants during the growing season, just enough to wet them lightly. They use a relatively high percentage of herbicide mixed with water. They add thickening agents where necessary to control drift, and might add dyes to see easily what areas have been treated.

- **Cut stump treatments.** Applicators apply herbicide to freshly cut stumps of undesirable vegetation to prevent re-growth by sprouting.

<u>Debris Disposal</u>

Managing vegetation includes cleanup – the treatment of slash and debris disposal. There are five basic methods of disposing of the vegetation debris generated when vegetation is cut, as follows:

- **Logging.** Marketable timber might be processed and piled for future removal from the ROW.
- **Chipping.** With chipping, a mechanical brush chipping unit cuts brush into chips 10 centimeters (4 inches) or less in diameter. The chips can be spread over the ROW, piled in the ROW, or trucked off the site. Trunks too large to be handled by the chipper are limbed and the limbs chipped. Trunks are placed in rows along the edge of the ROW or scattered, as the situation requires. Spreading chips in the ROW can be an effective ROW management tool to control erosion, reduce soil drying, improve aesthetics in the treated area, control noxious weeds, and control rapid re-growth of undesirable species by sprouting of seeds already in the soil.
- **Lopping and scattering.** With lopping and scattering, some of the branches of a fallen tree are cut off (lopped) by ax or chainsaw, so the tree trunk lies flat on the ground. The trunks are usually cut in 1- to 2-meter (4- to 8-foot) lengths. The cut branches and trunks are then scattered on the ground.
- **Mulching.** Mulching is a debris treatment that falls between chipping and lop and scatter. The debris is cut, shredded, or otherwise broken into 30- to 60-centimeter (1- to 2-foot) lengths and scattered in the ROW.
- **Pile burning.** With pile burning, vegetation debris is piled outside the ROW and burned in small piles. High-intensity burning is a hazard in the ROW and near electric facilities because the smoke can induce flashovers from electrified facilities. Burning also contributes to air pollution and can damage the soil below the burn piles. The fire can escape to other areas if not properly managed. Pile burning in an area outside the ROW would reduce the safety and fire risk issues

associated with in-ROW burning. Western would only use burning techniques in partnership with the Forest Service.

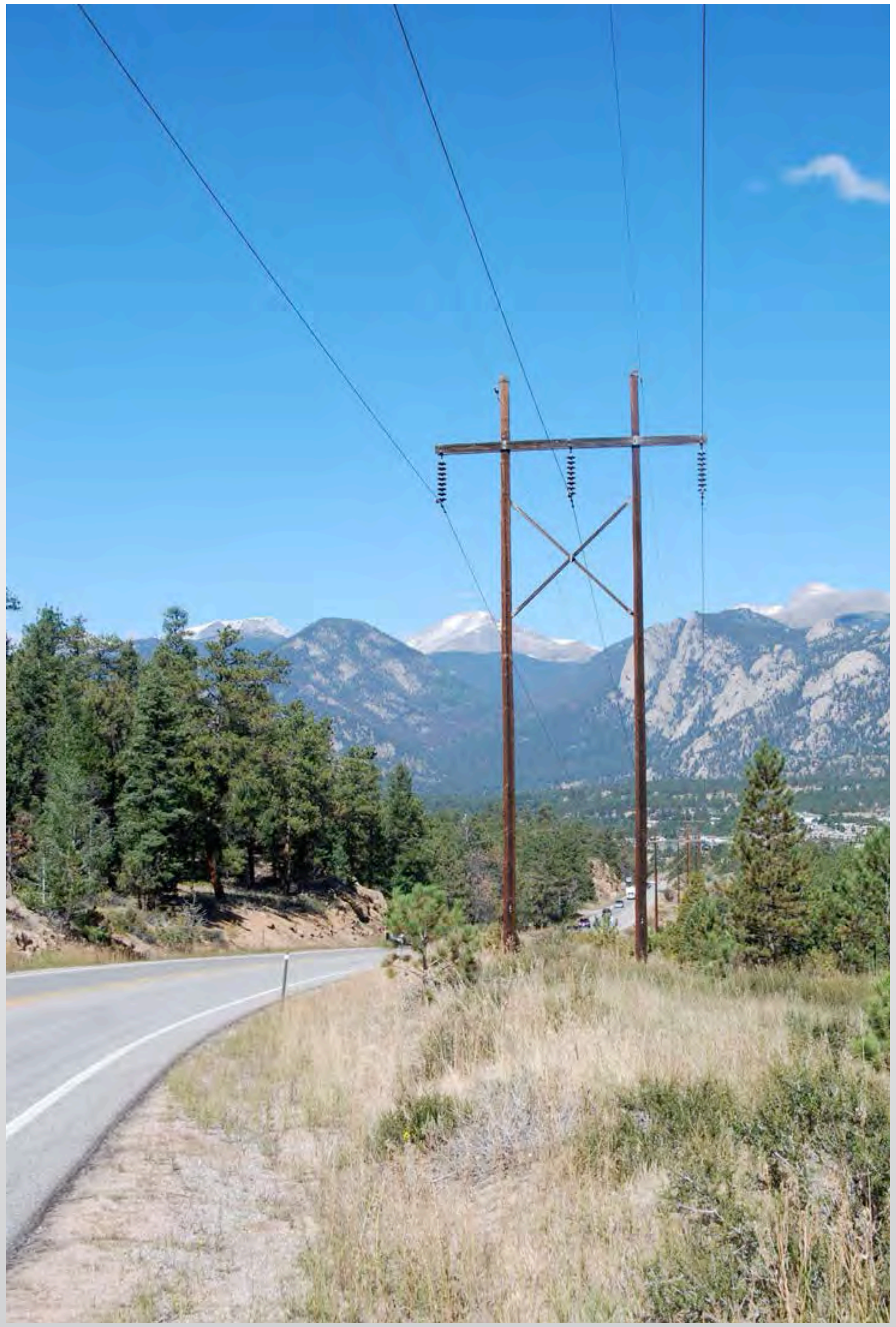
<u>Mechanical Fuel Reduction Methods</u>

Western would reduce existing fuel loads through mechanical thinning, mowing, chipping, and debris removal. Western would use site-specific treatments to reduce potential impacts from wildfire on the transmission line ROW by reducing the likely intensity and duration of fires in the ROW. Western would use a range of mechanical and manual methods, depending on site conditions. These include tree removals, mechanical and hand thinning of small-diameter trees to reduce ladder fuels, mechanical mastication (e.g., grinding and chipping), and hand and mechanical piling. The target fuels of these treatments include downed trees, slash, debris from past treatments, green fuels such as regenerated lodgepole pine, and brush such as Gambel oak and sagebrush.

Western would use prescribed burning only under optimum conditions, such as during periods of minimal wind speeds or high moisture content in fuels, to reduce the risk of fire escape and impacts from smoke. Prescribed fire treatments would include mechanical piling and burning and broadcast burns to reduce surface fuels over larger areas. Large pockets of dead and down woody material and slash generated from mechanical treatments would be broadcast burned or piled and burned to further reduce fuel loadings.

Appendix C

Key Observation Points and Visualizations






Estes-Flatiron 115 kV Transmission Line Rebuild EIS

Key Observation Point Photography and Visualizations *March 2014*

Western
AREA POWER
ADMINISTRATION

As described in Section 3.12 and Section 4.12, Western and the Forest Service identified Key Observation Points (KOPs), or viewpoints, to document effects from the project. From the total list of KOPs, Western and the Forest Service selected representative sites for photographic simulations, or photo-realistic renderings, in response to scoping comments. Visual simulations of the proposed project are based on Western's standards described in Chapter 2 and preliminary engineering (Western, various dates). Six simulations were prepared by View Point West in 2012 and the remainder were prepared by Logan Simpson Design. The simulations are fundamentally similar: simulations for Alternatives A, B, and C show an average structure height of 105 feet for the new double circuit 115kV transmission line and long-term vegetation management of the right of way (ROW). A structure height of 85 feet is also presented in KOP 8 for Alternative C. Clearing of the ROW would be consistent with Chapter 2 and Appendix B: Vegetation Management. Underground construction simulations for Variants A2 and C1 show a cleared 75 foot ROW and above-ground transition structures from KOPs 2 and 12, as described in Chapter 2. Potential access road improvements were not available at the time simulations were developed, and are not displayed on any simulation.

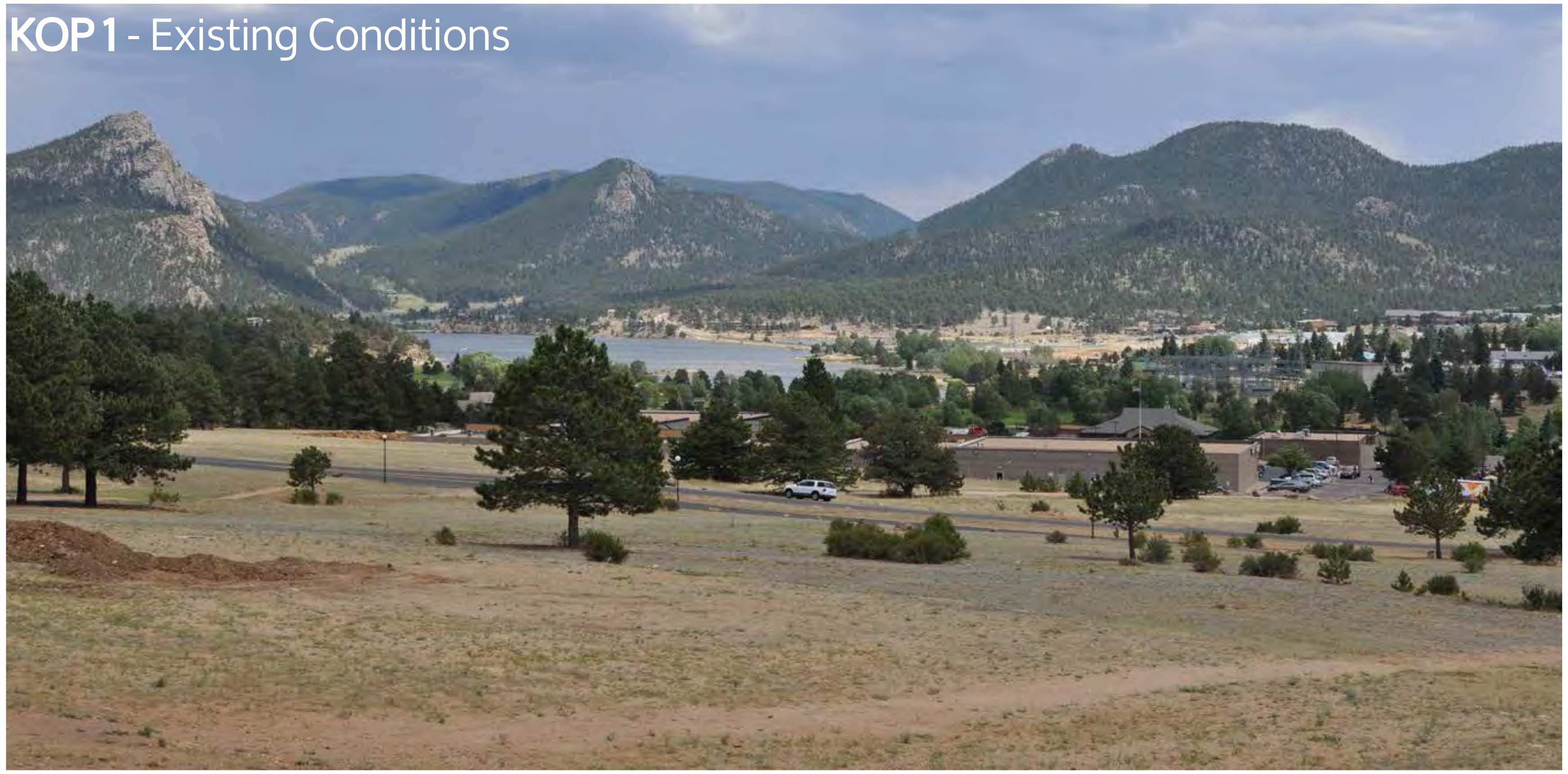
Minor differences in simulation methodology, cameras, and software had a negligible result on the utility of the visualizations. Simulations prepared by View Point West assumed 'structure for structure' replacements for the existing and proposed transmission structures, consequently the simulated structures are closer together than may actually be constructed. View Point West simulations were developed using ArcInfo and ArcScene, version 10 to accurately place and scale the proposed ROW and structures along new alignments and terrain models, and were rendered using AutoCAD 2011 and Photoshop. Simulations prepared by Logan Simpson Design assumed an average span length of 850 feet between 105 foot tall conceptual structures, subject to change during survey and design following the Record of Decision.

Simulations were developed using ArcInfo, version 10 for data mapping, 3D Studio Max 2013 for 3D modeling, texturing, lighting, and rendering; and Adobe Photoshop CS6 for photo editing and compositing. Metadata for each KOP (photograph date, time, coordinates, camera model, focal lens length) accompany each view.

To create the photo simulations, Logan Simpson Design transferred the locational and GPS data to ArcMap, where it was combined with GIS data of the preliminary structure locations for each alternative. A map showing these data was exported at true scale and imported into 3D Studio Max. Using this scaled map as a base, a 3D model of the Project area was created to scale. 3D models of the proposed angle and tangent transmission facilities and ROWs were modeled to scale in 3D Studio Max, and added in their appropriate locations and elevations. The views from the existing photographs were then matched in the 3D model using virtual cameras with the same focal length and field of view as the field camera. After date- and time-specific lighting was added to the 3D model, renderings from the virtual cameras were created. These renderings were then blended into the existing conditions photographs along with necessary ROW modifications to the existing landscape, such as tree removal, in Adobe Photoshop software. This process of creating a 3D model at true scale and rendering images using the same specifications used by the camera ensures that the spatial relationships of the landscape, project features, and viewer perspective are accurate and match the existing site photographs.

Final surveys and engineering after the Record of Decision will identify the actual structure designs, locations and heights, and may vary from the analysis assumptions used for this study.

KOP 1 - Existing Conditions



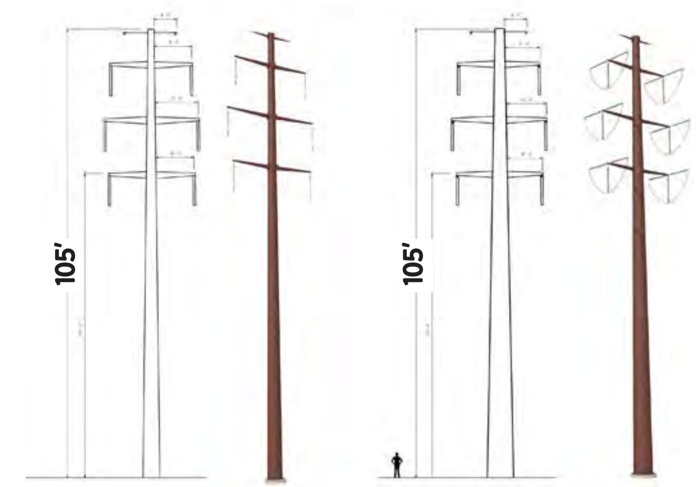
KOP 1 - Alternative A

Double Circuit Line on a Consolidated ROW (North)

KOP 1 - Alternative A

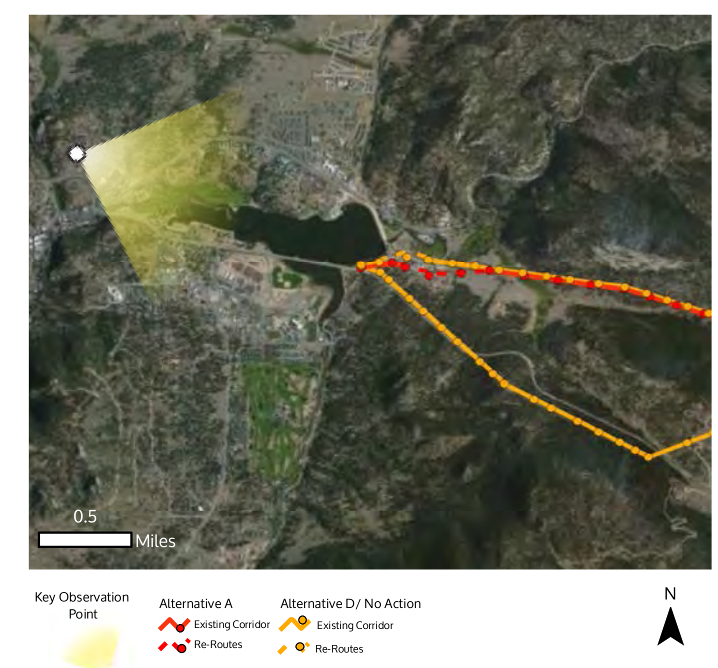
Description: Stanley Hotel: View looking southeast from the Stanley Hotel, 1.7 miles from the project end point
Date Taken: 6/23/2012
Time Taken: 2:03 p.m.
Longitude: 455941
Latitude: 4470341
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D90
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Nearest Structure: 9,500'

Structures

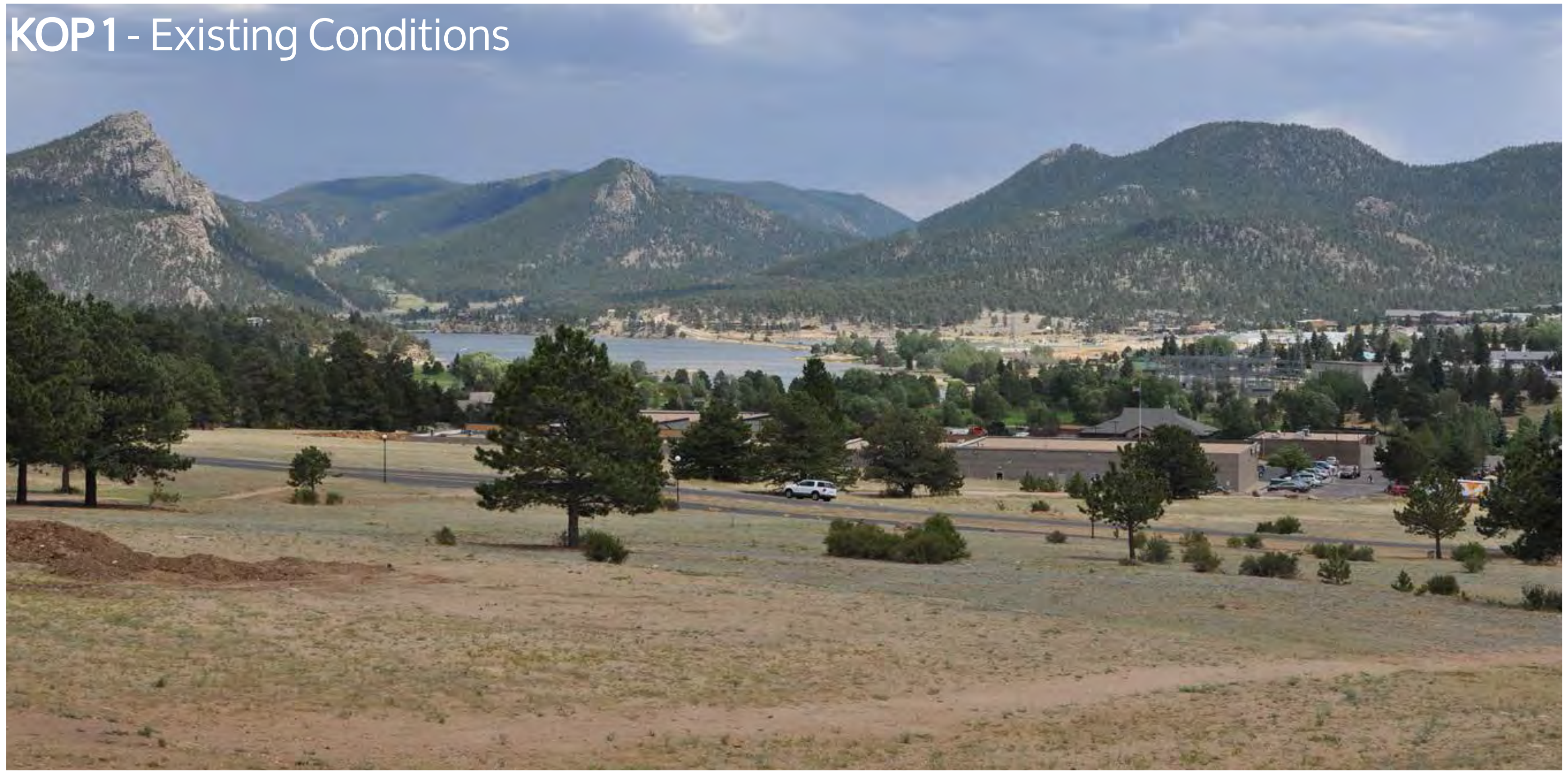


Monopole Structure   Angle Structure

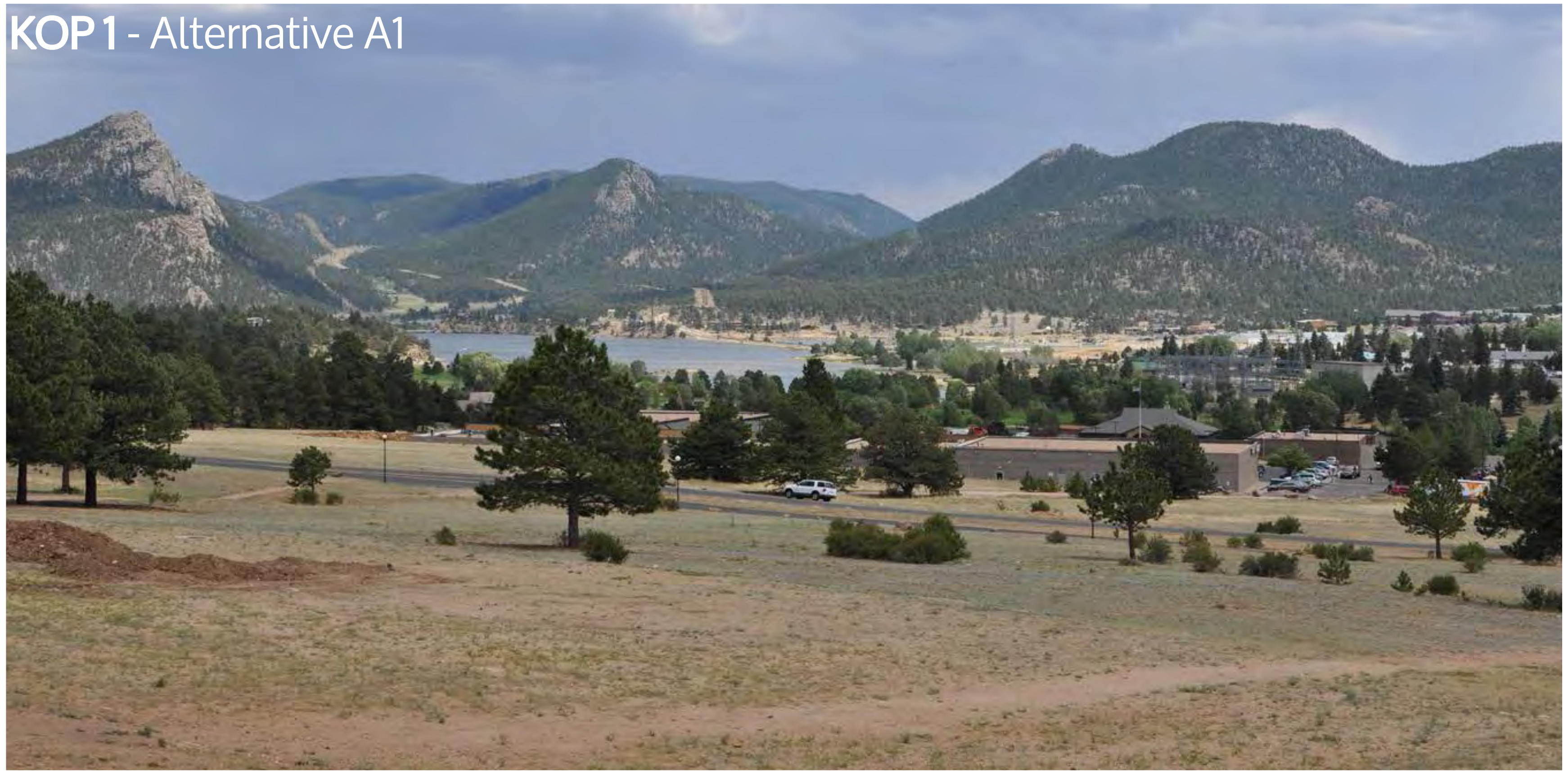
Key Map



KOP 1 - Existing Conditions



KOP 1 - Alternative A1

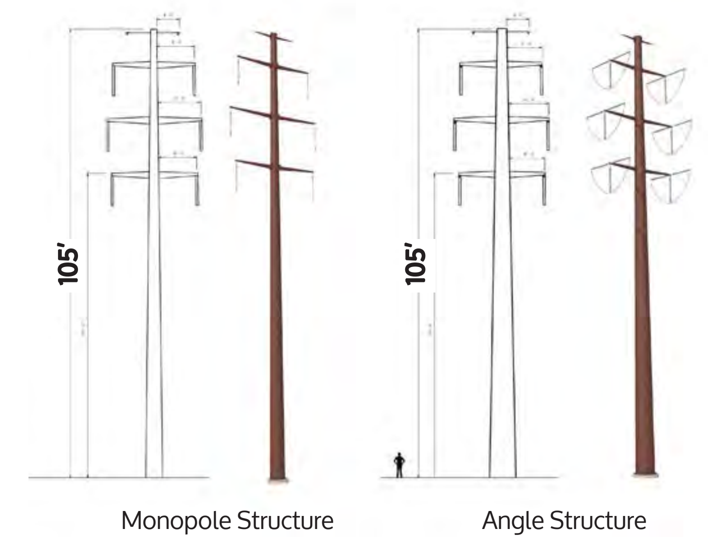


Double Circuit Line on a Consolidated ROW (North) Re-Route

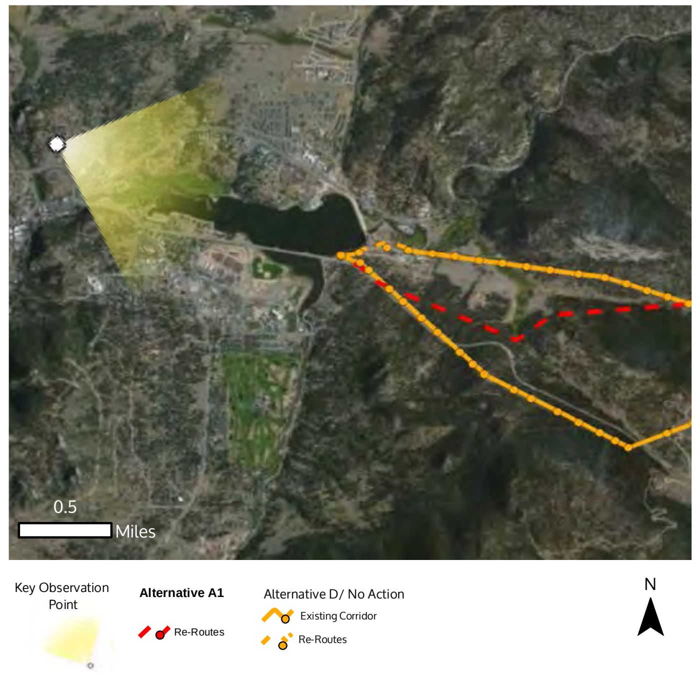
KOP 1 - Alternative A1

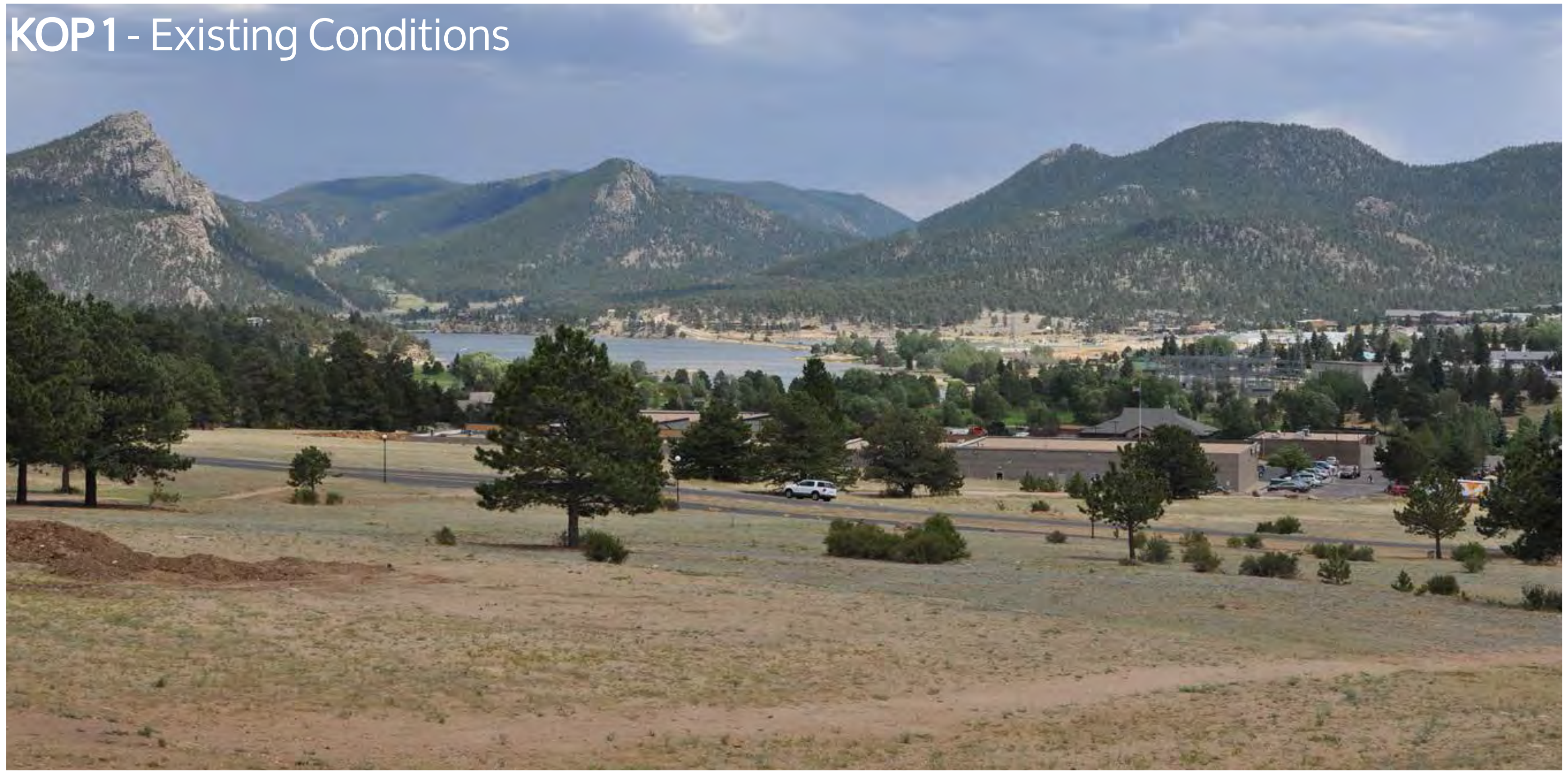
Description: Stanley Hotel: View looking southeast from the Stanley Hotel, 1.7 miles from the project end point
Date Taken: 6/23/2012
Time Taken: 2:03 p.m.
Longitude: 455941
Latitude: 4470341
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D90
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Nearest Structure: 9,300'

Structures



Key Map



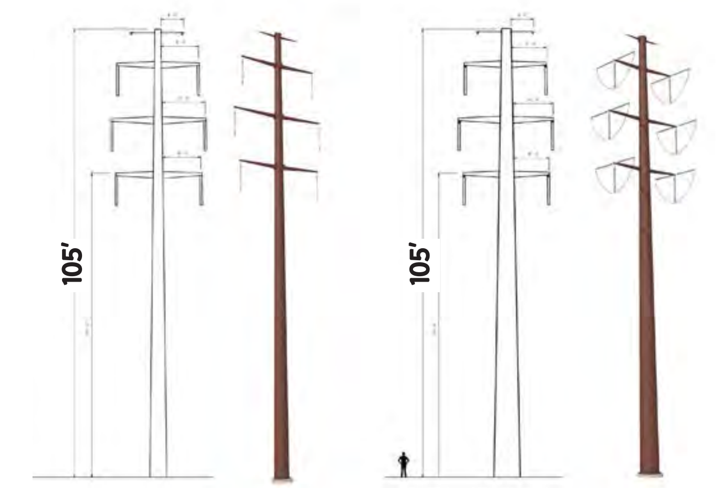


Double Circuit Line on a Consolidated ROW (South)

KOP 1 - Alternative B

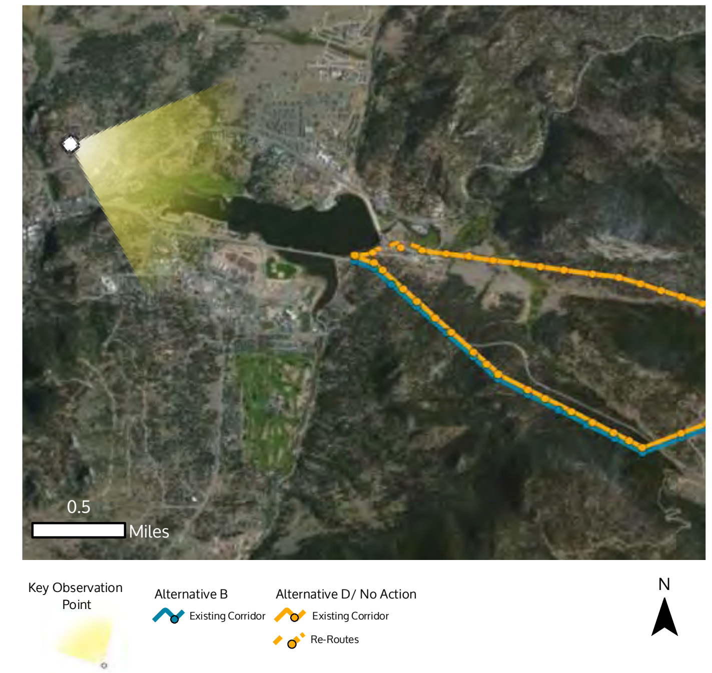
Description: Stanley Hotel: View looking southeast from the Stanley Hotel, 1.7 miles from the project end point
Date Taken: 6/23/2012
Time Taken: 2:03 p.m.
Longitude: 455941
Latitude: 4470341
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D90
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Nearest Structure: 9,300'

Structures



Monopole Structure | Angle Structure

Key Map



KOP 1 - Existing Conditions

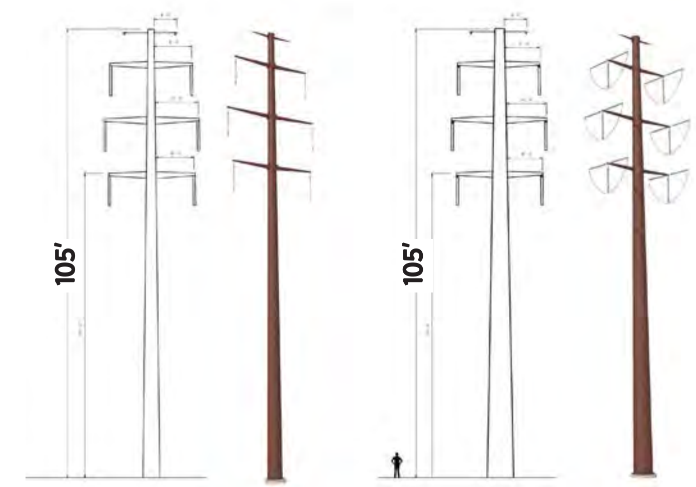
KOP 1 - Alternative C

Double Circuit Line on a Consolidated ROW Using North and South Alignments

KOP 1 - Alternative C

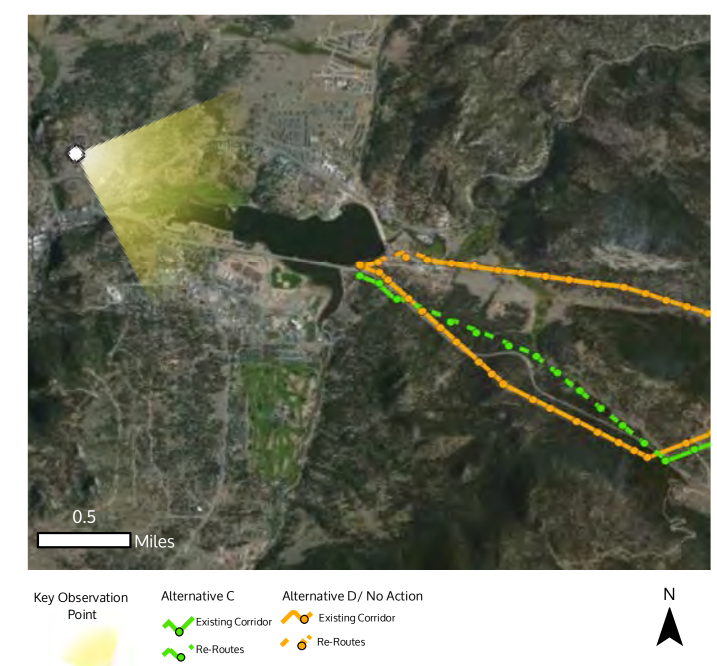
Description: Stanley Hotel: View looking southeast from the Stanley Hotel, 1.7 miles from the project end point
Date Taken: 6/23/2012
Time Taken: 2:03 p.m.
Longitude: 455941
Latitude: 4470341
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D90
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Nearest Structure: 9,300'

Structures



Monopole Structure   Angle Structure

Key Map



KOP 2 - Existing Conditions

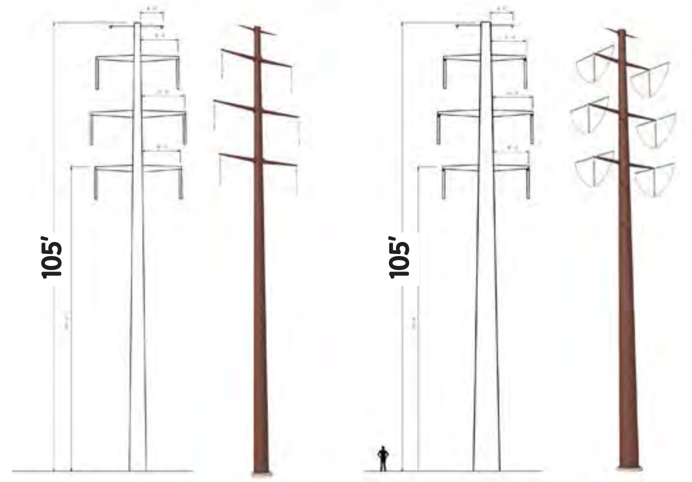
KOP 2 - Alternative A

Double Circuit Line on a Consolidated ROW (North)

KOP 2 - Alternative A

Description: Highway 34: View looking southeast from Highway 34 at Lone Tree Drive, 0.6 miles from the project end point
Date Taken: 10/19/2011
Time Taken: 1:43 p.m.
Latitude: 457929.706702
Longitude: 4470222.81195
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Distance to Nearest Proposed Structure: 3,673'

Structures



Monopole Structure   Angle Structure

Key Map

KOP 2 - Existing Conditions

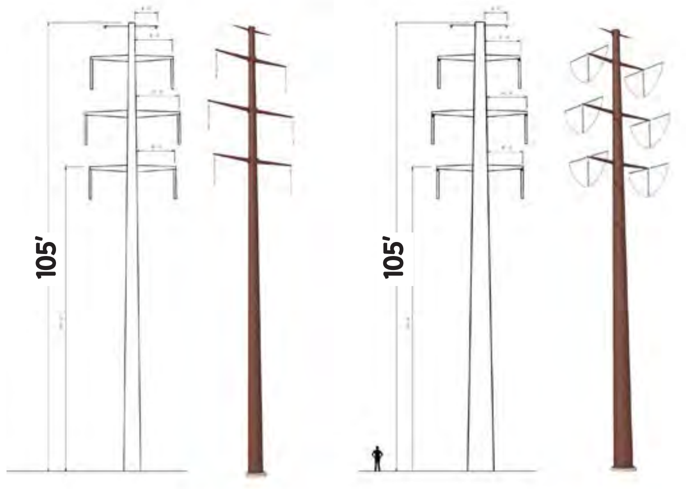
KOP 2 - Alternative A1

Double Circuit Line on a Consolidated ROW (North) Re-Route

KOP 2 - Alternative A1

Description: Highway 34: View looking southeast from Highway 34 at Lone Tree Drive, 0.6 miles from the project end point
Date Taken: 10/19/2011
Time Taken: 1:43 p.m.
Latitude: 457929.706702
Longitude: 4470222.81195
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Distance to Nearest Proposed Structure: 3,764'

Structures



Monopole Structure　　Angle Structure

Key Map

Key Observation Point
Alternative A1 Existing Corridor
Alternative D/ No Action Existing Corridor
Re-Routes
N

KOP 2 - Existing Conditions

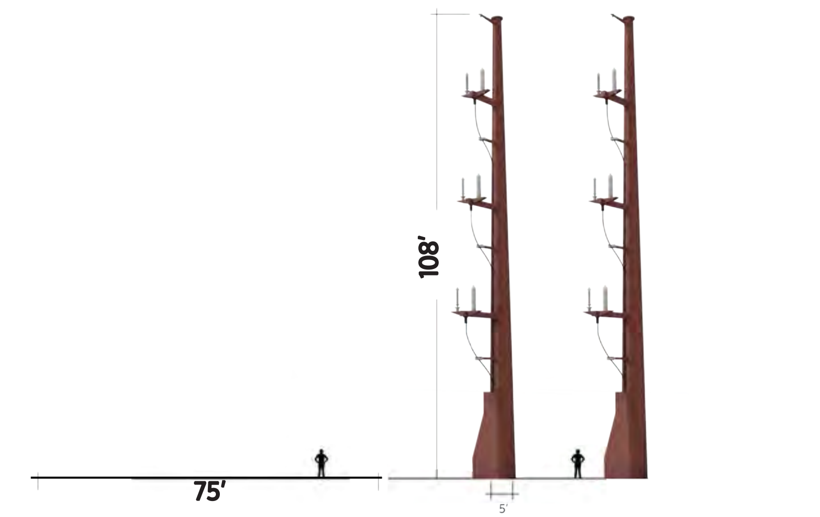
KOP 2 - Variant A2 Underground Construction

Underground construction of Double Circuit Line on a Consolidated ROW with Re-Routes

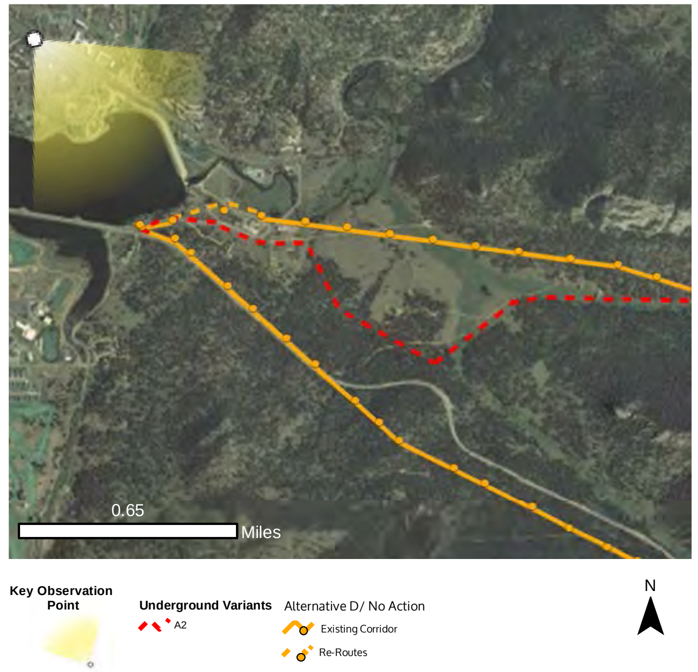
KOP 2 - Variant A2 Underground Construction

Description: Highway 34: View looking southeast from Highway 34 at Lone Tree Drive, 0.6 miles from the project end point
Date Taken: 10/19/2011
Time Taken: 1:43 p.m.
Latitude: 457929.706702
Longitude: 4470222.81195
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Distance to Nearest Proposed Structure: 3,764'

Structures



Key Map

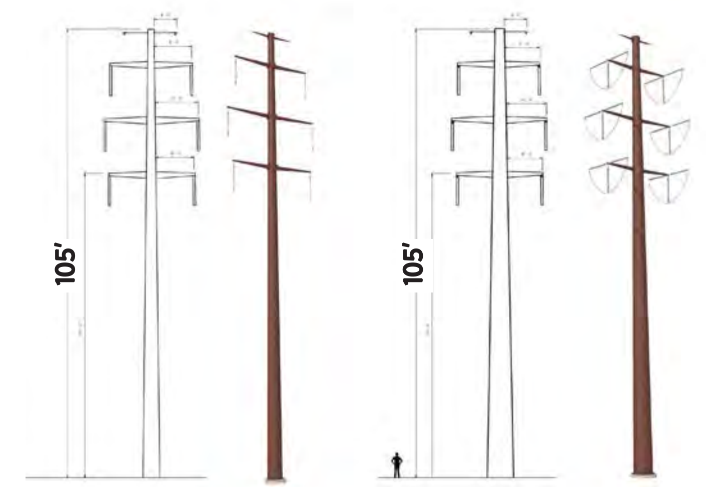


Double Circuit Line on a Consolidated ROW (South)

KOP 2 - Alternative B

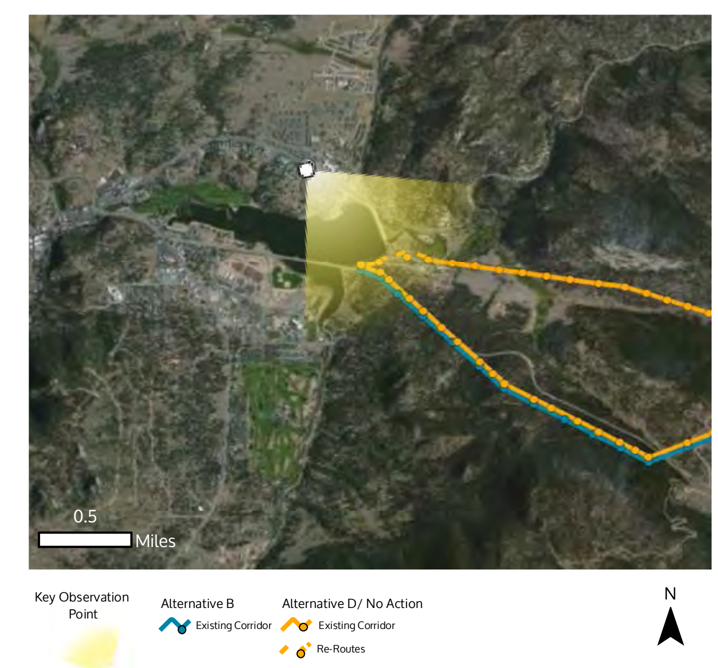
Description: Highway 34: View looking southeast from Highway 34 at Lone Tree Drive, 0.6 miles from the project end point
Date Taken: 10/19/2011
Time Taken: 1:43 p.m.
Latitude: 457929.706702
Longitude: 4470222.81195
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Distance to Nearest Proposed Structure: 3,764′

Structures



Monopole Structure   Angle Structure

Key Map



KOP 2 - Existing Conditions

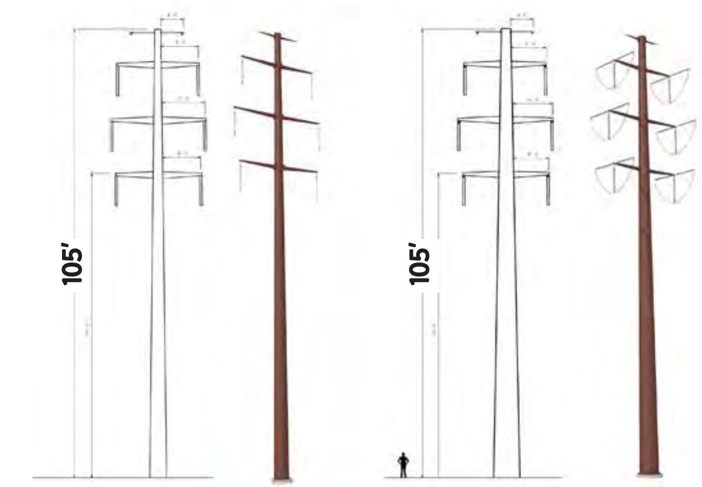
KOP 2 - Alternative C

Double Circuit Line on a Consolidated ROW Using North and South Alignments

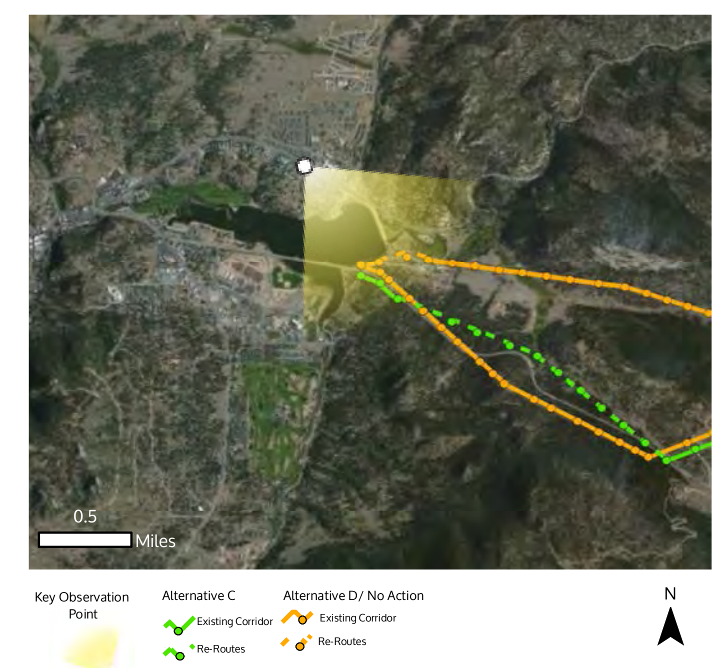
KOP 2 - Alternative C

Description: Highway 34: View looking southeast from Highway 34 at Lone Tree Drive, 0.6 miles from the project end point
Date Taken: 10/19/2011
Time Taken: 1:43 p.m.
Latitude: 457929.706702
Longitude: 4470222.81195
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Distance to Nearest Proposed Structure: 3,764'

Structures



Key Map



KOP 2 - Existing Conditions

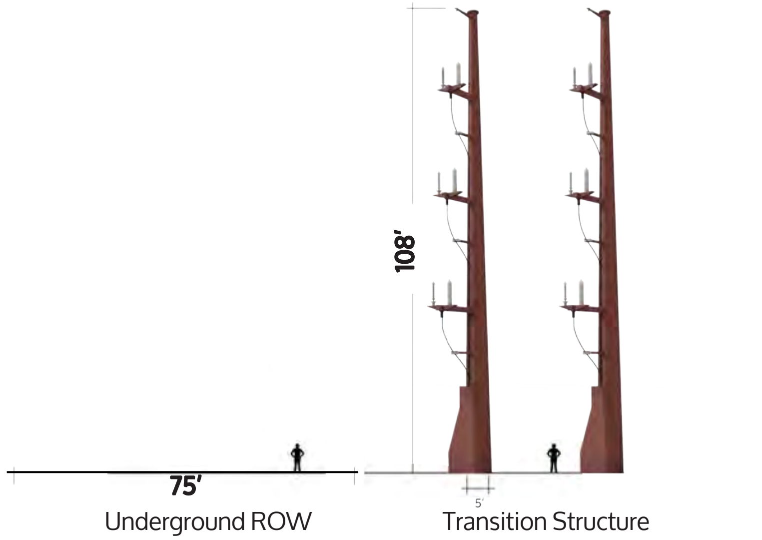
KOP 2 - Variant C1 Underground Construction

Underground construction of Double Circuit Line on a Consolidated ROW with Re-Routes

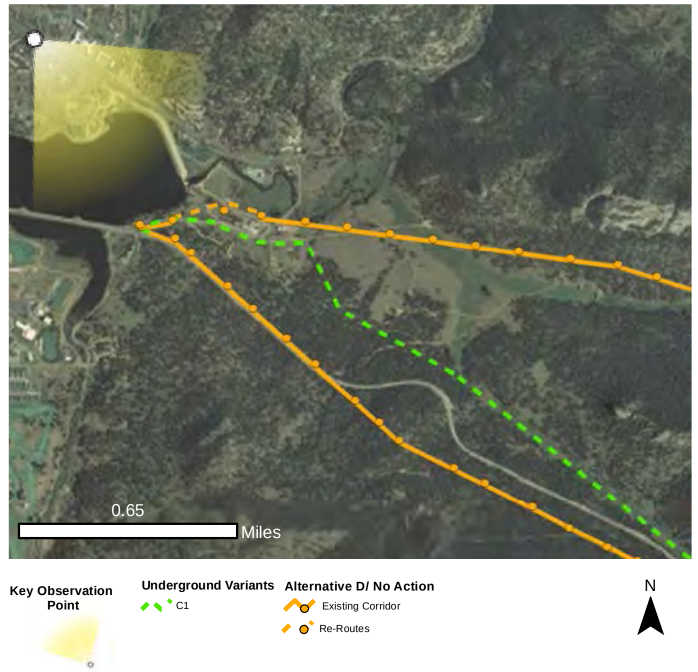
KOP 2 - Variant C1 Underground Construction

Description: Highway 34: View looking southeast from Highway 34 at Lone Tree Drive, 0.6 miles from the project end point
Date Taken: 10/19/2011
Time Taken: 1:43 p.m.
Latitude: 457929.706702
Longitude: 4470222.81195
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 52mm/Digital Focal Length: 35mm
Distance to Nearest Proposed Structure: 3,764'

Structures



Key Map

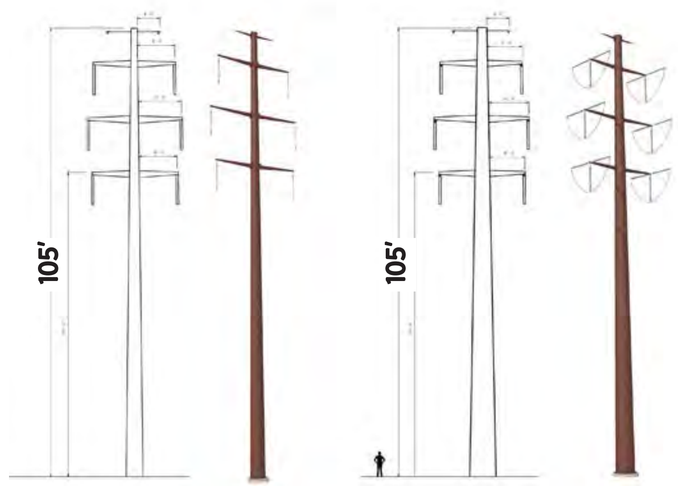


Double Circuit Line on a Consolidated ROW (South)

KOP 3 - Alternative B

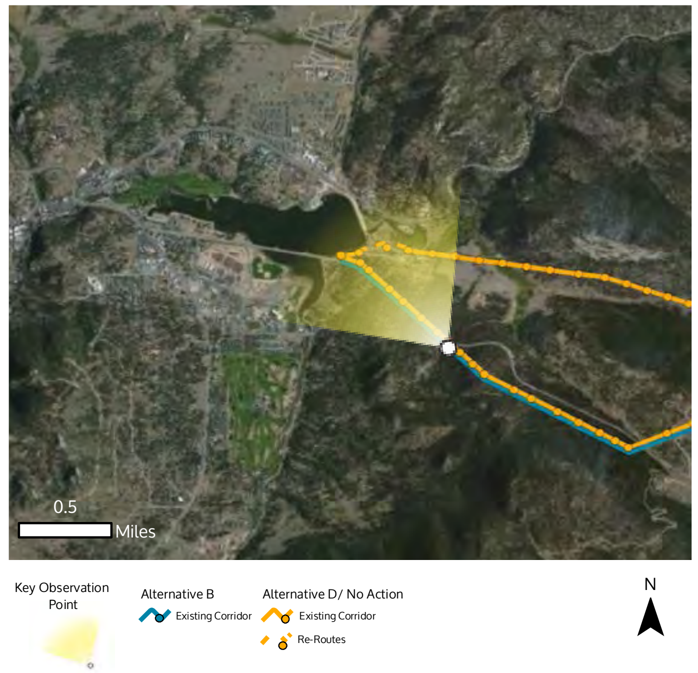
Description: Highway 36: View Looking Northwest towards E-PH Transmission Line
Date Taken: 9/18/2011
Time Taken: 10:34 a.m.
Latitude: 459278
Longitude: 4468625
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 51mm/Digital Focal Length: 34mm
Distance to Nearest Proposed Structure: 388'

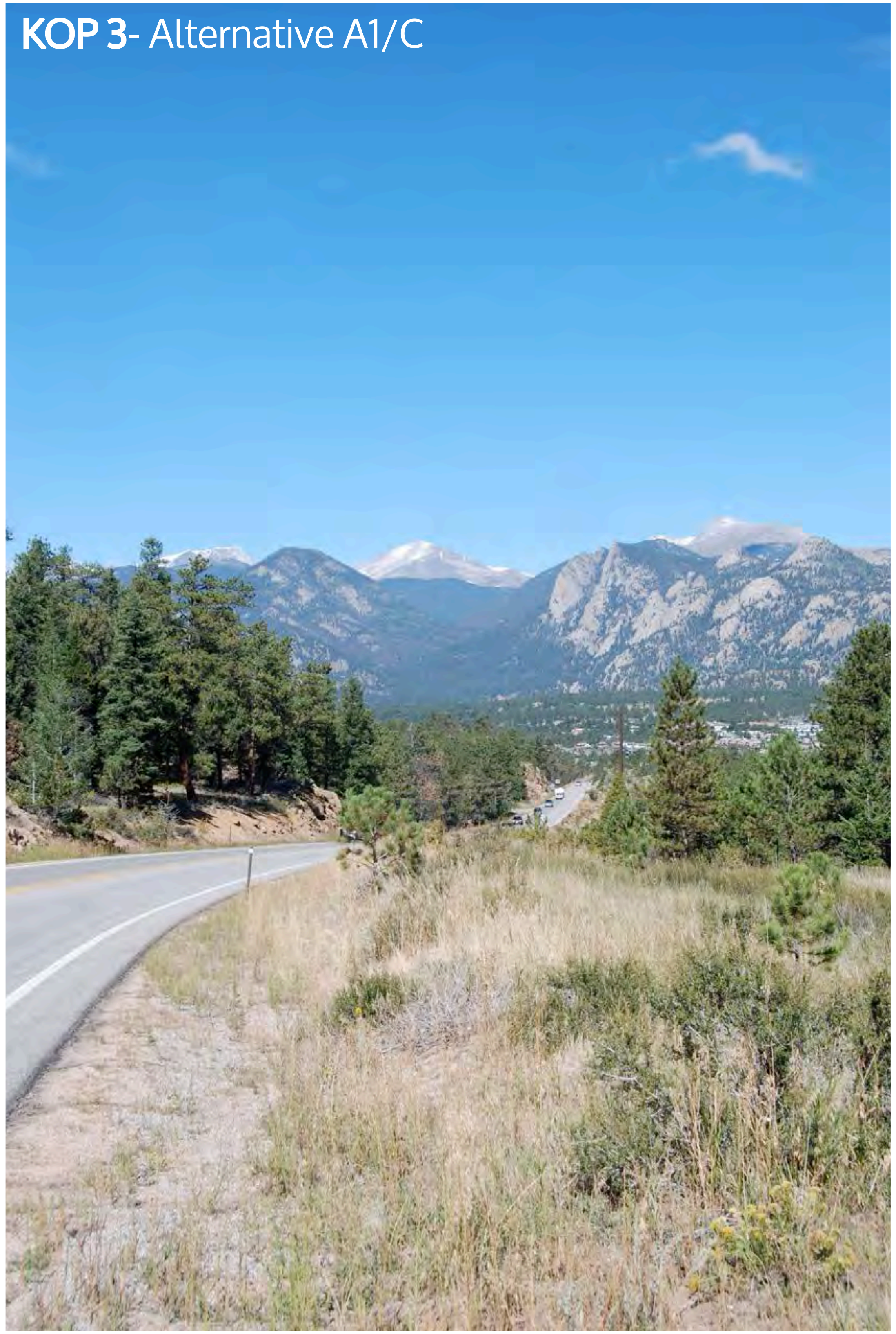
Structures



Monopole Structure   Angle Structure

Key Map



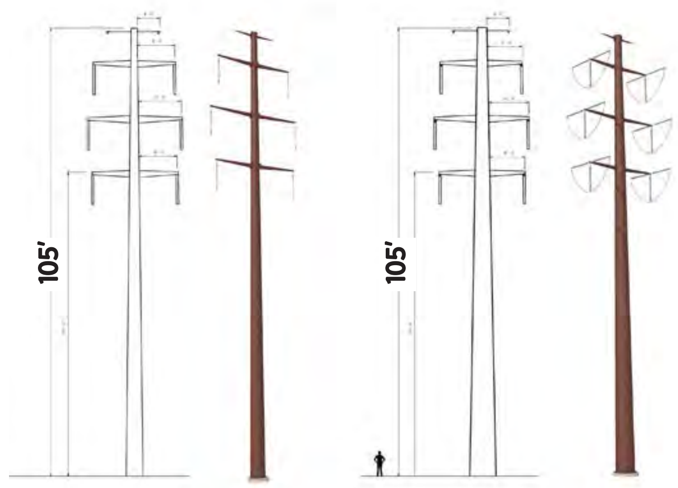


Double Circuit Line on a Consolidated ROW (North) Re-Route / Double Circuit Line on a Consolidated ROW Using North and South Alignments

KOP 3 - Alternative A1/Alternative C

Description: Highway 36: View Looking Northwest towards E-PH Transmission Line
Date Taken: 9/18/2011
Time Taken: 10:34 a.m.
Latitude: 459278
Longitude: 4468625
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 51mm/Digital Focal Length: 34mm
Distance to Nearest Proposed Structure: 2,430′

Structures



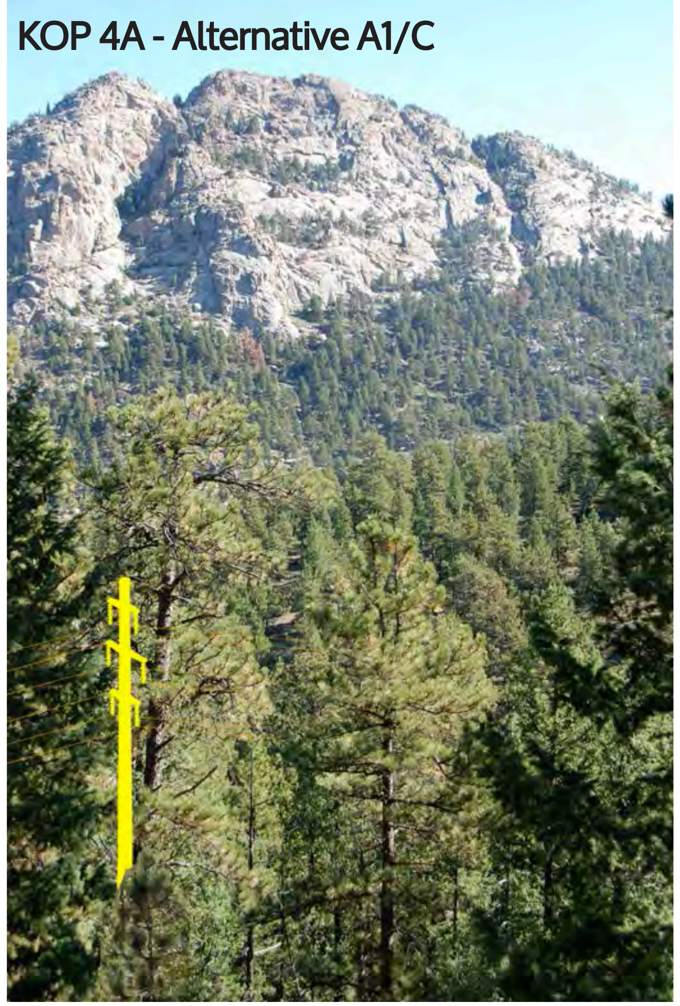
Monopole Structure

Angle Structure

Key Map

KOP 4 - Alternative A1/C

KOP 4A - Alternative A1/C



Double Circuit Line on a Consolidated ROW (North) Re-Route / Double Circuit Line on a Consolidated ROW Using North and South Alignments

KOP 4 - Alternative A1/Alternative C

Looking northwest towards Estes Park. The majority of the proposed transmission line would not be visible from this location. The transmission line structures are modeled in yellow to show their location, but would be screened from the viewer by the vegetation and highway.

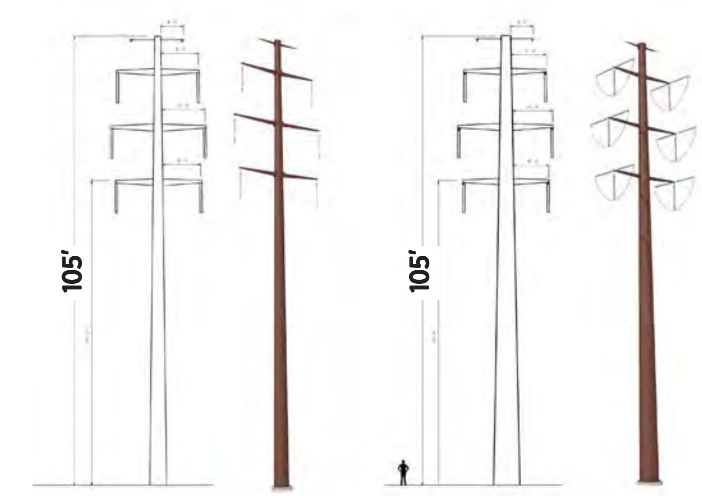
KOP 4A - Alternative A1/Alternative C

Looking northeast towards Mount Olympus. The majority of the proposed transmission line would not be visible from this location. The transmission line structures are modeled in yellow to show their location, but would be screened from the viewer by the vegetation and highway.

KOP 4 - Alternative A1/Alternative C

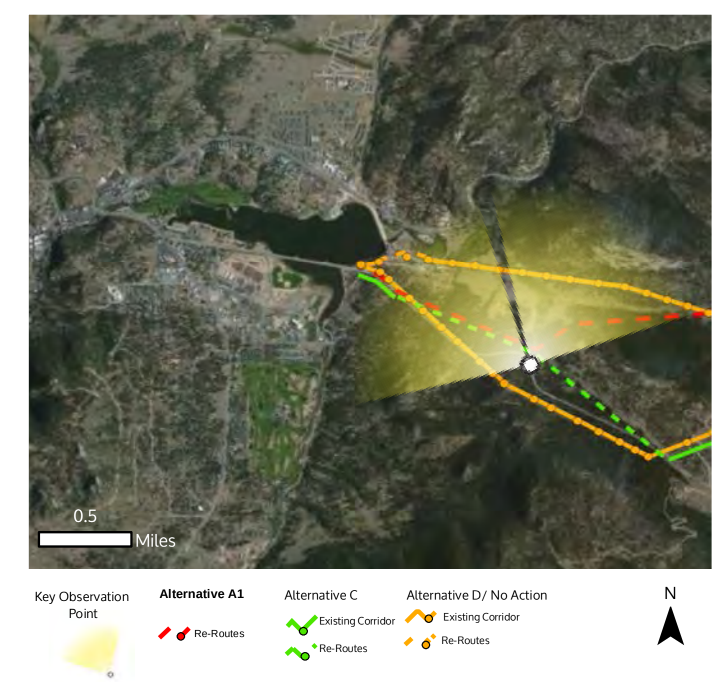
Description: Highway 36, Estes Park Overlook/Entrance Sign
Date Taken: 4/22/2012
Time Taken: 8:08 a.m.
Latitude: 476065
Longitude: 4468056
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D90
35mm Focal Length: 82mm/Digital Focal Length: 55mm
Distance to Nearest Proposed Structure: 796'

Structures



Monopole Structure Angle Structure

Key Map



KOP 5 - Existing Conditions

KOP 5 - Alternative B/C (105′ Structures)

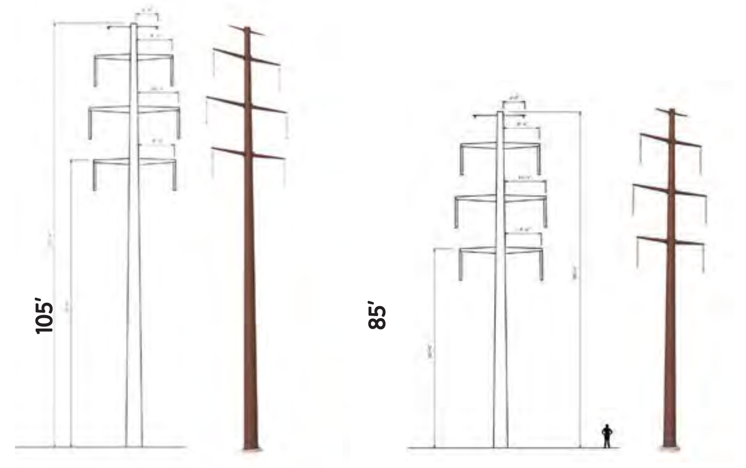
Double Circuit Line on a Consolidated ROW (South)

KOP 5 - Alternative B/C (85′ Structures)

KOP 5 - Alternative B / Alternative C

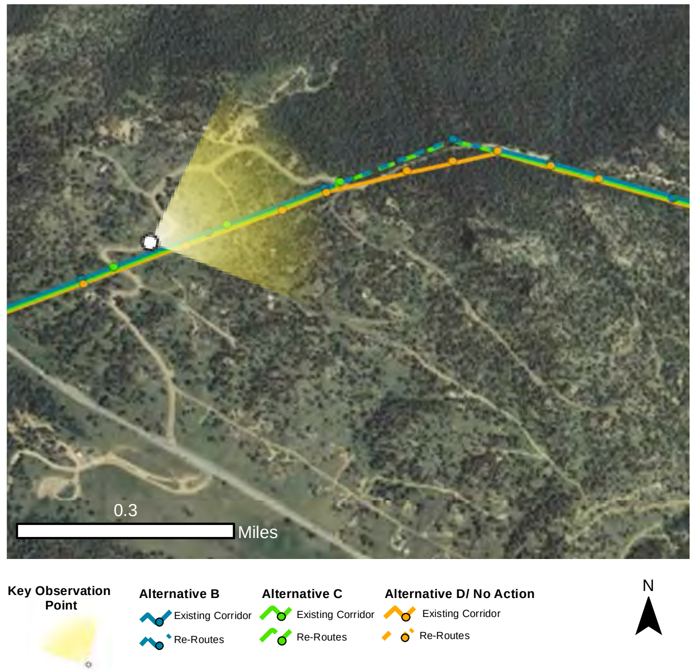
Description: Meadowdale Hills Subdivision: View Looking Northeast Towards E-PH Transmission Line
Date Taken: 9/18/2011
Time Taken: 3:40 p.m.
Latitude: 461375
Longitude: 4467871
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 51mm/Digital Focal Length: 34mm
Distance to Nearest Proposed Structure: 500′
**Prepared by View Point West*

Structures



Monopole Structure	Monopole Structure
850′ Ruling Span	450′ Ruling Span

Key Map

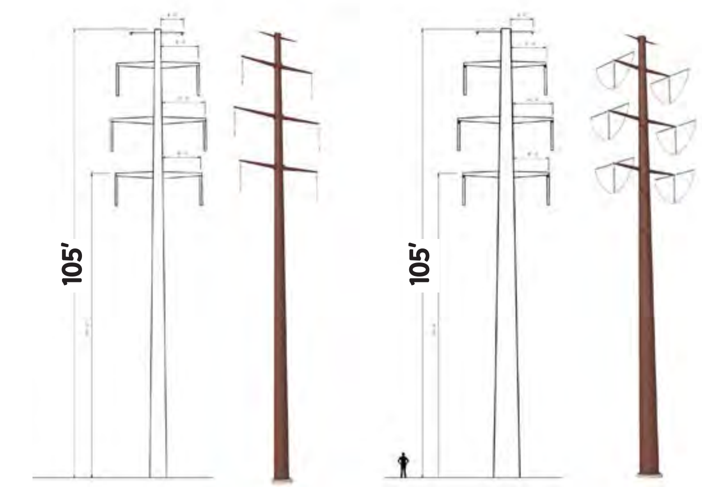


KOP 6 - Existing Conditions

KOP 6 - Alternative B / Alternative C

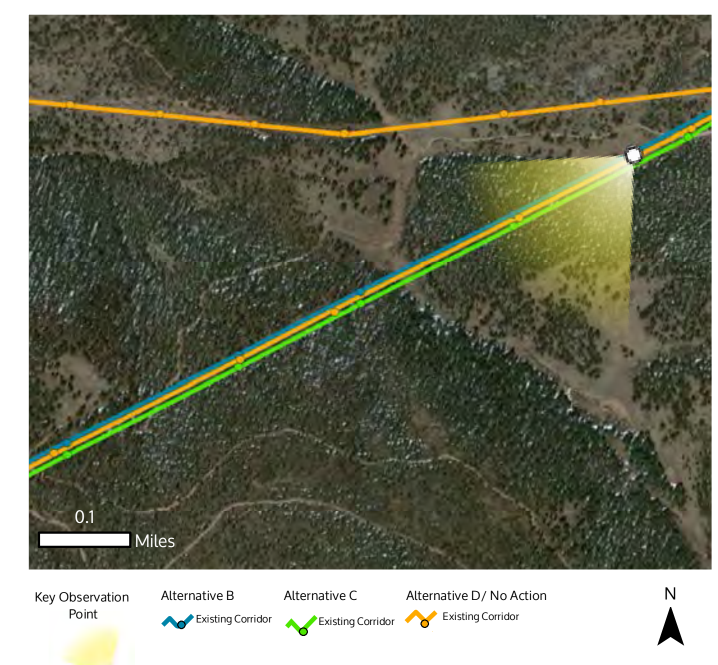
Description: Pole Hill Road: View from USFS Lands near Pole Hill Road and Microwave Station, Looking Southwest Towards E-PH Transmission Line
Date Taken: 2/15/2012
Time Taken: 2:11 p.m.
Latitude: 464170
Longitude: 4468409
Coordinate System: NAD 1983 UTM 13N
Camera: Olympus C3040Z
35mm Focal Length: 100mm/Digital Focal Length: 21mm
Distance to Nearest Proposed Structure: 788'
Prepared by View Point West

Structures



Monopole Structure   Angle Structure

Key Map



KOP 6 - Alternative B/C - Weathered Steel

KOP 6 - Alternative B/C - Galvanized

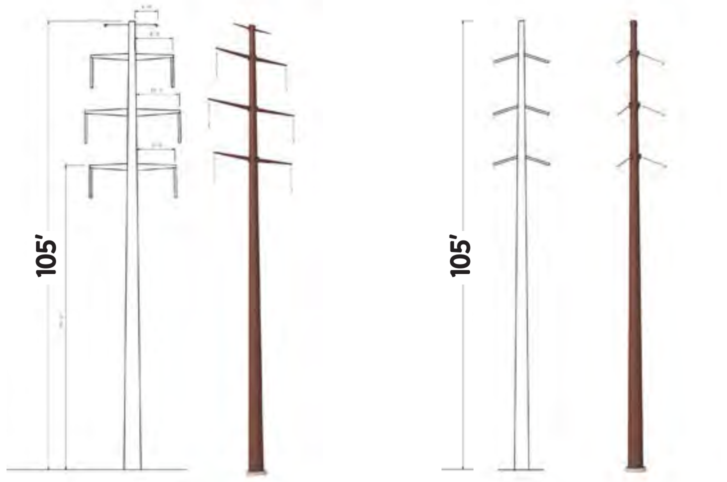
Double Circuit Line on a Consolidated ROW (South) / Double Circuit Line on a Consolidated ROW Using North and South Alignments

Double Circuit Line on a Consolidated ROW (South)

KOP 7 - Alternative B

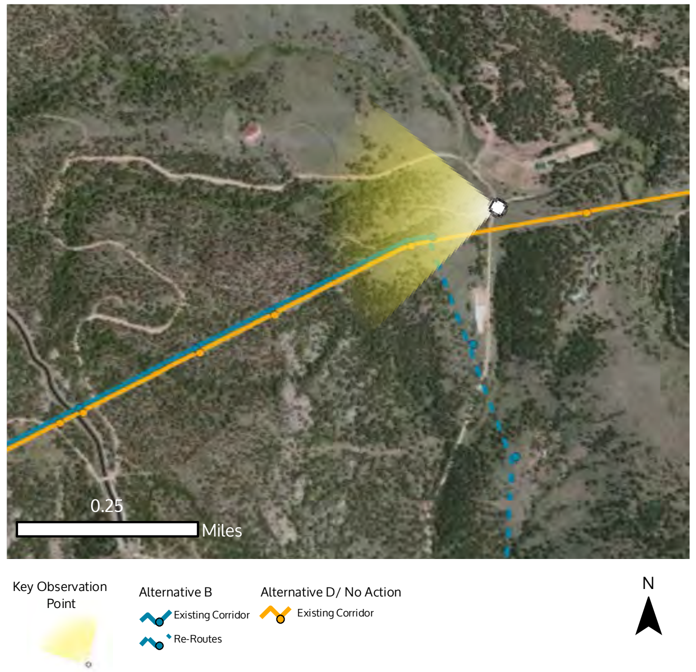
Description: Pole Hill Road: View from Quillan Gulch Road, Looking West Towards E-LS Transmission Line and USFS lands.
Date Taken: 10/19/2011
Time Taken: 10:01 a.m.
Latitude: 472673
Longitude: 4469230
Coordinate System: NAD 1983 UTM 13N
Camera: Apple Iphone 4
35mm Focal Length: 29mm/Digital Focal Length: 4mm
Distance to Nearest Proposed Structure: 520'
**Prepared by View Point West*

Structures



Monopole Structure
Monopole Angle Structure

Key Map



KOP 8 - Alternative C (105′ and 85′ Tall Structures)

Description: Pinewood Reservoir: Day Use Area View looking South/Southwest
Date Taken: 10/17/2012
Time Taken: 10:14 a.m.
Latitude: 475980.705067
Longitude: 4468147.04358
Coordinate System: NAD 1983 UTM 13N
Camera: Canon EOS Rebel T1i
Focal Length: 35mm
Distance to Nearest Proposed Structure: 979′

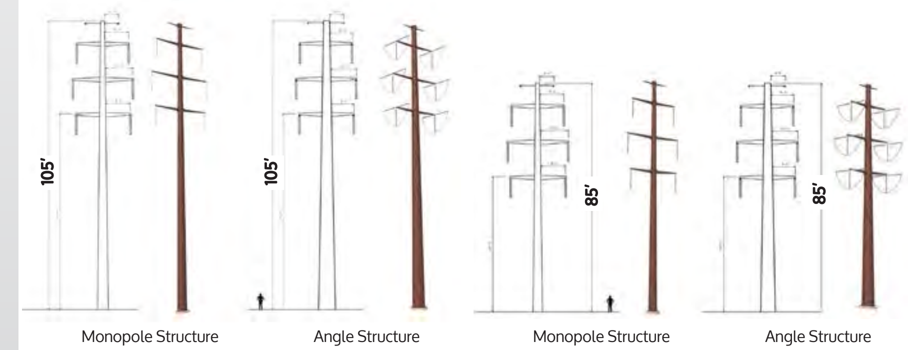
KOP 8 - Existing Conditions

KOP 8 - Alternative C (**85′** Structures)

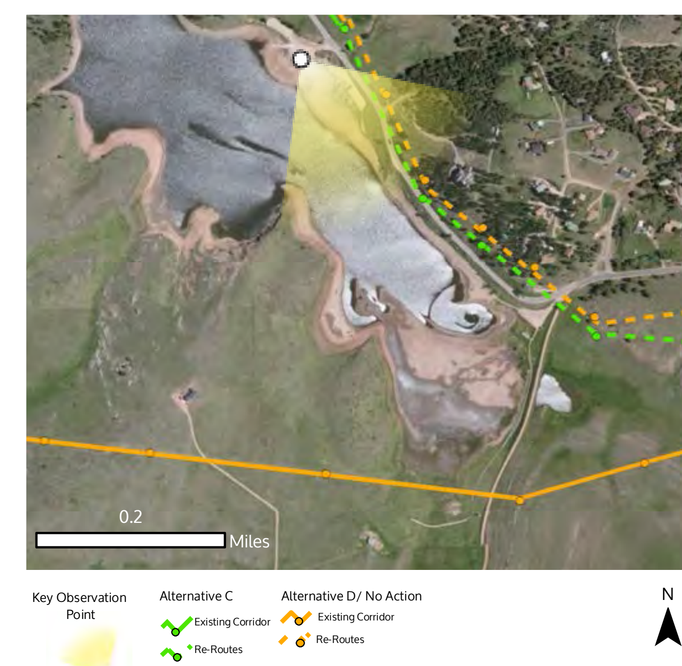
KOP 8 - Alternative C (**105′** Structures)

Double Circuit Line on a Consolidated ROW Using North and South Alignments

Structures



Key Map



Visualizations

Estes-Flatiron 115 kV Transmission Line Rebuild EIS

March 2014

Logan Simpson Design Inc.

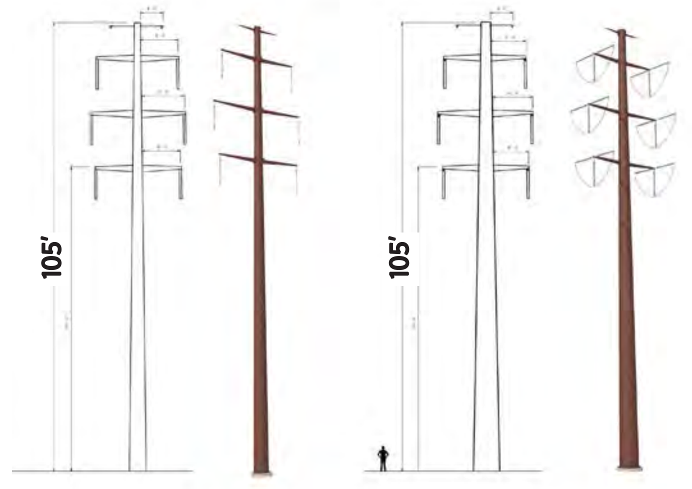
Western Area Power Administration

Double Circuit Line on a Consolidated ROW (South)

KOP 8a - Alternative B

Description: Pinewood Reservoir: Day Use Area View looking South
Date Taken: 9/19/2011
Time Taken: 10:42 a.m.
Latitude: 476065
Longitude: 4468056
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 51mm/Digital Focal Length: 34mm
Distance to Nearest Proposed Structure: 2,034'
**Prepared by View Point West*

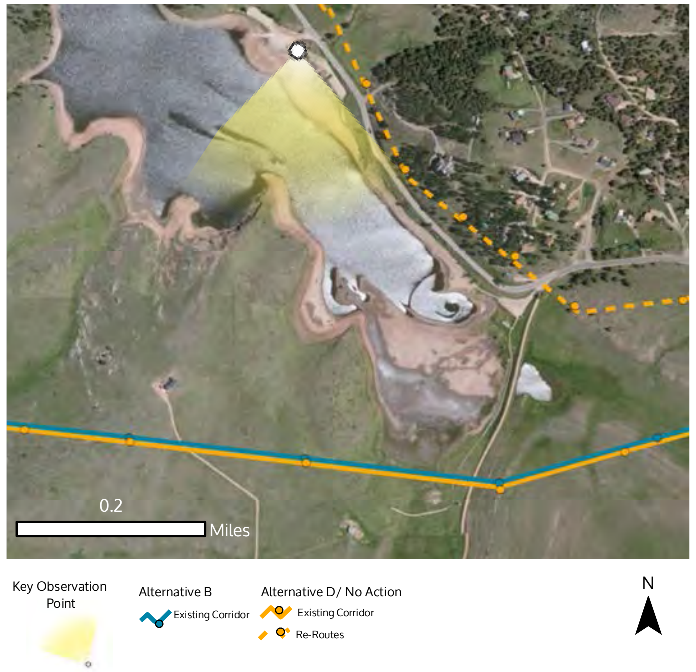
Structures



Monopole Structure

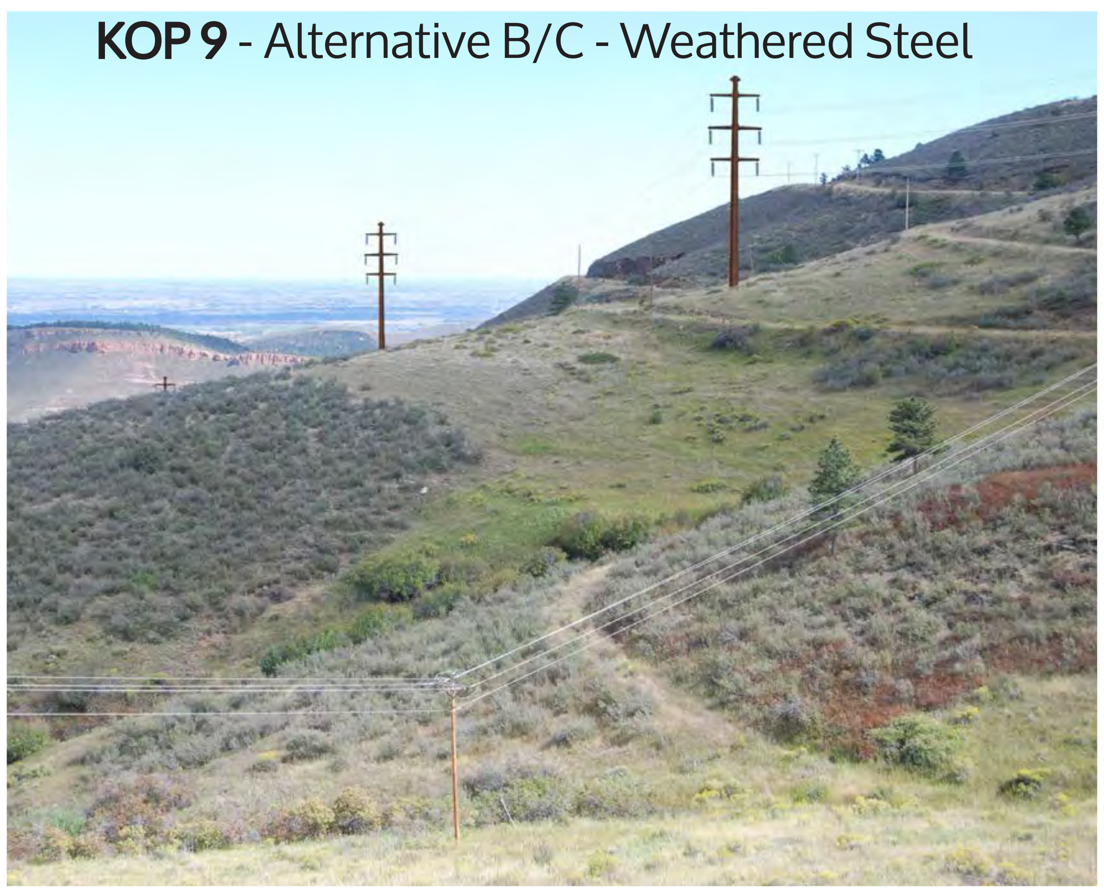
Angle Structure

Key Map

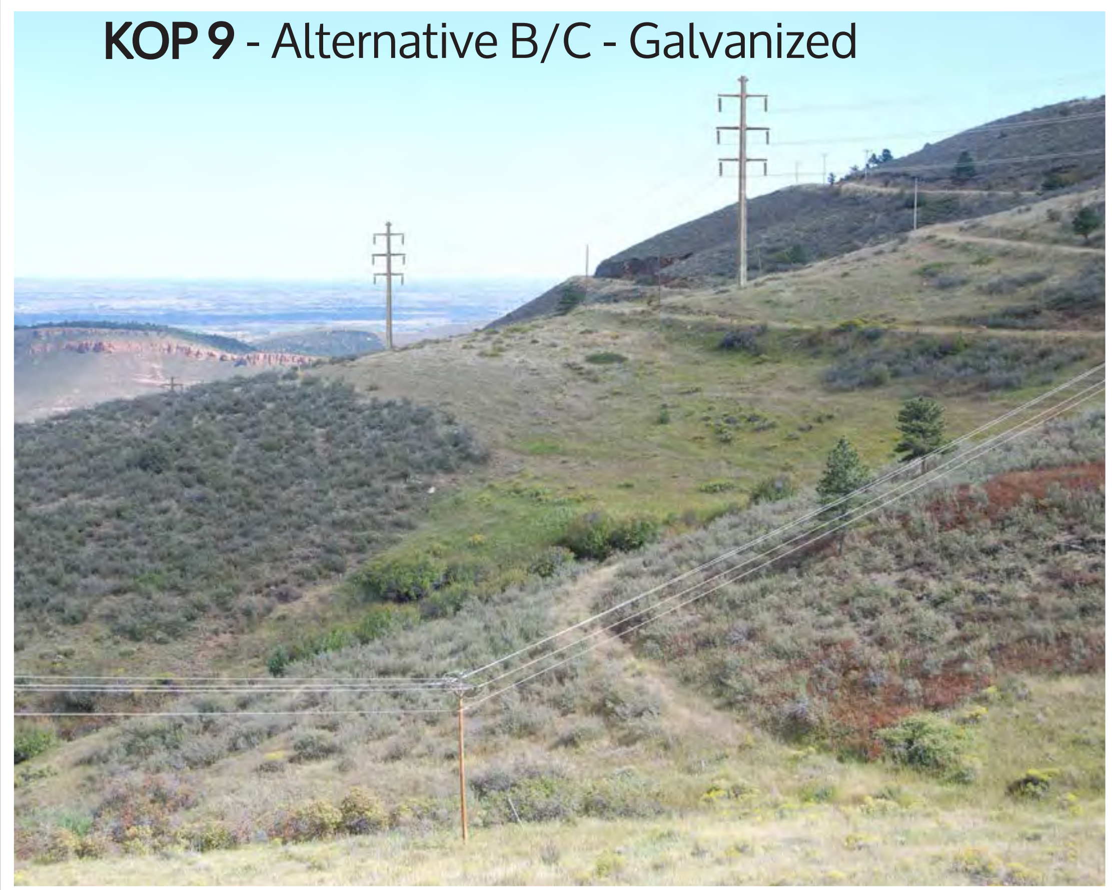


KOP 9 - Existing Conditions

KOP 9 - Alternative B/C - Weathered Steel



KOP 9 - Alternative B/C - Galvanized

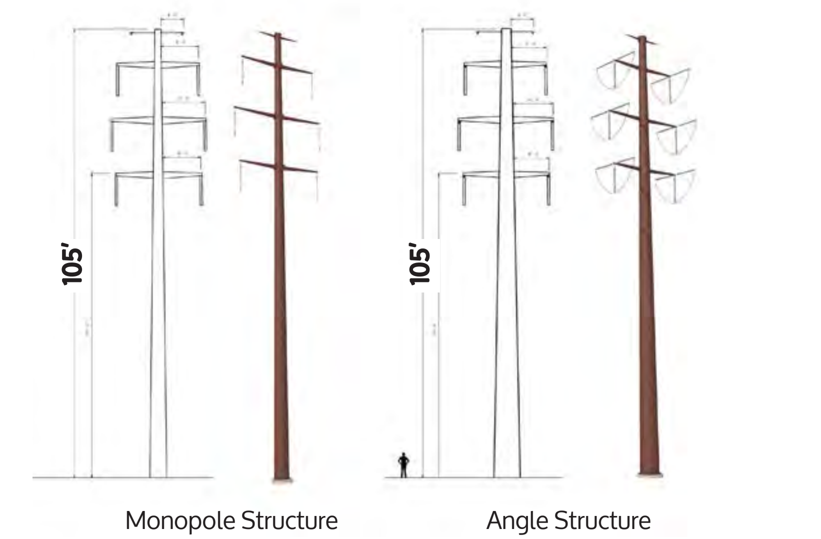


Double Circuit Line on a Consolidated ROW (South) / Double Circuit Line on a Consolidated ROW Using North and South Alignments

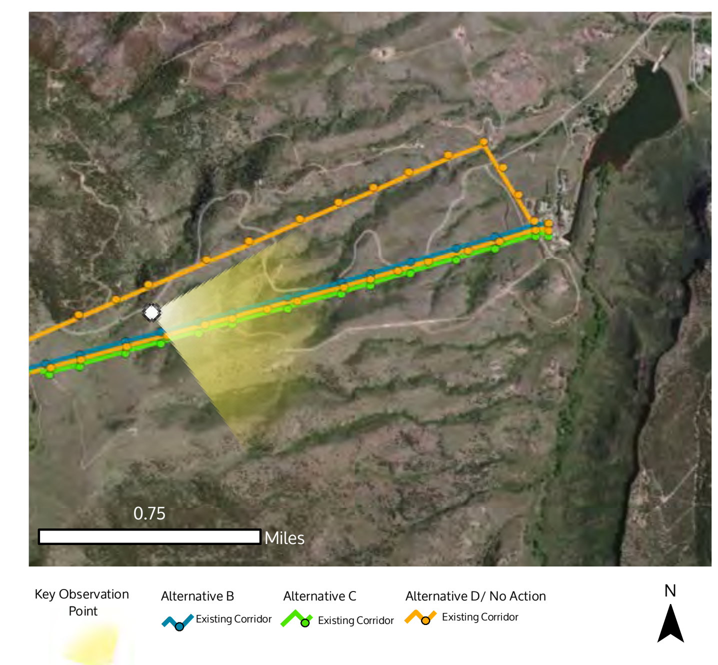
KOP 9 - Alternative B / Alternative C

Description: W County Road 18E: View Looking Southeast Towards FI-PH Transmission Line
Date Taken: 9/18/2011
Time Taken: 1:52 p.m.
Latitude: 477724
Longitude: 4467930
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 51mm/Digital Focal Length: 34mm
Distance to Nearest Proposed Structure: 798'
Prepared by View Point West

Structures



Key Map



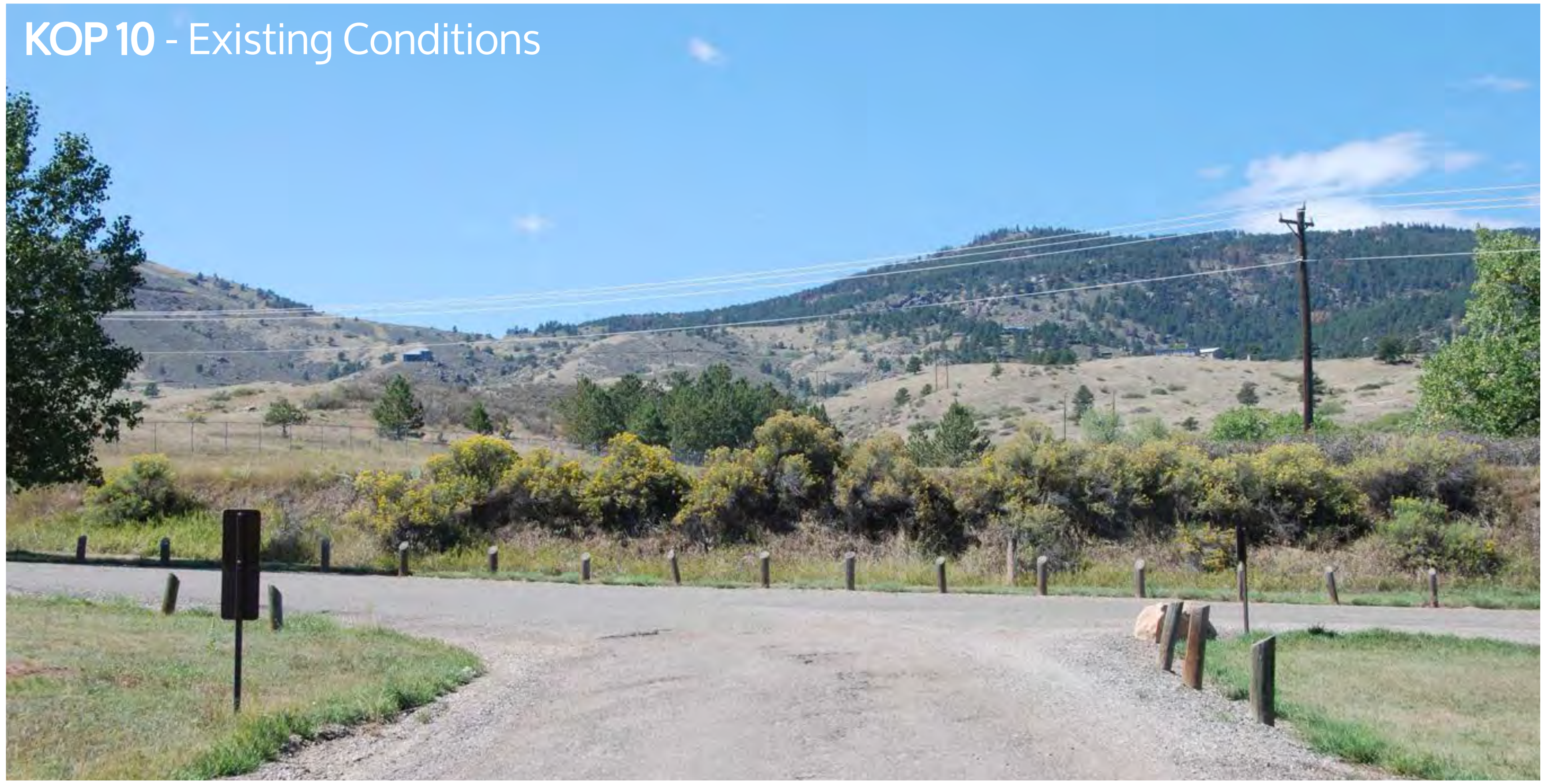
Visualizations

Estes-Flatiron 115 kV Transmission Line Rebuild EIS

March 2014

Logan Simpson Design Inc.

Western Area Power Administration

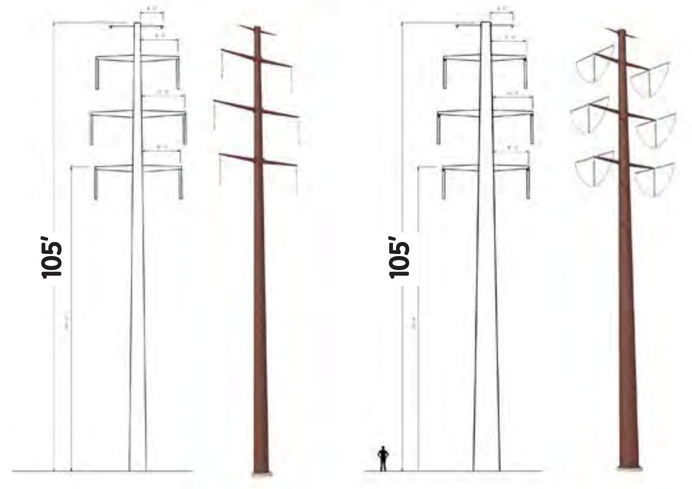


Double Circuit Line on a Consolidated ROW (North) Re-Route

KOP 10 - Alternative A

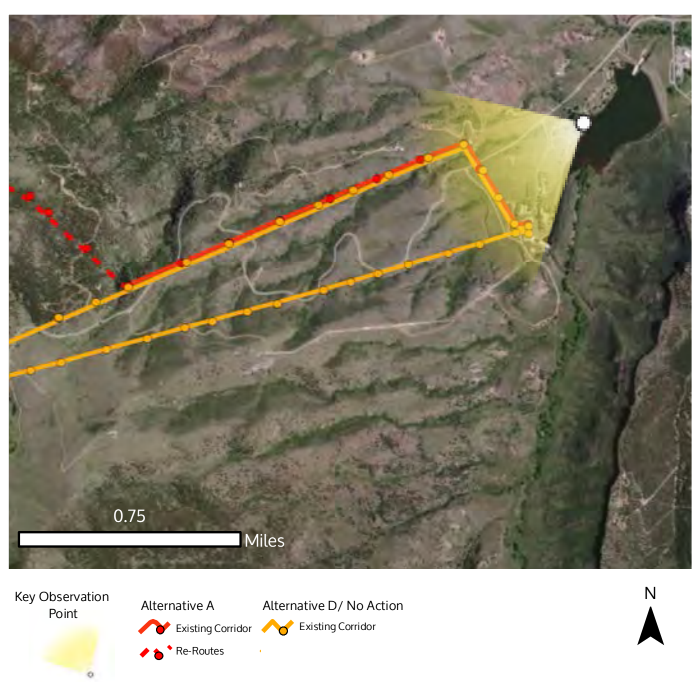
Description: Pole Hill Rd / CR 18E at Flatiron Picnic and Day Use Area: View Looking West Towards FI-PH and E-LS Transmission Lines
Date Taken: 9/18/2011
Time Taken: 11:56 a.m.
Latitude: 480053
Longitude: 4468877
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 51mm/Digital Focal Length: 34mm
Distance to Nearest Proposed Structure: 1,551'

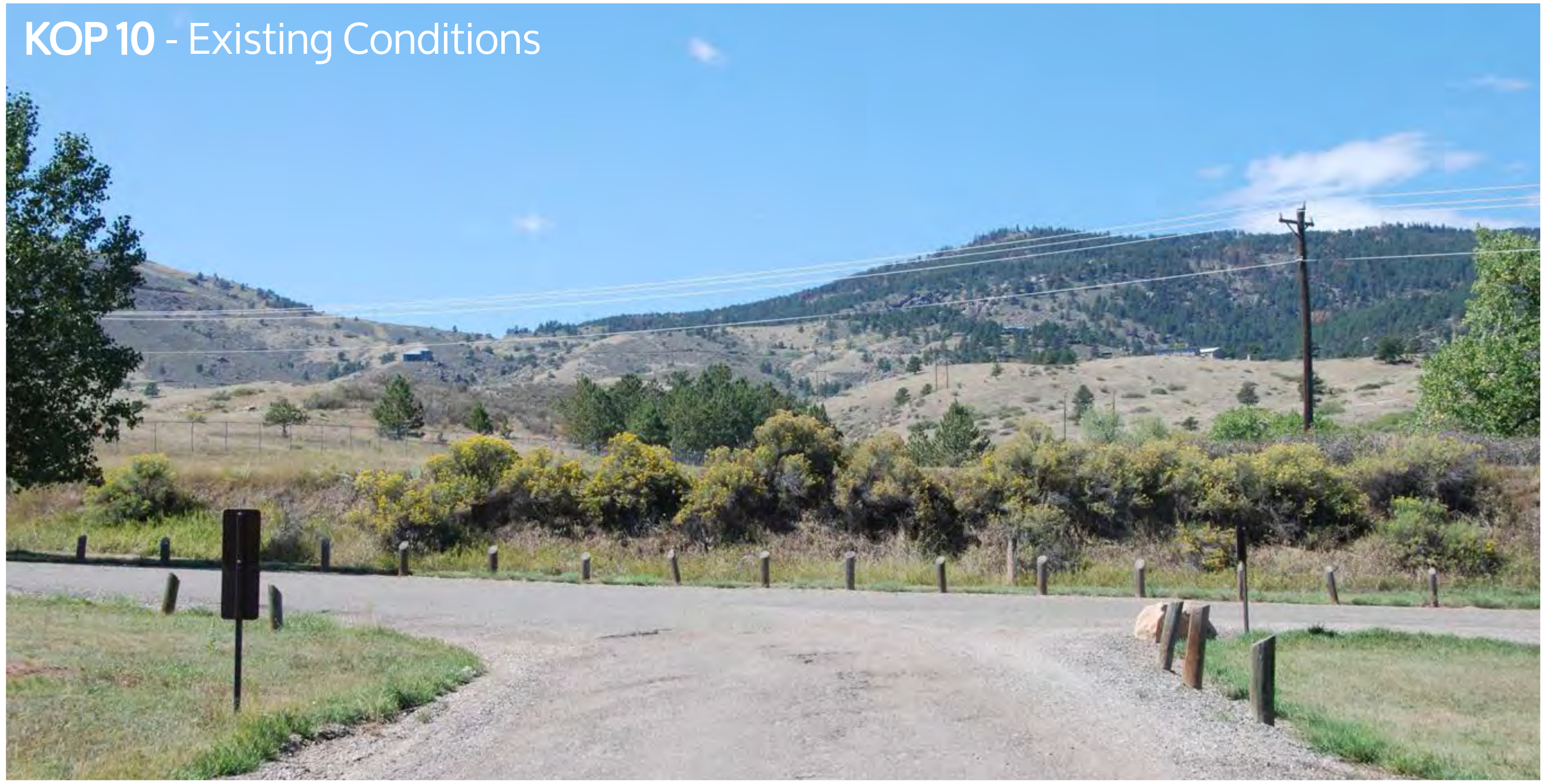
Structures



Monopole Structure   Angle Structure

Key Map



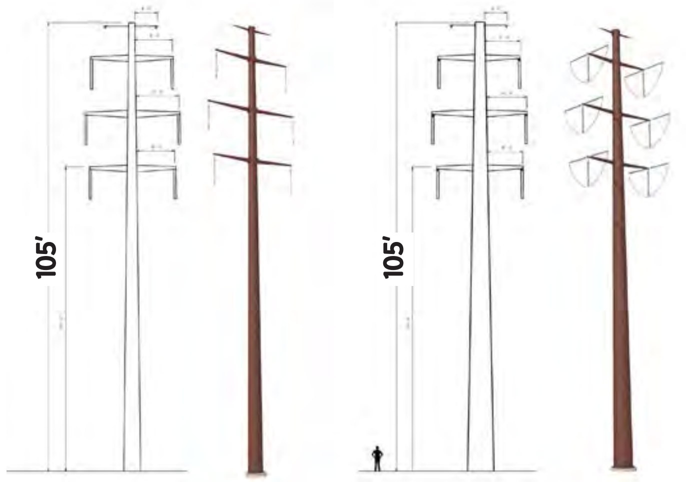


Double Circuit Line on a Consolidated ROW (South) / Double Circuit Line on a Consolidated ROW Using North and South Alignments

KOP 10 - Alternative B / Alternative C

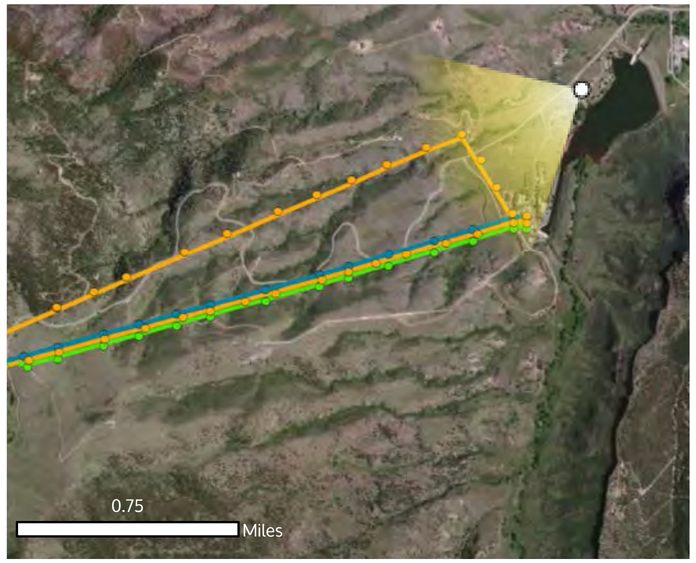
Description: Pole Hill Rd / CR 18E at Flatiron Picnic and Day Use Area: View Looking West Towards FI-PH and E-LS Transmission Lines
Date Taken: 9/18/2011
Time Taken: 11:56 a.m.
Latitude: 480053
Longitude: 4468877
Coordinate System: NAD 1983 UTM 13N
Camera: Nikon D80
35mm Focal Length: 51mm/Digital Focal Length: 34mm
Distance to Nearest Proposed Structure: 1,861'
Prepared by View Point West

Structures



Monopole Structure | Angle Structure

Key Map



KOP 11 - Existing Conditions

KOP 11

Description: Hermit Park
Date Taken: 11/17/2012
Time Taken: 1:15 p.m.
Latitude: 461282.200996
Longitude: 4467395.89025
Coordinate System: NAD 1983 UTM 13N
Camera: Canon EOS Digital Rebel XT
Focal Length: 43mm
Distance to Nearest Proposed Structure: 1,300'

No alternatives are simulated from KOP 11. Black arrows point to existing structures (No Action).

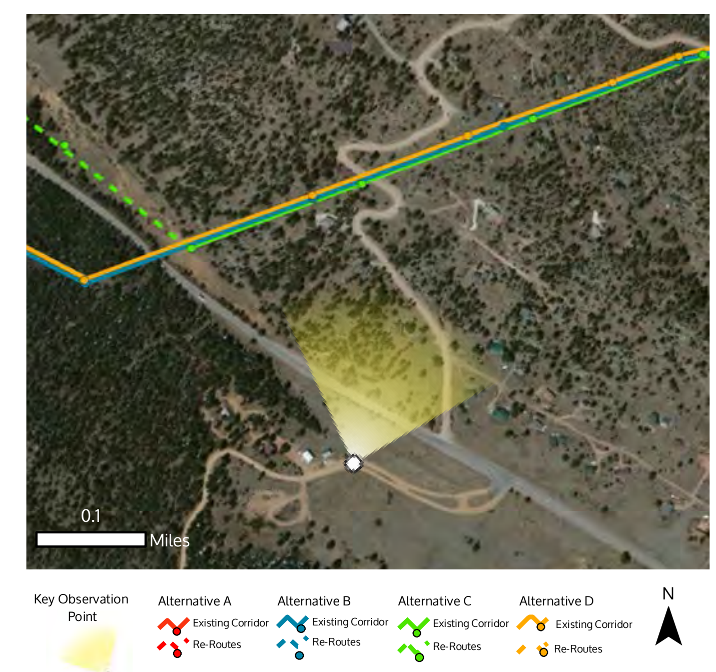
Alternative A and Variants A1/A2 would not be visible from KOP 11.

Alternatives B/C are not simulated in this panoramic view. A double-circuit line utilizing steel monopoles would replace the highlighted structures in the No Action.

Variant C1 is not simulated. Underground construction would replace the highlighted structures in the No Action.

Alternative D, rebuild with compliance mitigation, would appear similar to the existing conditions, with structures below each of the black arrows.

Key Map



KOP 12 - Existing Conditions

Black arrows point to existing structures (No Action).

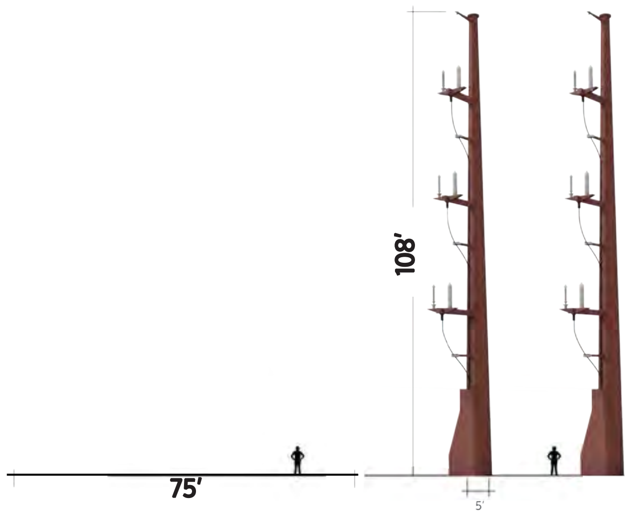
KOP 12 - Underground Variant A2 / C1

Consolidated ROWs for Underground Variants A2 / C1 would not be visible from KOP 12 except for two above-ground transition structures along Highway 36. The No Action Alternative would be visible following the north and south ROWs as shown in the existing conditions photograph. Alternative A and Variant A1 would be visible descending the Notch and then screened from view until reaching the Lake Estes Causeway. Alternative B would be visible south of Highway 36, replacing the two existing structures visible in the the south ROW. Alternative C would not be visible until reaching the Lake Estes Causeway. Alternative D, rebuild with compliance mitigation, would appear similar to the existing conditions, with structures below each of the black arrows.

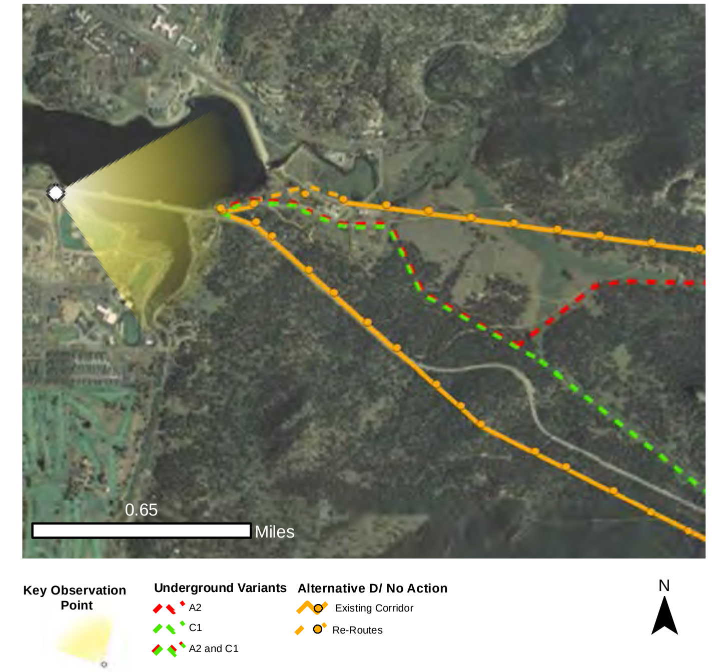
KOP 12 - Underground Variants A2 / C1

Description: Lake Estes Causeway
Date Taken: 10/3/2012
Time Taken: 1:23 p.m.
Latitude: 457580.165252
Longitude: 4469442.66784
Coordinate System: NAD 1983 UTM 13N
Camera: Canon EOS Rebel T1i
Focal Length: 35mm
Distance to Nearest Proposed Structure: 2,700'

Structures



Key Map



Visualizations

Estes-Flatiron 115 kV Transmission Line Rebuild EIS

March 2014

LOGAN SIMPSON DESIGN INC.

Western AREA POWER ADMINISTRATION

KOP 13

Description: Newell Lake Subdivision
Date Taken: 10/17/2012
Time Taken: 10:42 a.m.
Latitude: 476421.558363
Longitude: 4467930.24523
Coordinate System: NAD 1983 UTM 13N
Camera: Canon EOS Rebel T1i
Focal Length: 33mm
Distance to Nearest Proposed Structure: 560'

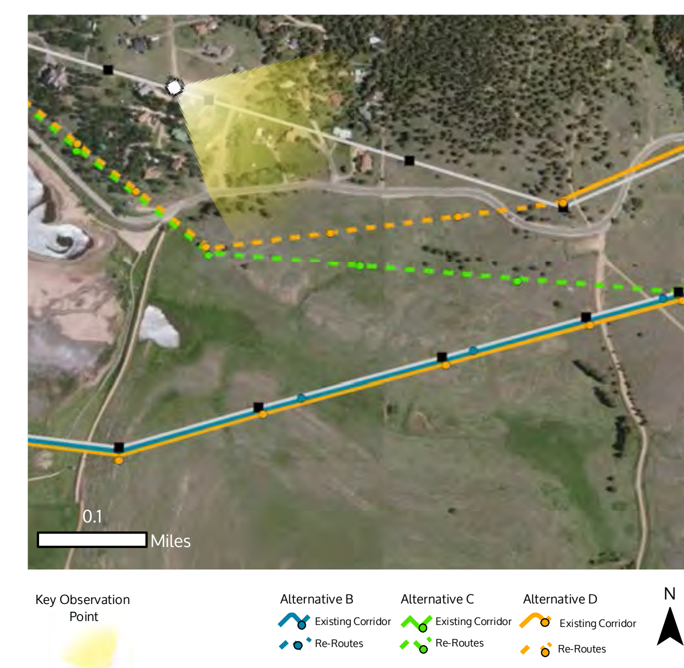
No alternatives are simulated from KOP 13. Black arrows point to existing structures.

No Action / Alternative D would remove the existing transmission line on the north ROW through the Newell Lake Subdivision, and re-route it along Pole Hill Road 0.1 mile to the south. Existing structures along the south ROW would remain unchanged (see two right black arrows).

Alternative A and Variants A1/A2 would not be visible.

Alternative B/C and Variant C1 would be visible, replacing the two existing structures visible in the the south ROW with double-circuit steel monopoles.

Key Map




KOP 14 - Existing Conditions

KOP 14

Description: Northeast of the Meadowdale Hills Subdivision: View Looking Northwest Towards E-PH Transmission Line
Date Taken: 1/04/2014
Time Taken: 1:15 p.m.
Latitude: 462204
Longitude: 4468070
Coordinate System: NAD 1983 UTM 13N
Camera: Olympus Optical Co
Digital Focal Length: 11mm
Distance to Nearest Proposed Structure: 230'

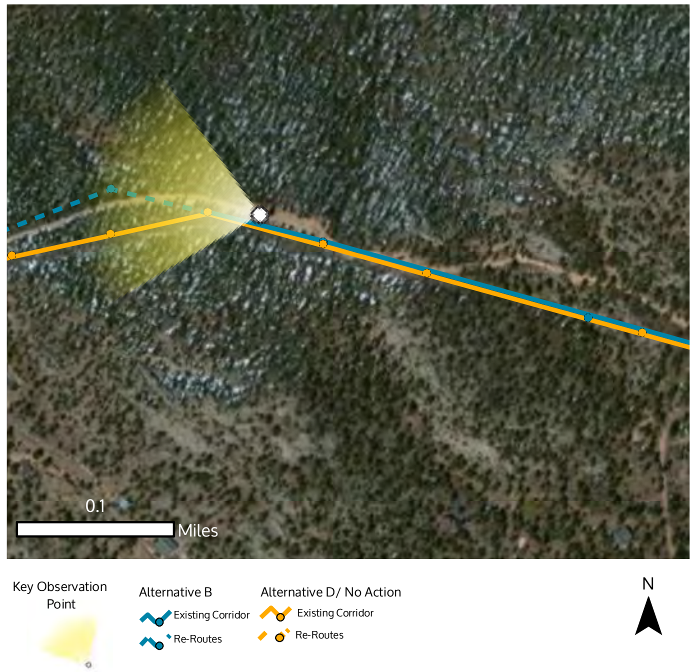
No alternatives are simulated from KOP 14. Black arrows point to existing structures.

No Action / Alternative D replace the existing transmission line similar to existing conditions.

Alternative A and Variants A1/A2 would not be visible.

Alternative B/C and Variant C1 would be visible, with one angle structure downhill replacing the existing structures visible in the the south ROW with double-circuit steel monopoles.

Key Map



Appendix D

Electric and Magnetic Fields Associated with the Use of Electric Power

June 2002

EMF

Electric and Magnetic Fields Associated with the Use of Electric Power

Questions & Answers

prepared by the
National Institute of Environmental Health Sciences
National Institutes of Health

sponsored by the
NIEHS/DOE EMF RAPID Program

Contents

Introduction

Since the mid-twentieth century, electricity has been an essential part of our lives. Electricity powers our appliances, office equipment, and countless other devices that we use to make life safer, easier, and more interesting. Use of electric power is something we take for granted. However, some have wondered whether the electric and magnetic fields (EMF) produced through the generation, transmission, and use of electric power [power-frequency EMF, 50 or 60 hertz (Hz)] might adversely affect our health. Numerous research studies and scientific reviews have been conducted to address this question.

Unfortunately, initial studies of the health effects of EMF did not provide straightforward answers. The study of the possible health effects of EMF has been particularly complex and results have been reviewed by expert scientific panels in the United States and other countries. This booklet summarizes the results of these reviews. Although questions remain about the possibility of health effects related to EMF, recent reviews have substantially reduced the level of concern.

The largest evaluation to date was led by two U.S. government institutions, the National Institute of Environmental Health Sciences (NIEHS) of the National Institutes of Health and the Department of Energy (DOE), with input from a wide range of public and private agencies. This evaluation, known as the Electric and Magnetic Fields Research and Public Information Dissemination (EMF RAPID) Program, was a six-year project with the goal of providing scientific evidence to determine whether exposure to power-frequency EMF involves a potential risk to human health.

In 1999, at the conclusion of the EMF RAPID Program, the NIEHS reported to the U.S. Congress that the overall scientific evidence for human health risk from EMF exposure is weak. No consistent pattern of biological effects from exposure to EMF had emerged from laboratory studies with animals or with cells. However, epidemiological studies (studies of disease incidence in human populations) had shown a fairly consistent pattern that associated potential EMF exposure with a small increased risk for leukemia in children and chronic lymphocytic leukemia in adults. Since 1999, several other assessments have been completed that support an association between childhood leukemia and exposure to power-frequency EMF. These more recent reviews, however, do not support a link between EMF exposures and adult leukemias. For both childhood and adult leukemias, interpretation of the epidemiological findings has been difficult due to the absence of supporting laboratory evidence or a scientific explanation linking EMF exposures with leukemia.

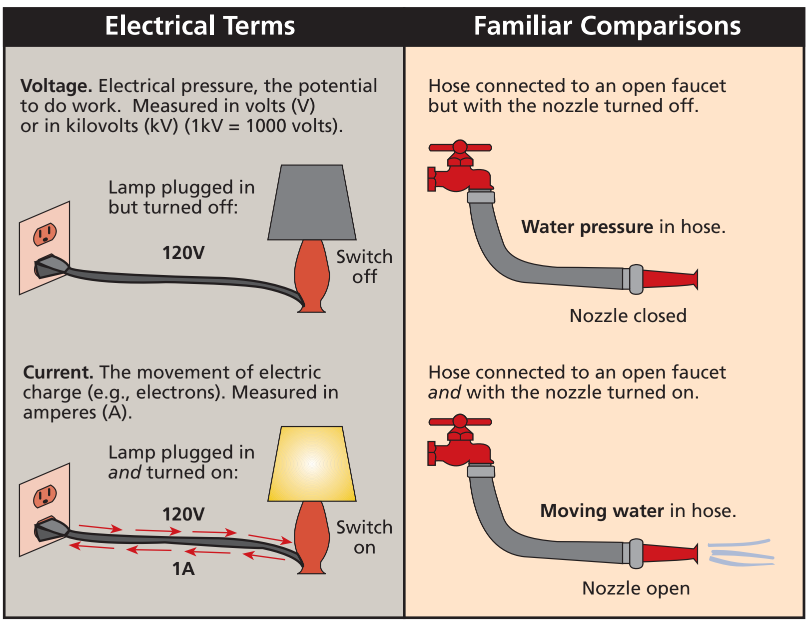
EMF exposures are complex and exist in the home and workplace as a result of all types of electrical equipment and building wiring as well as a result of nearby power lines. This booklet explains the basic principles of electric and magnetic fields, provides an overview of the results of major research studies, and summarizes conclusions of the expert review panels to help you reach your own conclusions about EMF-related health concerns.

1 EMF Basics

This chapter reviews terms you need to know to have a basic understanding of electric and magnetic fields (EMF), compares EMF with other forms of electromagnetic energy, and briefly discusses how such fields may affect us.

Q What are electric and magnetic fields?

A Electric and magnetic fields (EMF) are invisible lines of force that surround any electrical device. Power lines, electrical wiring, and electrical equipment all produce EMF. There are many other sources of EMF as well (see pages 33–35). The focus of this booklet is on power-frequency EMF—that is, EMF associated with the generation, transmission, and use of electric power.



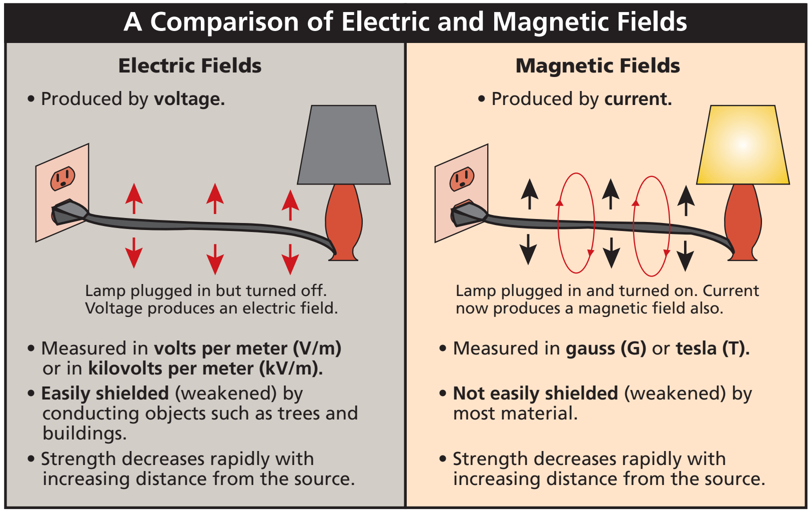
Voltage produces an electric field and current produces a magnetic field.

Electric fields are produced by voltage and increase in strength as the voltage increases. The electric field strength is measured in units of volts per meter (V/m). Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases. Magnetic fields are measured in units of gauss (G) or tesla (T).

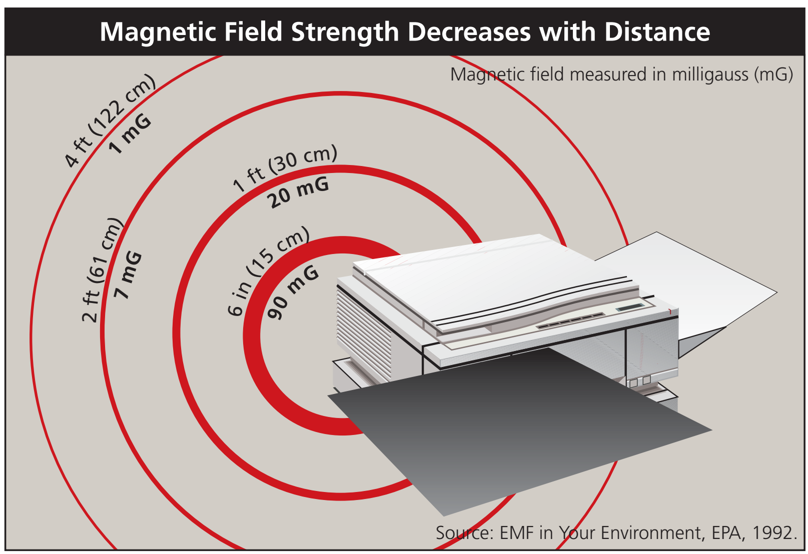
Most electrical equipment has to be turned on, i.e., current must be flowing, for a magnetic field to be produced. Electric fields are often present even when the equipment is switched off, as long as it remains connected to the source of electric power. Brief bursts of EMF (sometimes called "transients") can also occur when electrical devices are turned on or off.

Electric fields are shielded or weakened by materials that conduct electricity—even materials that conduct poorly, including trees, buildings, and human skin. Magnetic fields, however, pass through most materials and are therefore more difficult to shield. Both electric fields and magnetic fields decrease rapidly as the distance from the source increases.

Even though electrical equipment, appliances, and power lines produce both electric and magnetic fields, most recent research has focused on potential health effects of magnetic field exposure. This is because some epidemiological studies have reported an increased cancer risk associated with estimates of magnetic field exposure (see pages 19 and 20 for a summary of these studies). No similar associations have been reported for electric fields; many of the studies examining biological effects of electric fields were essentially negative.



An appliance that is plugged in and therefore connected to a source of electricity has an electric field even when the appliance is turned off. To produce a magnetic field, the appliance must be plugged in and turned on so that the current is flowing.



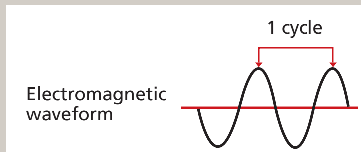
You cannot see a magnetic field, but this illustration represents how the strength of the magnetic field can diminish just 1–2 feet (30–61 centimeters) from the source. This magnetic field is a 60-Hz power-frequency field.

Characteristics of electric and magnetic fields

Electric fields and magnetic fields can be characterized by their wavelength, frequency, and amplitude (strength). The graphic below shows the waveform of an alternating electric or magnetic field. The direction of the field alternates from one polarity to the opposite and back to the first polarity in a period of time called one cycle. Wavelength describes the distance between a peak on the wave and the next peak of the same polarity. The frequency of the field, measured in hertz (Hz), describes the number of cycles that occur in one second. Electricity in North America alternates through 60 cycles per second, or 60 Hz. In many other parts of the world, the frequency of electric power is 50 Hz.

Frequency and Wavelength

Frequency is measured in hertz (Hz).
1 Hz = 1 cycle per second.



Examples:

Source	Frequency	Wavelength
Power line (North America)	60 Hz	3100 miles (5000 km)
Power line (Europe and most other locations)	50 Hz	3750 miles (6000 km)

Q How is the term EMF used in this booklet?

A The term “EMF” usually refers to electric and magnetic fields at extremely low frequencies such as those associated with the use of electric power. The term EMF can be used in a much broader sense as well, encompassing electromagnetic fields with low or high frequencies (see page 8).

Measuring EMF: Common Terms

Electric fields

Electric field strength is measured in volts per meter (V/m) or in kilovolts per meter (kV/m). 1 kV = 1000 V

Magnetic fields

Magnetic fields are measured in units of gauss (G) or tesla (T). Gauss is the unit most commonly used in the United States. Tesla is the internationally accepted scientific term. 1 T = 10,000 G

Since most environmental EMF exposures involve magnetic fields that are only a fraction of a tesla or a gauss, these are commonly measured in units of microtesla (μT) or milligauss (mG). A milligauss is 1/1,000 of a gauss. A microtesla is 1/1,000,000 of a tesla. 1 G = 1,000 mG; 1 T = 1,000,000 μT

To convert a measurement from microtesla (μT) to milligauss (mG), multiply by 10.
1 μT = 10 mG; 0.1 μT = 1 mG

When we use EMF in this booklet, we mean extremely low frequency (ELF) electric and magnetic fields, ranging from 3 to 3,000 Hz (see page 8). This range includes power-frequency (50 or 60 Hz) fields. In the ELF range, electric and magnetic fields are not coupled or interrelated in the same way that they are at higher frequencies. So, it is more useful to refer to them as "electric and magnetic fields" rather than "electromagnetic fields." In the popular press, however, you will see both terms used, abbreviated as EMF.

This booklet focuses on extremely low frequency EMF, primarily power-frequency fields of 50 or 60 Hz, produced by the generation, transmission, and use of electricity.

Q How are power-frequency EMF different from other types of electromagnetic energy?

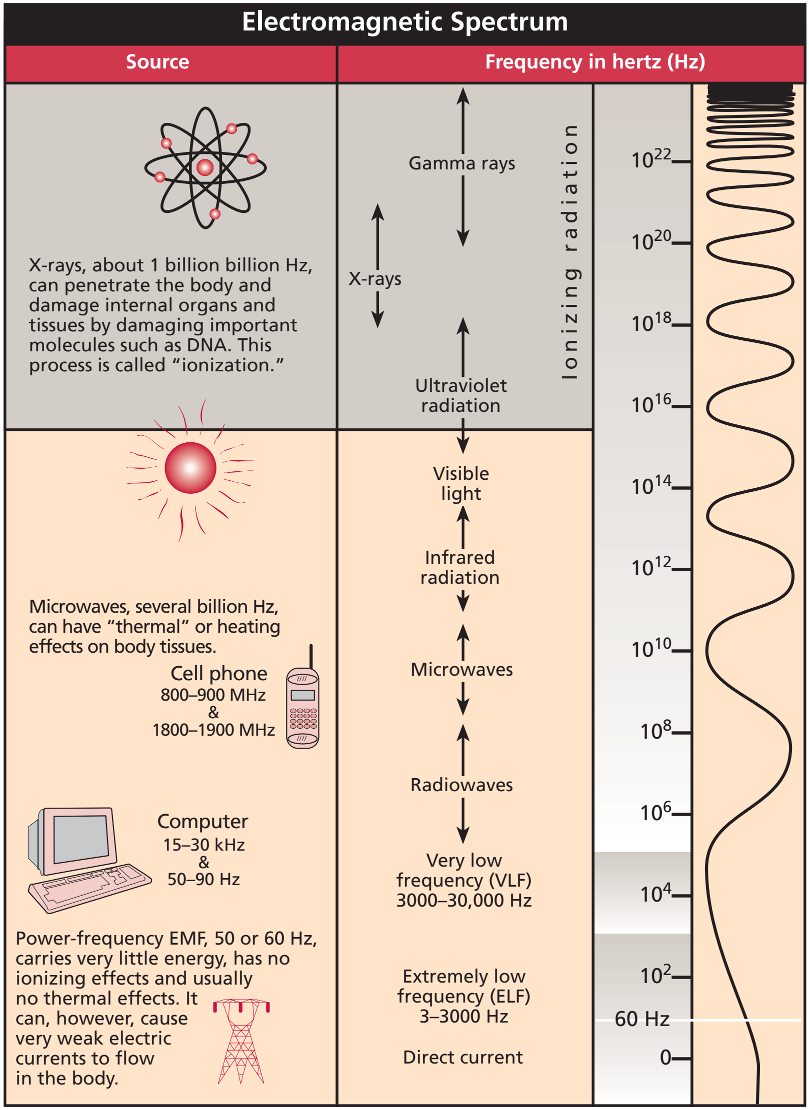
A X-rays, visible light, microwaves, radio waves, and EMF are all forms of electromagnetic energy. One property that distinguishes different forms of electromagnetic energy is the frequency, expressed in hertz (Hz). Power-frequency EMF, 50 or 60 Hz, carries very little energy, has no ionizing effects, and usually has no thermal effects (see page 8). Just as various chemicals affect our bodies in different ways, various forms of electromagnetic energy can have very different biological effects (see "Results of EMF Research" on page 16).

Some types of equipment or operations simultaneously produce electromagnetic energy of different frequencies. Welding operations, for example, can produce electromagnetic energy in the ultraviolet, visible, infrared, and radio-frequency ranges, in addition to power-frequency EMF. Microwave ovens produce 60-Hz fields of several hundred milligauss, but they also create microwave energy inside the oven that is at a much higher frequency (about 2.45 billion Hz). We are shielded from the higher frequency fields inside the oven by its casing, but we are not shielded from the 60-Hz fields.

Cellular telephones communicate by emitting high-frequency electric and magnetic fields similar to those used for radio and television broadcasts. These radio-frequency and microwave fields are quite different from the extremely low frequency EMF produced by power lines and most appliances.

Q How are alternating current sources of EMF different from direct current sources?

A Some equipment can run on either alternating current (AC) or direct current (DC). In most parts of the United States, if the equipment is plugged into a household wall socket, it is using AC electric current that reverses direction in the electrical wiring—or alternates—60 times per second, or at 60 hertz (Hz). If the equipment uses batteries, then electric current flows in one direction only. This



The wavy line at the right illustrates the concept that the higher the frequency, the more rapidly the field varies. The fields do not vary at 0 Hz (direct current) and vary trillions of times per second near the top of the spectrum. Note that 10^4 means 10 x 10 x 10 x 10 or 10,000 Hz. 1 kilohertz (kHz) = 1,000 Hz. 1 megahertz (MHz) = 1,000,000 Hz.

produces a “static” or stationary magnetic field, also called a direct current field. Some battery-operated equipment can produce time-varying magnetic fields as part of its normal operation.

Q What happens when I am exposed to EMF?

A In most practical situations, DC electric power does not induce electric currents in humans. Strong DC magnetic fields are present in some industrial environments, can induce significant currents when a person moves, and may be of concern for other reasons, such as potential effects on implanted medical devices (see page 47 for more information on pacemakers and other medical devices).

AC electric power produces electric and magnetic fields that create weak electric currents in humans. These are called “induced currents.” Much of the research on how EMF may affect human health has focused on AC-induced currents.

Electric fields

A person standing directly under a high-voltage transmission line may feel a mild shock when touching something that conducts electricity. These sensations are caused by the strong electric fields from the high-voltage electricity in the lines. They occur only at close range because the electric fields rapidly become weaker as the distance from the line increases. Electric fields may be shielded and further weakened by buildings, trees, and other objects that conduct electricity.

Magnetic fields

Alternating magnetic fields produced by AC electricity can induce the flow of weak electric currents in the body. However, such currents are estimated to be smaller than the measured electric currents produced naturally by the brain, nerves, and heart.

Q Doesn’t the earth produce EMF?

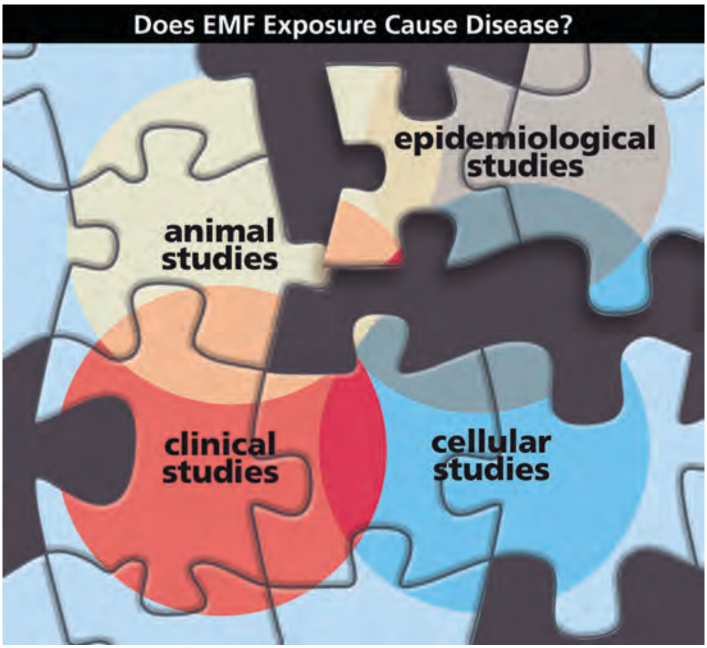
A Yes. The earth produces EMF, mainly in the form of static fields, similar to the fields generated by DC electricity. Electric fields are produced by air turbulence and other atmospheric activity. The earth’s magnetic field of about 500 mG is thought to be produced by electric currents flowing deep within the earth’s core. Because these fields are static rather than alternating, they do not induce currents in stationary objects as do fields associated with alternating current. Such static fields can induce currents in moving and rotating objects.

2 Evaluating Potential Health Effects

This chapter explains how scientific studies are conducted and evaluated to assess potential health effects.

Q How do we evaluate whether EMF exposures cause health effects?

A Animal experiments, laboratory studies of cells, clinical studies, computer simulations, and human population (epidemiological) studies all provide valuable information. When evaluating evidence that certain exposures cause disease, scientists consider results from studies in various disciplines. No single study or type of study is definitive.



Laboratory studies and human studies provide pieces of the puzzle, but no single study can give us the whole picture.

Laboratory studies

Laboratory studies with cells and animals can provide evidence to help determine if an agent such as EMF causes disease. Cellular studies can increase our understanding of the biological mechanisms by which disease occurs. Experiments with animals provide a means to observe effects of specific agents under carefully controlled conditions. Neither cellular nor animal studies, however, can recreate the complex nature of the whole human organism and its environment. Therefore, we must use caution in applying the results of cellular or animal studies directly to humans or concluding that a lack of an effect in laboratory studies proves that an agent is safe. Even with these limitations, cellular and animal studies have proven very useful over the years for identifying and understanding the toxicity of numerous chemicals and physical agents.

Very specific laboratory conditions are needed for researchers to be able to detect EMF effects, and experimental exposures are not easily comparable to human exposures. In most cases, it is not clear how EMF actually produces the effects observed in some experiments. Without understanding how the effects occur, it is difficult to evaluate how laboratory results relate to human health effects.

Some laboratory studies have reported that EMF exposure can produce biological effects, including changes in functions of cells and tissues and subtle changes in hormone levels in animals. It is important to distinguish between a biological effect and a health effect. Many biological effects are within the normal range of variation and are not necessarily harmful. For example, bright light has a biological effect on our eyes, causing the pupils to constrict, which is a normal response.

Clinical studies

In clinical studies, researchers use sensitive instruments to monitor human physiology during controlled exposure to environmental agents. In EMF studies, volunteers are exposed to electric or magnetic fields at higher levels than those commonly encountered in everyday life. Researchers measure heart rate, brain activity, hormonal levels, and other factors in exposed and unexposed groups to look for differences resulting from EMF exposure.

Epidemiology

A valuable tool to identify human health risks is to study a human population that has experienced the exposure. This type of research is called epidemiology.

The epidemiologist observes and compares groups of people who have had or have not had certain diseases and exposures to see if the risk of disease is different between the exposed and unexposed groups. The epidemiologist does not control the exposure and cannot experimentally control all the factors that might affect the risk of disease.

Most researchers agree that epidemiology—the study of patterns and possible causes of diseases—is one of the most valuable tools to identify human health risks.

Q How do we evaluate the results of epidemiological studies of EMF?

A Many factors need to be considered when determining whether an agent causes disease. An exposure that an epidemiological study associates with increased risk of a certain disease is not always the actual cause of the disease. To judge whether an agent actually causes a health effect, several issues are considered.

Strength of association

The stronger the association between an exposure and disease, the more confident we can be that the disease is due to the exposure being studied. With cigarette smoking and lung cancer, the association is very strong—20 times the normal risk. In the studies that suggest a relationship between EMF and certain rare cancers, the association is much weaker (see page 19).

Dose-response

Epidemiological data are more convincing if disease rates increase as exposure levels increase. Such dose-response relationships have appeared in only a few EMF studies.

Consistency

Consistency requires that an association found in one study appears in other studies involving different study populations and methods. Associations found consistently are more likely to be causal. With regard to EMF, results from different studies sometimes disagree in important ways, such as what type of cancer is associated with EMF exposure. Because of this inconsistency, scientists cannot be sure whether the increased risks are due to EMF or other factors.

Biological plausibility

When associations are weak in an epidemiological study, results of laboratory studies are even more important to support the association. Many scientists remain skeptical about an association between EMF exposure and cancer because laboratory studies thus far have not shown any consistent evidence of adverse health effects, nor have results of experimental studies revealed a plausible biological explanation for such an association.

Reliability of exposure information

Another important consideration with EMF epidemiological studies is how the exposure information was obtained. Did the researchers simply estimate people's EMF exposures based on their job titles or how their houses were wired, or did they actually conduct EMF measurements? What did they measure (electric fields, magnetic fields, or both)? How often were the EMF measurements made and at what time? In how many different places were the fields measured? More recent studies have included measurements of magnetic field exposure. Magnetic fields measured at the time a study is conducted can only estimate exposures that occurred in previous years (at the time a disease process may have begun). Lack of comprehensive exposure information makes it more difficult to interpret the results of a study, particularly considering that everyone in the industrialized world has been exposed to EMF.

Confounding

Epidemiological studies show relationships or correlations between disease and other factors such as diet, environmental conditions, and heredity. When a disease is correlated with some factor, it does not necessarily mean that the correlated factor causes the disease. It could mean that the factor occurs together with some other factor, not measured in the study, that actually causes the disease. This is called confounding.

For example, a study might show that alcohol consumption is correlated with lung cancer. This could occur if the study group consists of people who drink and also smoke tobacco, as often happens. In this example, alcohol use is correlated with lung cancer, but cigarette smoking is a confounding factor and the true cause of the disease.

Statistical significance

Researchers use statistical methods to determine the likelihood that the association between exposure and disease is due simply to chance. For a result to be considered “statistically significant,” the association must be stronger than would be expected to occur by chance alone.

Meta-analysis

One way researchers try to get more information from epidemiological studies is to conduct a meta-analysis. A meta-analysis combines the summary statistics of many studies to explore their differences and, if appropriate, calculates an overall summary risk estimate. The main challenge faced by researchers performing meta-analyses is that populations, measurements, evaluation techniques, participation rates, and potential confounding factors vary in the original studies. These differences in the studies make it difficult to combine the results in a meaningful way.

Pooled analysis

Pooled analysis combines the original data from several studies and conducts a new analysis on the primary data. It requires access to the original data from individual studies and can only include diseases or factors included in all the studies, but it has the advantage that the same parameters can be applied to all studies. As with meta-analysis, pooled analysis is still subject to the limitations of the experimental design of the original studies (for example, evaluation techniques, participation rates, etc.). Pooled analysis differs from meta-analysis, which combines the summary statistics from different studies, not their original data.

Q How do we characterize EMF exposure?

A No one knows which aspect of EMF exposure, if any, affects human health. Because of this uncertainty, in addition to the field strength, we must ask how long an exposure lasts, how it varies, and at what time of day or night it occurs. House wiring, for example, is often a significant source of EMF exposure for an individual, but the magnetic fields produced by the wiring depend on the amount of current flowing. As heating, lighting, and appliance use varies during the day, magnetic field exposure will also vary.

For many studies, researchers describe EMF exposures by estimating the average field strength. Some scientists believe that average exposure may not be the best measurement of EMF exposure and that other parameters, such as peak exposure or time of exposure, may be important.

Q What is the average field strength?

A In EMF studies, the information reported most often has been a person's EMF exposure averaged over time (average field strength). With cancer-causing chemicals, a person's average exposure over many years can be a good way to predict his or her chances of getting the disease.

There are different ways to calculate average magnetic field exposures. One method involves having a person wear a small monitor that takes many measurements over a work shift, a day, or longer. Then the average of those measurements is calculated. Another method involves placing a monitor that takes many measurements in a residence over a 24-hour or 48-hour period. Sometimes averages are calculated for people with the same occupation, people working in similar environments, or people using several brands of the same type or similar types of equipment.

Q How is EMF exposure measured in epidemiological studies?

A Epidemiologists study patterns and possible causes of diseases in human populations. These studies are usually observational rather than experimental. This means that the researcher observes and compares groups of people who have had certain diseases and exposures and looks for possible "associations." The epidemiologist must find a way to estimate the exposure that people had at an earlier time.

Association

In epidemiology, a positive association between an exposure (such as EMF) and a disease is not necessarily proof that the exposure *caused* the disease. However, the more often the exposure and disease occur together, the stronger the association, and the stronger is the possibility that the exposure may increase the risk of the disease.

Some exposure estimates for residential studies have been based on designation of households in terms of "wire codes." In other studies, measurements have been made in homes, assuming that EMF levels at the time of the measurement are similar to levels at some time in the past. Some studies involved "spot measurements." Exposure levels change as a person moves around in his or her environment, so spot measurements taken at specific locations only approximate the complex variations in exposure a person experiences. Other studies measured magnetic fields over a 24-hour or 48-hour period. Exposure levels for some occupational studies are measured by having certain employees wear personal monitors. The data taken from these monitors are sometimes used to estimate typical exposure levels for employees with certain job titles. Researchers can then estimate exposures using only an employee's job title and avoid measuring exposures of all employees.

Methods to Estimate EMF Exposure

Wire Codes

A classification of homes based on characteristics of power lines outside the home (thickness of the wires, wire configuration, etc.) and their distance from the home. This information is used to code the homes into groups with higher and lower predicted magnetic field levels.

Spot Measurement

An instantaneous or very short-term (e.g., 30-second) measurement taken at a designated location.

Time-Weighted Average

A weighted average of exposure measurements taken over a period of time that takes into account the time interval between measurements. When the measurements are taken with a monitor at a fixed sampling rate, the time-weighted average equals the arithmetic mean of the measurements.

Personal Monitor

An instrument that can be worn on the body for measuring exposure over time.

Calculated Historical Fields

An estimate based on a theoretical calculation of the magnetic field emitted by power lines using historical electrical loads on those lines.

3 Results of EMF Research

This chapter summarizes the results of EMF research worldwide, including epidemiological studies of children and adults, clinical studies of how humans react to typical EMF exposures, and laboratory research with animals and cells.

Q Is there a link between EMF exposure and childhood leukemia?

A Despite more than two decades of research to determine whether elevated EMF exposure, principally to magnetic fields, is related to an increased risk of childhood leukemia, there is still no definitive answer. Much progress has been made, however, with some lines of research leading to reasonably clear answers and others remaining unresolved. The best available evidence at this time leads to the following answers to specific questions about the link between EMF exposure and childhood leukemia:

Is there an association between power line configurations (wire codes) and childhood leukemia? No.

Is there an association between measured fields and childhood leukemia? Yes, but the association is weak, and it is not clear whether it represents a cause-and-effect relationship.

Q What is the epidemiological evidence for evaluating a link between EMF exposure and childhood leukemia?

A The initial studies, starting with the pioneering research of Dr. Nancy Wertheimer and Ed Leeper in 1979 in Denver, Colorado, focused on power line configurations near homes. Power lines were systematically evaluated and coded for their presumed ability to produce elevated magnetic fields in homes and classified into groups with higher and lower predicted magnetic field levels (see discussion of wire codes on page 15). Although the first study and two that followed in Denver and Los Angeles showed an association between wire codes indicative of elevated magnetic fields and childhood leukemia, larger, more recent studies in the central part of the United States and in several provinces of Canada did not find such an association. In fact, combining the evidence from all the studies, we can conclude with some confidence that wire codes are not associated with a measurable increase in the risk of childhood leukemia.

The other approach to assessing EMF exposure in homes focused on the measurements of magnetic fields. Unlike wire codes, which are only applicable in North America due to the nature of the electric power distribution system, measured fields have been studied in relation to childhood leukemia in research conducted around the world, including Sweden, England, Germany, New Zealand, and Taiwan. Large, detailed studies have recently been completed in the United States, Canada, and the United Kingdom that provide the most evidence for making an evaluation. These studies have produced variable findings, some reporting small associations, others finding no associations.

National Cancer Institute Study

In 1997, after eight years of work, Dr. Martha Linet and colleagues at the National Cancer Institute (NCI) reported the results of their study of childhood acute lymphoblastic leukemia (ALL). The case-control study involved more than 1,000 children living in 9 eastern and midwestern U.S. states and is the largest epidemiological study of childhood leukemia to date in the United States. To help resolve the question of wire code versus measured magnetic fields, the NCI researchers carried out both types of exposure assessment. Overall, Linet reported little evidence that living in homes with higher measured magnetic-field levels was a disease risk and found no evidence that living in a home with a high wire code configuration increased the risk of ALL in children.

United Kingdom Childhood Cancer Study

In December 1999, Sir Richard Doll and colleagues in the United Kingdom announced that the largest study of childhood cancer ever undertaken—involving nearly 4,000 children with cancer in England, Wales, and Scotland—found no evidence of excess risk of childhood leukemia or other cancers from exposure to power-frequency magnetic fields. It should be noted, however, that because most power lines in the United Kingdom are underground, the EMF exposures of these children were mostly lower than 0.2 microtesla or 2 milligauss.

After reviewing all the data, the U.S. National Institute of Environmental Health Sciences (NIEHS) concluded in 1999 that the evidence was weak, but that it was still sufficient to warrant limited concern. The NIEHS rationale was that no individual epidemiological study provided convincing evidence linking magnetic field exposure with childhood leukemia, but the overall pattern of results for some methods of measuring exposure suggested a weak association between increasing exposure to EMF and increasing risk of childhood leukemia. The small number of cases in these studies made it impossible to firmly demonstrate this association. However, the fact that similar results had been observed in studies of different populations using a variety of study designs supported this observation.

A major challenge has been to determine whether the most highly elevated, but rarely encountered, levels of magnetic fields are associated with an increased risk of leukemia. Early reports focused on the risk associated with exposures above 2 or 3 milligauss, but the more recent studies have been large enough to also provide some information on levels above 3 or 4 milligauss. It is estimated that 4.5% of homes in the United States have magnetic fields above 3 milligauss, and 2.5% of homes have levels above 4 milligauss.

What is Cancer?

Cancer

"Cancer" is a term used to describe at least 200 different diseases, all involving uncontrolled cell growth. The frequency of cancer is measured by the incidence—the number of new cases diagnosed each year. Incidence is usually described as the number of new cases diagnosed per 100,000 people per year.

The incidence of cancer in adults in the United States is 382 per 100,000 per year, and childhood cancers account for about 1% of all cancers. The factors that influence risk differ among the forms of cancer. Known risk factors such as smoking, diet, and alcohol contribute to specific types of cancer. (For example, smoking is a known risk factor for lung cancer, bladder cancer, and oral cancer.) For many other cancers, the causes are unknown.

Leukemia

Leukemia describes a variety of cancers that arise in the bone marrow where blood cells are formed. The leukemias represent less than 4% of all cancer cases in adults but are the most common form of cancer in children. For children age 4 and under, the incidence of childhood leukemia is approximately 6 per 100,000 per year, and it decreases with age to about 2 per 100,000 per year for children 10 and older. In the United States, the incidence of adult leukemia is about 10 cases per 100,000 people per year. Little is known about what causes leukemia, although genetic factors play a role. The only known causes are ionizing radiation, benzene, and other chemicals and drugs that suppress bone marrow function, and a human T-cell leukemia virus.

Brain Cancer

Cancer of the central nervous system (the brain and spinal cord) is uncommon, with incidence in the United States now at about 6 cases in 100,000 people per year. The causes of the disease are largely unknown, although a number of studies have reported an association with certain occupational chemical exposures. Ionizing radiation to the scalp is a known risk factor for brain cancer. Factors associated with an increased risk for other types of cancer—such as smoking, diet, and excessive alcohol use—have not been found to be associated with brain cancer.

To determine what the integrated information from all the studies says about magnetic fields and childhood leukemia, two groups have conducted pooled analyses in which the original data from relevant studies were integrated and analyzed. One report (Greenland et al., 2000) combined 12 relevant studies with magnetic field measurements, and the other considered 9 such studies (Ahlbom et al., 2000). The details of the two pooled analyses are different, but their findings are similar. There is weak evidence for an association (relative risk of approximately 2) at exposures above 3 mG. However, few individuals had high exposures in these studies; therefore, even combining all studies, there is uncertainty about the strength of the association.

The following table summarizes the results for the epidemiological studies of EMF exposure and childhood leukemia analyzed in the pooled analysis by Greenland et al. (2000). The focus of the summary review was the magnetic fields that occurred three months prior to diagnosis. The results were derived from either calculated historical fields or multiple measurements of magnetic fields. The North American

Residential Exposure to Magnetic Fields and Childhood Leukemia

	Magnetic field category (mG)					
	>1 – ≤2 mG		>2 – ≤3 mG		>3 mG	
First author	Estimate	95% CL	Estimate	95% CL	Estimate	95% CL
Coghill	0.54	0.17, 1.74	No controls		No controls	
Dockerty	0.65	0.26, 1.63	2.83	0.29, 27.9	No controls	
Feychting	0.63	0.08, 4.77	0.90	0.12, 7.00	4.44	1.67, 11.7
Linet	1.07	0.82, 1.39	1.01	0.64, 1.59	1.51	0.92, 2.49
London	0.96	0.54, 1.73	0.75	0.22, 2.53	1.53	0.67, 3.50
McBride	0.89	0.62, 1.29	1.27	0.74, 2.20	1.42	0.63, 3.21
Michaelis	1.45	0.78, 2.72	1.06	0.27, 4.16	2.48	0.79, 7.81
Olsen	0.67	0.07, 6.42	No cases		2.00	0.40, 9.93
Savitz	1.61	0.64, 4.11	1.29	0.27, 6.26	3.87	0.87, 17.3
Tomenius	0.57	0.33, 0.99	0.88	0.33, 2.36	1.41	0.38, 5.29
Tynes	1.06	0.25, 4.53	No cases		No cases	
Verkasalo	1.11	0.14, 9.07	No cases		2.00	0.23, 17.7
Study summary	0.95	0.80, 1.12	1.06	0.79, 1.42	1.69*	1.25, 2.29
	1 – <2 mG		2 – <4 mG		≥4 mG	
**United Kingdom	0.84	0.57, 1.24	0.98	0.50, 1.93	1.00	0.30, 3.37

95% CL = 95% confidence limits.

Source: Greenland et al., 2000.

* Mantel-Haenszel analysis (*p* = 0.01). Maximum-likelihood summaries differed by less than 1% from these summaries; based on 2,656 cases and 7,084 controls. Adjusting for age, sex, and other variables had little effect on summary results.

** These data are from a recent United Kingdom study not included in the Greenland analysis but included in another pooled analysis (Ahlbom et al. 2000). The United Kingdom study included 1,073 cases and 2,224 controls.

For this table, the column headed "estimate" describes the relative risk. Relative risk is the ratio of the risk of childhood leukemia for those in a magnetic field exposure group compared to persons with exposure levels of 1.0 mG or less. For example, Coghill estimated that children with exposures between 1 and 2 mG have 0.54 times the risk of children whose exposures were less than 1 mG. London's study estimates that children whose exposures were greater than 3 mG have 1.53 times the risk of children whose exposures were less than 1 mG. The column headed "95% CL" (confidence limits) describes how much random variation is in the estimate of relative risk. The estimate may be off by some amount due to random variation, and the width of the confidence limits gives some notion of that variation. For example, in Coghill's estimate of 0.54 for the relative risk, values as low as 0.17 or as high as 1.74 would not be statistically significantly different from the value of 0.54. Note there is a wide range of estimates of relative risk across the studies and wide confidence limits for many studies. In light of these findings, the pooling of results can be extremely helpful to calculate an overall estimate, much better than can be obtained from any study taken alone.

studies (Linet, London, McBride, Savitz) were 60 Hz; all other studies were 50 Hz. Results from the recent study from the United Kingdom (see page 17) are also included in the table. This study was included in the analysis by Ahlbom et al. (2000). The relative risk estimates from the individual studies show little or no association of magnetic fields with childhood leukemia. The study summary for the pooled analysis by Greenland et al. (2000) shows a weak association between childhood leukemia and magnetic field exposures greater 3 mG.

Q Is there a link between EMF exposure and childhood brain cancer or other forms of cancer in children?

A Although the earliest studies suggested an association between EMF exposure and all forms of childhood cancer, those initial findings have not been confirmed by other studies. At present, the available series of studies indicates no association between EMF exposure and childhood cancers other than leukemia. Far fewer of these studies have been conducted than studies of childhood leukemia.

Q Is there a link between residential EMF exposure and cancer in adults?

A The few studies that have been conducted to address EMF and adult cancer do not provide strong evidence for an association. Thus, a link has not been established between residential EMF exposure and adult cancers, including leukemia, brain cancer, and breast cancer (see table below).

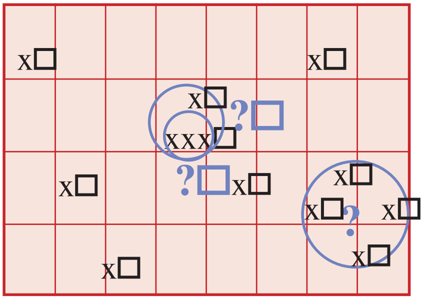
Residential Exposure to Magnetic Fields and Adult Cancer

			Results (odds ratios)		
First author	Location	Type of exposure data	Leukemia	CNS tumors	All cancers
Coleman	United Kingdom	Calculated historical fields	0.92	NA	NA
Feychting and Ahlbom	Sweden	Calculated & spot measurements	1.5*	0.7	NA
Li	Taiwan	Calculated historical fields	1.4*	1.1	NA
Li	Taiwan	Calculated historical fields	1.1 (breast cancer)		
McDowall	United Kingdom	Calculated historical fields	1.43	NA	1.03
Severson	Seattle	Wire codes & spot measurements	0.75	NA	NA
Wrensch	San Francisco	Wire codes & spot measurements	NA	0.9	NA
Youngson	United Kingdom	Calculated historical fields	1.88	NA	NA

CNS = central nervous system.
*The number is statistically significant (greater than expected by chance).
Study results are listed as "odds ratios" (OR). An odds ratio of 1.00 means there was no increase or decrease in risk. In other words, the odds that the people in the study who had the disease (in this case, cancer) and were exposed to a particular agent (in this case, EMF) are the same as for the people in the study who did not have the disease. An odds ratio greater than 1 may occur simply by chance, unless it is statistically significant.

Q Have clusters of cancer or other adverse health effects been linked to EMF exposure?

A An unusually large number of cancers, miscarriages, or other adverse health effects that occur in one area or over one period of time is called a "cluster." Sometimes clusters provide an early warning of a health hazard. But most of the time the reason for the cluster is not known. There have been no proven instances of cancer clusters linked with EMF exposure.



The definition of a "cluster" depends on how large an area is included. Cancer cases (x's in illustration) in a city, neighborhood, or workplace may occur in ways that suggest a cluster due to a common environmental cause. Often these patterns turn out to be due to chance. Delineation of a cluster is subjective—where do you draw the circles?

Q If EMF does cause or promote cancer, shouldn't cancer rates have increased along with the increased use of electricity?

A Not necessarily. Although the use of electricity has increased greatly over the years, EMF exposures may not have increased. Changes in building wiring codes and in the design of electrical appliances have in some cases resulted in lower magnetic field levels. Rates for various types of cancer have shown both increases and decreases through the years, due in part to improved prevention, diagnosis, reporting, and treatment.

Q Is there a link between EMF exposure in electrical occupations and cancer?

A For almost as long as we have been concerned with residential exposure to EMF and childhood cancers, researchers have been studying workplace exposure to EMF and adult cancers, focusing on leukemia and brain cancer. This research began with surveys of job titles and cancer risks, but has progressed to include very large, detailed studies of the health of workers, especially electric utility workers, in the United States, Canada, France, England, and several Northern European countries. Some studies have found evidence that suggests a link between EMF exposure and both leukemia and brain cancer, whereas other studies of similar size and quality have not found such associations.

California
A 1993 study of 36,000 California electric utility workers reported no strong, consistent evidence of an association between magnetic fields and any type of cancer.

Canada/France
A 1994 study of more than 200,000 utility workers in 3 utility companies in Canada and France reported no significant association between all leukemias combined and cumulative exposure to magnetic fields. There was a slight, but not statistically significant, increase in brain cancer. The researchers concluded that the study did not provide clear-cut evidence that magnetic field exposures caused leukemia or brain cancer.

North Carolina
Results of a 1995 study involving more than 138,000 utility workers at 5 electric utilities in the United States did not support an association between occupational magnetic field exposure and leukemia, but suggested a link to brain cancer.

Denmark
In 1997 a study of workers employed in all Danish utility companies reported a small, but statistically significant, excess risk for all cancers combined and for lung cancer. No excess risk was observed for leukemia, brain cancers, or breast cancer.

United Kingdom
A 1997 study among electrical workers in the United Kingdom did not find an excess risk for brain cancer. An extension of this work reported in 2001 also found no increased risk for brain cancer.

Efforts have also been made to pool the findings across several of the above studies to produce more accurate estimates of the association between EMF and cancer (Kheifets et al., 1999). The combined summary statistics across studies provide insufficient evidence for an association between EMF exposure in the workplace and either leukemia or brain cancer.

Q Have studies of workers in other industries suggested a link between EMF exposure and cancer?

A One of the largest studies to report an association between cancer and magnetic field exposure in a broad range of industries was conducted in Sweden (1993). The study included an assessment of EMF exposure in 1,015 different workplaces and involved more than 1,600 people in 169 different occupations. An association was reported between estimated EMF exposure and increased risk for chronic lymphocytic leukemia. An association was also reported between exposure to magnetic fields and brain cancer, but there was no dose-response relationship.

Another Swedish study (1994) found an excess risk of lymphocytic leukemia among railway engine drivers and conductors. However, the total cancer incidence (all tumors included) for this group of workers was lower than in the general Swedish population. A study of Norwegian railway workers found no evidence for an association between EMF exposure and leukemia or brain cancer. Although both positive and negative effects of EMF exposure have been reported, the majority of studies show no effects.

Q Is there a link between EMF exposure and breast cancer?

A Researchers have been interested in the possibility that EMF exposure might cause breast cancer, in part because breast cancer is such a common disease in adult women. Early studies identified a few electrical workers with male breast cancer, a very rare disease. A link between EMF exposure and alterations in the hormone melatonin was considered a possible hypothesis (see page 24). This idea provided motivation to conduct research addressing a possible link between EMF exposure and breast cancer. Overall, the published epidemiological studies have not shown such an association.

Q What have we learned from clinical studies?

A Laboratory studies with human volunteers have attempted to answer questions such as,

Does EMF exposure alter normal brain and heart function?
Does EMF exposure at night affect sleep patterns?
Does EMF exposure affect the immune system?
Does EMF exposure affect hormones?

The following kinds of biological effects have been reported. Keep in mind that a biological effect is simply a measurable change in some biological response. It may or may not have any bearing on health.

Heart rate

An inconsistent effect on heart rate by EMF exposure has been reported. When observed, the biological response is small (on average, a slowing of about three to five beats per minute), and the response does not persist once exposure has ended.

Two laboratories, one in the United States and one in Australia, have reported effects of EMF on heart rate variability. Exposures used in these experiments were relatively high (about 300 mG), and lower exposures failed to produce the effect. Effects have not been observed consistently in repeated experiments.

Sleep electrophysiology

A laboratory report suggested that overnight exposure to 60-Hz magnetic fields may disrupt brain electrical activity (EEG) during night sleep. In this study subjects were exposed to either continuous or intermittent magnetic fields of 283 mG. Individuals exposed to the intermittent magnetic fields showed alterations in traditional EEG sleep parameters indicative of a pattern of poor and disrupted sleep. Several studies have reported no effect with continuous exposure.

Hormones, immune system, and blood chemistry

Several clinical studies with human volunteers have evaluated the effects of power-frequency EMF exposure on hormones, the immune system, and blood chemistry. These studies provide little evidence for any consistent effect.

Melatonin

The hormone melatonin is secreted mainly at night and primarily by the pineal gland, a small gland attached to the brain. Some laboratory experiments with cells and animals have shown that melatonin can slow the growth of cancer cells, including breast cancer cells. Suppressed nocturnal melatonin levels have been observed in some studies of laboratory animals exposed to both electric and magnetic fields. These observations led to the hypothesis that EMF exposure might reduce melatonin and thereby weaken one of the body's defenses against cancer.

Many clinical studies with human volunteers have now examined whether various levels and types of magnetic field exposure affect blood levels of melatonin. Exposure of human volunteers at night to power-frequency EMF under controlled laboratory conditions has no apparent effect on melatonin. Some studies of people exposed to EMF at work or at home do report evidence for a small suppression of melatonin. It is not clear whether the decreases in melatonin reported under environmental conditions are related to the presence of EMF exposure or to other factors.

Q What effects of EMF have been reported in laboratory studies of cells?

A Over the years, scientists have conducted more than 1,000 laboratory studies to investigate potential biological effects of EMF exposure. Most have been *in vitro* studies; that is, studies carried out on cells isolated from animals and plants, or on cell components such as cell membranes. Other studies involved animals, mainly rats and mice. In general, these studies do not demonstrate a consistent effect of EMF exposure.

Most *in vitro* studies have used magnetic fields of 1,000 mG (100 µT) or higher, exposures that far exceed daily human exposures. In most incidences, when one laboratory has reported effects of EMF exposure on cells, other laboratories have not been able to reproduce the findings. For such research results to be widely accepted by scientists as valid, they must be replicated—that is, scientists in other laboratories should be able to repeat the experiment and get similar results. Cellular studies have investigated potential EMF effects on cell proliferation and differentiation, gene expression, enzyme activity, melatonin, and DNA. Scientists reviewing the EMF research literature find overall that the cellular studies provide little convincing evidence of EMF effects at environmental levels.

Q Have effects of EMF been reported in laboratory studies in animals?

A Researchers have published more than 30 detailed reports on both long-term and short-term studies of EMF exposures in laboratory animals (bioassays). Long-term animal bioassays constitute an important group of studies in EMF research. Such studies have a proven record for predicting the carcinogenicity of chemicals, physical agents, and other suspected cancer-causing agents. In the EMF studies, large groups of mice or rats were continuously exposed to EMF for two years or longer and were then evaluated for cancer. The U.S. National Toxicology Program (http://ntp-server.niehs.nih.gov/) has an extensive historical database for hundreds of different chemical and physical agents evaluated using this model. EMF long-term bioassays examined leukemia, brain cancer, and breast cancer—the diseases some epidemiological studies have associated with EMF exposure (see pages 16–23).

Several different approaches have been used to evaluate effects of EMF exposure in animal bioassays. To investigate whether EMF could promote cancer after genetic damage had occurred, some long-term studies used cancer initiators such as ultraviolet light, radiation, or certain chemicals that are known to cause genetic damage. Researchers compared groups of animals treated with cancer initiators to groups treated with cancer initiators and then exposed to EMF, to see if EMF exposure promoted the cancer growth (initiation-promotion model). Other studies tested the cancer promotion potential of EMF using mice that were predisposed to cancer because they had defects in the genes that control cancer.

Animal Leukemia Studies: Long-Term, Continuous Exposure Studies, Two or More Years in Length			
First author	Sex/species	Exposure/animal numbers	Results
Babbitt (U.S.)	Female mice	14,000 mG, 190 or 380 mice per group. Some groups treated with ionizing radiation.	No effect
Boorman (U.S.)	Male and female rats	20 to 10,000 mG, 100 per group	No effect
McCormick (U.S.)	Male and female mice	20 to 10,000 mG, 100 per group	No effect
Mandeville (Canada)	Female rats	20 to 20,000 mG, 50 per group *In utero* exposure	No effect
Yasui (Japan)	Male and female rats	5,000 to 50,000 mG, 50 per group	No effect

10 milligauss (mG) = 1 microtesla (μT) = 0.001 millitesla (mT)

Leukemia

Fifteen animal leukemia studies have been completed and reported. Most tested for effects of exposure to power-frequency (60-Hz) magnetic fields using rodents. Results of these studies were largely negative. The Babbitt study evaluated the subtypes of leukemia. The data provide no support for the reported epidemiology findings of leukemia from EMF exposure. Many scientists feel that the lack of effects seen in these laboratory leukemia studies significantly weakens the case for EMF as a cause of leukemia.

Breast cancer

Researchers in the Ukraine, Germany, Sweden, and the United States have used initiation-promotion models to investigate whether EMF exposure promotes breast cancer in rats.

The results of these studies are mixed; while the German studies showed some effects, the Swedish and U.S. studies showed none. Studies in Germany reported effects on the numbers of tumors and tumor volume. A National Toxicology Program long-term bioassay performed without the use of other cancer-initiating substances showed no effects of EMF exposure on the development of mammary tumors in rats and mice.

The explanation for the observed difference among these studies is not readily apparent. Within the limits of the experimental rodent model of mammary carcinogenesis, no conclusions are possible regarding a promoting effect of EMF on chemically induced mammary cancer.

Other cancers

Tests of EMF effects on skin cancer, liver cancer, and brain cancer have been conducted using both initiation-promotion models and non-initiated long-term bioassays. All are negative.

Three positive studies were reported for a co-promotion model of skin cancer in mice. The mice were exposed to EMF plus cancer-causing chemicals after cancers had already been initiated. The same research team as well as an independent laboratory were unable to reproduce these results in subsequent experiments.

Non-cancer effects

Many animal studies have investigated whether EMF can cause health problems other than cancer. Researchers have examined many endpoints, including birth defects, immune system function, reproduction, behavior, and learning. Overall, animal studies do not support EMF effects on non-cancer endpoints.

Q Can EMF exposure damage DNA?

A Studies have attempted to determine whether EMF has genotoxic potential; that is, whether EMF exposure can alter the genetic material of living organisms. This question is important because genotoxic agents often also cause cancer or birth defects. Studies of genotoxicity have included tests on bacteria, fruit flies, and some tests on rats and mice. Nearly 100 studies on EMF genotoxicity have been reported. Most evidence suggests that EMF exposure is not genotoxic. Based on experiments with cells, some researchers have suggested that EMF exposure may inhibit the cell's ability to repair normal DNA damage, but this idea remains speculative because of the lack of genotoxicity observed in EMF animal studies.

4 Your EMF Environment

This chapter discusses typical magnetic field exposures in home and work environments and identifies common EMF sources and field intensities associated with these sources.

Q How do we define EMF exposure?

A Scientists are still uncertain about the best way to define "exposure" because experiments have yet to show which aspect of the field, if any, may be relevant to reported biological effects. Important aspects of exposure could be the highest intensity, the average intensity, or the amount of time spent above a certain baseline level. The most widely used measure of EMF exposure has been the time-weighted average magnetic field level (see discussion on page 15).

Q How is EMF exposure measured?

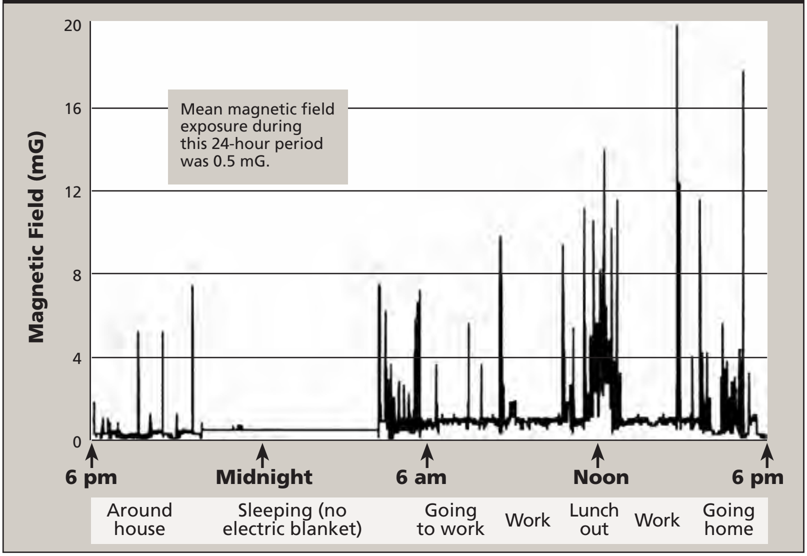
A Several kinds of personal exposure meters are now available. These automatically record the magnetic field as it varies over time. To determine a person's EMF exposure, the personal exposure meter is usually worn at the waist or is placed as close as possible to the person during the course of a work shift or day.

EMF can also be measured using survey meters, sometimes called "gaussmeters." These measure the EMF levels in a given location at a given time. Such measurements do not necessarily reflect personal EMF exposure because they are not always taken at the distance from the EMF source that the person would typically be from the source. Measurements are not always made in a location for the same amount of time that a person spends there. Such "spot measurements" also fail to capture variations of the field over time, which can be significant.

Q What are some typical EMF exposures?

A The figure below is an example of data collected with a personal exposure meter.

Personal Magnetic Field Exposure



In the above example, the magnetic field was measured every 1.5 seconds over a period of 24 hours. For this person, exposure at home was very low. The occasional spikes (short exposure to high fields) occurred when the person drove or walked under power lines or over underground power lines or was close to appliances in the home or office.

Several studies have used personal exposure meters to measure field exposure in different environments. These studies tend to show that appliances and building wiring contribute to the magnetic field exposure that most people receive while at home. People living close to high voltage power lines that carry a lot of current tend to have higher overall field exposures. As shown on page 32, there is considerable variation among houses.

Q What are typical EMF exposures for people living in the United States?

A Most people in the United States are exposed to magnetic fields that average less than 2 milligauss (mG), although individual exposures vary.

The following table shows the estimated average magnetic field exposure of the U.S. population, according to a study commissioned by the U.S. government as part of the EMF Research and Public Information Dissemination (EMF RAPID) Program (see page 50). This study measured magnetic field exposure of about 1,000 people of all ages randomly selected among the U.S. population. Participants wore or carried with them a small personal exposure meter and kept a diary of their activities both at home and away from home. Magnetic field values were automatically recorded twice a second for 24 hours. The study reported that exposure to magnetic fields is similar in different regions of the country and similar for both men and women.

Estimated Average Magnetic Field Exposure of the U.S. Population

Average 24-hour field (mG)	Population exposed (%)	95% confidence interval (%)	People exposed* (millions)
> 0.5	76.3	73.8–78.9	197–211
> 1	43.6	40.9–46.5	109–124
> 2	14.3	11.8–17.3	31.5–46.2
> 3	6.3	4.7–8.5	12.5–22.7
> 4	3.6	2.5–5.2	6.7–13.9
> 5	2.42	1.65–3.55	4.4–9.5
> 7.5	0.58	0.29–1.16	0.77–3.1
> 10	0.46	0.20–1.05	0.53–2.8
> 15	0.17	0.035–0.83	0.09–2.2

*Based on a population of 267 million. This table summarizes some of the results of a study that sampled about 1,000 people in the United States. In the first row, for example, we find that 76.3% of the sample population had a 24-hour average exposure of greater than 0.5 mG. Assuming that the sample was random, we can use statistics to say that we are 95% confident that the percentage of the overall U.S. population exposed to greater than 0.5 mG is between 73.8% and 78.9%. Source: Zaffanella, 1993.

The following table shows average magnetic fields experienced during different types of activities. In general, magnetic fields are greater at work than at home.

Estimated Average Magnetic Field Exposure of the U.S. Population for Various Activities

Average field (mG)	Population exposed (%)				
	Home	Bed	Work	School	Travel
> 0.5	69	48	81	63	87
> 1	38	30	49	25	48
> 2	14	14	20	3.5	13
> 3	7.8	7.2	13	1.6	4.1
> 4	4.7	4.7	8.0	< 1	1.5
> 5	3.5	3.7	4.6		1.0
> 7.5	1.2	1.6	2.5		0.5
> 10	0.9	0.8	1.3		< 0.2
> 15	0.1	0.1	0.9		

Source: Zaffanella, 1993.

Q What levels of EMF are found in common environments?

A Magnetic field exposures can vary greatly from site to site for any type of environment. The data shown in the following table are median measurements taken at four different sites for each environment category.

EMF Exposures in Common Environments
Magnetic fields measured in milligauss (mG)

Environment	Median* exposure	Top 5th percentile
OFFICE BUILDING		
Support staff	0.6	3.7
Professional	0.5	2.6
Maintenance	0.6	3.8
Visitor	0.6	2.1
SCHOOL		
Teacher	0.6	3.3
Student	0.5	2.9
Custodian	1.0	4.9
Administrative staff	1.3	6.9
HOSPITAL		
Patient	0.6	3.6
Medical staff	0.8	5.6
Visitor	0.6	2.4
Maintenance	0.6	5.9
MACHINE SHOP		
Machinist	0.4	6.0
Welder	1.1	24.6
Engineer	1.0	5.1
Assembler	0.5	6.4
Office staff	0.7	4.7
GROCERY STORE		
Cashier	2.7	11.9
Butcher	2.4	12.8
Office staff	2.1	7.1
Customer	1.1	7.7

*The median of four measurements. For this table, the median is the average of the two middle measurements.
Source: National Institute for Occupational Safety and Health.

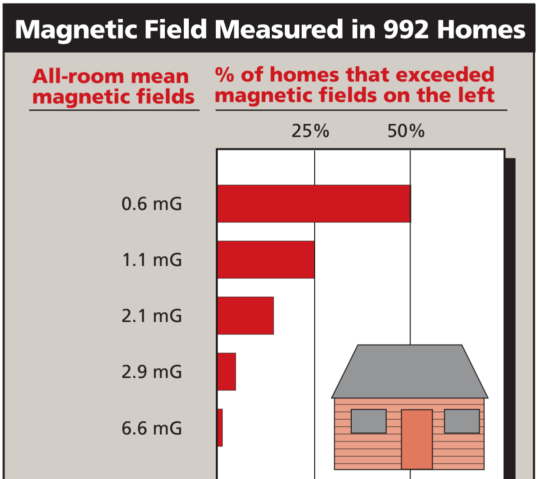
Q What EMF field levels are encountered in the home?

A Electric fields

Electric fields in the home, on average, range from 0 to 10 volts per meter. They can be hundreds, thousands, or even millions of times weaker than those encountered outdoors near power lines. Electric fields directly beneath power lines may vary from a few volts per meter for some overhead distribution lines to several thousands of volts per meter for extra high voltage power lines. Electric fields from power lines rapidly become weaker with distance and can be greatly reduced by walls and roofs of buildings.

Magnetic fields

Magnetic fields are not blocked by most materials. Magnetic fields encountered in homes vary greatly. Magnetic fields rapidly become weaker with distance from the source.



Source: Zaffanella, 1993

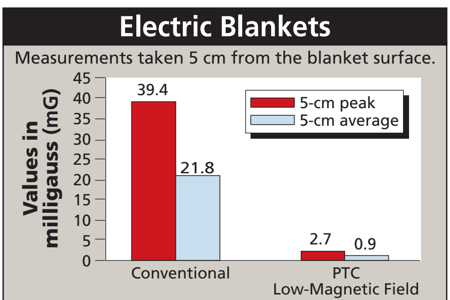
The chart on the left summarizes data from a study by the Electric Power Research Institute (EPRI) in which spot measurements of magnetic fields were made in the center of rooms in 992 homes throughout the United States. Half of the houses studied had magnetic field measurements of 0.6 mG or less, when the average of measurements from all the rooms in the house was calculated (the all-room mean magnetic field). The all-room mean magnetic field for all houses studied was 0.9 mG. The measurements were made away from electrical appliances and reflect primarily the fields from household wiring and outside power lines.

If you are comparing the information in this chart with measurements in your own home, keep in mind that this chart shows averages of measurements taken throughout the homes, not the single highest measurement found in the home.

Q What are EMF levels close to electrical appliances?

A Magnetic fields close to electrical appliances are often much stronger than those from other sources, including magnetic fields directly under power lines. Appliance fields decrease in strength with distance more quickly than do power line fields.

The following table, based on data gathered in 1992, lists the EMF levels generated by common electrical appliances. Magnetic field strength (magnitude) does not depend on how large, complex, powerful, or noisy the appliance is. Magnetic fields near large appliances are often weaker than those near small devices. Appliances in your home may have been redesigned since the data in the table were collected, and the EMF they produce may differ considerably from the levels shown here.



Source: Center for Devices and Radiological Health, U.S. Food and Drug Administration.

The graph shows magnetic fields produced by electric blankets, including conventional 110-V electric blankets as well as the PTC (positive temperature coefficient) low-magnetic-field blankets. The fields were measured at a distance of about 2 inches from the blanket's surface, roughly the distance from the blanket to the user's internal organs. Because of the wiring, magnetic field strengths vary from point to point on the blanket. The graph reflects this and gives both the peak and the average measurement.

Sources of Magnetic Fields (mG)*

Office Sources	6″	1′	2′	4′
AIR CLEANERS				
Lowest	110	20	3	–
Median	180	35	5	1
Highest	250	50	8	2
COPY MACHINES				
Lowest	4	2	1	–
Median	90	20	7	1
Highest	200	40	13	4
FAX MACHINES				
Lowest	4	–	–	–
Median	6	–	–	–
Highest	9	2	–	–
FLUORESCENT LIGHTS				
Lowest	20	–	–	–
Median	40	6	2	–
Highest	100	30	8	4
ELECTRIC PENCIL SHARPENERS				
Lowest	20	8	5	–
Median	200	70	20	2
Highest	300	90	30	30
VIDEO DISPLAY TERMINALS (see page 48) (PCs with color monitors)**				
Lowest	7	2	1	–
Median	14	5	2	–
Highest	20	6	3	–

Bathroom Sources	6″	1′	2′	4′
HAIR DRYERS				
Lowest	1	–	–	–
Median	300	1	–	–
Highest	700	70	10	1
ELECTRIC SHAVERS				
Lowest	4	–	–	–
Median	100	20	–	–
Highest	600	100	10	1

Workshop Sources	6″	1′	2′	4′
BATTERY CHARGERS				
Lowest	3	2	–	–
Median	30	3	–	–
Highest	50	4	–	–
DRILLS				
Lowest	100	20	3	–
Median	150	30	4	–
Highest	200	40	6	–
POWER SAWS				
Lowest	50	9	1	–
Median	200	40	5	–
Highest	1000	300	40	4
ELECTRIC SCREWDRIVERS (while charging)				
Lowest	–	–	–	–
Median	–	–	–	–
Highest	–	–	–	–

Living/Family Room Sources	1′	2′	4′
CEILING FANS			
Lowest	–	–	–
Median	3	–	–
Highest	50	6	1
WINDOW AIR CONDITIONERS			
Lowest	–	–	–
Median	3	1	–
Highest	20	6	4
COLOR TELEVISIONS**			
Lowest	–	–	–
Median	7	2	–
Highest	20	8	4

Distances are distance from source.

Continued

Sources of Magnetic Fields (mG)*

	Distance from source 6″	1′	2′	4′
Kitchen Sources				
BLENDERS				
Lowest	30	5	–	–
Median	70	10	2	–
Highest	100	20	3	–
CAN OPENERS				
Lowest	500	40	3	–
Median	600	150	20	2
Highest	1500	300	30	4
COFFEE MAKERS				
Lowest	4	–	–	–
Median	7	–	–	–
Highest	10	1	–	–
DISHWASHERS				
Lowest	10	6	2	–
Median	20	10	4	–
Highest	100	30	7	1
FOOD PROCESSORS				
Lowest	20	5	–	–
Median	30	6	2	–
Highest	130	20	3	–
GARBAGE DISPOSALS				
Lowest	60	8	1	–
Median	80	10	2	–
Highest	100	20	3	–
MICROWAVE OVENS***				
Lowest	100	1	1	–
Median	200	4	10	2
Highest	300	200	30	20
MIXERS				
Lowest	30	5	–	–
Median	100	10	1	–
Highest	600	100	10	–

	Distance from source 6″	1′	2′	4′
Kitchen Sources				
ELECTRIC OVENS				
Lowest	4	1	–	–
Median	9	4	–	–
Highest	20	5	1	–
ELECTRIC RANGES				
Lowest	20	–	–	–
Median	30	8	2	–
Highest	200	30	9	6
REFRIGERATORS				
Lowest	–	–	–	–
Median	2	2	1	–
Highest	40	20	10	10
TOASTERS				
Lowest	5	–	–	–
Median	10	3	–	–
Highest	20	7	–	–
Bedroom Sources				
DIGITAL CLOCK****				
Lowest		–	–	–
Median		1	–	–
High		8	2	1
ANALOG CLOCKS (conventional clockface)****				
Lowest		1	–	–
Median		15	2	–
Highest		30	5	3
BABY MONITOR (unit nearest child)				
Lowest	4	–	–	–
Median	6	1	–	–
Highest	15	2	–	–

Continued

Sources of Magnetic Fields (mG)*

	Distance from source 6″	1′	2′	4′
Laundry/Utility Sources				
ELECTRIC CLOTHES DRYERS				
Lowest	2	–	–	–
Median	3	2	–	–
Highest	10	3	–	–
WASHING MACHINES				
Lowest	4	1	–	–
Median	20	7	1	–
Highest	100	30	6	–
IRONS				
Lowest	6	1	–	–
Median	8	1	–	–
Highest	20	3	–	–

	Distance from source 6″	1′	2′	4′
Laundry/Utility Sources				
PORTABLE HEATERS				
Lowest	5	1	–	–
Median	100	20	4	–
Highest	150	40	8	1
VACUUM CLEANERS				
Lowest	100	20	4	–
Median	300	60	10	1
Highest	700	200	50	10

SEWING MACHINES

Home sewing machines can produce magnetic fields of 12 mG at chest level and 5 mG at head level. Magnetic fields as high as 35 mG at chest level and 215 mG at knee level have been measured from industrial sewing machine models (Sobel, 1994).

Source: EMF In Your Environment, U.S. Environmental Protection Agency, 1992.

* Dash (–) means that the magnetic field at this distance from the operating appliance could not be distinguished from background measurements taken before the appliance had been turned on.

** Some appliances produce both 60-Hz and higher frequency fields. For example, televisions and computer screens produce fields at 10,000-30,000 Hz (10-30 kHz) as well as 60-Hz fields.

*** Microwave ovens produce 60-Hz fields of several hundred milligauss, but they also create microwave energy inside the appliance that is at a much higher frequency (about 2.45 billion hertz). We are shielded from the higher frequency fields but not from the 60-Hz fields.

**** Most digital clocks have low magnetic fields. In some analog clocks, however, higher magnetic fields are produced by the motor that drives the hands. In the above table, the clocks are electrically powered using alternating current, as are all the appliances described in these tables.

Q What EMF levels are found near power lines?

A Power transmission lines bring power from a generating station to an electrical substation. Power distribution lines bring power from the substation to your home. Transmission and distribution lines can be either overhead or underground. Overhead lines produce both electric fields and magnetic fields. Underground lines do not produce electric fields above ground but may produce magnetic fields above ground.

Power transmission lines

Typical EMF levels for transmission lines are shown in the chart on page 37. At a distance of 300 feet and at times of average electricity demand, the magnetic fields from many lines can be similar to typical background levels found in most homes. The distance at which the magnetic field from the line becomes indistinguishable from typical background levels differs for different types of lines.

Power distribution lines

Typical voltage for power distribution lines in North America ranges from 4 to 24 kilovolts (kV). Electric field levels directly beneath overhead distribution lines may vary from a few volts per meter to 100 or 200 volts per meter. Magnetic fields directly beneath overhead distribution lines typically range from 10 to 20 mG for main feeders and less than 10 mG for laterals. Such levels are also typical directly above underground lines. Peak EMF levels, however, can vary considerably depending on the amount of current carried by the line. Peak magnetic field levels as high as 70 mG have been measured directly below overhead distribution lines and as high as 40 mG above underground lines.

Q How strong is the EMF from electric power substations?

A In general, the strongest EMF around the outside of a substation comes from the power lines entering and leaving the substation. The strength of the EMF from equipment within the substations, such as transformers, reactors, and capacitor banks, decreases rapidly with increasing distance. Beyond the substation fence or wall, the EMF produced by the substation equipment is typically indistinguishable from background levels.

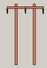
Q Do electrical workers have higher EMF exposure than other workers?

A Most of the information we have about occupational EMF exposure comes from studies of electric utility workers. It is therefore difficult to compare electrical workers' EMF exposures with those of other workers because there is less information about EMF exposures in work environments other than electric utilities. Early studies did not include actual measurements of EMF exposure on the job but used job titles as an estimate of EMF exposure among electrical workers. Recent studies, however, have included extensive EMF exposure assessments.

A report published in 1994 provides some information about estimated EMF exposures of workers in Los Angeles in a number of electrical jobs in electric utilities and other industries. Electrical workers had higher average EMF exposures (9.6 mG) than did workers in other jobs (1.7 mG). For this study, the category "electrical workers" included electrical engineering technicians, electrical engineers, electricians, power line workers, power station operators, telephone line workers, TV repairers, and welders.

Typical EMF Levels for Power Transmission Lines*

115 kV



		Approx. Edge of Right-of-Way 15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	91 m (300 ft)
Electric Field (kV/m)	1.0	0.5	0.07	0.01	0.003
Mean Magnetic Field (mG)	29.7	6.5	1.7	0.4	0.2

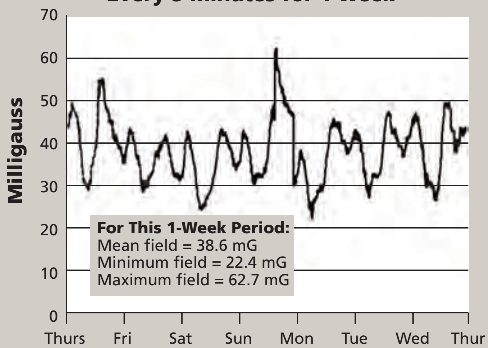
230 kV

		Approx. Edge of Right-of-Way 15 m (50 ft)	30 m (100 ft)	61 m (200 ft)	91 m (300 ft)
Electric Field (kV/m)	2.0	1.5	0.3	0.05	0.01
Mean Magnetic Field (mG)	57.5	19.5	7.1	1.8	0.8

500 kV

		Approx. Edge of Right-of-Way 20 m (65 ft)	30 m (100 ft)	61 m (200 ft)	91 m (300 ft)
Electric Field (kV/m)	7.0	3.0	1.0	0.3	0.1
Mean Magnetic Field (mG)	86.7	29.4	12.6	3.2	1.4

Magnetic Field from a 500-kV Transmission Line Measured on the Right-of-Way Every 5 Minutes for 1 Week



Electric fields from power lines are relatively stable because line voltage doesn't change very much. Magnetic fields on most lines fluctuate greatly as current changes in response to changing loads. Magnetic fields must be described statistically in terms of averages, maximums, etc. The magnetic fields above are means calculated for 321 power lines for 1990 annual mean loads. During peak loads (about 1% of the time), magnetic fields are about twice as strong as the mean levels above. The graph on the left is an example of how the magnetic field varied during one week for one 500-kV transmission line.

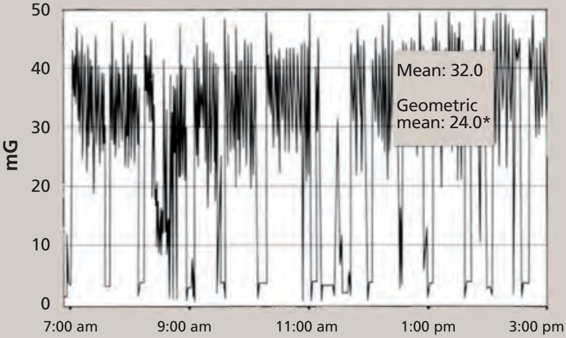
*These are typical EMFs at 1 m (3.3 ft) above ground for various distances from power lines in the Pacific Northwest. They are for general information. For information about a specific line, contact the utility that operates the line.
Source: Bonneville Power Administration, 1994.

Q What are possible EMF exposures in the workplace?

A The figures below are examples of magnetic field exposures determined with exposure meters worn by four workers in different occupations. These measurements demonstrate how EMF exposures vary among individual workers. They do not necessarily represent typical EMF exposures for workers in these occupations.

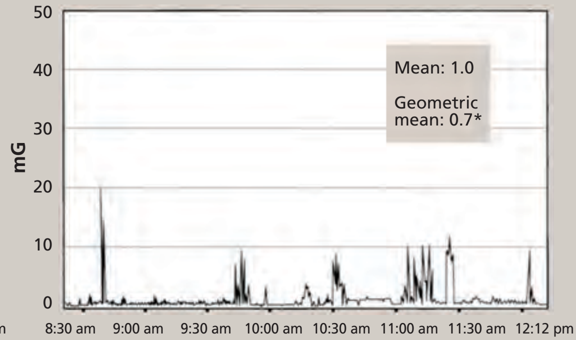
Magnetic Field Exposures of Workers (mG)

Sewing machine operator in garment factory



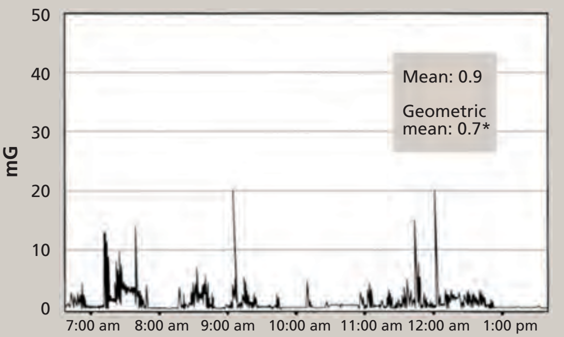
The sewing machine operator worked all day, took a 1-hour lunch break at 11:15 am, and took 10-minute breaks at 8:55 am and 2:55 pm.

Maintenance mechanic



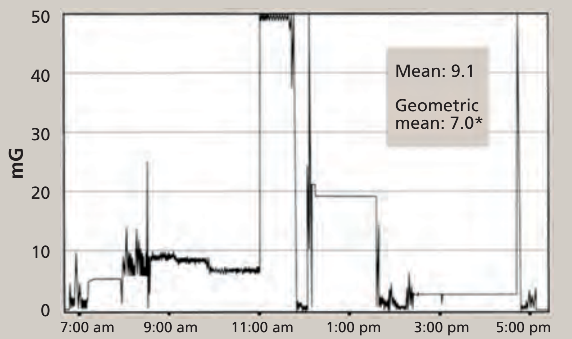
The mechanic repaired a compressor at 9:45 am and 11:10 am.

Electrician



The electrician repaired a large air-conditioning motor at 9:10 am and at 11:45 am.

Government office worker



The government worker was at the copy machine at 8:00 am, at the computer from 11:00 am to 1:00 pm and also from 2:30 pm to 4:30 pm.

*The geometric mean is calculated by squaring the values, adding the squares, and then taking the square root of the sum.
Source: National Institute for Occupational Safety and Health and U.S. Department of Energy.

The tables below and on page 41 can give you a general idea about magnetic field levels for different jobs and around various kinds of electrical equipment. It is important to remember that EMF levels depend on the actual equipment used in

EMF Measurements During a Workday

Industry and occupation	ELF magnetic fields measured in mG: Median for occupation*	ELF magnetic fields measured in mG: Range for 90% of workers**
ELECTRICAL WORKERS IN VARIOUS INDUSTRIES		
Electrical engineers	1.7	0.5–12.0
Construction electricians	3.1	1.6–12.1
TV repairers	4.3	0.6–8.6
Welders	9.5	1.4–66.1
ELECTRIC UTILITIES		
Clerical workers without computers	0.5	0.2–2.0
Clerical workers with computers	1.2	0.5–4.5
Line workers	2.5	0.5–34.8
Electricians	5.4	0.8–34.0
Distribution substation operators	7.2	1.1–36.2
Workers off the job (home, travel, etc.)	0.9	0.3–3.7
TELECOMMUNICATIONS		
Install, maintenance, & repair technicians	1.5	0.7–3.2
Central office technicians	2.1	0.5–8.2
Cable splicers	3.2	0.7–15.0
AUTO TRANSMISSION MANUFACTURE		
Assemblers	0.7	0.2–4.9
Machinists	1.9	0.6–27.6
HOSPITALS		
Nurses	1.1	0.5–2.1
X-ray technicians	1.5	1.0–2.2
SELECTED OCCUPATIONS FROM ALL ECONOMIC SECTORS		
Construction machine operators	0.5	0.1–1.2
Motor vehicle drivers	1.1	0.4–2.7
School teachers	1.3	0.6–3.2
Auto mechanics	2.3	0.6–8.7
Retail sales	2.3	1.0–5.5
Sheet metal workers	3.9	0.3–48.4
Sewing machine operators	6.8	0.9–32.0
Forestry and logging jobs	7.6	0.6–95.5***

Source: National Institute for Occupational Safety and Health.
ELF (extremely low frequency)—frequencies 3–3,000 Hz.
* The median is the middle measurement in a sample arranged by size. These personal exposure measurements reflect the median magnitude of the magnetic field produced by the various EMF sources and the amount of time the worker spent in the fields.
** This range is between the 5th and 95th percentiles of the workday averages for an occupation.
*** Chain saw engines produce strong magnetic fields that are not pure 60-Hz fields.

the workplace. Different brands or models of the same type of equipment can have different magnetic field strengths. It is also important to keep in mind that the strength of a magnetic field decreases quickly with distance.

If you have questions or want more information about your EMF exposure at work, your plant safety officer, industrial hygienist, or other local safety official can be a good source of information. The National Institute for Occupational Safety and Health (NIOSH) is asked occasionally to conduct health hazard evaluations in workplaces where EMF is a suspected cause for concern. For further technical assistance contact NIOSH at 800-356-4674.

Q What are some typical sources of EMF in the workplace?

A Exposure assessment studies so far have shown that most people's EMF exposure at work comes from electrical appliances and tools and from the building's power supply. People who work near transformers, electrical closets, circuit boxes, or other high-current electrical equipment may have 60-Hz magnetic field exposures of hundreds of milligauss or more. In offices, magnetic field levels are often similar to those found at home, typically 0.5 to 4.0 mG. However, these levels can increase dramatically near certain types of equipment.

EMF Spot Measurements

Industry and sources	ELF magnetic fields (mG)	Other frequencies	Comments
ELECTRICAL EQUIPMENT USED IN MACHINE MANUFACTURING			
Electric resistance heater	6,000–14,000	VLF	
Induction heater	10–460	High VLF	
Hand-held grinder	3,000	–	Tool exposures measured at operator's chest.
Grinder	110	–	Tool exposures measured at operator's chest.
Lathe, drill press, etc.	1–4	–	Tool exposures measured at operator's chest.
ALUMINUM REFINING			
Aluminum pot rooms	3.4–30	Very high static field	Highly-rectified DC current (with an ELF ripple) refines aluminum.
Rectification room	300–3,300	High static field	
STEEL FOUNDRY			
Ladle refinery			
Furnace active	170–1,300	High ULF from the ladle's big magnetic stirrer	Highest ELF field was at the chair of control room operator.
Furnace inactive	0.6–3.7	High ULF from the ladle's big magnetic stirrer	Highest ELF field was at the chair of control room operator.
Electrogalvanizing unit	2–1,100	High VLF	
TELEVISION BROADCASTING			
Video cameras (studio and minicams)	7.2–24.0	VLF	
Video tape degaussers	160–3,300	–	Measured 1 ft away.
Light control centers	10–300	–	Walk-through survey.
Studio and newsrooms	2–5	–	Walk-through survey.
HOSPITALS			
Intensive care unit	0.1–220	VLF	Measured at nurse's chest.
Post-anesthesia care unit	0.1–24	VLF	
Magnetic resonance imaging (MRI)	0.5–280	Very high static field, VLF and RF	Measured at technician's work locations.
TRANSPORTATION			
Cars, minivans, and trucks	0.1–125	Most frequencies less than 60 Hz	Steel-belted tires are the principal ELF source for gas/diesel vehicles.
Bus (diesel powered)	0.5–146	Most frequencies less than 60 Hz	
Electric cars	0.1–81	Some elevated static fields	
Chargers for electric cars	4–63	–	Measured 2 ft from charger.
Electric buses	0.1–88	–	Measured at waist. Fields at ankles 2-5 times higher.
Electric train passenger cars	0.1–330	25 & 60 Hz power on U.S. trains	Measured at waist. Fields at ankles 2-5 times higher.
Airliner	0.8–24.2	400 Hz power on airliners	Measured at waist.
GOVERNMENT OFFICES			
Desk work locations	0.1–7	–	Peaks due to laser printers.
Desks near power center	18–50	–	
Power cables in floor	15–170	–	
Building power supplies	25–1,800	–	
Can opener	3,000	–	Appliance fields measured 6 in. away.
Desktop cooling fan	1,000	–	Appliance fields measured 6 in. away.
Other office appliances	10–200	–	

Source: National Institute for Occupational Safety and Health, 2001.
ULF (ultra low frequency)—frequencies above 0, below 3 Hz.
ELF (extremely low frequency)—frequencies 3–3,000 Hz.
VLF (very low frequency)—frequencies 3,000–30,000 Hz (3–30 kilohertz).

Q What EMF exposure occurs during travel?

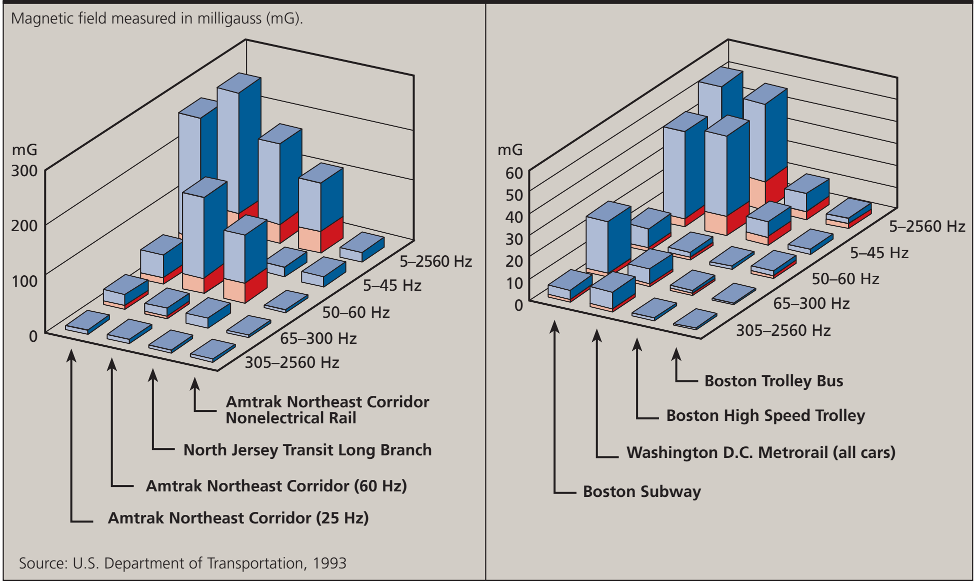
A Inside a car or bus, the main sources of magnetic field exposure are those you pass by (or under) as you drive, such as power lines. Car batteries involve direct current (DC) rather than alternating current (AC). Alternators can create EMF, but at frequencies other than 60 Hz. The rotation of steel-belted tires is also a source of EMF.

Most trains in the United States are diesel powered. Some electrically powered trains operate on AC, such as the passenger trains between Washington, D.C. and New Haven, Connecticut. Measurements taken on these trains using personal exposure monitors have suggested that average 60-Hz magnetic field exposures for passengers and conductors may exceed 50 mG. A U.S. government-sponsored exposure assessment study of electric rail systems found average 60-Hz magnetic field levels in train operator compartments that ranged from 0.4 mG (Boston high speed trolley) to 31.1 mG (North Jersey transit). The graph on the next page shows average and maximum magnetic field measurements in operator compartments of several electric rail systems. It illustrates that 60 Hz is one of several electromagnetic frequencies to which train operators are exposed.

Workers who maintain the tracks on electric rail lines, primarily in the northeastern United States, also have elevated magnetic field exposures at both 25 Hz and 60 Hz. Measurements taken by the National Institute for Occupational Safety and Health show that typical average daily exposures range from 3 to 18 mG, depending on how often trains pass the work site.

Rapid transit and light rail systems in the United States, such as the Washington D.C. Metro and the San Francisco Bay Area Rapid Transit, run on DC electricity. These DC-powered trains contain equipment that produces AC fields. For example, areas of strong AC magnetic fields have been measured on the Washington Metro close to the floor, during braking and acceleration, presumably near equipment located underneath the subway cars.

Magnetic Field Measurements in Train Operators' Compartments



These graphs illustrate that 60 Hz is one of several electromagnetic frequencies to which train operators are exposed. The maximum exposure is the top of the blue (upper) portion of the bar; the average exposure is the top of the red (lower) portion.

Q How can I find out how strong the EMF is where I live and work?

A The tables throughout this chapter can give you a general idea about magnetic field levels at home, for different jobs, and around various kinds of electrical equipment. For specific information about EMF from a particular power line, contact the utility that operates the line. Some will perform home EMF measurements.

You can take your own EMF measurements with a magnetic field meter. For a spot measurement to provide a useful estimate of your EMF exposure, it should be taken at a time of day and location when and where you are typically near the equipment. Keep in mind that the strength of a magnetic field drops off quickly with distance.

Independent technicians will conduct EMF measurements for a fee. Search the Internet under "EMF meters" or "EMF measurement." You should investigate the experience and qualifications of commercial firms, since governments do not standardize EMF measurements or certify measurement contractors.

At work, your plant safety officer, industrial hygienist, or other local safety official can be a good source of information. The National Institute for Occupational Safety and Health (NIOSH) sometimes conducts health hazard evaluations in workplaces where EMF is a suspected cause for concern. For further technical assistance, contact NIOSH at 800-356-4674.

Q How much do computers contribute to my EMF exposure?

A Personal computers themselves produce very little EMF. However, the video display terminal (VDT) or monitor provides some magnetic field exposure unless it is of the new flat-panel design. Conventional VDTs containing cathode ray tubes use magnetic fields to produce the image on the screen, and some emission of those magnetic fields is unavoidable. Unlike most other appliances which produce predominantly 60-Hz magnetic fields, VDTs emit magnetic fields in both the extremely low frequency (ELF) and very low frequency (VLF) frequency ranges (see page 8). Many newer VDTs have been designed to minimize magnetic field emissions, and those identified as "TCO'99 compliant" meet a standard for low emissions (see page 48).

Q What can be done to limit EMF exposure?

A Personal exposure to EMF depends on three things: the strength of the magnetic field sources in your environment, your distance from those sources, and the time you spend in the field.

If you are concerned about EMF exposure, your first step should be to find out where the major EMF sources are and move away from them or limit the time you spend near them. Magnetic fields from appliances decrease dramatically about an arm's length away from the source. In many cases, rearranging a bed, a chair, or a work area to increase your distance from an electrical panel or some other EMF source can reduce your EMF exposure.

Another way to reduce EMF exposure is to use equipment designed to have relatively low EMF emissions. Sometimes electrical wiring in a house or a building can be the source of strong magnetic field exposure. Incorrect wiring is a common source of higher-than-usual magnetic fields. Wiring problems are also worth correcting for safety reasons.

In its 1999 report to Congress, the National Institute of Environmental Health Sciences suggested that the power industry continue its current practice of siting power lines to reduce EMF exposures.

There are more costly actions, such as burying power lines, moving out of a home, or restricting the use of office space that may reduce exposures. Because scientists are still debating whether EMF is a hazard to health, it is not clear that the costs of such measures are warranted. Some EMF reduction measures may create other problems. For instance, compacting power lines reduces EMF but increases the danger of accidental electrocution for line workers.

We are not sure which aspects of the magnetic field exposure, if any, to reduce. Future research may reveal that EMF reduction measures based on today's limited understanding are inadequate or irrelevant. No action should be taken to reduce EMF exposure if it increases the risk of a known safety hazard.

5 EMF Exposure Standards

This chapter describes standards and guidelines established by state, national, and international safety organizations for some EMF sources and exposures.

Q Are there exposure standards for 60-Hz EMF?

A In the United States, there are no federal standards limiting occupational or residential exposure to 60-Hz EMF.

At least six states have set standards for transmission line electric fields; two of these also have standards for magnetic fields (see table below). In most cases, the maximum fields permitted by each state are the maximum fields that existing lines produce at maximum load-carrying conditions. Some states further limit electric field strength at road crossings to ensure that electric current induced into large metal objects such as trucks and buses does not represent an electric shock hazard.

State Transmission Line Standards and Guidelines

	Electric Field		Magnetic Field	
State	On R.O.W.*	Edge R.O.W.	On R.O.W.	Edge R.O.W.
Florida	8 kV/m[a] 10 kV/m[b]	2 kV/m	—	150 mG[a] (max. load) 200 mG[b] (max. load) 250 mG[c] (max. load)
Minnesota	8 kV/m	—	—	—
Montana	7 kV/m[d]	1 kV/m[e]		
New Jersey	—	3 kV/m		
New York	11.8 kV/m 11.0 kV/m[f] 7.0 kV/m[d]	1.6 kV/m	—	200 mG (max. load)
Oregon	9 kV/m	—	—	—

*R.O.W. = right-of-way (or in the Florida standard, certain additional areas adjoining the right-of-way). kV/m = kilovolt per meter. One kilovolt = 1,000 volts. [a]For lines of 69-230 kV. [b]For 500 kV lines. [c]For 500 kV lines on certain existing R.O.W. [d]Maximum for highway crossings. [e]May be waived by the landowner. [f]Maximum for private road crossings.

Two organizations have developed voluntary occupational exposure guidelines for EMF exposure. These guidelines are intended to prevent effects, such as induced currents in cells or nerve stimulation, which are known to occur at high magnitudes, much higher (more than 1,000 times higher) than EMF levels found typically in occupational and residential environments. These guidelines are summarized in the tables on the right.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) concluded that available data regarding potential long-term effects, such as increased risk of cancer, are insufficient to provide a basis for setting exposure restrictions.

The American Conference of Governmental Industrial Hygienists (ACGIH) publishes "Threshold Limit Values" (TLVs) for various physical agents. The TLVs for 60-Hz EMF shown in the table are identified as guides to control exposure; they are not intended to demarcate safe and dangerous levels.

ICNIRP Guidelines for EMF Exposure

Exposure (60 Hz)	Electric field	Magnetic field
Occupational	8.3 kV/m	4.2 G (4,200 mG)
General Public	4.2 kV/m	0.833 G (833 mG)

International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an organization of 15,000 scientists from 40 nations who specialize in radiation protection.
Source: ICNIRP, 1998.

ACGIH Occupational Threshold Limit Values for 60-Hz EMF

	Electric field	Magnetic field
Occupational exposure should not exceed	25 kV/m	10 G (10,000 mG)
Prudence dictates the use of protective clothing above	15 kV/m	–
Exposure of workers with cardiac pacemakers should not exceed	1 kV/m	1 G (1,000 mG)

American Conference of Governmental Industrial Hygienists (ACGIH) is a professional organization that facilitates the exchange of technical information about worker health protection. It is not a government regulatory agency.
Source: ACGIH, 2001.

Q Does EMF affect people with pacemakers or other medical devices?

A According to the U.S. Food and Drug Administration (FDA), interference from EMF can affect various medical devices including cardiac pacemakers and implantable defibrillators. Most current research in this area focuses on higher frequency sources such as cellular phones, citizens band radios, wireless computer links, microwave signals, radio and television transmitters, and paging transmitters.

Sources such as welding equipment, power lines at electric generating plants, and rail transportation equipment can produce lower frequency EMF strong enough to interfere with some models of pacemakers and defibrillators. The occupational exposure guidelines developed by ACGIH state that workers with cardiac pacemakers should not be exposed to a 60-Hz magnetic field greater than 1 gauss (1,000 mG) or a 60-Hz electric field greater than 1 kilovolt per meter (1,000 V/m) (see ACGIH guidelines above). Workers who are concerned about EMF exposure effects on pacemakers, implantable defibrillators, or other implanted electronic medical devices should consult their doctors or industrial hygienists.

Nonelectronic metallic medical implants (such as artificial joints, pins, nails, screws, and plates) can be affected by high magnetic fields such as those from magnetic resonance imaging (MRI) devices and aluminum refining equipment, but are generally unaffected by the lower fields from most other sources.

The FDA MedWatch program is collecting information about medical device problems thought to be associated with exposure to or interference from EMF. Anyone experiencing a problem that might be due to such interference is encouraged to call and report it (800-332-1088).

Q What about products advertised as producing low or reduced magnetic fields?

A Virtually all electrical appliances and devices emit electric and magnetic fields. The strengths of the fields vary appreciably both between types of devices and among manufacturers and models of the same type of device. Some appliance manufacturers are designing new models that, in general, have lower EMF than older models. As a result, the words "low field" or "reduced field" may be relative to older models and not necessarily relative to other manufacturers or devices. At this time, there are no domestic or international standards or guidelines limiting the EMF emissions of appliances.

The U.S. government has set no standards for magnetic fields from computer monitors or video display terminals (VDTs). The Swedish Confederation of Professional Employees (TCO) established in 1992 a standard recommending strict limits on the EMF emissions of computer monitors. The VDTs should produce magnetic fields of no more than 2 mG at a distance of 30 cm (about 1 ft) from the front surface of the monitor and 50 cm (about 1 ft 8 in) from the sides and back of the monitor. The TCO'92 standard has become a *de facto* standard in the VDT industry worldwide. A 1999 standard, promulgated by the Swedish TCO (known as the TCO'99 standard), provides for international and environmental labeling of personal computers. Many computer monitors marketed in the U.S. are certified as compliant with TCO'99 and are thereby assured to produce low magnetic fields.

Beware of advertisements claiming that the federal government has certified that the advertised equipment produces little or no EMF. The federal government has no such general certification program for the emissions of low-frequency EMF. The U.S. Food and Drug Administration's Center for Devices and Radiological Health (CDRH) does certify medical equipment and equipment producing high levels of ionizing radiation or microwave radiation. Information about certain devices as well as general information about EMF is available from the CDRH at 888-463-6332.

Q Are cellular telephones and towers sources of EMF exposure?

A Cellular telephones and towers involve radio-frequency and microwave-frequency electromagnetic fields (see page 8). These are in a much higher frequency range than are the power-frequency electric and magnetic fields associated with the transmission and use of electricity.

The U.S. Federal Communications Commission (FCC) licenses communications systems that use radio-frequency and microwave electromagnetic fields and ensures that licensed facilities comply with exposure standards. Public information on this topic is published on two FCC Internet sites: http://www.fcc.gov/oet/info/documents/bulletins/#56 and http://www.fcc.gov/oet/rfsafety/

The U.S. Food and Drug Administration also provides information about cellular telephones on its web site (http://www.fda.gov/cdrh/ocd/mobilphone.html).

6 National and International EMF Reviews

This chapter presents the findings and recommendations of major EMF research reviews, including the U.S. government's EMF RAPID Program.

Q What have national and international agencies concluded about the impact of EMF exposure on human health?

A Since 1995, two major U.S. reports have concluded that limited evidence exists for an association between EMF exposure and increased leukemia risk, but that when all the scientific evidence is considered, the link between EMF exposure and cancer is weak. The World Health Organization in 1997 reached a similar conclusion.

The two reports were the U.S. National Academy of Sciences report in 1996 and, in 1999, the National Institute of Environmental Health Sciences report to the U.S. Congress at the end of the U.S. EMF Research and Public Information Dissemination (RAPID) Program.

The U.S. EMF RAPID Program

Initiated by the U.S. Congress and established by law in 1992, the U.S. EMF Research and Public Information Dissemination (EMF RAPID) Program set out to study whether exposure to electric and magnetic fields produced by the generation, transmission, or use of electric power posed a risk to human health. For more information about the EMF RAPID Program, visit the web site (http://www.niehs.nih.gov/emfrapid).

The U.S. Department of Energy (DOE) administered the overall EMF RAPID Program, but health effects research and risk assessment were supervised by the National Institute of Environmental Health Sciences (NIEHS), a branch of the U.S. National Institutes of Health (NIH). Together, DOE and NIEHS oversaw more than 100 cellular and animal studies, as well as engineering and exposure assessment studies. Although the EMF RAPID Program did not fund any additional epidemiological studies, an analysis of the many studies already conducted was an important part of its final report.

The electric power industry contributed about half, or $22.5 million, of the $45 million eventually spent on EMF research over the course of the EMF RAPID Program. The NIEHS received $30.1 million from this program for research, public outreach, administration, and the health assessment evaluation of extremely low frequency (ELF) EMF. The DOE received approximately $15 million from this program for engineering and EMF mitigation research. The NIEHS contributed an additional $14.5 million for support of extramural and intramural research including long-term toxicity and carcinogenicity studies conducted by the National Toxicology Program.

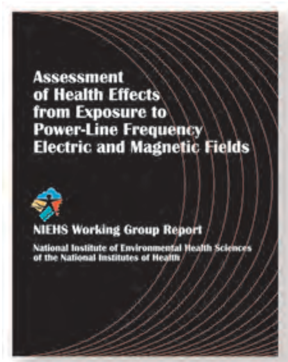
EMF RAPID Program Interagency Committee

- National Institute of Environmental Health Sciences
- Department of Energy
- Department of Defense
- Department of Transportation
- Environmental Protection Agency
- Federal Energy Regulatory Commission
- National Institute of Standards and Technology
- Occupational Safety and Health Administration
- Rural Electrification Administration

An interagency committee was established by the President of the United States to provide oversight and program management support for the EMF RAPID Program. The interagency committee included representatives from NIEHS, DOE, and seven other federal agencies with EMF-related responsibilities.

The EMF RAPID Program also received advice from a National EMF Advisory Committee (NEMFAC), which included representatives from citizen groups, labor, utilities, the National Academy of Sciences, and other groups. They met regularly with DOE and NIEHS staff to express their views. NEMFAC meetings were open to the public. The EMF RAPID Program sponsored citizen participation in some scientific meetings as well. A broad group of citizens reviewed all major public information materials produced for the program.

NIEHS Working Group Report 1998

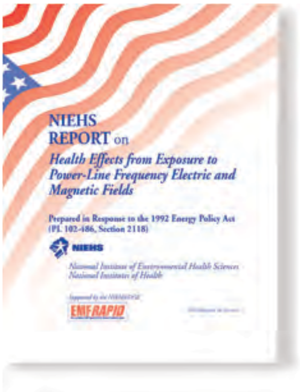


In preparation for the EMF RAPID Program's goal of reporting to the U.S. Congress on possible health effects from exposure to EMF from power lines, the NIEHS convened an expert working group in June 1998. Over 9 days, about 30 scientists conducted a complete review of EMF studies, including those sponsored by the EMF RAPID Program and others. Their conclusions offered guidance to the NIEHS as it prepared its report to Congress.

Using criteria developed by the International Agency for Research on Cancer, a majority of the members of the working group concluded that exposure to power-frequency EMF is a possible human carcinogen.

The majority called their opinion "a conservative public health decision based on limited evidence for an increased occurrence of childhood leukemias and an increased occurrence of chronic lymphocytic leukemia (CLL) in occupational settings." For these diseases, the working group reported that animal and cellular studies neither confirm nor deny the epidemiological studies' suggestion of a disease risk. This report is available on the NIEHS EMF RAPID web site (http://www.niehs.nih.gov/emfrapid).

NIEHS Report to Congress at Conclusion of EMF RAPID Program



In June 1999, the NIEHS reported to the U.S. Congress that scientific evidence for an EMF-cancer link is weak.

The following are excerpts from the 1999 NIEHS report:

> The NIEHS believes that the probability that ELF-EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal, scientific support that exposure to this agent is causing any degree of harm.
>
> The scientific evidence suggesting that extremely low frequency EMF exposures pose any health risk is weak. The strongest evidence for health effects comes from associations observed in human populations with two forms of cancer: childhood leukemia and chronic lymphocytic leukemia in occupationally exposed adults. While the support from individual studies is weak, the epidemiological studies demonstrate, for some methods of measuring exposure, a fairly consistent pattern of a small, increased risk with increasing exposure that is somewhat weaker for chronic lymphocytic leukemia than for childhood leukemia. In contrast, the mechanistic studies and the animal toxicology literature fail to demonstrate any consistent pattern across studies, although sporadic findings of biological effects (including increased cancers in animals) have been reported. No indication of increased leukemias in experimental animals has been observed.

The full report is available on the NIEHS EMF RAPID web site (http://www.niehs.nih.gov/emfrapid).

No regulatory action was recommended or taken based on the NIEHS report. The NIEHS director, Dr. Kenneth Olden, told the Congress that, in his opinion, the conclusion of the NIEHS report was not sufficient to warrant aggressive regulatory action.

The NIEHS did not recommend adopting EMF standards for electric appliances or burying electric power lines. Instead, it recommended providing public information about practical ways to reduce EMF exposure. The NIEHS also suggested that power companies and utilities "continue siting power lines to reduce exposures and . . . explore ways to reduce the creation of magnetic fields around transmission and distribution lines without creating new hazards." The NIEHS encouraged manufacturers to reduce magnetic fields at a minimal cost, but noted that the risks do not warrant expensive redesign of electrical appliances.

The NIEHS also encouraged individuals who are concerned about EMF in their homes to check to see if their homes are properly wired and grounded, since incorrect wiring or other code violations are a common source of higher-than-usual magnetic fields.

National Academy of Sciences Report

In October 1996, a National Research Council committee of the National Academy of Sciences (NAS) released its evaluation of research on potential associations between EMF exposure and cancer, reproduction, development, learning, and behavior. The report concluded:

> Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects.

The NAS report focused primarily on the association of childhood leukemia with the proximity of the child's home to power lines. The NAS panel found that although a link between EMF exposure and increased risk for childhood leukemia was observed in studies that had estimated EMF exposure using the wire code method (distance of home from power line), such a link was not found in studies that had included actual measurements of magnetic fields at the time of the study. The panel called for more research to pinpoint the unexplained factors causing small increases in childhood leukemia in houses close to power lines.

World Health Organization International EMF Project

The World Health Organization (WHO) International EMF Project, with headquarters in Geneva, Switzerland, was launched at a 1996 meeting with representatives of 23 countries attending. It was intended to respond to growing concerns in many member states over possible EMF health effects and to address the conflict between such concerns and technological and economic progress. In its advisory role, the WHO International EMF Project is now reviewing laboratory and epidemiological evidence, identifying gaps in scientific knowledge, developing an agenda for future research, and developing risk communication booklets and other public information. The WHO International EMF Project is funded with contributions from governments and institutions and is expected to provide an overall EMF health risk assessment. Additional information about this program can be found on the WHO EMF web site (http://www.who.int/peh-emf).

As part of this project, in 1997 a working group of 45 scientists from around the world surveyed the evidence for adverse

EMF health effects. They reported that, “taken together, the findings of all published studies are suggestive of an association between childhood leukemia and estimates of ELF (extremely low frequency or power-frequency) magnetic fields.”

Much like the 1996 U.S. NAS report, the WHO report noted that living in homes near power lines was associated with an approximate 1.5-fold excess risk of childhood leukemia. But unlike the NAS panel, WHO scientists had seen the results of the 1997 U.S. National Cancer Institute study of EMF and childhood leukemia (see page 17). This work showed even more strongly the inconsistency between results of studies that used a wire code to estimate EMF exposure and studies that actually measured magnetic fields.

Regarding health effects other than cancer, the WHO scientists reported that the epidemiological studies “do not provide sufficient evidence to support an association between extremely-low-frequency magnetic-field exposure and adult cancers, pregnancy outcome, or neurobehavioural disorders.”

World Health Organization International Agency for Research on Cancer

The WHO International Agency for Research on Cancer (IARC) produces a monograph series that reviews the scientific evidence regarding potential carcinogenicity associated with exposure to environmental agents. An international scientific panel of 21 experts from 10 countries met in June 2001 to review the scientific evidence regarding the potential carcinogenicity of static and ELF (extremely low frequency or power-frequency) EMF. The panel categorized its conclusions for carcinogenicity based on the IARC classification system—a system that evaluates the strength of evidence from epidemiological, laboratory (human and cellular), and mechanistic studies. The panel classified power-frequency EMF as “possibly carcinogenic to humans” based on a fairly consistent statistical association between a doubling of risk of childhood leukemia and magnetic field exposure above 0.4 microtesla (0.4 µT, 4 milligauss or 4 mG).

In contrast, they found no consistent evidence that childhood EMF exposures are associated with other types of cancer or that adult EMF exposures are associated with increased risk for any kind of cancer. The IARC panel reported that no consistent carcinogenic effects of EMF exposure have been observed in experimental animals and that there is currently no scientific explanation for the observed association between childhood leukemia and EMF exposure. Further information can be obtained at the IARC web sites (http://www.iarc.fr and http://monographs.iarc.fr).

International Commission on Non-Ionizing Radiation Protection

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) issued exposure guidelines to guard against known adverse effects such as stimulation of nerves and muscles at very high EMF levels, as well as shocks and burns caused by touching objects that conduct electricity (see page 47). In April 1998, ICNIRP revised its exposure guidelines and characterized as “unconvincing” the evidence for an association between everyday power-frequency EMF and cancer.

European Union

In 1996, a European Union (EU) advisory panel provided an overview of the state of science and standards among EU countries. With respect to power-frequency EMF, the panel members said that there is no clear evidence that exposure to EMF results in an increased risk of cancer.

Australia—Radiation Advisory Committee Report to Parliament

In 1997, Australia's Radiation Advisory Committee briefly reviewed the EMF scientific literature and advised the Australian Parliament that, overall, there is insufficient evidence to come to a firm conclusion regarding possible health effects from exposure to power-frequency magnetic fields.

The committee also reported that "the weight of opinion as expressed in the U.S. National Academy of Sciences report, and the negative results from the National Cancer Institute study (Linet et al., 1997) would seem to shift the balance of probability more towards there being no identifiable health effects" (see pages 17 and 53).

Canada—Health Canada Report

In December 1998, a working group of public health officers at Health Canada, the federal agency that manages Canada's health care system, issued a review of the scientific literature regarding power-frequency EMF health effects. They found the evidence to be insufficient to conclude that EMF causes a risk of cancer.

The report concluded that while EMF effects may be observed in biological systems in a laboratory, no adverse health effects have been demonstrated at the levels to which humans and animals are typically exposed.

As for epidemiology, 25 years of study results are inconsistent and inconclusive, the panel said, and a plausible EMF-cancer mechanism is missing. Health Canada pledged to continue monitoring EMF research and to reassess this position as new information becomes available.

Germany—Ordinance 26

On January 1, 1997, Germany became the first nation to adopt a national rule on EMF exposure for the general public. Ordinance 26 applies only to facilities such as overhead and underground transmission and distribution lines, transformers, switchgear and overhead lines for electric-powered trains. Both electric (5 kV/m) and magnetic field exposure limits (1 Gauss) are high enough that they are unlikely to be encountered in ordinary daily life. The ordinance also requires that precautionary measures be taken on a case-by-case basis when electric facilities are sited or upgraded near homes, hospital, schools, day care centers, and playgrounds.

Great Britain—National Radiological Protection Board Report

The National Radiological Protection Board (NRPB) in Great Britain advises the government of the United Kingdom regarding standards of protection for exposure to non-ionizing radiation. The NRPB's advisory group on non-ionizing radiation periodically reviews new developments in EMF research and reports its findings. Results of the advisory group's latest review were published in 2001. The report reviewed residential and occupational epidemiological studies, as well as cellular, animal, and human volunteer studies that had been published.

The advisory group noted that there is "some epidemiological evidence that prolonged exposure to higher levels of power frequency magnetic fields is associated with a small risk of leukaemia in children." Specifically, the NRPB advisory group's analysis suggests "that relatively heavy average exposures of 0.4 µT [4 mG] or more are associated with a doubling of the risk of leukaemia in children under 15 years of age." The group pointed out, however, that laboratory experiments have provided "no good evidence that extremely low frequency electromagnetic fields are capable of producing cancer."

Scandinavia—EMF Developments

In October 1995, a group of Swedish researchers and government officials published a report about EMF exposure in the workplace. This "Criteria Group" reviewed EMF scientific literature and, using the IARC classification system, ranked occupational EMF exposure as "possibly carcinogenic to humans." They also endorsed the Swedish government's 1994 policy statement that public exposure limits to EMFs were not needed, but that people might simply want to use caution with EMFs.

In 1996, five Swedish government agencies further explained their precautionary advice about EMF. EMF exposure should be reduced, they said, but only when practical, without great inconvenience or cost.

Health experts in Norway, Denmark, and Finland generally agreed in reviews published in the 1990s that if an EMF health risk exists, it is small. They acknowledged that a link between residential magnetic fields and childhood leukemia cannot be confirmed or denied. In 1994, several Norwegian government ministries also recommended increasing the distance between residences and electrical facilities, if it could be done at low cost and with little inconvenience.

Q What other U.S. organizations have reported on EMF?

A

American Medical Association

In 1995, the American Medical Association advised physicians that no scientifically documented health risk had been associated with "usually occurring" EMF, based on a review of EMF epidemiological, laboratory studies, and major literature reviews.

American Cancer Society

In 1996, the American Cancer Society released a review of 20 years of EMF epidemiological research including occupational studies and residential studies of adult and childhood cancer. The society noted that some data support a possible relationship of magnetic field exposure with leukemia and brain cancer, but further research may not be justified if studies continue to find uncertain results. Of particular interest is the summary of results from eight studies of risk from use of household appliances with relatively high magnetic fields, such as electric blankets and electric razors. The summary suggested that there is no persuasive evidence for increased risk with more frequent or longer use of these appliances.

American Physical Society

The American Physical Society (APS) represents thousands of U.S. physicists. Responding to the NIEHS Working Group's conclusion that EMF is a possible human carcinogen, the APS executive board voted in 1998 to reaffirm its 1995 opinion that there is "no consistent, significant link between cancer and power line fields."

California's Department of Health Services

In 1996, California's Department of Health Services (DHS) began an ambitious five-year effort to assess possible EMF public health risk and offer guidance to school administrators and other decision-makers. The California Electric and Magnetic Fields (EMF) Program is a research, education, and technical assistance program concerned with the possible health effects of EMF from power lines, appliances, and other uses of electricity. The program's goal is to find a rational and fair approach to dealing with the potential risks, if any, of exposure to EMF. This is done through research, policy analysis, and education. The web site has educational materials on EMF and related health issues for individuals, schools, government agencies, and professional organizations (http://www.dhs.ca.gov/ps/deodc/ehib/emf).

Q What can we conclude about EMF at this time?

A Electricity is a beneficial part of our daily lives, but whenever electricity is generated, transmitted, or used, electric and magnetic fields are created. Over the past 25 years, research has addressed the question of whether exposure to power-frequency EMF might adversely affect human health. For most health outcomes, there is no evidence that EMF exposures have adverse effects. There is some evidence from epidemiology studies that exposure to power-frequency EMF is associated with an increased risk for childhood leukemia. This association is difficult to interpret in the absence of reproducible laboratory evidence or a scientific explanation that links magnetic fields with childhood leukemia.

EMF exposures are complex and come from multiple sources in the home and workplace in addition to power lines. Although scientists are still debating whether EMF is a hazard to health, the NIEHS recommends continued education on ways of reducing exposures. This booklet has identified some EMF sources and some simple steps you can take to limit your exposure. For your own safety, it is important that any steps you take to reduce your exposures do not increase other obvious hazards such as those from electrocution or fire. At the current time in the United States, there are no federal standards for occupational or residential exposure to 60-Hz EMF.

7 References

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