B O N N E V I L L E P O W E R A D M I N I S T R A T I O N

I-5 Corridor Reinforcement Project
Draft Environmental Impact Statement

Volume 1: Chapters 1-13

November 2012

DOE/EIS-0436

Cooperating agencies: U.S. Army Corps of Engineers; Oregon Energy Facility Siting Council; Washington Energy Facility Site Evaluation Council; Cowlitz and Clark Counties, Washington

BONNEVILLE POWER ADMINISTRATION
DOE/BP-4390 • November 2012

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I-5 Corridor Reinforcement Project

Responsible Agency: U.S. Department of Energy, Bonneville Power Administration (BPA)

Cooperating Agencies: U.S. Army Corps of Engineers, Washington Energy Facility Site Evaluation Council, Oregon Department of Energy, Cowlitz County, Washington, Clark County, Washington

Title of Proposed Project: I-5 Corridor Reinforcement Project, DOE/EIS - 0436

States Involved: Washington and Oregon

Abstract: BPA is proposing to build a 500-kilovolt (kV) lattice-steel-tower transmission line that would run from a new 500-kV substation near Castle Rock, Washington to a new 500-kV substation near Troutdale, Oregon. The proposed transmission line and substations would increase the electrical capacity and transfer capability of BPA's transmission system in this area. BPA is considering four action alternatives (with options) that include transmission line routes, three sites for the proposed substation near Castle Rock, and one site for the proposed substation near Troutdale. The transmission line routing alternatives and options use varying amounts of existing BPA and new 150-foot wide right-of-way. The routing alternatives and options range from about 67 to 80 miles long. BPA is considering different tower designs (single circuit, double circuit and triple circuit) for portions of the alternatives and options on existing right-of-way where existing transmission lines may be removed or replaced. In addition to the transmission line and substations, the proposed project includes construction of new access roads and improvements of existing access roads for the line and substations. BPA's preferred alternative is the Central Alternative using Central Option 1.

The proposed project could create impacts to land use, recreation, visual resources, public health and safety, social and economic resources, transportation, cultural resources, geology and soils, water resources and wetlands, vegetation, wildlife, fish, air quality, and greenhouse gases. Chapters 5 though 22 of the EIS describe the affected environment and potential impacts from the proposed project, and possible mitigation measures.

Public review of and comment on this Draft EIS will continue through March 1, 2013.

For additional information, contact:

Nancy Wittpenn – KEC-4
Project Environmental Lead
Bonneville Power Administration
P. O. Box 3621
Portland, Oregon 97208
Telephone: (503) 230-3297
Email: nawittpenn@bpa.gov

To submit a comment:

Online: www.bpa.gov/corporate/i-5-eis/ecomment.cfm
Mail: I-5 Corridor Reinforcement Project
PO Box 9250
Portland, OR 97207
Email: I-5@bpa.gov
Voicemail: 800-230-6593
Fax: 888-315-4503

For additional copies of this document:

Internet—The EIS is on the Internet at: http://www.bpa.gov/go/i5
Compact Disc and Hard Copies*—Complete a request form at www.bpa.gov/go/i5 or call the automated recording line at 1-800-230-6593 and leave your name and mailing address.
*A limited number of hard copies will be available upon request due to the size of the document (nearly 2,000 pages with multiple appendices). Hard copies will be available for review at many locations in the project area. A complete list of locations can be found at www.bpa.gov/go/i5 or in our materials announcing availability of this EIS.

You may also request copies by writing to:
I-5 Corridor Reinforcement Project
PO Box 9250
Portland, OR 97207

For additional information on DOE NEPA activities, please contact Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, GC-20, U.S. Department of Energy, 1000 Independence Avenue S.W., Washington D.C. 20585-0103, phone: 1-800-472-2756 or visit the DOE NEPA Web site at www.eh.doe.gov/nepa.

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Notes to Readers

Thank you for taking time to review the I-5 Corridor Reinforcement Project EIS. We acknowledge the complexity of the project and this document, and hope that these notes make the information contained in the EIS easier to find and understand. These notes are not a complete chronicling of what is contained in the EIS; rather, they highlight a few key aspects to assist readers as they navigate through this EIS.

We have also included information about submitting comments on the EIS at the end of these notes.

Navigating the EIS

Summary: The summary provided as part of this EIS gives a good overview of the proposed project, project alternatives, and potential impacts associated with these actions. However, if you are interested in a better and deeper understanding of these aspects of the proposed action and other considerations and the EIS itself, we encourage you to read the main body of the EIS.

Getting Started—Read Chapters 1-4: At a minimum, we recommend you read these chapters first to understand the project and alternatives, and details about how a transmission project is built. The route alternatives for the I-5 Project analyzed in detail in this EIS total over 300 miles. The information in these chapters will help as you read the resource chapters and their impact analyses.

Project Need (Chapter 1): The need for the project is explained in Chapter 1. The various purposes, or goals, we are trying to meet are also described in this chapter.

Project Alternatives (Chapters 2 and 4; Appendix B): How the project developed from route segments to alternatives is described in Chapter 2. We are considering four *action* alternatives, that is, these alternatives propose taking action and building a new 500-kV transmission line and two substations.

The four action alternatives are the West, Central, East and Crossover alternatives. Each action alternative also includes three options (e.g., West Option 1, West Option 2, and West Option 3). Options were developed along with each alternative so that all route segments were used, and they provide additional route segment combinations in certain areas of the alternative.

In this document when we refer to the West Alternative, for example, it does not include the options. If the options are included it will say "West Alternative and Options."

The action alternatives are briefly introduced in Chapter 2, but more detail about each alternative and their options, and the No Action Alternative (i.e., the project would not be built) are found in Chapter 4 and Appendix B. Appendix B has a table that describes potential right-of-way configurations (types of towers, amount of right-of-way needed) for each action alternative. Appendix B also includes figures referenced in the table that show existing and proposed right-of-way configurations. This appendix can be used as you read through Chapter 4 and the resource chapters.

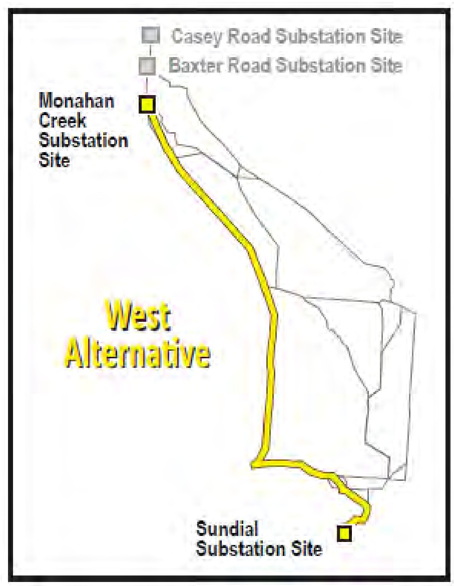
Chapter 4 also includes a table with a comparison of the alternatives to the project need and purposes, and a summary table of impacts from each alternative.

Project Components (Chapter 3): This chapter provides an overview of the components of the proposed project and the typical area of disturbance created by these components. This chapter also discusses project design activities; and construction, operation, and maintenance requirements for the project, including removing and replacing existing transmission lines.

Mitigation included in the Project (Chapter 3): We have included many mitigation measures as part of our project design and if a decision is made to build the project, we are committed to implementing these measures. The measures are found in a table at the end of Chapter 3. Additional measures that BPA is considering for specific resources can be found in the chapter covering that resource (e.g., see Recommended Mitigation Measures in Chapter 17, Vegetation).

Resource Chapters—Read Chapters 5-22: The chapters following Chapter 1-4 are referred to as the "resource chapters" of the EIS. These are the chapters that describe the resources (such as land, wildlife, etc.) in the existing environment and how the project would affect these resources. Resource chapters in the EIS begin with Chapter 5, Land, and end with Chapter 22, Greenhouse Gases.

Icons: When discussing individual alternatives and options throughout the document, we have inserted icons, such as the one to the right, to help you recall the different alternatives and options.



Note: Icons are used throughout the EIS

Copies of these icons are on a separate page that follows these notes. This page is perforated (in the hard copy version) and can be torn out to use as you go through the EIS. The project map and the action alternative maps in Chapter 2 are also perforated and can be torn out for your use.

Project Area and Study Area: As you read through the chapters you will notice we use two different terms to describe areas. The project area is the general vicinity of the proposed project alternatives. Rather than having prescribed boundaries, the project area is intended to simply be those areas generally adjacent to or nearby the proposed project facilities. The project area is intended to give a general sense of the key resources in areas surrounding the proposed project. The study area is a more focused area that was determined to ensure that we identified the resources that could be affected by the direct and indirect impacts of the project. The study area may be defined for an individual resource in that resource chapter. For example, the study area for recreation is a 2,000-foot-wide corridor along the entire route of each action alternative, 1,000 feet on either side of the transmission line centerline. This area is large enough to include the proposed transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way. For those resources where a study area has been defined and is used, the relevant resource chapter specifically describes this in the text.

Tables: Tables used throughout the EIS display information referred to in the text. In tables where impacts are shown for an alternative and its options, the information for the options is the net impact, that is, an increase or decrease from the amount of impact in the portion of the alternative the option replaces. For example, the West Alternative creates impacts to about 141 acres of soil with moderate soil erosion potential. If West Option 1 is used, this amount would decrease by 7 acres.

More Information: The EIS draws from many sources for information. In general, resource specialists used a combination of geographic information system (GIS) analysis of existing databases, aerial photo interpretation, reconnaissance-level on-the-ground observation, and aerial review. Supporting information is in Chapter 29, References; appendices; and on the I-5 Project website: www.bpa.gov/go/i-5. The website provides additional information referred to in the EIS that may be helpful when reviewing the EIS.

Submitting Comments on the EIS

Providing Helpful Comments: Public review of and comment on this Draft EIS will continue through March 1, 2013. BPA staff will review all comments received and respond to them in the Final EIS. Comments should be as specific as possible, with references to particular pages, sections and chapters. Additional or clarifying information that should be considered is helpful. Factual corrections are appreciated.

There are many ways to submit a comment:

- Online: www.bpa.gov/corporate/i-5-eis/ecomment.cfm
- Mail: I-5 Corridor Reinforcement Project
  PO Box 9250
  Portland, OR 97207
- Email: I-5@bpa.gov
- Voicemail: 800-230-6593
- Fax: 888-315-4503

Comments will also be accepted at the following drop-in sessions and public meetings.

Draft EIS Drop-In Sessions

Drop in anytime to get help navigating the Draft EIS. Review the document, view the project interactive map, and submit comments through the project website.

Date	Time	Location
Tuesday, December 4, 2012	5 pm–8 pm	Castle Rock, Castle Rock Elementary School, Cafeteria
Thursday, December 6, 2012	5 pm–8 pm	Amboy, Amboy Middle School, Commons area
Saturday, December 8, 2012	1 pm–4 pm	Camas, Liberty Middle School, Cafeteria
Tuesday, December 11, 2012	5 pm–8 pm	Vancouver, Vancouver Community Library, Columbia Room
Wednesday, December 12, 2012	5 pm–8 pm	Camas, Liberty Middle School, Cafeteria
Saturday, December 15, 2012	1 pm–4 pm	Amboy, Amboy Middle School, Commons area

Public Comment Meetings

BPA will host six public meetings to accept comments on the Draft EIS.

Date	Time	Location
Thursday, January 10, 2013	5 pm–9 pm	Camas, Liberty Middle School, Cafeteria
Saturday, January 12, 2013	1 pm–5 pm	Amboy, Amboy Middle School, Commons area
Wednesday, January 23, 2013	5 pm–9 pm	Battle Ground, Battle Ground Community Center, Lewis River Reception Hall, and Moulton Falls Creek Room
Saturday, February 2, 2013	1 pm–5 pm	Longview, Mark Morris High School, Commons area
Monday, February 4, 2013	5 pm–9 pm	Castle Rock, Castle Rock Elementary School, Cafeteria
Wednesday, February 6, 2013	5 pm–9 pm	Vancouver, Clark College, Gaiser Hall

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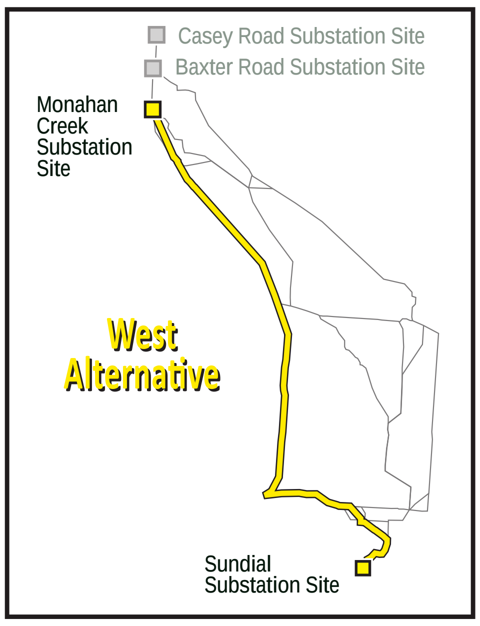

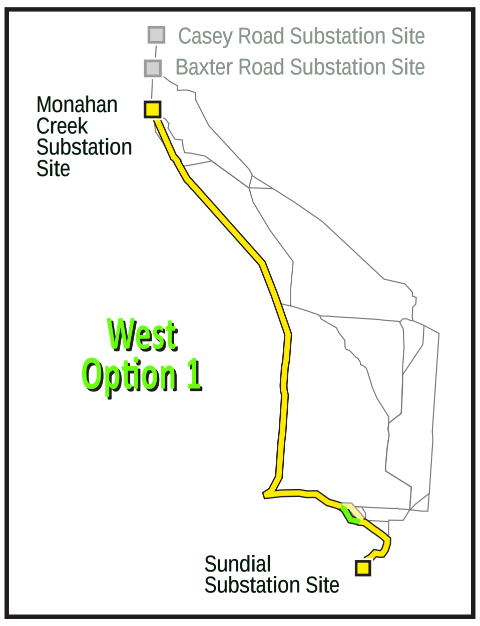

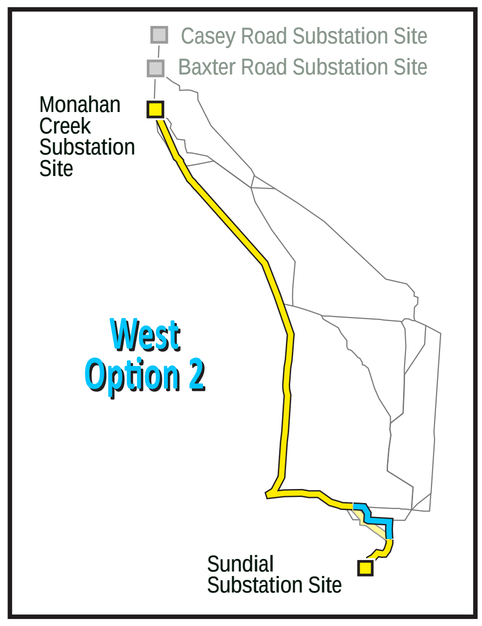

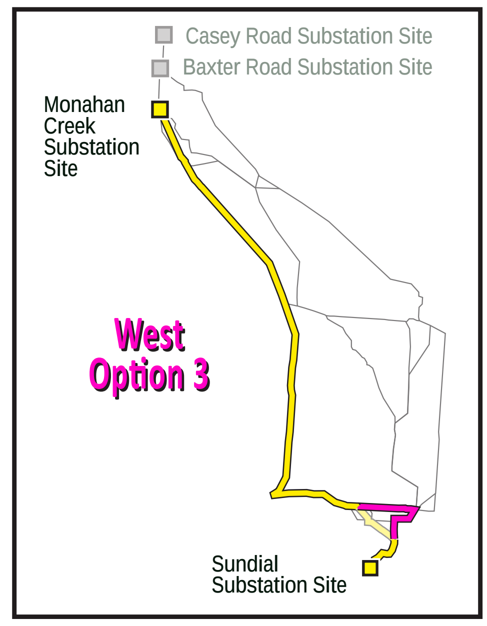

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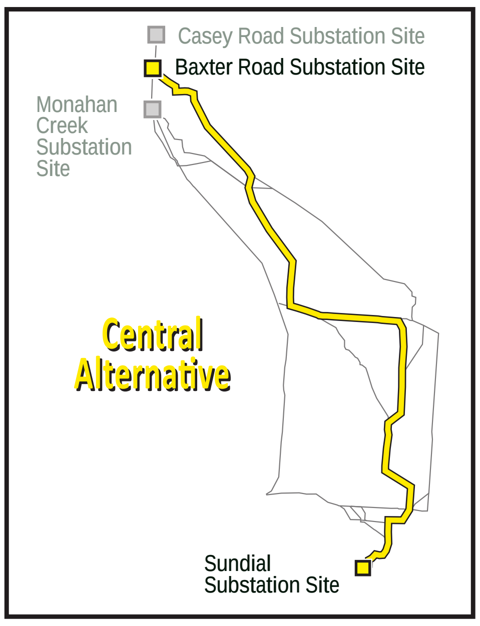

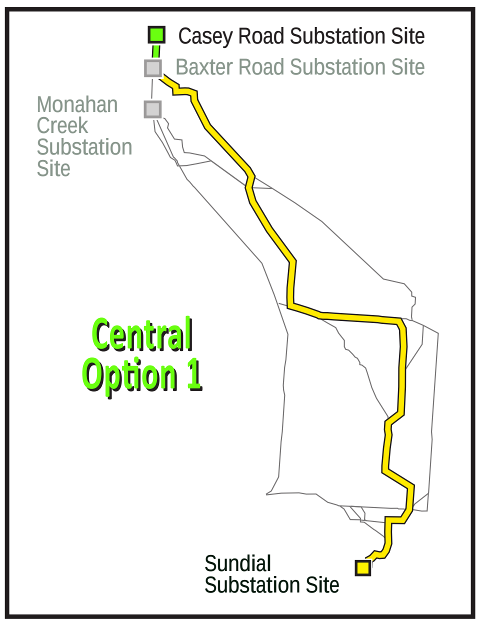

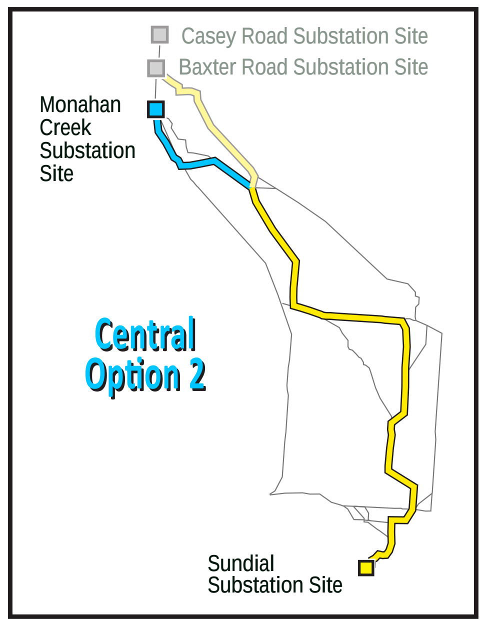

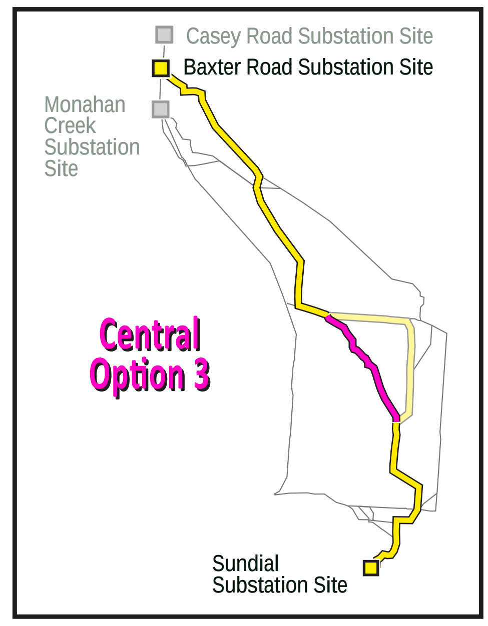

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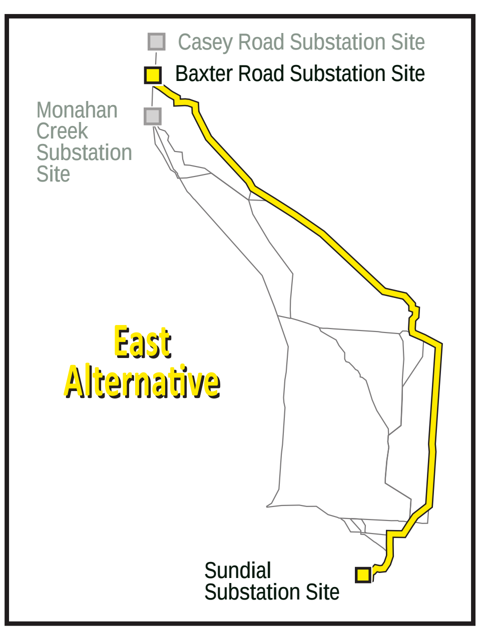

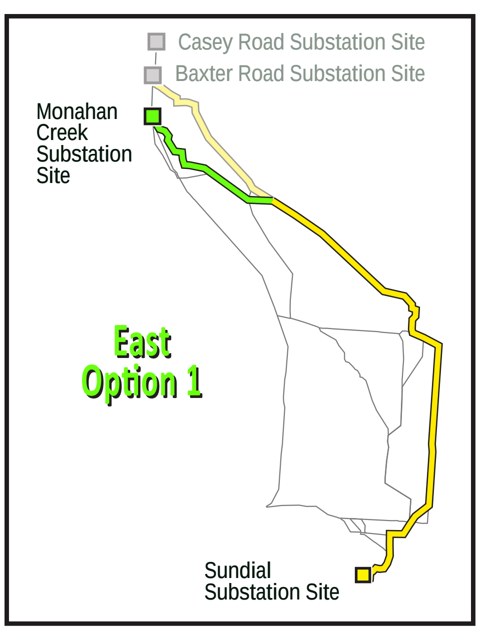

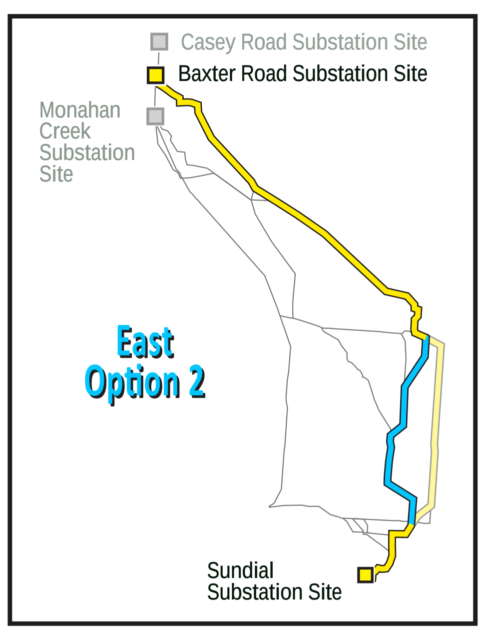

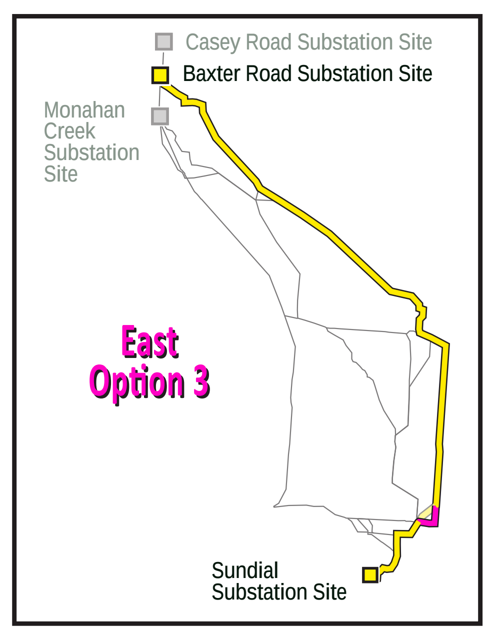

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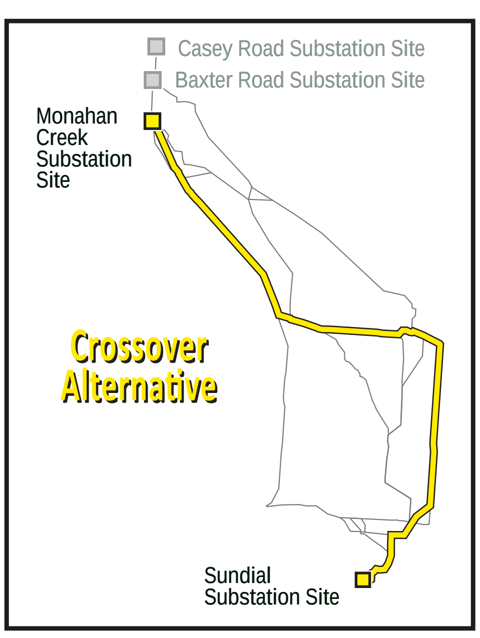
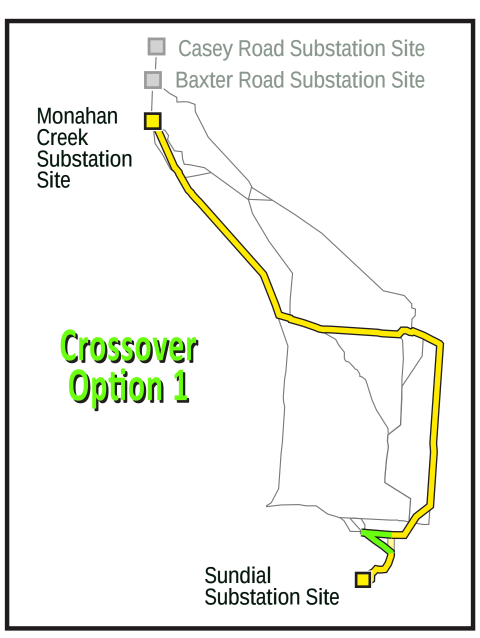
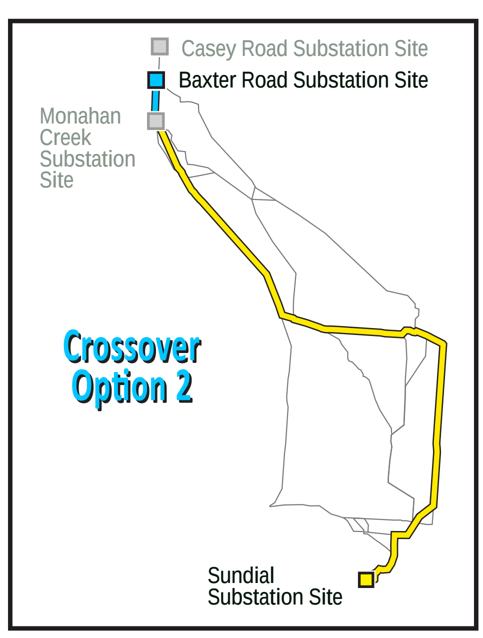
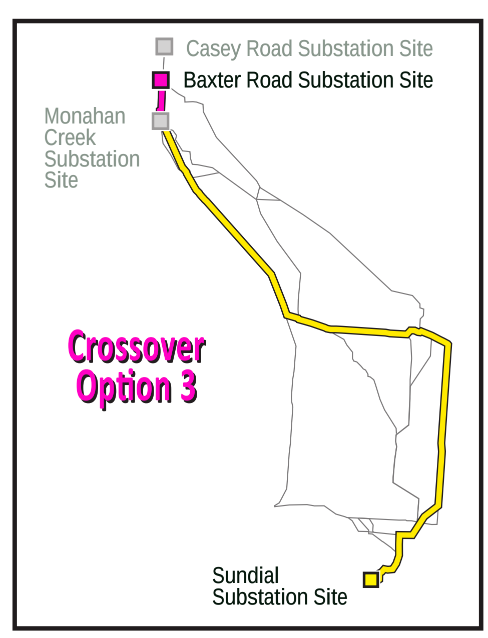
Action Alternatives and Options









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Summary

This chapter summarizes the draft environmental impact statement (EIS) prepared for the I-5 Corridor Reinforcement Project:

- Purpose of and need for action
- Project overview, including the four proposed action alternatives and their optional route segments (“options”) and proposed new substations
- Affected environment and environmental impacts

S.1 Purpose of and Need for Action

S.1.1 Background

Bonneville Power Administration (BPA) is a federal agency within the U.S. Department of Energy that markets wholesale electric power generated by federal and private facilities to customers in the Pacific Northwest and nearby regions. To deliver this power, it operates and maintains more than 15,000 circuit miles of high-voltage transmission lines.

BPA has a statutory obligation to ensure it has sufficient capability to serve its customers through a safe and reliable transmission system. The Federal Columbia River Transmission Act directs BPA to construct improvements, additions, and replacements to its transmission system that the BPA Administrator determines are necessary to provide service to BPA’s customers, maintain electrical stability and reliability, and integrate new power sources (16 U.S.C. § 838b). If there is not enough available transmission capacity on the system to serve growing demand and accommodate new transmission requests, new transmission facilities may be proposed, subject to appropriate environmental review under the National Environmental Policy Act (NEPA).

S.1.2 Need for Action

Based on a decade of studies, BPA has determined that the portion of its transmission system (known as the SOA, or South of Allston, path) serving the Portland, Oregon-Vancouver, Washington, metropolitan area is becoming congested during the summer months because of greater use of air conditioning in the metro area, new generating plants interconnecting to BPA’s transmission system north of the SOA path, and, to a lesser extent, power transfers from Canada through the Northwest to load centers south of the metro area. When this growing local summer peak load is combined with traditional high air conditioning loads in California and the Southwest, the probability that the SOA path will exceed its operating limit during the summer months increases. BPA’s analysis indicates that by spring 2016 the existing transmission system’s capacity will likely be reached, forcing BPA to reduce power deliveries and compromising transmission system reliability.

Also, based on Network Open Season (NOS) marketing processes conducted in 2008, 2009 and 2010, BPA has received several new transmission service requests to use the SOA path but BPA is unable to accommodate them because there is no more firm capacity available on the SOA path. The 2011 NOS was delayed to conduct regional discussion on how to meet these and subsequent transmission needs in the Northwest.

BPA has taken several steps to reduce congestion on the transmission system and delay the need for new lines. It has upgraded many facilities and initiated operating procedures to maximize the use of existing transmission line capacity. In addition, BPA commissioned a study to determine if any "non-wires" measures could help alleviate power flow bottlenecks on the SOA path. The study explored four options: Promoting increased energy efficiency among regional customers; using demand response to manage when power is used; using small generators or solar power close to load centers (called distributed generation); and changing which large generation sources serve loads (called "generation redispatch"). The study found that the first three options would provide minimal relief on the SOA path during summer peak usage, while generation redispatch could defer the need for the new line by 2 to 6 years. However, aggressive implementation of all four non-wires options would not be enough to meet the need after 2020 due to the combination of increased summer peak loads, additional requests for firm transmission service and forecasted base load growth. Consequently, BPA is analyzing the feasibility of redispatch to assist in the short-term, but continuing to pursue the new line to meet needs in the long-term.

As a result, BPA is proposing to build a 500-kilovolt (kV) lattice-steel-tower transmission line that would run from a new 500-kV substation near Castle Rock, Washington, to a new 500-kV substation near Troutdale, Oregon. BPA is considering four action alternatives (transmission line routes, each with optional route variations), three sites for the proposed substation near Castle Rock, and one site for the proposed substation near Troutdale (see Map S-1). The ultimate action taken will depend on which alternative best meets the project's primary purposes: maintaining system reliability and performance, helping BPA meet its statutory and contractual obligations, using ratepayer funds responsibly and efficiently, and minimizing impacts to the natural and human environment (see Tables 4-9, 4-10, and 4-11 in Chapter 4).

In addition to service and reliability benefits, the project's additional capacity would benefit BPA's transmission system and customers in other ways. The proposed new line and substations would help redistribute the flow of power, which would increase the capacity of the overall system, and would also provide the transmission flexibility required to bring more renewable wind power from the east to population centers along the I-5 corridor. The project would also allow BPA to schedule outages on existing lines, which is necessary to perform critical maintenance but currently challenging to arrange.

S.1.3 Public Involvement

During the initial scoping period of this EIS (fall 2009), BPA solicited comments from the public; Tribes; federal, state, regional, and local agencies; interest groups and others to help determine what issues should be studied. Information about the project was publicized by publishing notices in the *Federal Register,* mailing information packets to more than 9,500 landowners and other interested groups or individuals in the project vicinity, holding six public open-house style meetings (attended by more than 2,500 people), establishing a project website, and placing ads in and sending press releases to local media. BPA invited comments through several methods, including online, through a dedicated voice-messaging system, comment forms mailed or faxed, and written and verbal comments collected at public scoping meetings. All comments received were posted on the project's website.

Based on comments from more than 7,000 people and additional studies of the transmission system, BPA refined the proposed transmission line routing alternatives. In late summer 2010, BPA hosted four additional public meetings to present updated project information, publicized by placing ads in and sending press releases to local media. In the period following (until release of this draft EIS), BPA staff has met with property owners, neighborhood groups, community organizations, elected officials, Tribes, state agencies and other interest groups, and hosted additional public meetings. Comments received from the close of the scoping period to the release of the draft EIS are contained in supplemental comment reports posted on the project website.

S.2 Project Overview

The proposed 500-kV transmission line would run from a new 500-kV substation near Castle Rock, Washington to a new 500-kV substation near Troutdale, Oregon, crossing through Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. BPA is considering four routing alternatives for the transmission line: a West Alternative, Central Alternative, East Alternative and Crossover Alternative (see Map S-1). Each has three additional optional routes ("options") that replace a portion of the alternative. BPA is also considering three sites for the new substation near Castle Rock: Monahan Creek, Baxter Road, and Casey Road. The new substation near Troutdale would be built west of Sundial Road. All alternatives and options would cross the Columbia River at the same location.

The four action alternatives (including options) vary in length from about 67 to 80 miles, and cross mostly private property, some federally and state owned land, and municipal lands owned by cities, counties, and the Port of Portland. Project construction would require easements (rights for use and access) for transmission line rights-of-way and access roads in some locations, and land purchases for the substations. In general, BPA needs a 150-foot wide right-of-way easement for a new 500-kV transmission line, and a 50-foot wide easement for new access roads. However, some route segments within the alternatives and options use all or part of existing right-of way, with no or a smaller amount of new right-of-way needed. BPA would purchase 25 to 50 acres for each new substation; exact acreage would depend on the site selected.

About 375 to 390 lattice steel towers would be constructed. These would primarily be single- and double-circuit towers, with some triple-circuit towers possible depending on the alternative or option selected. Single-circuit towers are between 120 and 150 feet tall; double- and triple-circuit towers are between 180-and 200-feet tall. The towers on either side of the Columbia River would be up to 280-feet tall.

The road system used to access the transmission towers and substations would be a mix of public, private, and BPA access roads across public and private land. Roads would be built within the transmission line right-of-way as much as possible if terrain and land use allow. In some areas, new roads would be required; in others, existing roads would be improved. Between 63 and 207 miles of new and improved roads would be required, depending on the action alternative or option selected. In coordination with landowners, BPA installs gates at entrances to access roads to prevent public access to private lands and the transmission line right-of-way.

For all action alternatives and options, fiber optic cable would be installed on the towers to provide a communication link between the new substations and BPA's power system, and dispatchers and maintenance crews. Equipment changes would be made inside control houses at three BPA substations.

If a decision is made to build the project, construction could begin as early as 2014 and take about 30 months. The transmission line and substations would be built by two or more construction contractors. A typical transmission line construction crew has 50-60 workers (70 to 100 at the peak of construction). A typical substation construction crew has 20-30 workers (40-50 at the peak of construction). The total estimated project cost is $385-489 million depending on the action alternative selected.

BPA is also considering a No Action Alternative and, as mentioned, is exploring the feasibility of non-wires solutions that could defer the need for the line.

BPA has evaluated the alternatives and options, considered the purpose of and need for the proposed project, the affected environment, and environmental consequences, and based on these factors, BPA's preferred alternative at this time is the Central Alternative, using Central Option 1.

S.2.1 Proposed Action Alternatives

From north to south, each of the four action alternatives would begin at a new substation near Castle Rock and end at the proposed Sundial Substation in Oregon. (Proposed substation sites are summarized first below.) Each action alternative has three additional route options—where some line segments are replaced with different ones—to provide routing flexibility in certain locations.

S.2.1.1 Substations

Each of the project's substations would be built on a large parcel purchased by BPA. They would not be used to transform voltages and so would not have transformers. Instead they would operate as switching stations and would have equipment for controlling power flow only. Each substation would include a control house and equipment inside a fenced substation yard, with a 10-foot-wide gravel buffer outside the fence.

- Castle Rock area substation (three possible sites)
    - **Casey Road site**. This site is 2 miles west of Westside Highway, northwest of Castle Rock and, like the other two, adjacent to several BPA 500- and 230-kV transmission lines. The site is on 14.6 acres of Washington Department of Natural Resources (WDNR) property in a recently cleared, hilly area. A 2.5-acre detention pond would be built north of the site to collect and filter substation water runoff. About 2.8 miles of existing road would be improved to access the site.
    - **Baxter Road site**. This site is located 4 miles north of the Monahan Creek substation site, 4 miles west of Westside Highway, northwest of Castle Rock, and also adjacent to several BPA transmission lines. The 17-acre site is Sierra Pacific Industries-owned forest land surrounded by forested wetlands. A 2.5-acre detention pond would be built just south of the site. About 2 miles of existing road would be improved for access.

- **Monahan Creek site**. This site is near the intersection of Monahan and Delameter roads 3.5 miles west of Castle Rock. Currently privately owned grazing land located among rural residences, the 14.4-acre site is next to several BPA 500- and 230-kV transmission lines. A 2.25-acre detention pond would be built at the intersection of Delameter, Garlock, and Otter roads. About 0.1 mile of new road would be built for access from Delameter Road.

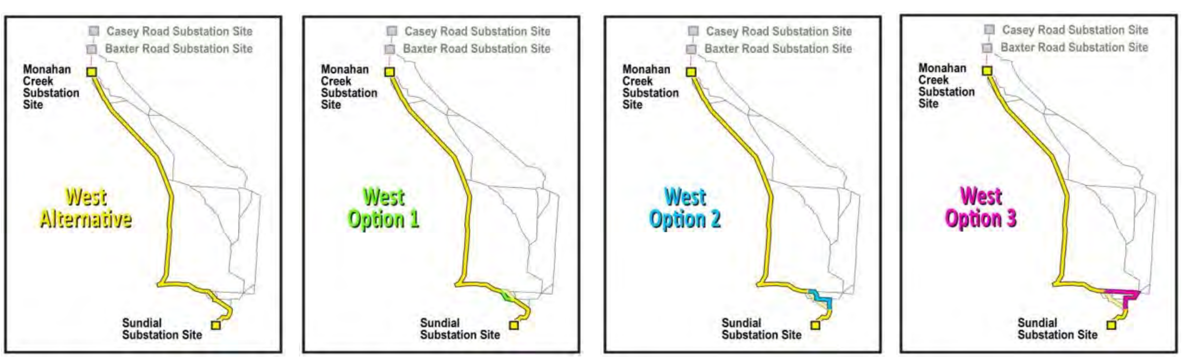
- Sundial Substation. The project would end at a 17.3-acre site west of Sundial Road about 1 mile north of Interstate-84 in Troutdale, Oregon. The site is part of a light-industrial complex owned by the Port of Portland. BPA's existing Troutdale Substation and non-BPA substations are east of the site and several BPA and non-BPA transmission lines run in or near the site. No detention pond is required. The site would be accessed by about 0.5 mile of new road.

S.2.1.2 Transmission Line Alternatives and Options

The transmission line alternatives and options use a combination of existing and new rights-of-way. The alternatives and options cross through varying proportions of different land uses. Specific route segments included in each alternative and its options are listed in Chapter 2.

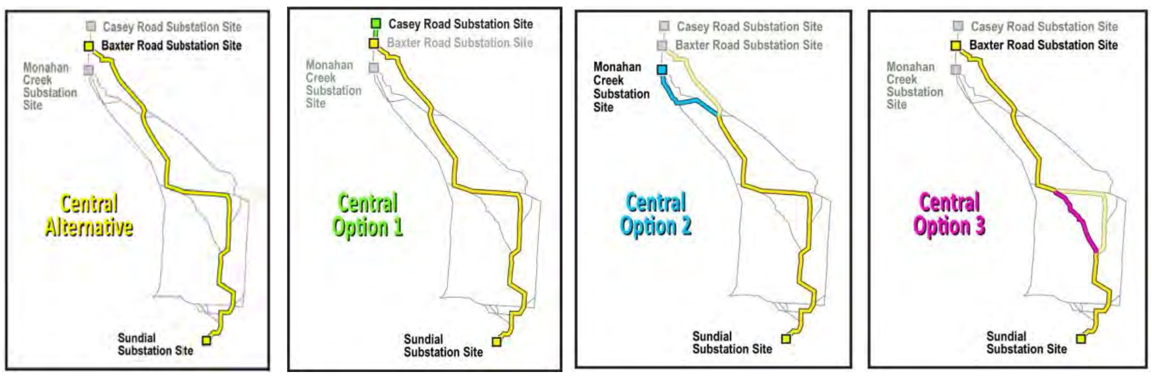
West Alternative and Options

The West Alternative begins at the Monahan Creek substation site west of Castle Rock and runs 67.5 miles southeast to the Sundial substation site in Oregon. The options add slightly to the net length: West Option 1, +0.1 mile; West Option 2, +1.6 miles; West Option 3, +5.6 miles. About 63 miles of new and improved access roads would be required. Most of the West Alternative (98 percent) uses existing BPA right-of-way (paralleling existing lines) which crosses the highest proportion (17 percent) of populated area among the action alternatives—about 7 percent urban/suburban and 10 percent rural. It crosses the northeast tip of the Longview/Kelso urban area and several miles of the Vancouver urban area farther south; most of the rural area crossed is undeveloped. Beyond the right-of-way—from the right-of-way edge out to 1,000 feet on either side of the line—the West Alternative would cross near a greater percentage of property zoned for residential use than the other alternatives: about 46 percent is zoned residential.



Central Alternative and Options

The Central Alternative begins at the Baxter Road substation site northwest of Castle Rock and immediately heads east, crossing north of Castle Rock before running south and east to the Sundial substation site, a total of 77.3 miles. The options vary the net length only slightly: Central Option 1 (begins at Casey Road substation site), +2.5 miles; Central Option 2 (begins at Monahan Creek substation site), -2.3 mile; Central Option 3, -5.8 miles. About 160 miles of new and improved access roads would be required. The Central Alternative would primarily use new right-of-way (about 90 percent) that would run mostly through forest land (around 90 percent of land use crossed). Only 3 percent of the land crossed by the right-of-way would be populated—1 percent urban/suburban, primarily north of Castle Rock, and 2 percent rural (exception: Central Option 2 would cross 4 percent rural land). About 14 percent of the land beyond the right-of-way (out to 1,000 feet on both sides) of the Central Alternative is zoned for residential use.

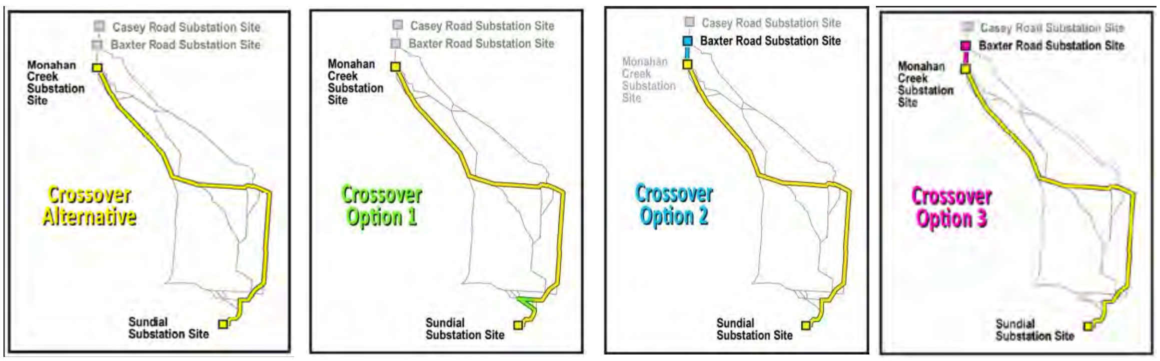


East Alternative and Options

Like the Central Alternative, the East Alternative begins at the Baxter Road substation site and heads east, crossing north of Castle Rock, but then continues farther east before turning south around Yale Dam to proceed to the Sundial substation site, a total of 75.5 miles. The options vary net length slightly: East Option 1 (begins at Monahan Creek substation site, crossing south of Castle Rock), -1.8 miles; East Option 2, +1 mile; East Option 3, +1.1 miles. About 207 miles of new and improved access roads would be required. The East Alternative would primarily use new right-of-way (about 90 percent) that would run through predominantly forest land (around 90 percent of land use crossed). Only 3 percent of the land crossed by the right-of-way would be populated—about 1 percent urban/suburban, primarily near Castle Rock, and 2 percent rural (exception: East Option 1 would cross 4 percent rural land). About 7 percent of the land beyond the right-of-way (out to 1,000 feet) of the East Alternative is zoned for residential use.

Crossover Alternative and Options

The Crossover Alternative begins at the Monahan Creek substation site west of Castle Rock and runs 74 miles to the Sundial substation site. The options add slightly to net length: Crossover Option 1, +5.2 mile; Crossover Option 2 (begins at Baxter Road substation site), +4.3 miles; Crossover Option 3 (begins at Baxter Road substation site), +4.2 miles. About 127 miles of new and improved access roads would be required. While the Crossover Alternative shares a portion of the West Alternative's northern route, running along existing right-of-way, it turns east above the Lewis River and south below Yale Dam, requiring about 55 percent new right-of-way that would mostly cross forest land (about 76 percent). About 8 percent of the land crossed by the right-of-way would be populated—about 1 percent urban/suburban, primarily in Longview, and 7 percent rural. About 14 percent of the land beyond the right-of-way (out to 1,000 feet) of the Crossover Alternative is zoned for residential use.



S.2.1.3 No Action Alternative

Under the No Action Alternative, BPA would not build the proposed I-5 project, including the new 500-kV transmission line and substations and upgrades at existing facilities. Under this alternative, BPA would not increase the electrical capacity of its transmission system along the SOA path to respond to increasing congestion on the system, load growth, and new requests for transmission service. Although BPA would continue to implement operational procedures to maximize use of existing capacity, transmission system congestion along this path would be expected to increase, making it difficult for BPA to preserve system reliability and risking unplanned outages. In addition, BPA would likely need to curtail path flows to keep the system within operating limits, which would make it difficult for local utilities to schedule power to their customers.

S.3 Environmental Impacts

Construction and installation of lattice-steel towers, new access roads and new substations, and related counterpoise installation, pulling/tensioning sites, and staging areas, would have temporary and permanent impacts on area resources. Construction would require heavy vehicles, helicopters, and equipment such as cranes and bulldozers and would create dust, noise and potential traffic delays that could temporarily disturb local residents, motorists, wildlife, and the natural environment. Permanent impacts would include removing some land from current uses or restricting its future uses and clearing vegetation and trees, which could cause soil compaction and erosion and disturb habitat for fish and wildlife. The transmission line would span the area's major rivers and streams, but some fish-bearing streams and wetlands would be affected by vegetation clearing, access road crossings and tower sites. Besides these physical impacts, some new towers and roads would be visible and could affect scenic views near residential, rural residential, or recreation areas.

This section summarizes the proposed project's environmental impacts on natural resources in the area. Impacts unique to each proposed substation, alternative, and option are summarized following a brief look at common impacts (e.g., ones that would occur regardless of action alternative or option selected). Impact levels and assessment methodology are defined in each resource chapter. For comparison purposes, these impacts have been compiled in Tables 4-10 and 4-11 in Chapter 4. Mitigation measures to lessen impacts are incorporated in the project's design (see Table 3-2 in Chapter 3); additional recommended measures are listed at the end of each resource chapter.

S.3.1 Land

S.3.1.1 Affected Environment

For project analysis purposes, the project area includes lands at and near proposed project facilities in Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. This includes unincorporated portions of these counties and the cities of Kelso in Cowlitz County, the cities of Vancouver, Camas, and Washougal in Clark County, and the cities of Troutdale and Fairview in Multnomah County. Land potentially affected by the project is predominately privately owned, with some public ownership scattered throughout. Private land includes small parcels or holdings by individual landowners, and large parcel or holdings owned by PacifiCorp and private commercial timber companies such as Longview Timberlands LLC, Sierra Pacific Industries, and Weyerhaeuser Company. Public landowners include federal and state agencies and city and county governments. Public agencies that own or manage lands directly crossed by the project include WDNR, the city of Camas, and the Port of Portland.

In the counties and cities where the action alternatives are located, there are five general categories of existing land use: urban/suburban, rural, timber production, agriculture, and open space (which include both forested and non-forested areas). Cowlitz County has large areas of mostly forested open space and timber production, with some scattered agriculture and rural residential land. Clark County also has large areas of forested open space and timber production, but more agriculture and rural residences. Higher density urban/suburban areas occur in and around the cities of Kelso and Longview to the north and in the greater Portland-Vancouver metro area to the south, which includes land in Multnomah County.

West Alternative and Options

This alternative, the closest to I-5, would pass through the cities of Kelso, Vancouver, Camas, Washougal, Troutdale, and Fairview; the Longview urbanized area; the urban growth boundaries of Vancouver and Washougal; and the Portland metro area. In some areas, it would cross unincorporated land with rural, agricultural and open space uses, but it would cross significantly more urban/suburban areas (including residential, commercial and industrial uses) than the other action alternatives. It also crosses the highest percentage (99 percent) of private land; the 1 percent of public land is owned by WDNR. However, it would occupy substantially more existing transmission line right-of-way (66 miles, almost 98 percent of the total distance) than the other action alternatives.

Central Alternative and Options

This alternative would pass through the cities of Camas, Washougal, Troutdale, and Fairview, as well as unincorporated land, crossing less urban/suburban land (mostly near the northern and southern ends) and more rural, agricultural, forested open space, and timber production land than the West Alternative. Most land crossed is privately owned (73 percent); WDNR (26 percent) and the city of Camas (1 percent) own the remainder. The alternative parallels existing lines for about 8 miles (10 percent of its total distance), requiring mostly new right-of-way.

East Alternative and Options

Like the Central Alternative, this alternative would pass through the cities of Camas, Washougal, Troutdale, and Fairview, as well as unincorporated land, crossing less urban/suburban land (mostly near the northern and southern ends) and more rural, agricultural, forested open space, and timber production land than the West Alternative. Most land crossed is privately owned (85 percent); WDNR (14 percent) and city and county governments (less than 1 percent) own the remainder. The alternative parallels existing lines for about 8 miles (11 percent of its total distance), requiring mostly new right-of-way.

Crossover Alternative and Options

This alternative would pass through the cities of Kelso, Camas, Washougal, Troutdale and Fairview; the Longview urbanized area; and unincorporated land. It crosses less urban/suburban, agricultural, and open space land, more timber land, and about the same amount of rural land as the West Alternative. Most land crossed is privately owned (79 percent); WDNR (20 percent) and city and county governments (less than 1 percent) own the remainder. The alternative parallels existing lines for about 33 miles, 45 percent of its total distance.

S.3.1.2 Impacts Common to Action Alternatives

Construction of the line, access roads and substations could temporarily disrupt adjacent land uses. For developed urban/suburban and rural land uses, construction activities would predominantly have temporary **low** impacts for a few weeks, with the exception of temporary **low-to-moderate** impacts on landowners who may be required to remove encroachments (buildings, vehicles, fences, etc.) within rights-of-way. For timber production land use, construction would have temporary **no-to-low** impacts because, while trees within or near the right-of-way must be cleared, BPA would coordinate with harvest schedules and the landowner would be compensated for trees cleared earlier than planned. Similarly, construction would have temporary **low** impacts on agricultural land uses because landowners would be compensated for any crop losses and BPA contractors would coordinate with farmers to minimize disruption to grazing or other farm activities. Where open space throughout the project area is used for recreation, the intrusion by construction activities could have temporary **low** impacts; elsewhere, where open spaces may be used for timber production, construction would have **no-to-low** impacts.

Once constructed, the line, access roads and substations would permanently remove land from use or limit land uses and activities within the right-of-way. BPA would negotiate and purchase easements for new right-of-way from landowners with affected properties. These easement documents would describe right-of-way use limitations for the underlying landowner. In urban/suburban and rural areas, permanent use limitations by the line would have permanent **low-to-moderate** impacts on landowners. Where BPA would acquire new easements for right-of-way where none have previously existed, there could be some permanent **high** impacts. Likewise, permanent impacts could be **low-to-high** where new line easements create use limitations off (but adjacent to) existing right-of-way, depending on whether that use could continue or if the easement would cause "stranded uses" of the property. New and improved access roads would have **moderate** impacts in urban/suburban areas, where they are usually compatible uses, but potential **moderate-to-high** impacts in rural areas, depending on existing or planned development. If unauthorized users gain access to the new (line or road) easements, impacts could be **low-to-high**, depending on land use and proximity of houses.

In timber production areas, removal of land for timber use could have permanent **high** impacts on some landowners, despite compensation, and where rights-of-way could make certain timber stands inaccessible or economically infeasible to harvest (stranded use). Staging areas and conductor pulling areas that require clearing during construction and are not located within the right-of-way could be replanted, having temporary **no-to-low** impacts on timber production uses.

Agricultural uses can continue within rights-of-way under certain conditions. In general, cultivated crops that are unsupported and do not grow higher than 4 feet at mature height may remain in existing right-of-way or be allowed in new right-of-way under the transmission line between towers and roads. However, orchards and other tall-growing natural or planted vegetation would likely not be allowed within the right-of-way, a **high** permanent impact if they already exist or are planned for these areas. Where agricultural land may be stranded due to the project, the permanent impact would also be **high**. Livestock grazing is usually allowed to continue within rights-of-way, although the line and roads could have **low-to-high** impacts on grazing depending on the size of the property, amount of grazing land and any limitations posed by the project.

Permanent conversion of forested open spaces to non-forested open space (utility use) would have **moderate-to-high** impacts. Impacts on compatible open space activities, such as recreation, would be **moderate** because these could continue.

There would be temporary **no-to-low** impacts on land uses by operation and maintenance activities (traffic, noise, dust and vegetation management) in and around rights-of-way and substations.

Sundial Substation Site. Because the site would be within the Troutdale Reynolds Industrial Park, temporary construction impacts would be **low**. About 40 acres (likely less) would be removed from Port of Portland ownership, precluding future industrial use or planned wetland mitigation. Although the Port would be compensated, this would be a **high** permanent impact. Operation and maintenance activities would have **no** impact on the industrial park and nearby uses.

S.3.1.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

Regardless of site, the substation would require BPA to purchase between 25 and 50 acres, having a **high** impact on landownership. Landowners affected would be WDNR (Casey Road site), Sierra Pacific (Baxter Road site) or some private residents (Monahan Creek site). Impacts on land use would also be **high** on any site. The Casey Road site would require clearing up to 63 acres of mostly timber production land; unauthorized target practice occurring on-site would be discontinued, a separate **moderate** impact on a few users. The Baxter Road substation would clear about 47 acres of timber production land, although the substation would be partially within an existing right-of-way and would not prevent access to or strand surrounding forest production uses. The Monahan Creek substation would remove up to 67 acres of mostly rural and open space lands (used for grazing and rural residences); grazing may or may not be able to continue.

West Alternative

Because this alternative would cross more urban/suburban areas than the other action alternatives (7 percent vs. 1 percent), it passes through the greatest quantity of areas with high densities of multi- and single-family residential units per acre and the highest number of homes within 500 feet of the edge of right-of-way (more than 3,000). However, it does so on predominantly existing right-of-way, requiring many fewer acres of new easements. BPA would need to acquire up to 401 acres of new easements for transmission line right-of-way and new and improved roads. Most land subject to new easements is privately held (391 acres) and about 10 acres is publicly owned (8 acres by WDNR).

The West Alternative would occupy about 1,097 acres of existing right-of-way and require about 127 acres of additional new right-of-way along and adjacent to existing right-of-way. About 104 acres (82 percent) of this new right-of-way would be on open space land. Outside the new right-of-way, an additional 131 acres (including 81 acres of open space) would be affected by project-related activities, such as removing or installing new towers or establishing new or improved roads beyond the right-of-way edge.

As for all action alternatives, portions of the line or roads built on existing easements would cause **low-to-moderate** impacts on adjacent landowners; in areas requiring new right-of-way and subsequent easements restricting use, impact on landowners would be **high**. Because the West Alternative would occupy 98 percent existing right-of-way and a larger proportion of existing access roads, it would have the least overall impact on landowners of the action alternatives. At the same time, it would cross near more private land held by a large number of small landowners.

The West Alternative would have the following permanent impacts on land uses:

Urban/suburban (7 percent of area crossed, most of the action alternatives)—potential **high** impacts on existing land uses within 2 acres of new right-of-way due to clearing and use restrictions, although the acreage affected is small and impacts would be **low-to-moderate** where existing uses are compatible (e.g., low-growing landscaping). Restrictions on new development adjacent to new right-of-way would have **no-to-high** impact, depending on development plans. Impacts by new and improved roads and related project activities occurring on other BPA rights-of-way—affecting 6 acres—would have **no** impacts because roads are compatible uses within urban/suburban areas and could aid future development (**low-to-high** impact if a road encourages unauthorized access). **Low-to-moderate** impacts in a larger area of urban/suburban land (about 89 acres) on existing right-of-way where, because it has long been vacant, some adjacent landowners have installed ornamental landscaping or structures (residential or commercial/industrial) that would have to be removed.

Rural (7 percent of area crossed, most of the action alternatives)—potential **high** impacts within 4 acres of new right-of-way due to clearing and land use restrictions. Restrictions by new right-of-way on adjacent new development could have **no-to-high** impacts. **Low-to-moderate** impacts on 81 acres of existing right-of-way because, despite initial vegetation clearing and removal of incompatible uses, most recreation, livestock grazing and low-profile rural uses could continue. Because access roads are common and compatible with rural uses, new access roads would have a **moderate** impact; improved roads would have **no** impact on land use. Roads and other off-right-of-way project activities would affect 13 rural acres, having **no** impact unless unauthorized use occurs as a result (a potential **low-to-high** impact).

Timber production (1 percent of area crossed, least of the action alternatives)—**no** impact by new right-of-way since none crosses timber production land. About 12 acres outside the new right-of-way would be converted to new or improved roads, having **no-to-low** impacts initially because landowners would be compensated for timber removed, but permanent **high** impacts because forest production could not continue. Where the line crosses 5 acres in existing right-of-way, the land is not being used for timber production; removal of existing vegetation within the right-of-way and of danger trees outside the right-of-way, would have **no-to-low** impacts because landowners would be compensated and replanting would be allowed in certain areas.

Agriculture (14 percent of area crossed, most of the action alternatives)—**high** impact within 17 acres of new rights-of-way where certain agricultural activities could not continue or encroachments would have to be removed but **low-to-moderate** impact where grazing and low-profile agricultural activities could continue between towers and roads on new right-of-way. For the same reason, impacts would be **low-to-moderate** within about 165 acres of existing vacant right-of-way used for agriculture. Where 19 acres outside new right-of-way would be affected by new and improved access roads and other project activities; new roads would have **no-to-low** impacts initially because landowners would be compensated for damaged crops, but permanent **high** impacts because agricultural activities could not continue or a portion of land could be stranded. Improved roads and tower removals or rebuilds, which would occur on existing right-of-way, would have **no** impact. About 3 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (68 percent of area crossed, most of the action alternatives)—**low-to-moderate** impacts within 104 acres of new rights-of-way, on 81 acres of land outside new rights-of-way needed for new and improved access roads and other project-related activities, and within about 762 acres of existing vacant right-of-way, most with timber that would require clearing. (If unauthorized access increases, this could have a **low-to-moderate** impact.) None of the open space along the West Alternative is part of a designated wilderness area or wildlife preserve, but a portion was recently designated as a natural area by the Washington State Commissioner of Public Lands. WDNR also owns a forest riparian conservation easement along Segment 9 that would likely be affected by clearing along the existing right-of-way and possibly off right-of-way for danger trees, a potential **moderate-to-high** impact.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, but in different locations.)

- **West Option 1:** Negligible decrease in private lands impacted and no change in public lands impacted. Would affect slightly less (-2 acres) rural land, the same acreage of urban/suburban and timber production land, less (-6 acres) agricultural land, and more (+10 acres) open space land. Would require 3 fewer acres of prime farmland and farmland of statewide importance.
- **West Option 2:** Decrease in private lands (-75 acres) but increase in public lands (+12 acres) required. Would affect more (+6 acres) rural land, more (+11 acres) timber production land, more (+28 acres) agricultural land, less (-9 acres) open space land, and the same amount of urban/suburban land. Impacted prime farmland and farmland of statewide importance: +5 acres.
- **West Option 3:** Decrease in private lands (-20 acres) but increase in public lands (+10 acres) required. Would affect more (+32 acres) urban/suburban and rural land, more (+32 acres) timber production land, more (+13 acres) agricultural land, and more (+44 acres) open space land—the largest acreage totals for all land uses except agricultural that would be impacted by any option. Impacted prime farmland and farmland of statewide importance: +3 acres.

Central Alternative

BPA would need to acquire up to 2,113 acres of new easements for transmission line right-of-way and new and improved roads. Most land subject to new easements is privately held (1,502 acres) by large landowners, including Sierra Pacific, Weyerhaeuser, and Longview Timber. About 610 acres of public land would also be subject to easements, of which 594 is owned by WDNR. There would be **low-to-moderate** impacts on landowners adjacent to existing easements and **high** impacts on landowners adjacent to new right-of-way and easements restricting use.

Because the Central Alternative would follow existing right-of-way for only 8 miles, it would need about 1,287 acres of new right-of-way for both towers and roads—the most of the action alternatives. About 974 acres (76 percent) would be on timber production land. An additional 362 acres (including 240 acres of timber production) would be affected by road construction and project-related activities off the proposed right-of-way or on existing right-of-way. Densities of residential units near its right-of-way are similar to the West Alternative and in some cases higher, although a much smaller number (327) of homes are within 500 feet of the right-of-way edge.

The Central would have the following permanent impacts on land uses:

Urban/suburban (1 percent of area crossed)—**low-to-moderate** impact within 13 acres of new right-of-way where existing uses (e.g., a garden or low-growing landscape) would be compatible with the project, but **high** impact where incompatible uses would require clearing and be restricted. Where an additional 3 acres of urban/suburban land outside the new right-of-way would be affected by new and improved roads or other project activities, there would be **no** impacts unless unauthorized access increases (potential **low-to-high** impact). Along 8 acres of existing urban/suburban right-of-way, impacts would be **low-to-moderate** due to required removal of obstructions and continuing restrictions.

Rural (2 percent of area crossed)—would require 7 acres for new right-of-way, cross 20 acres within existing right-of-way, and affect 8 acres outside of the right-of-way for roads and other project activities, with impacts similar to the West Alternative.

Timber production (67 percent of area crossed)—initial **no-to-low** impact within 974 acres of new rights-of-way and on 239 acres required for new and improved roads and other components off the right-of-way, because timber producers would be compensated, but permanent **high** impact because timber production could not continue and new right-of-way could strand some timber land. No existing right-of-way would cross timber production land. Where danger trees would need to be removed outside the right-of-way, there would be **no-to-low** impact because landowners would be compensated and replanting would be allowed. Unauthorized access resulting from road constructions could have **low-to-high** impacts.

Agriculture (2 percent of area crossed)—**high** impact within 12 acres of new rights-of-way, where certain agricultural activities could not continue or encroachments would have to be removed; **low-to-moderate** impact where low-profile agricultural activities could continue between towers and roads. Likewise, there would be a **low-to-moderate** impact within about 23 acres of existing vacant right-of-way used for agriculture. Where 8 acres outside new right-of-way would be affected by new and improved access roads and other project activities, impacts would be similar to that of the West Alternative (**low-to-moderate** initially; **high** permanently.) About 1 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (26 percent of area crossed)—**low-to-moderate** impact within 281 acres of new rights-of-way, on 121 acres of land outside new rights-of-way needed for new and improved access roads and other project-related activities, and within about 66 acres of existing vacant right-of-way because, while forested areas would require clearing, most uses within open space lands would remain compatible with the project, although somewhat altered. Development of access roads could increase unauthorized access to open space areas, with potential **low-to-high** impacts.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, just in different locations.)

- **Central Option 1:** Increase in private lands (+40 acres) and public lands (+50 acres) required. Would affect more (+52 acres) timber production land and more (+14 acres) open space land, with no change in acreage under other uses. No change in acreage of prime farmland and farmland of statewide importance.
- **Central Option 2:** Decrease in private lands (-88 acres) but no change in public lands required. Would affect less (-7 acres) urban/suburban land, more (+2 acres) rural land, less (-90 acres) timber production land, less (-4 acres) agricultural land, and more (+45 acres) open space land. Impacted prime farmland and farmland of statewide importance: -<1 acre.
- **Central Option 3:** Decrease in private lands (-61 acres) and public lands (-94) required (although 3 additional acres of public land at Moulton Falls Regional Park would be impacted). Would affect marginally less (-<1 acre) urban/suburban land, more (+16 acres) rural land, less (-207 acres) timber production land, more (+9 acres) agricultural land, and more (+57 acres) open space land, including a portion of a WDNR

genetic reserve. Impacted prime farmland and farmland of statewide importance: +<1 acre.

East Alternative

BPA would need to acquire up to 2,376 acres of new easements for transmission line right-of-way and new and improved roads. Most land subject to new easements is privately held (1,993 acres). About 387 acres of public land would also be subject to easements, of which 358 acres are owned by WDNR and 18 acres managed by the city of Camas (City of Camas Watershed). There would be **low-to-moderate** impacts on landowners adjacent to existing easements and **high** impacts on landowners adjacent to new right-of-way and easements restricting use.

Similar to the Central Alternative, the East Alternative would follow existing right-of-way for about 8 miles, needing about 1,255 acres of new right-of-way for both towers and roads, of which about 1,020 acres (81 percent) would be on timber production land. An additional 476 acres (including 319 acres of timber production) would be affected by project-related activities off the proposed right-of-way or on existing right-of-way. Among the action alternatives, the East Alternative has the fewest homes (286) within 500 feet of the right-of-way edge.

The East Alternative would have the following permanent impacts on land uses:

Urban/suburban (1 percent of area crossed)—would require 12 acres of new right-of-way, use 8 acres of existing right-of-way and affect 2 acres off the right-of-way for roads and other activities, with impacts similar to the Central Alternative.

Rural (2 percent of area crossed)—would require 10 acres for new right-of-way, cross 20 acres within existing right-of-way and affect 12 acres outside of the right-of-way. Impacts similar to the Central Alternative.

Timber production (72 percent of area crossed, most of the action alternatives)—would require 1,020 acres of new right-of-way (no existing right-of-way could cross this land use) and affect 319 acres off the right-of-way, with impacts similar to the Central Alternative.

Agriculture (3 percent of area crossed)—would require about 12 acres for new right-of-way, use about 23 acres of existing vacant right-of-way and affect 11 acres outside the right-of-way, with impacts similar to the Central Alternative. About 1 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (22 percent of area crossed)—would require about 201 acres for new right-of-way, use 66 acres of existing vacant right-of-way and affect 132 acres of land outside the right-of-way. Impacts similar to the Central Alternative.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, just in different locations.)

- **East Option 1:** Decrease in private lands (-74 acres) but no change in public lands required. Would affect less (-9 acres) urban/suburban land, more (+11 acres) rural land, less (-67 acres) timber production land, less (-6 acres) agricultural land, and more

(+53 acres) open space land. Impacted prime farmland and farmland of statewide importance: -1 acre.

- **East Option 2:** Decrease in private lands (-182 acres) but increase in public lands (+31 acres) required, although 8 fewer acres in the City of Camas Watershed would be impacted. Would affect less (-51 acres) timber production land and less (-2 acre) agricultural land, with marginal or no change in acreage in other land use categories. Impacted prime farmland and farmland of statewide importance: -<1 acre.
- **East Option 3:** Decrease in private lands (-15 acres) but increase in public (WDNR) lands (+24 acres) required; the City of Camas Watershed would not be impacted by new easements under this option. Would affect more (+23 acres) timber production land and less (-5 acres) open space land, with no change in acreage in other land use categories. No change in acreage of prime farmland and farmland of statewide importance.

Crossover Alternative

BPA would need to acquire up to 1,420 acres of new easements for transmission line right-of-way and new and improved roads. Most land subject to new easements is privately held (972 acres). About 449 acres of public land would also be subject to easements, of which 422 acres are owned by WDNR. There would be **low-to-moderate** impacts on landowners adjacent to existing easements and **high** impacts on landowners adjacent to new right-of-way and easements restricting use.

Because the Crossover Alternative would follow existing right-of-way for about 33 miles, it would need about 772 acres of new right-of-way for towers and roads, of which about 627 acres (81 percent) would be on timber production land. An additional 286 acres (including 160 acres of timber production) would be affected by project-related activities off the proposed right-of-way or on existing right-of-way. The alternative's right-of-way would cross within 500 feet of 657 homes—less than the West Alternative because it does not pass through the highly urban/suburban areas on the south, but more than the Central and East alternatives because it does pass through the more urban/suburban areas of Kelso and Longview.

The Crossover Alternative would have the following permanent impacts on land uses:

Urban/suburban (1 percent of area crossed)—would require about 3 acres for new right-of-way, use 20 acres of existing right-of-way and affect 2 acres outside the right-of-way, with impacts similar to the West Alternative.

Rural (7 percent of area crossed)—would require 3 acres for new right-of-way, use 59 acres of existing right-of-way, and affect 10 acres outside of the right-of-way. Impacts similar to the other action alternatives.

Timber production (48 percent of area crossed)—would require about 627 acres of new right-of-way (existing right-of-way does not cross this land use) and affect 160 acres off the right-of-way, with impacts similar to the other action alternatives.

Agriculture (3 percent of area crossed)—would require 3 acres for new right-of-way, use 39 acres of existing vacant right-of-way and affect 9 acres outside the right-of-way. Impacts similar to the other action alternatives. About 1 percent of agricultural land removed is designated as prime farmland and farmland of statewide importance.

Open space (43 percent of area crossed)—would require about 136 acres for new right-of-way, use 453 acres of existing vacant right-of-way and affect 105 acres of land outside the right-of-way, with impacts similar to the other action alternatives.

(Note: all options would have the same overall land ownership and land use impacts as the alternative, just in different locations.)

- **Crossover Option 1:** Increase in private lands (+60 acres) but no change in public lands required. Would affect less (-4 acres) rural land, more (+55 acres) agricultural land, and more (+46 acres) open space land (near the Little Washougal River and north of Lacamas Lake); marginal or no change in urban/suburban and timber production acreage. Impacted prime farmland and farmland of statewide importance: +10 acres.
- **Crossover Option 2:** Increase in private lands (+42 acres) but no change in public lands required. Would affect more (+18 acres) rural land, more (+4 acres) timber production land, and more (+76 acres) open space land (most near the Baxter Road substation site); no change in urban/suburban or agricultural acreage. No change in acreage of prime farmland and farmland of statewide importance.
- **Crossover Option 3:** Increase in private lands (+85 acres) but no change in public lands required. Would affect more (+18 acres) rural land, more (+22 acres) timber production land, and more (+56 acres) open space land (most near the Baxter Road substation site); no change in urban/suburban or agricultural acreage. No change in acreage of prime farmland and farmland of statewide importance.

S.3.2 Recreation

S.3.2.1 Affected Environment

Recreation resources in the project area include urban parks and greenways, developed facilities in rural areas such as campgrounds or trails (motorized and non-motorized), and undeveloped rural and open space areas. Recreational activities within the three counties (Cowlitz and Clark counties in Washington and Multnomah County in Oregon) include boating, fishing, hunting, target practice, camping, hiking, swimming, picnicking, sports games, sightseeing and wildlife watching, horseback riding, all terrain vehicle (ATV) use, and mountain biking.

Cowlitz County manages developed parks at 14 sites in rural areas and other recreation areas in developed areas and around lakes and rivers. The Vancouver-Clark Parks and Recreation Department (VCPRD) manages developed parks at 239 sites in Clark County and Vancouver, and a variety of recreation facilities from sports fields and pools to gyms and community centers. Also in Clark County, the western portion of the Yacolt Burn State Forest (managed by WDNR) provides opportunities for camping, hiking, hunting and other outdoor activities. PacifiCorp provides public recreational opportunities along the Lewis River, below Merwin Dam and along the shores of Yale, Merwin and Swift reservoirs.

In Multnomah County, the 40-Mile Loop Land Trust manages the 40-Mile Loop Trail within the cities of Troutdale and Fairview, Multnomah County, and other local jurisdictions. In Fairview, the Metropolitan Service District (Metro), a regional government for the Portland metropolitan area, manages the Chinook Landing Marine Park, a public boating facility. Other facilities within the study area include public and private golf courses.

For this EIS, recreation resources within 1,000 feet either side of the transmission line were analyzed for impacts.

S.3.2.2 Impacts Common to Action Alternatives

All action alternatives would cross the following recreation resources: Oak Park in Camas, Washington, the Washougal River Greenway east of Camas, the Lewis and Clark Trail Scenic Byway and Columbia River Gorge Scenic Byway on SR 14, and the Columbia River. Goot Park in Camas would not be crossed but is just east of the action alternatives. Temporary construction impacts (noise, dust, visual intrusion, access delays or restrictions) to these resources would generally be **low.** If construction takes place during peak use periods, temporary impacts on the parks and the greenway could be **moderate**.

Operation and maintenance of the line, which would involve twice annual helicopter inspections and occasional use of access roads by maintenance crews, are expected to have mostly **low-to-moderate** impacts due to infrequent maintenance and the small portion of recreational property permanently affected by towers or access roads under all action alternatives (0.3 acre crossed by right-of-way and access road within the Washougal River Greenway, a **moderate** impact; less than 0.1 acre crossed by access road within the Port of Camas-Washougal Marina property, a **low** impact; and less than 0.1 acre crossed by access road within Oak Park, a **low** impact). New and improved access roads elsewhere in the project area could also encourage unauthorized access of some lands, with localized **moderate** impacts where signs and fencing could not prevent it.

Sundial Substation Site. No impact: there are no existing recreation resources within the site.

S.3.2.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

No impact: there are no existing recreation resources within the three sites. The Casey Road site, however, could have a **low** impact on unauthorized dispersed recreation.

West Alternative

During project construction, about 5 acres of recreation facilities and less than 0.1 mile of trails would be temporarily disturbed, creating a **low** temporary impact during non-peak periods and **moderate** temporary impact during peak use periods. Construction could occasionally disturb visitors at other nearby recreation resources, but at most would have temporary **low** impacts.

The West Alternative would permanently occupy about 8.9 acres of recreation land: just under 1 acre for towers and about 8 acres and less than 0.1 mile of trails for new or improved access roads. (This includes acreage affected in Washougal River Greenway, Port of Camas-Washougal Marina and Oak Park, for which impacts are discussed under common recreation impacts above.) This is the highest amount of recreational acreage impacted by any alternative. Impacts would be **high** on the East Fork Lewis River Greenway, where 3 miles of new access roads would be built; on Washington State University's Vancouver Campus, where a portion (less than 0.1 mile) of the Campus Trail would be converted to new and improved access roads; and on the Ellen Davis Trail, where less than 0.1 mile would be converted to new access road. Impacts would be **moderate** on 3 acres of the Green Meadows Golf Course and 2 acres of Camp Currie where project towers or roads would be placed along existing rights-of-way. There would be **no-to-low** impacts on remaining parks, campgrounds and trails crossed or in the vicinity, including on Northern Clark County Scenic Drive, which is crossed in existing right-of-way.

- **West Option 1:** About 3 more acres impacted by construction; same **low** or **moderate** temporary impacts, depending non-peak/peak usage of resources, as the alternative. Avoids permanent impacts within Green Meadows Golf Course (-2.9 acres), but shifts permanent impacts to Camas Meadows Golf Club (+0.5 acre). Impacts about 0.5 mile more of the Lacamas Heritage Trail, and the same amount of acreage in Camp Currie as the alternative, but within the camp instead of along the eastern border. Impact would be **moderate** on these facilities. Net reduction in permanent impacts on parks (primarily golf courses) of about 2 acres, but net increase in permanent impacts on trails of less than 0.5 mile.
- **West Option 2:** About 2 fewer acres impacted by construction; same temporary impacts as alternative. Avoids permanent impacts within Green Meadows Golf Course (-2.9 acres) and Camp Currie (-2.1 acres). Additional permanent impacts on 5.2 acres within Green Mountain Park; however, impact would be **low**. Net increase in permanent impacts of about 0.2 acre.
- **West Option 3:** About 2 fewer acres impacted by construction; same temporary impacts as alternative. Avoids permanent impacts within Green Meadows Golf Course and Camp Currie, like West Option 2. Additional permanent impacts on 3.8 acres within Green Mountain Park; impact would be **low.** Net decrease in permanent impacts of about 1.2 acres.

Central Alternative

During project construction, about 1 acre of recreation facilities would be temporarily disturbed (in the Washougal River Greenway), creating a **low** impact during non-peak periods and a **moderate** impact during peak use periods; no trails would be disturbed. The Central Alternative would permanently occupy about 0.5 acre of recreation land: 0.1 acre for towers, and less than 0.4 acre of land and less than 0.2 mile of trails for new and improved roads. (This includes acreage affected in Washougal River Greenway, Port of Camas-Washougal Marina and Oak Park, for which impacts are discussed under common recreation impacts above.) Riverfront Trail (East) and Bells Mountain Trail would be affected by improved access roads (less than 0.1 mile each), a **low** impact; where new right-of-way would cross Bells Mountain Trail, it would have a **moderate** impact. This is the smallest amount of recreation acreage directly affected by any action alternative.

The alternative would cross the scenic Spirit Lake Memorial Highway (SR 504), but at a developed location, a **low** impact. It would also be visible to recreationists at Merwin Park, Goot Park and Western Yacolt Burn Forest, but no components would be placed there, resulting in **no-to-low** impacts.

- **Central Option 1:** No change in impacts on recreational land. Avoids crossing the Spirit Lake Memorial Highway.
- **Central Option 2:** Same temporary impacts as the alternative. Avoids permanent impacts on Riverfront Trail (East) and avoids crossing the Spirit Lake Memorial Highway. Net reduction in permanent trail impacts of less than 0.1 mile.

- **Central Option 3:** Same temporary impacts. Avoids direct impacts on Bells Mountain Trail and visual impacts on PacifiCorp's public recreation areas along the Lewis River (Merwin Park) and the Western Yacolt Burn Forest. Additional temporary and permanent impacts on 0.8 acre in Moulton Falls Park and less than 0.2 mile of Lucia Falls/Moulton Falls Trail; permanent impact would be **high.** Crosses the Northern Clark County Scenic Tour at NE Cedar Creek Road and Lucia Falls Road, a **moderate** impact. Net increase in permanent impacts of about 0.8 acre of park and less than 0.2 mile of trail.

East Alternative

During project construction, about 0.7 acre of the Washougal River Greenway and 0.1 mile of Tarbell Trail would be temporarily disturbed, creating a **low** impact during non-peak periods and **moderate** impact during peak use periods. Similar to the Central Alternative, the East Alternative's right-of-way would be near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), Goot Park, and the Western Yacolt Burn Forest, and near Larch Mountain Trail, but there would be **no-to-low** impacts on these facilities.

The East Alternative would permanently occupy less than 0.5 acre of recreation land: about 0.1 acre for towers, and less than 0.4 acre of land and less than 0.5 mile of trail for new or improved roads. (This includes acreage affected in Washougal River Greenway, Port of Camas-Washougal Marina and Oak Park, for which impacts are discussed under common recreation impacts above.) Trails impacted by the alternative include the Tarbell Trail (less than 0.2 mile for access roads; less than 0.1 mile for towers), Jones Creek Trail (0.2 mile for improved road), and Riverfront Trail (East) (less than 0.1 mile for improved road). Impact on the Tarbell Trail, which is crossed eight times and paralleled for about 1 mile, would be **moderate-to-high**; impact on the Jones Creek Trail would be **moderate**.

Similar to the Central Alternative, the East Alternative would cross the scenic Spirit Lake Memorial Highway (SR 504) and would be visible to recreationists between Merwin and Yale lakes, Goot Park, Larch Mountain Trail and Western Yacolt Burn Forest, but would have **no-to-low** impacts. Hikers along the Silver Star Trail on Silver Star Mountain, about 2 miles east of the alternative, could experience a **moderate** impact from visual intrusion.

- **East Option 1:** Same temporary impacts as alternative. Would avoid permanent impacts on the Riverfront Trail (East) and avoid crossing Spirit Lake Memorial Highway. Right-of-way would be near Riverside Park, creating a **moderate** visual impact**.** Net reduction in permanent impacts on trails of less than 0.1 mile.
- **East Option 2:** Same temporary and permanent impacts on parks. Would avoid permanent impacts on less than 0.5 mile of Tarbell and Jones Creek trails. Additional **low** temporary and **moderate** permanent impacts on less than 0.1 mile of Bells Mountain Trail. Would modify the route south of Yale Dam to go farther west and closer to the western edge of the Western Yacolt Burn State Forest. Net reduction in permanent impacts on trails of less than 0.4 mile.
- **East Option 3:** Same temporary and permanent impacts on parks. Additional temporary and permanent impacts on less than 0.4 mile of Jones Creek Trail Connector A (affected acreage of the main Jones Creek Trail is the same, but in a different location), with the same **moderate** permanent impact as the alternative. Net increase in permanent impacts on trails of less than 0.3 mile.

Crossover Alternative

There are no recreation resources along the northern portion. Temporary and permanent impacts on the Washougal River Greenway, Tarbell Trail, Jones Creek Trail, and other parks and trails (such as near PacifiCorp's public recreation areas) would be the same as those discussed for the East Alternative, because the Crossover Alternative shares the East Alternative's right-of-way through its southern portion, where these resources are located. This alternative would not impact Riverfront Trail (East). Similar to the Central and East alternatives, it would be visible to recreationists at Merwin Park, Goot Park, Larch Mountain Trail and Western Yacolt Burn Forest, but would have **no-to-low** impacts on these facilities. Would permanently occupy about 0.5 acre of recreation land: 0.1 acre for towers and 0.4 acre of land and less than 0.5 mile of trail for new and improved access roads.

- **Crossover Option 1:** About 1.5 additional acres temporarily impacted and 1.2 acres permanently impacted, all within Camp Currie. This would have a **moderate** impact on the camp. Net increase in permanent impacts of 1.2 acres.
- **Crossover Options 2 and 3:** No change in impacts.

S.3.3 Visual Resources

S.3.3.1 Affected Environment

The action alternatives would cross five regions with similar types, quality, and quantity of environmental resources. From north to south, these regions are identified as the Willapa Hills, Cowlitz/Chehalis Foothills, Western Cascades Lowlands and Valleys, Valley Foothills, and Portland/Vancouver Basin.

Substations

The Casey Road site contains visual landscape common to the region (forest), is partially logged and is adjacent to an existing transmission corridor, resulting in low scenic quality. Given its location in a relatively remote area with no nearby residential or recreational uses, viewer sensitivity is also low, for an overall landscape rating of low. The Baxter Road site, in the same remote area as the Casey Road site, is in a small topographical depression surrounded by vegetation and adjacent to a transmission corridor. Scenic quality and viewer sensitivity are similar at both sites (low), which share the same overall landscape rating of low. The Monahan Creek site contains visual landscape common to the region (grazing land), has limited visibility and is adjacent to a transmission corridor, resulting in low scenic quality. Due to nearby rural residences and an adjacent rural road, viewer sensitivity is medium. Overall landscape rating is low. The Sundial site, located in an industrial park, is in an area of low scenic quality. Despite its location in a populated area with a high amount of use, there is low public interest in the site itself, resulting in medium viewer sensitivity. Overall landscape rating is low.

West Alternative and Options

Originating in the Willapa Hills (as all action alternatives do), the West Alternative would pass through rolling vegetated hills and rural residential areas before entering the communities of West Side Highway and Kelso, where it would pass through many more residential areas. The hills become larger and the population less dense where it would enter the Western Cascades

Lowlands and Valleys. After crossing the East Fork Lewis River, the alternative would enter the Portland/Vancouver Basin. Based on a standardized assessment of landscape features, the West Alternative would cross through areas with generally low scenic quality. However, the alternative would pass relatively close to residential areas for most of its length and these viewers can have high levels of viewer sensitivity. The combination of low scenic quality and high viewer sensitivity gives the West Alternative and options an overall medium landscape rating.

Central Alternative and Options

Northwest of the Cowlitz River, the Central Alternative would pass through landscape similar to the West Alternative (rolling vegetated hills and rural residential areas), but in an area north of Castle Rock. East of the Cowlitz River, the Central Alternative would cross the Cowlitz/Chehalis Foothills area and then enter the Western Cascades Lowlands and Valleys. After crossing the Lewis River, the alternative would enter the Portland/Vancouver Basin. General scenic quality is low. The area between the Cowlitz and Lewis rivers is sparsely populated and has limited use, with generally low viewer sensitivity. Pockets of greater sensitivity exist where the alternative would cross the Lewis River (west of Lake Merwin through Ariel). Where the alternative would pass near rural residences around Castle Rock to the north, and Amboy, Yacolt and Camas to the south, viewers could have medium sensitivity. Overall viewer sensitivity is medium, resulting in an overall landscape rating of low.

East Alternative and Options

The East Alternative's northernmost segment is the same as the Central Alternative's. It would pass by some rural residential areas north of Castle Rock, cross the Cowlitz River and pass through the Cowlitz/Chehalis Foothills before entering the Western Cascades Lowlands and Valleys. It would then cross the Lewis River farther east, between Lake Merwin and Yale Lake, before entering the Portland/Vancouver Basin. General scenic quality is low. Except for the area nearest Castle Rock (with medium viewer sensitivity), most of the alternative's northern portion has low viewer sensitivity because there are few homes and roads and low levels of use. For the rest of its route, viewer sensitivity ranges from low to high depending on proximity to residents, motorists or recreationists, with greater sensitivities along Lewis River Road and near Ariel, Lake Merwin, and Camas. Overall viewer sensitivity is medium, resulting in an overall landscape rating of low.

Crossover Alternative and Options

The Crossover Alternative shares its northern portion with the West Alternative, its middle portion with the Central Alternative, and its southern portion (south of Lake Merwin and Yale Lake) with the East Alternative. General scenic quality is low. Viewer sensitivity ranges from low to high depending on the number of nearby residents, motorists and recreation opportunities. Overall viewer sensitivity is medium, resulting in an overall landscape rating of low.

S.3.3.2 Impacts Common to Action Alternatives

During construction of the towers, access roads, and substations, there would be temporary changes in scenery due to helicopters, trucks, and heavy equipment operating in the area. Construction crews would work in localized areas of the transmission line right-of-way and at the substations, and would be visible primarily to nearby viewers or those with a direct line of sight. Installation of towers and conductor stringing by helicopter would be visible from a greater distance. Construction of any action alternative or substation would create a temporary **low** visual impact.

When construction is completed, the project's towers, conductors, access roads, rights-of-way clearing and substations would cause permanent visual changes in the landscape. The degree of impact on viewers would depend on many factors, including surrounding land uses, topography, vegetation, distance and weather conditions. The project's new towers would range from 50 to 140 feet taller than existing BPA structures in the area, making them more visible, particularly where they break the skyline. New access roads' visual impacts could be limited to localized areas or, where built on steep slopes, be seen from a distance. Maintenance activities would have **no-to-low** temporary impacts on views.

Sundial Substation Site. Low impact: the site is near many existing transmission lines and two existing substations in an industrial park.

S.3.3.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

Low impacts. The Casey Road and Baxter Road sites are in remote areas with low scenic quality adjacent to four transmission lines. Though the Monahan Creek site, also adjacent to a transmission corridor, would likely be visible to a few surrounding residents and local motorists, it would otherwise have limited visibility.

West Alternative

With a low scenic quality rating but high viewer sensitivity, the West Alternative would have a **moderate** impact on visual resources for most of its length, with localized areas of **high** impacts on some parks and natural areas and on residences near the Longview/Kelso area (including the West Side Highway neighborhood) and east of Vancouver. It would travel primarily in existing right-of-way where transmission lines already have affected views, but new towers would be taller than existing towers.

- **West Option 1:** Same overall impact as the alternative. Would reduce impacts on some residents (in NE 48th Circle) and the Green Meadows Golf Course east of Vancouver and north of Camas, but cross Camp Currie, Camas Meadows Golf Course and pass near other residences and roads (including NE Stoney Meadows Dr. and NE Goodwin Rd.).
- **West Options 2 and 3:** Slightly higher overall impact. Would avoid impacts on the Green Meadows Golf Course, but have potentially **high** impacts on a greater number of residents and Green Mountain Park to the east due to required new right-of-way and longer line length. Both options would have higher visual impacts on residents along NE 48th Circle. West Option 2 would also impact residents along NE Zeek Rd. and NE 28th St.

Central Alternative

Because most of this alternative would run through sparsely populated land with few sensitive viewers and low scenic quality, most visual impacts would be **low**, with a few **moderate** impacts around Castle Rock, Ariel, the Lewis River, Lake Merwin and Camas (where there are parks and greenspaces) and on residences close to the right-of-way.

- **Central Option 1:** Same overall impact as the alternative. Starting the transmission line at the Casey Road substation site instead of the Baxter Road substation site would extend it through unpopulated land with few distinctive viewpoints.
- **Central Option 2:** Slightly higher overall impact. Starting the transmission line at the Monahan Creek substation site means it would travel south of Castle Rock, crossing through largely sparsely populated or unpopulated areas except for the unincorporated community of West Side Highway adjacent to SR 411, where it would have potentially high visual impacts. Monahan Creek substation site would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.
- **Central Option 3:** Slightly higher overall impact. Would move the Lewis River crossing near Ariel farther downstream through a visually sensitive area (including Lake Merwin) that attracts recreational users and would take a direct southeast route toward Venersborg on new right-of-way through more populated (rural residential) areas.

East Alternative

Because most of this alternative would run through sparsely populated or unpopulated land with few sensitive viewers and low scenic quality, most visual impacts would be **low**, with a few **moderate** impacts in and around the Cowlitz River and SR 504 to the north, Camas (parks and greenspaces) on the south and the Western Yacolt Burn State Forest.

- **East Option 1:** Slightly higher overall impact. Starting the transmission line at the Monahan Creek substation site means it would travel south of Castle Rock, crossing through largely sparsely populated or unpopulated areas. The option would remove visual impacts north of Castle Rock but introduce impacts where it crosses the Cowlitz River farther south. The Monahan Creek substation site would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.
- **East Options 2 and 3:** Same overall impact as the alternative. East Option 2 would replace route segments between Yale and the rural residential areas north of Camas with similarly rated segments traveling farther to the west, removing visual impacts on outdoor and recreational users east of the alternative but introducing impacts on nearby rural residences. East Option 3 would replace a very short route segment north of Camas crossing through unpopulated land.

Crossover Alternative

While this alternative would share its northern portion with the West Alternative, which would have localized **high** impacts on some viewers (such as those in the West Side Highway neighborhood), the rest of its route passes through sparsely populated or unpopulated land where it would be highly visible in only a few areas, such as around Ariel, the Lewis River and Lake Merwin. Consequently, the alternative would have a **low-to-moderate** visual impact along most of its length.

- **Crossover Option 1:** Slightly higher overall impact. Would replace a small segment running north-south through rural residential areas north of Camas with a longer route running west along existing right-of-way and then southeast through some Lacamas natural areas, open fields and more rural residential areas. This would remove visual impacts around NE Zeek Rd. and NE Blair Rd., but introduce impacts on residences around NE 267th Ave., where taller towers could dominate surroundings.

- **Crossover Options 2 and 3:** Slightly lower overall impact. Would start the new transmission line farther north at the Baxter Road substation site (which has a lower visual impact rating than the Monahan Creek site). Both options would travel through sparsely populated land, but Option 3 would require additional right-of-way parallel to an existing line.

S.3.4 Electric and Magnetic Fields

S.3.4.1 Affected Environment

Existing electric and magnetic fields (EMF) vary widely throughout the project area, depending on proximity to electronic devices or electrical lines and intervening landscape or walls. In general, existing EMF levels are higher in developed areas where electrical lines and buildings with electrical wiring, electrical equipment, and appliances are present. Throughout a home, for example, average electric fields can range from 5 to 60 volts per meter (V/m)—the highest measurement next to a running household appliance. Outdoor electric fields in publicly accessible places can range from 1 V/m to 12 kilovolts per meter (kV/m), with the higher fields present near high-voltage transmission lines of 500 kV or more. Magnetic fields are typically less than 2 milligauss (mG) in homes and range from less than a milligauss to about 1 gauss (G) outdoors in publicly accessible places.

During foul weather, a strong electric field at the surface of wet transmission line conductors can cause corona, which creates audible noise and can cause electromagnetic interference affecting AM radio or broadcast television signals. Corona likely occurs periodically along existing lines in the project area.

S.3.4.2 Impacts Common to Action Alternatives

Impacts from EMF generated by a new transmission line would be similar for each action alternative and option. Construction standards, grounding requirements and right-of-way restrictions would minimize the potential for electric fields to cause nuisance shocks or interference with implanted medical devices for anyone near the right-of-way, regardless of location. Likewise, new transmission lines are configured to reduce EMF and minimize electromagnetic interference that could affect older audio and video equipment. If interference occurs, BPA has a mitigation program to correct it.

At the *edge* of the right-of-way, electric fields for the action alternatives would range from 0.6 to 2.4 kV/m (2.3 kV/m on new right-of-way) under both extreme (maximum) and normal (average) operating conditions. This would meet BPA's guidelines of 2.5 kV/m. The highest electric fields allowed, which would occur *on* the right-of-way (on new or existing right-of-way) directly under the line under extreme operating conditions (e.g., high temperatures, heavy electrical load), would range from 8.8 to 9 kV/m, meeting BPA's 9 kV/m guideline. (Generally, the public only accesses rights-of-way where lines cross roads or parking lots. At those locations, BPA requires lower fields. Where lines cross trails, the standard limit applies.) Under normal conditions, electric fields on the right-of-way would range from 5.3 to 5.8 kV/m. These electric field levels would be comparable to or less than those from existing 500-kV lines in the area and elsewhere.

Magnetic field levels on existing right-of-way for the action alternatives would be comparable to those from existing 500-kV lines in the area and elsewhere:

- At the *edge* of the right-of-way, under normal (average) conditions, fields would range from 6 to 15 mG (12 mG on new right-of-way).
- At the *edge* of the right-of-way, under extreme (e.g., high temperatures, heavy electrical load) conditions, fields would range from 26 to 59 mG (48 mG on new right-of-way).
- *On* the right-of-way, under normal (average) conditions, fields would range from 28 to 68 mG (35 mG on new right-of-way).
- *On* the right-of-way, under extreme conditions (e.g., high temperatures, heavy electrical load), fields could range from 139 to 276 mG (184 mG on new right-of-way).

Based on land uses and zoning along the action alternatives, a greater number of people would live near or pass by the West Alternative—and potentially pass through fields from the new line—than the other action alternatives.

EMF levels at the perimeter of the substations' yards, regardless of site, would reflect fields generated by the new 500-kV line. The magnitudes and impacts would be similar to those for the transmission line alone. Within a few hundred feet, these fields would dissipate to normal surrounding levels.

S.3.5 Noise

S.3.5.1 Affected Environment

Throughout the project area, noise levels can vary widely. Typical noise levels may be intermittently high in urban areas such as Longview and Vancouver, Washington, particularly near industrial and commercial uses and highways, but consistently low or moderate elsewhere, depending on suburban and rural population, wind levels, aircraft traffic, and recreation, forest, or agricultural activities. In some areas, existing transmission lines may contribute to this noise, particularly those of higher voltage (345-kV or higher) built before 1978, when noise limits were not yet established. Foul weather may induce corona and corona-generated noise (see Section S.3.4.1, Affected Environment). Based on several years' meteorological records (2005-2009) from the Portland International Airport, foul weather conditions occur about 20 percent of the time in the general project area. (Continuous hourly meteorological records were not found for other locations in the project area.)

Some existing substations in the project area may contribute noise as well, mainly caused by transformer equipment that creates a hum or the infrequent sound of opening and closing circuit breakers.

S.3.5.2 Impacts Common to Action Alternatives

Construction of the transmission line, substations, and access roads would involve the use of heavy equipment and helicopters and generate temporary noise that could affect nearby individuals. Although project construction would occur over 30 months, most transmission line construction activities would last only days or a few weeks at any one location, having an overall **low-to-moderate** impact. Noise impacts from construction of the 500-kV substations, which would take about 13 months, would occur at the substation locations the entire time, although potentially loud equipment would not be used during all phases of construction. Residents near substation sites, particularly near the Monahan Creek substation site, may experience **moderate-to-high** noise impacts over a longer period. Where blasting may be required in rocky areas, there would be temporary and infrequent **high** noise impacts.

Once operating, average potential corona noise levels on existing right-of-way for the alternatives are estimated to range from 47 to 48 decibels on the A-weighted scale (dBA) at the edge of the right-of-way during foul weather. Where an alternative would occupy new rights-of-way (i.e., areas with no existing transmission lines), audible noise levels at the edge would be 47 dBA. This level would drop about 3 dBA for every doubling of distance away from the line.

Though the alternatives and most options could increase potential corona noise by 5 to 8 dBA on existing right-of-way (Crossover Option 1 corona noise levels increase by 10dBA), they would meet BPA's 50 dBA design criteria and statutory noise limits established in Oregon and Washington. Three options (Central Option 1 and Crossover Options 2 and 3) where older lines would remain on the right-of-way would exceed the 50 dBA criterion but would meet a second criterion—falling within a maximum 3 dBA increase. All alternatives and options (except for Crossover Option 2 at 56 dBA) would also meet the U.S. Environmental Protection Agency's 55 dBA guideline for noise at the edge of right-of-way during foul weather. During fair weather, which occurs 80 percent of the time in the project area, audible noise at the edge of the right-of-way would be about 20 dBA lower if corona were present at all.

For all action alternatives and options, transmission line operations would have **no-to-low** noise impacts. The West Alternative would cross through slightly more urban, suburban, and rural development areas than the other action alternatives (17 percent vs. 3-8 percent), but would still have no-to-low impacts on affected individuals. Occasional maintenance activities such as twice annual helicopter patrols, periodic repairs by field crews, and vegetation maintenance would have infrequent, temporary **low** impacts—except when loud equipment like chainsaws may be required, causing a temporary **moderate** impact.

The new substations would meet BPA's 50 dBA design criteria at the station perimeters and all state noise limits and federal guidelines. Audible noise levels at the proposed substations would predominantly reflect foul weather corona noise from incoming and outgoing transmission lines and so be similar to levels discussed above. Maintenance impacts would also be similar.

S.3.6 Health and Safety

S.3.6.1 Affected Environment

Transmission facilities provide electricity for heating, lighting, and other services essential for public health and safety. At the same time, if not constructed, operated, and maintained properly, these same facilities could pose health and safety risks such as electrocution, fire, collision hazards for aircraft and watercraft, exposure to toxic and hazardous substances, including herbicides, and attractive targets for vandalism or sabotage. BPA designs and maintains its facilities to meet safety requirements to prevent or reduce these risks. Meeting these requirements includes maintaining proper clearances between transmission lines and the ground, roadways and treetops, and preventing inappropriate use of rights-of-way. All Federal Aviation Administration (FAA) requirements for lighting or marking towers and conductors are followed.

Three documented hazardous waste and contaminated sites are located in the project area: the BPA Ross Complex, which the West Alternative would cross within existing right-of-way and where an existing access road would be improved; the International Paper Co. Mill and Solid Waste Site, which the Central Alternative would cross on new right-of-way (including a new access road); and the Reynolds Metals site, where the Sundial Substation would be built and which all action alternatives and options would cross to connect to the substation.

S.3.6.2 Impacts Common to Action Alternatives

All construction activities would be guided by site- and task-specific safety plans prepared by BPA and its contractors. During construction, there would be **no** health and safety impacts on members of the general public, who would not be allowed in construction areas. By following all safety requirements and implementing mitigation measures, construction activities would have temporary **low** impacts on worker health and safety. Similarly, **no-to-low** impacts would occur from toxic and hazardous substances because of the small quantities generated during construction, strict adherence to all regulations, the unlikely occurrence of spills, and required quick response to hazardous wastes that may be discovered. Construction on known contaminated sites would also have **low** impacts (see individual discussions under the affected action alternatives or substations).

Construction vehicles would be equipped with fire suppression equipment and construction activities would be coordinated with local fire agencies, with special care taken during fire danger advisories. Because BPA and its contractors would use proper precautions and be aware of conditions during construction, potential fire impacts would be **low**. Increased traffic during construction would have a temporary **low** impact on transportation safety.

Once the line is operating, BPA would restrict access to or uses of rights-of-way to prevent unsafe activities, keeping long-term health and safety impacts **low**. The general public would not be allowed in areas where maintenance activities are occurring, ensuring **no** impacts; maintenance activities would have temporary **low** impacts on worker health and safety. Maintenance vehicles would travel infrequently on area roads, with **low** long-term impact on transportation safety. BPA would require the line to meet or exceed nationally required clearance standards and maintenance activities would include vegetation management to maintain these clearances. BPA works with landowners to maintain vegetation on the right-of-way using a variety of methods including herbicides. To avoid impacts to domestic water supply wells and other domestic water sources, BPA would strictly follow the guidelines set forth in its Transmission System Vegetation Management Program including maintaining adequate buffers and herbicide-free zones around any potential water sources and work with existing landowners to accommodate their concerns and needs. Impacts would be **low**.

Maintenance would be conducted by vehicles and personnel equipped with fire safety equipment. For these reasons, long-term fire impacts would be **low**. The public would have limited access to the right-of-way and access roads, ensuring that unauthorized access and risks of fire or trash dumping are minimized and have a **low** impact.

Some equipment at the new substations may contain diesel and oil. Any oil-containing equipment would be designed with proper containment and spill control devices, and a spill response plan would be in place, ensuring **no-to-low** long-term impacts from toxic or hazardous substance during operations.

By following all FAA requirements for lighting or marking towers and conductors, impacts on aircraft safety would be **low**. There would be **no-to-low** safety impacts on commercial and recreational river traffic because the project would avoid placing structures within the navigable portion of the Columbia River.

Vandalism and theft at BPA facilities has occurred in the past and will likely continue. Depending on the damage, these acts can cause fires, pose electrocution risks to nearby persons and utility or maintenance staff, or disrupt power. BPA inspects transmission lines twice annually by helicopter and once annually from the ground, repairing damage as required. The overall impact of theft or vandalism would be **low-to-moderate**. If acts of sabotage or terrorism occur, these could create temporary **high** impacts.

Sundial Substation Site. The substation site, as well as the end of Segment 52 (shared by all alternatives) south of the Columbia River and connector lines between the substation and BPA's existing Troutdale Substation, would be constructed within three areas of the previously contaminated Reynolds Metals site. However, impacts to public health and safety would be **low** because special care would be taken during excavation for the substation and towers, information about known contaminants on-site is available, most contaminated debris and soil has been removed, and existing health risk levels are considered acceptable by the EPA and Oregon Department of Environmental Quality (ODEQ).

S.3.6.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

The three sites would have no additional health and safety impacts.

West Alternative and Options

About 600 feet of access road would need to be improved within one of the "control areas" of BPA's Ross Complex. Control areas reduce the potential for hazardous substance exposure by restricting access or usage. To avoid disturbing the soil, BPA would add rock to the existing road surface, but not blade the existing road, and would not allow temporary tower disturbance areas to interfere with the site. By preserving the "cap" on this site, project construction and maintenance activities would have **no** hazardous substance impacts at the complex.

Central Alternative and Options

One segment (Segment 28, east of Amboy and Yacolt), one tower and a new access road would be located on the far eastern edge of the former International Paper Co. Mill site. This location is likely not within areas potentially contaminated by prior paper mill operations. Hazardous substance impacts at this location would be **low** because the site would be investigated further and risks would be mitigated if the Central Alternative is selected.

East and Crossover Alternatives and Options

Same general health and safety impacts as those common to all alternatives.

S.3.7 Socioeconomics

S.3.7.1 Affected Environment

Socioeconomic conditions and resources include population and housing, employment and income, public services, utilities and infrastructure, government revenue, property values, and land-generated income from agricultural and private timber production. The project could also affect existing quality of life and other community values.

Population and Housing. About 1.26 million people live in Cowlitz, Clark, and Multnomah counties, in communities ranging from concentrated urbanized areas to sparsely populated rural areas. The population of the cities and towns in the project area range from about 1,500 in Yacolt to about 162,000 in Vancouver. Temporary housing, including rental housing, hotel/motel accommodations, campgrounds and RV parks, are plentiful in the Portland-Vancouver metro area and in Kelso and Longview, Washington, but are more limited in the communities in the eastern portions of the project area.

Employment and Income. In 2008, about 3.7 million people were employed in the Seattle-Tacoma-Olympia and Portland-Vancouver-Beaverton economic areas. Government, wholesale and retail trades employ the greatest numbers (14 percent each), followed by health care and manufacturing (9 percent each); professional services, construction, and accommodation and food sectors (7 percent each); and real estate, finance and insurance, arts, entertainment and recreation, and farm sectors (5 percent each) The annual unemployment rate in the combined economic areas was about 9 percent in 2009. Average per-capita income in the combined economic areas was about $43,000 in 2008, and personal income totaled about $333 million.

Public Services and Infrastructure. Fire protection is provided by municipal fire departments, rural fire districts, and the WDNR (for state lands). Police protection is provided by state police, sheriff's deputies and municipal police departments. Other public services include water and sewer, provides by local municipalities.

Government Revenue. State, county, and local governments rely on taxes and other revenue sources to fund public services and programs. These include sales and use taxes (Washington only), income taxes (Oregon only), business and occupation taxes (Washington), timber harvest taxes (Washington), property taxes and lodging taxes. Land held in trust by WDNR provides revenue to separate trusts managed for various public services, including schools.

Property Values. The assessed value of real property was about $8 billion in Cowlitz County, $40 billion in Clark County, and $59 billion in Multnomah County in 2009. Due to market adjustments from the recent recession, it is expected these values have dropped.

Agricultural Production. Agricultural land comprises about 9 percent of the total land area in Cowlitz, Clark, and Multnomah counties, of which about 35 percent is harvested cropland. In 2007, agricultural crops in the three counties produced about $157 million in revenues. Farmland also provides open space and other amenities important to residents and visitors.

Private Timber Production. Private timber production occurs on about 47 percent of the total land area in Cowlitz, Clark, and Multnomah counties. Private timberland owners harvested about 114 million board feet of timber from about 4,500 acres in the three counties in 2009, accounting for about 62 percent of the total timber harvest in these counties. Stumpage values for softwood timber in the Pacific Northwest in 2008-09 averaged about $200 per thousand board feet.

Community Values. Many people who live in the project area identify the rural character of the landscape, close-knit communities, high-quality public services, and distance from higher density development as defining the quality of life they enjoy. Individuals enjoy benefits from the natural environment surrounding their homes and other amenities, such as scenic views, solitude and quiet, a sense of safety, and a sense of privacy—all of which can directly contribute to property values. Visitors also enjoy these benefits; recreation and tourism is an important part of the project area's economy. Travel-related spending in the three counties in 2008, in 2010 dollars, ranged from about $430 million in Cowlitz County to about $2.6 billion in Multnomah County. The reliable supply of electricity also contributes to the area's quality of life and stability of the economy, although it comes with public health and safety risks, such as concerns about EMF.

Environmental Justice. Federal agencies must determine if their activities could have disproportionately high, adverse effects on minority and low-income populations. Based on a study of 2000 Census tracts, the project would cross areas with lower minority population percentages than the surrounding counties and states as a whole. The 2000 Census also showed areas crossed by the project had median household incomes comparable to or higher than surrounding counties and the states as a whole. In Cowlitz and Clark counties, affected tracts had lower poverty levels than the counties and state with one exception: a tract in Clark County with a 23 percent poverty level and median income that is 50 percent of the state's, may be considered a low-income area. In Multnomah County, the one tract that would be affected had about the same poverty level as the state of Oregon but lower than the county as a whole.

S.3.7.2 Impacts Common to Action Alternatives

Population and Housing. There would be a short-term **increase** in population and demand for housing during construction but **no** long-term impact because existing BPA staff would operate and maintain project facilities.

Employment and Income. Construction activities would create a short-term **increase** in employment (about 200 jobs). Short-term **increases** in income are estimated to be about 0.01 percent of total personal income in the project area, with short-term benefits to local businesses when workers spend wages on products and services, although these impacts would be too small to be discernible. There would be **no** long-term impact on employment or income, but by improving the reliability of electricity delivery in the region, the project would encourage businesses who need high-quality power to locate and invest in the area, which could provide jobs.

Public Services and Infrastructure. If a serious accident were to occur during construction or operations, demands on emergency medical, police or fire services would be temporary and localized, potentially causing a short-term **decrease** in availability of services elsewhere. Water used during construction would only be obtained from a permitted source and would not displace existing water requirements by municipalities. Water and wastewater treatment for Sundial Substation would be coordinated with the city of Troutdale. There would be **no** impacts on public service providers and infrastructure most of the time and only temporary **low** impacts if project workers should require them during a fire or accident.

Government Revenue. Short-term **increases** in government revenue would result from taxes on direct and indirect project-related spending (by contractors) during construction, and from the harvest of privately owned timber in and near the new right-of-way, access roads and substation sites. Additional short-term **increases** in revenue to state trusts would occur if the project requires the harvest of timber from trust lands that otherwise would not be harvested until later. Some of the timber-related increase would be offset if state and private timberland managers decided to reduce harvest on other lands. Overall, there would be **no** adverse impact on tax revenues in the three counties during project construction. However, the project would cause long-term **decreases** in government revenue by diminishing the property tax base (BPA-purchased property would be permanently removed from tax rolls), reducing future timber-related revenue from state trust lands, and decreasing future revenue from taxes on private timber harvests and some agricultural products. Revenue impacts differ for each action alternative and substation site and are summarized in more detail below. In general, revenue decreases could have **high** impacts on Cowlitz or Clark counties in some years.

Property Values. The value of some residential properties near the line could **decrease** slightly in the short-term, depending on many variables. The project is expected to have **no** appreciably measurable impacts on long-term residential property values. Some timberland would be less valuable if taken out of production; however, BPA compensates owners of property it acquires or from which it secures an easement.

Agricultural Production. Construction of towers and access roads would permanently remove land from agricultural production. Operation of the new line may permanently remove the ability of landowners to grow certain crops on the right-of-way. The project would create short-term **decreases** in agricultural revenue on lands directly affected by the project, and possibly long-term **decreases** if such production were prohibited. Revenue impacts differ for each action alternative and are summarized below. Line repairs may also cause temporary crop damage; BPA would assess and pay for the damage. Overall, the project would likely have **no** impact on the overall supply and price of crops in the regional agricultural markets, although there could be **low** impacts on farmers who produce products for niche markets.

Private Timber Production. The project may create short-term **increases** in timber production revenues where clearing would require harvesting immediately , but this could create long-term **decreases** because of restrictions on replanting in the right-of-way. Revenue impacts differ for each action alternative and substation site and are summarized below. Overall, the project would likely have **no** impact on the price of private timber in regional markets.

Community Values. The project could cause short-term **decreases** in the value of amenities, such as peace and quiet, for residents that would be affected by increased noise, traffic, and other aspects of construction. It could cause long-term **decreases** in the value of amenities, such as being close to forested open space, for residents of properties near the transmission line or substations. If any construction workers are injured, they could experience short- or long-term **decreases** in well-being (health and safety), as could any person who believes the project could expose them to higher risks from EMF or electrocution. Short- and long-term **decreases** in recreational values could result if the project diminishes visual aesthetics, but it could also provide long-term **increases** where access roads would enhance accessibility or visibility. The project would provide long-term **increases** in transmission system reliability.

Environmental Justice. **No** impact: none of the action alternatives cross population areas with disproportionately high minority populations. Only the West Alternative crosses one low-income population area, but the alternative as a whole does not affect low-income populations disproportionately.

Sundial Substation Site. BPA would purchase 40 acres from the Port of Portland at market value. This could cause increases or decreases in revenue for the Port, depending on its affect on the value of remaining lots in the industrial park. If BPA displaces a potential private landowner who would pay property taxes, this could create a long-term decrease in revenue for Multnomah County, a moderate impact.

S.3.7.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

BPA would purchase the Casey Road site and access road property from WDNR. Timber harvested during construction would create a short-term increase of about $158,900 in revenues from state trust lands. Converting the property permanently would cause a long-term decrease in state trust revenue from forgone future harvests currently valued at $124,100, a **moderate** impact.

BPA would purchase the Baxter Road site and access road property from Sierra Pacific Industries, causing a long-term decrease (-0.001 percent) in property tax revenues for Cowlitz County. Timber harvested during construction would create short-term increases in revenues of about $71,300 for Sierra Pacific and in timber-harvest tax revenues of $2,900 for Cowlitz County and $700 for the state of Washington. Converting the property permanently would cause long-term decreases in revenues of about $198,000 for Sierra Pacific, $7,900 for Cowlitz County and $2,000 for the state. This would have a **moderate** impact on Cowlitz County, but **no** impact on market prices for timber.

BPA would purchase the Monahan Creek site and access road property from multiple landowners, causing a long-term decrease (-0.001 percent) in property tax revenues for Cowlitz County. Timber harvested during construction would create short-term increases in revenues of about $30,900 for private timber producers and in timber-harvest tax revenues of $1,200 for Cowlitz County and $300 for the state. Converting the property permanently would cause long-term decreases in revenues of about $85,800 for private timber producers, $3,400 for Cowlitz County and $900 for the state. This would have a **moderate** impact on Cowlitz County but **no** impact on market prices for timber.

West Alternative and Options

During construction, there would be the following short-term impacts:

- increases in timber-harvest revenues on state trust lands (West Alternative and Option 1, $2,390; Option 2, +$52,410; Option 3, +$36,650);
- increases in timber-harvest tax revenues (West Alternative and Options 1 and 2, $940; Option 3, +$2,040);

> Short-term and long-term socioeconomic impacts would include increases or decreases in certain revenues, as summarized here. Where increases are compared among alternatives and options, a plus sign (+) means a larger increase and a minus sign (-) means a smaller increase. Where decreases are compared among alternatives and options, (+) means a larger decrease and (-) means a smaller decrease.

- increases in private timber production revenues (West Alternative and Options 1 and 2, $18,810; Option 3, +$40,810);
- and decreases in agricultural production revenues (West Alternative and Option 1, $820,000; Option 2, +$650; Option 3, +$790).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (West Alternative and Option 1, $1,860; Option 2, +$40,950; Option 3, +$28,630)—**moderate** impacts on Cowlitz County;
- decreases in timber-harvest tax revenues (West Alternative and Options 1 and 2, $2,610; Option 3, +$5,670)—**moderate** impacts on Cowlitz County;
- decreases in private timber production revenues (West Alternative and Options 1 and 2, $52,260; Option 3, +$113,300)—**no** impact on regional prices;
- and decreases in agricultural production revenues (West Alternative and Option 1, $12.3 million; Option 2, +$4,700; Option 3, +$4,300)—**no** impact on regional prices.

When annualized, these increases and decreases would be minor relative to annual revenues in each category, although impacts could be proportionally greater on individual landowners.

Central Alternative and Options

During construction, there would be the following short-term impacts:

- increases in timber-harvest revenues on state trust lands (Central Alternative and Option 2, $2.3 million; Option 1, +$255,600; Option 3, -$431,950);
- increases in timber-harvest taxes (Central Alternative, $65,950; Option 1, -$1,110; Option 2, -$11,350; Option 3, -$10,000);
- increases in private timber production revenues (Central Alternative, $1.3 million; Option 1, -$22,230; Option 2, -$227,030; Option 3, -$200,010);
- and decreases in agricultural production revenues (Central Alternative and Option 1, $3,000; Option 2, -$160; Option 3, +$35,000).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (Central Alternative and Option 2, $1.8 million; Option 1, +$199,700; Option 3, -$337,450)—potential **high** impacts on Cowlitz or Clark counties;
- decreases in timber-harvest tax revenues (Central Alternative, $183,200; Option 1, -$3,090; Option 2, -$31,530; Option 3, -$27,780)—potential **high** impacts on Cowlitz or Clark counties;
- decreases in private timber production revenues (Central Alternative, $3.7 million; Option 1, -$61,750; Option 2, -$630,570; Option 3, -$555,550)—**no** impact on regional prices;
- and decreases in agricultural production revenues (Central Alternative and Option 1, $120,000; Option 2, -$5,100; Option 3, +$1.4 million)—**no** impact on regional prices.

Like the West Alternative, these revenue impacts would be small relative to annual totals, although impacts could be proportionally greater on individual landowners.

East Alternative and Options

During construction, there would be the following short-term impacts:

- increases in timber-harvest revenues on state trust lands (East Alternative and Option 1, $1.3 million; Option 2, +$260,000; Option 3, +$170,900);
- increases in timber-harvest taxes (East Alternative, $94,340; Option 1, -$9,400; Option 2, -$8,400; Option 3, -$1,140);
- increases in private timber production revenues (East Alternative, $1.9 million; Option 1, -$188,030; Option 2, -$167,930; Option 3, -$22,740);
- and decreases in agricultural production revenues (East Alternative and Options 2 and 3, $160; Option 1, -$160).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (East Alternative and Option 1, $949,500; Option 2, +$203,100; Option 3, +$133,500)—potential **moderate** impacts on Cowlitz or Clark counties;
- decreases in timber-harvest tax revenues (East Alternative, $262,100; Option 1, -$26,110; Option 2, -$23,320; Option 3, -$3,160)—potential **moderate** impacts on Cowlitz or Clark counties;
- decreases in private timber production revenues (East Alternative, $5.2 million; Option 1, -$522,240; Option 2, -$466,410; Option 3, -$63,150)—**no** impact on regional prices;
- and decreases in agricultural production revenues (East Alternative and Options 2 and 3, $5,300; Option 1, -$5,100)—**no** impact on regional prices.

Like the other action alternatives, these revenue impacts would be small relative to annual totals, but impacts could be proportionally greater on individual landowners.

Crossover Alternative and Options

During construction, there would be the following short-term impacts:

- increases in timber-harvest revenues on state trust lands (Crossover Alternative and all options, $1.6 million);
- increases in timber-harvest taxes (Crossover Alternative and Option 1, $37,300; Option 2, +$4,020; Option 3, +$5,610);
- increases in private timber production revenues (Crossover Alternative and Option 1, $746,200; Option 2, +$80,460; Option 3, +$112,400);
- and decreases in agricultural production revenues (Crossover Alternative and Options 2 and 3, $2,800; Option 1, +$650).

Over the life of the project, there would be the following long-term impacts:

- decreases in trust revenues from forgone timber harvests (Crossover Alternative and all options, $1.3 million)—potential **moderate** impacts on Cowlitz or Clark counties;
- decreases in timber-harvest tax revenues (Crossover Alternative and Option 1, $103,600; Option 2, +$11,170; Option 3, +$15,600)—potential **moderate** impacts on Cowlitz or Clark counties;

- decreases in private timber production revenues (Crossover Alternative and Option 1, $2.1 million; Option 2, +$223,500; Option 3, +$312,000)—**no** impact on regional prices;
- and decreases in agricultural production revenues (Crossover Alternative and Options 2 and 3, $110,000; Option 1, +$3,700)—**no** impact on regional prices.

Like the other action alternatives, these revenue impacts would be small relative to annual totals, but impacts could be proportionally greater on individual landowners.

S.3.8 Transportation

S.3.8.1 Affected Environment

The transportation system includes public highways and roads, private logging and other private local roads, public transit, railroads, public and private airports and airstrips, and marine traffic. Regional highways include I-5, I-205 and I-84; state highways (all in Washington) include SR 14, SR 411 (West Side Highway), SR 500, SR 502 and SR 503. Interconnecting the highways are hundreds of county and city roads. Public transit is provided by the Cowlitz Transit Authority (Community Urban Bus Service [CUBS]) and Clark County Public Transportation Benefit Authority (C-TRAN).

Rail lines operating in the area include Burlington Northern Sante Fe, Lewis and Clark Railroad and Amtrak; Union Pacific operates close to the project area near Troutdale. Airports located in and near the area include Portland International Airport (PDX), which also operates Portland-Troutdale Airport located southeast of the proposed Sundial substation site; Southwest Washington Regional Airport in Cowlitz County; and Pearson Field and Grove Field airports in Clark County. There are also several private airstrips and heliports operating throughout the area.

General marine traffic occurs on the Columbia River at the proposed transmission line crossing north of Troutdale. While large cargo ships do not travel through this area, tugs, barges and recreational boaters use this stretch of the river. Recreational boating also occurs on Yale Lake and Lake Merwin to the northwest. Some small float planes also use local lakes and rivers.

S.3.8.2 Impacts Common to Action Alternatives

Construction of the line, including transport of construction equipment and supplies, commuting by project workers, improvements made to county roads and development of BPA access roads, would temporarily and intermittently increase traffic and cause potential delays along the transportation corridors in the project area, including I-5, I-205, I-84, SR 14, SR 500, SR 503 and SR 411. The project would add an estimated 45 trucks per day, or about 4,500 driven miles per day on highways, state routes and local roads—a temporary **moderate** impact on traffic volume. Traffic delays due to increased truck traffic, blasting (to protect cars from flying debris) and conductor-stringing across roadways (by helicopter or caterpillar pull) would also have temporary **moderate** impacts. BPA contractors would be required to follow all legal size and load limits on state and county roads and to repair any damage to existing roads caused by the project, having an expected **low** impact on existing road conditions.

Construction activities would have **no-to-low** impacts on public transit services because any temporary service disruptions needed would be coordinated with the applicable transit agency before construction. Crossings of railroads would be timed to avoid interrupting freight or passenger trains, and if necessary, appropriate coordination and crossing permits would be obtained from the affected railroad operator. Project construction would have **no-to-low** impact on rail.

Any project structure 200 feet or taller or within a certain distance of an airport will require pre-approval by the FAA, which may require appropriate lighting and marking. Conformance with all FAA requirements as part of project design and construction would result in **no** impact on air traffic. One Columbia River crossing tower would need to be placed within the river (outside the river channel); boaters would be diverted from construction activities. **No-to-low** impact on river traffic would occur from these temporary diversions.

Once the line is operating, project-related traffic on area roads would be minimal and infrequent. Maintenance traffic would normally involve a few maintenance vehicles along the right-of-way several times a year and helicopters flying overhead twice a year. Even if larger vehicles such as cranes are periodically required to repair the line and cause minor traffic delays, the project would have **no-to-low** long-term impacts on roads. For the same reasons, line operations and maintenance would have **no-to-low** impact on public transit and rail. Conformance to FAA standards would ensure the line has **no** impact on nearby airport operations. Where the project would cross any navigable streams or rivers, including the Columbia River, conductors would be high enough to allow boaters to pass underneath unhindered, with **no** impact on marine traffic, At most, any recreational boats or marine traffic present during in-water maintenance activities would be temporarily diverted away, resulting in **no-to-low** impact.

Sundial Substation Site. Construction at the site would periodically disrupt local motorists and existing truck traffic and workers in the larger industrial park over 13-24 months, a **moderate** impact. Conformance to FAA standards would ensure site work, specifically added towers, has **no** impact on the nearby Portland-Troutdale Airport. Maintenance activities would occur infrequently, having **no-to-low** impacts on traffic and roads in the industrial complex.

S.3.8.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

The Casey Road site is relatively remote; construction and maintenance traffic could temporarily delay logging trucks in the area, but would have a **low** impact because logging companies could arrange trips around the construction schedule and maintenance traffic would be infrequent. Construction vehicles using Casey Road and the West Side Highway (SR 411) could interrupt or slow traffic for long periods as fill material is transported to the substation site, a **moderate** impact on these roadways. The Baxter Road site is also relatively remote, but could occasionally delay residential homeowners along Beebe Road (off of West Side Highway) as well as logging trucks, a **low** impact during construction. The Monahan Creek site is less remote, but would require much less access road work. Intermittent traffic delays on Delameter Road, possible detours, and temporary increased traffic would cause **moderate** short-term impacts. Maintenance of the unmanned substation, regardless of site chosen, would have **no-to-low** impact on surrounding traffic and roads.

All Action Alternatives and Options

The four action alternatives and their options would have the same overall impacts on traffic and roadways: there would be **low-to-moderate** impacts during construction due to intermittent traffic disruptions and **no-to-low** impacts during operation and maintenance of the line. The only differences among them are locations of roads affected and the number of new and improved access roads required, both inside and outside the right-of-way.

Because the West Alternative would cross a more developed area, road construction during construction may temporarily affect more motorists; at the same time, a larger network of roads would partially mitigate these impacts. The West Alternative also requires the fewest miles of new and improved roads outside of existing or proposed right-of-way of any action alternative. The other alternatives would cross more rural areas with fewer existing roadways and require a much higher number of new and improved access roads outside existing/proposed right-of-way. However, there would also be less traffic subject to disruption in these areas.

Once built, new and improved roads built within rights-of-way would have **no** impacts on the transportation system because they would not be public, although they could encourage trespassing. Those built outside the right-of-way may affect local transportation slightly by improving or adding to existing roads used for other purposes (by the landowner or public), having **no-to-low** long-term impact due to infrequent maintenance activities. The East Alternative would have the highest mileage of new or improved roads outside the right-of-way (21 miles new, 161 miles improved). The next highest would be the Central Alternative (25 miles new, 109 miles improved), followed by the Crossover Alternative (19 miles new, 78 miles improved). The West Alternative, because it would be built primarily within existing right-of-way with an extensive access road system, would only require 10 new and 20 improved miles of road outside the right-of-way.

S.3.9 Cultural Resources

S.3.9.1 Affected Environment

The project is within three physiographic regions primarily in Washington, with a small portion in Oregon: the Willapa Hills, Southern Cascades, and the Portland Basin. The project extends through lands traditionally inhabited by two Native American groups, the Cowlitz and the Chinook, and occasionally visited by the Klickitat. Most of the project area is within the traditional territory of the Cowlitz, who had winter villages along the Cowlitz River. The southern end of the project is within the traditional territory of the Chinookan group known as the Multnomah. Their territory extended just south of the mouth of the Kalama River to the vicinity of the Sandy River. The Chinook maintained villages on or near the Columbia River between the mouths of the Cowlitz and Washougal Rivers. Later, Europeans established posts in this area, such as Fort Vancouver, and created settlements south of the Columbia River and in areas along the Cowlitz, Skookumchuck rivers in southwestern Washington, and along the Deschutes River in central Oregon.

Background research has identified 39 archaeological resources previously documented in the project area. This includes 33 resources recorded in the Washington Department of Archaeology and Historic Preservation (DAHP) database and six identified in previous survey reports but not officially recorded. The 39 archaeological resources consist of 17 pre-contact sites, 17 historic sites, and five mixed sites (both pre-contact and historic materials present).

The pre-contact sites include four village locations, 10 lithic scatter sites, and three isolated artifact sites. The 17 recorded historic sites include two farmstead sites, two abandoned roads, five cemeteries, two grave markers, one debris scatter, one mine, one rock feature site, one aircraft crash site, one hydroelectric site, and one site with irrigation system remnants. Most known archaeological resources are along southern portions of the action alternatives; many of the recorded pre-contact sites are near major waterways, including Lacamas Lake and the Washougal and Columbia rivers. Few archaeological sites have been identified in the eastern and northern portions of the action alternatives.

In addition to the archaeological resources, there are 16 previously recorded historic resources (structures or objects with potential for listing in the National Registry of Historic Places [NRHP]) within the project area, including BPA's transmission network. There are also 27 locations classified as ethnographic cultural resources that may be eligible traditional cultural properties (TCPs).

S.3.9.2 Impacts Common to Action Alternatives

Because the project transects areas where humans have lived for 10,000 years, construction of the line could potentially disturb cultural sites. It would also introduce visual elements that could alter the character of sensitive cultural resources. However, towers and access roads would be sited to avoid known sensitive areas whenever possible and trained cultural resource monitors would be consulted during construction to ensure unidentified sites are not inadvertently impacted. Where certain segments of older BPA transmission lines may be removed and older substations are modified, the project could impact historically significant BPA facilities. Operations and maintenance of the line would not directly affect cultural resources.

Comparison of potential impacts by the alternatives and options was made based on the Washington Statewide Predictive Model. Using the model and knowledge of existing cultural resource sites, each individual route segment within the alternatives and options was given a cultural sensitivity "score." This score reflects both the number and significance of known cultural resources within each route segment, as well as the probability of encountering previously undiscovered cultural resources. The appropriate route segment scores were then added together to provide a total score for each alternative and option. Each total incorporates impacts from building the line, access roads and relevant substation. BPA will conduct an on-the-ground survey of cultural resources on the preferred alternative and consult with appropriate entities to better identify and minimize impacts.

Based on this methodology, all action alternatives and options would have potential **moderate-to-high** impacts on cultural resources in the project area, but primarily in different locations.

Sundial Substation Site. Cultural sensitivity score of 25. **Moderate** impact because the site has a high probability for disturbing historic resources due to BPA's nearby Troutdale Substation, a historic property that has been determined NRHP-eligible. This site has a very low probability for disturbing archaeological or ethnographic resources, due to its location in a previously-disturbed industrial area near other substations and transmission lines.

S.3.9.3 Impacts Unique to Action Alternatives

Castle Rock Area Substations

The Casey Road site has the lowest sensitivity score of 15. The Monahan Creek and Baxter Road sites each have a higher score of 24, likely due to their proximity to creeks. All three substation sites are in remote areas that have been previously logged and are next to existing transmission lines that may have disturbed archaeological resources previously. However, logging activities and the existing transmission lines may contribute to a higher possibility that historic resources are present (i.e., historic transmission lines and logging camps). Construction of a substation at any of the three sites would have a **moderate** impact because of the adjacent historic BPA transmission lines.

West Alternative and Options

Highest sensitivity score among the alternatives (498), likely because it would cross some large population centers—primarily in its southern half—that contain a greater number of known sites. Segments with the highest probability of cultural resources present are 25, 40, 46 and 52. Segments that have resources located at proposed tower sites are 2, 4, 9, 25, 36b, 41, 45, 50, and 52. Resources include trails, village sites, an ethnographic fishing location and prairie, a cemetery and other possible burial sites, an historic grave marker, an historic Northern Pacific Railroad site, the Ostrander Tunnel and Portal, village sites and lithic scatters. Segment 52, the southernmost segment shared by all alternatives, has a lithic scatter, a historic site and the NRHP-listed Parkersville site. **Moderate-to-high** impacts on cultural resources. (The options may lower or boost sensitivity scores, but overall impacts are the same as the alternative.)

- **West Option 1:** Slightly **higher** sensitivity score (+21). Would remove three segments with known resources, but two of three replacement segments would also have resources. Segments 40 and 46 have an historic road and grave marker, among other resources.
- **West Option 2:** **Higher** score (+53). Would remove four segments where towers could impact resources, but add four more sensitive segments that also have resources at tower sites (segments 36, 36a, 37, 43), including a village and ethnographic prairie.
- **West Option 3:** **Higher** score (+42) because it would remove four segments where towers could impact resources, but add three more sensitive segments (36, 36a, 37) that also have resources at tower sites.

Central Alternative and Options

Second lowest sensitivity score (435), partly because this alternative would run in a less-populated area with fewer previous surveys completed. Segments with the highest probability of cultural resources present are 4 and 52. Segments that have resources located at proposed tower sites are 10, 28, and 52, B and F. Resources include trails, villages and lithic scatters. **Moderate-to-high** impacts on cultural resources. (The options may alter sensitivity scores, but overall impacts are the same as the alternative.)

- **Central Option 1:** Slightly **higher** sensitivity score (+12). Would add Segment A, which has the same trail at a tower location as segments B and F.

- **Central Option 2: Higher** score (+51). Would remove two segments where towers could impact resources, but add three more sensitive segments with resources at tower sites (1, 4, 5), including a village site and ethnographic site likely to contain burials.
- **Central Option 3: Lower** score (-26). Would replace one segment with another (30) that has less impact on an ethnographic trail.

East Alternative and Options

Lowest sensitivity score (394), because it would cross a less-populated area with more slopes and higher elevations that are less likely to have been used by Tribes. Segments with the highest probability of cultural resources present are 3 and 52. Six segments have resources located at proposed tower sites (52, B, F, K, O, W). Resources include historic military roads, trails and lithic scatters. **Moderate-to-high** impacts on cultural resources. (The options may alter sensitivity scores, but overall impacts are the same as the alternative.)

- **East Option 1:** Slightly **higher** sensitivity score (+11). Would remove two segments where towers would impact resources, but one (3) of four replacement segments (3, 7, 11, J) has a known village site that may be affected by tower locations.
- **East Option 2: Higher** score (+31). Would remove three segments with known resources, but one (U) of five replacement segments (35, P, T, U, V) has a known cultural site (trail) that could be impacted by a tower.
- **East Option 3:** Nearly the **same** impact as the alternative (-5). Would replace one segment with another, which contains no known sites at proposed tower locations.

Crossover Alternative and Options

Second highest sensitivity score (463), likely because a number of its segments cross highly populated areas where more surveys have been conducted. Segments with the highest probability of cultural resources present are 4 and 52. Seven segments have resources located at proposed tower sites (2, 4, 9, 52, N, O, W). Resources include trails, villages sites and lithic scatters. **Moderate-to-high** impacts on cultural resources. (The options may alter sensitivity scores, but overall impacts are the same as the alternative.)

- **Crossover Option 1: Higher** score (+57). Would remove one segment and add three segments (47, 48, 50), two of which (47, 50) have towers located where they could impact ethnographic prairies and a village site.
- **Crossover Option 2: Higher** score (+35), because one (C) of two replacement segments (C, E) has a tower located where it could affect an historic military road.
- **Crossover Option 3: Higher** score (+34), because two replacement segments (D, E) have towers located where they could affect the same historic military road as Option 2.

S.3.10 Geology and Soils

S.3.10.1 Affected Environment

The project area is within three physiographic regions: the Willapa Hills, South Cascades, and Portland Basin. The northern portions of the action alternatives and the three Castle Rock area substation sites are within the Willapa Hills region. Remaining portions of the Central, East, and

Crossover alternatives, and the portion of the West Alternative between the Cowlitz and Lewis rivers, are within the South Cascades region. Topography of these two regions is mostly rolling to steep hills or relatively level terrain in the floodplains of major rivers, such as the Cowlitz River. South of the Lewis River, most of the West Alternative is within the Portland Basin, which is mostly flat or nearly flat terrain. Elevation in the project area ranges from 25 to 3,311 feet above sea level.

In the Willapa Hills and South Cascades regions, igneous rock is covered by varying depths of clay-rich soils weathered from the underlying bedrock. The Portland Basin is mostly filled with sediment (sand, clay and gravel) deposited by ice age floods. In all three regions, some sediments are derived from volcanic eruptions and mudflows from Mt. St. Helens and Mt. Hood, such as near the Cowlitz and Kalama rivers and eastern portions of the Lewis River, and at the Sundial substation site. Where the transmission line would cross these areas, it would be potentially subject to additional mudflows or ash fall from future volcanic eruption. Other geologic deposits include glacial till, glacial outwash, alluvium at river crossings, and lake and wetland deposits.

Soils in the area generally support agriculture, forest production, urban and rural development, and natural functions such as wetlands and aquifer recharge. Erosion risk varies by topography and soil makeup. Most soils in the northern (north of the Lewis River) and eastern portions of the project area have a severe soil erosion potential. The portion of the West Alternative from the Lewis River to the Columbia River is on flatter terrain, with most soils rated as having a low or moderate soil erosion potential. A few small areas are rated very severe south of Lake Merwin, along the East Fork Lewis River, and south of Rock Creek along the East Alternative.

Most soils in the project area are susceptible to compaction. Areas with low resistance to compaction occur along the northern portions of the action alternatives, the middle portion of the West Alternative and the southern portions of the Central, East, and Crossover alternatives. Areas with moderate resistance occur along the Cowlitz and Lewis rivers, between Lake Merwin and Yale Dam, and south near Amboy. Less than 1 percent of the soils within the project area have a high resistance to soil compaction.

The action alternatives and options cross known landslides and relatively steep slopes that may be susceptible to landslides. In general, mapped landslides and steep slopes are found in the northern (north of the Lewis River) and eastern portions of the project within the Willapa Hills and South Cascades regions of Washington. The risk of landslides is low in the relatively flat Portland Basin along the southern portion of the West Alternative.

Several hundred earthquakes of less than magnitude 3 have occurred within 60 miles of the project area since 1973. Earthquakes measured as magnitude 3 are common in the project area and earthquakes in the 3.2 to 3.4 range are common in the Kelso area. Four earthquakes between magnitudes 5.2 and 6.9 occurred between 1949 and 2001. Only one fault considered active within the past 1.6 million years is crossed by one action alternative—the Lacamas Lake Fault, believed to have last ruptured between 10,000 and 100,000 years ago, is crossed by the southern portion of the West Alternative. Although quiet for centuries and not in the project area, the fault along the Cascadia Subduction Zone is expected to cause a very large earthquake (magnitude 9.0 or higher) that would be felt in the project area and across the Northwest. Because most of the land crossed by the action alternatives is underlain by bedrock, liquefaction (extreme movement of loose, saturated sediment during earthquakes) is unlikely except within the Cowlitz, Coweeman, Lewis, East Fork Lewis and Columbia River valleys, which have moderate-to-high liquefaction susceptibility.

S.3.10.2 Impacts Common to Action Alternatives

Transmission lines and access roads would generally be sited (and all substations would be sited) to avoid unstable (landslide) locations. Where unavoidable, engineers and geologists would survey locations by foot to select the best tower and road locations. Similarly, tower sites in geologic fault zones would be evaluated for surface ruptures and relocated if necessary. All facilities would be built to applicable seismic standards. In the few areas (about 42-43 acres for each alternative) where soil is susceptible to liquefaction, the low potential for major seismic activity reduces the likelihood of this affecting towers. Where possible, project facilities would also be sited to avoid areas where volcanic mudflows could travel, although ash fall could not be avoided.

Excavation for project facilities and removal of vegetation along rights-of-way would affect soils by causing erosion and compaction. Impacts would be greatest during and immediately after construction, before vegetation becomes re-established or disturbed soil has been covered (e.g., by gravel), and on steeper slopes. By following best management practices, erosion impacts during construction would be kept **low-to-moderate** where soil is moderately (or moderately to severely) susceptible to erosion and **low** where erosion potential is slight. Infrequent operations and maintenance activities would have **low** erosion impacts.

By keeping construction equipment and vehicles on access roads and within approved construction footprints, temporary soil compaction impacts would be **moderate**. By taking mitigation measures after construction, long-term compaction impacts on soils not under roads, towers and substations would be **low**. However, soil under these facilities would be permanently compacted and removed from use; the project would have long-term **high** compaction impacts in these areas.

Sundial Substation Site. Temporary and permanent **low** erosion impacts because the site is very flat and has only a slight erosion-hazard potential. Long-term **high** impacts on soil compaction under the substation, but temporary **moderate** and long-term **low** compaction impacts on soil compaction beyond the substation footprint (due to mitigation measures).

S.3.10.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

The Casey Road, Baxter Road and Monahan Creek sites have the same impacts. Due to the sites' underlying geology, they are unlikely to be subject to liquefaction during earthquakes. No mapped landslides are within the sites, but soils are considered to have moderate-to-severe (Monahan) or severe (Casey, Baxter) erosion potential. However, with mitigation, erosion impacts would be temporarily **low-to-moderate** during construction and **low** when the substation is operating. Soil compaction impacts would be permanent and **high** directly under the substation; in the adjacent disturbance area, compaction impacts would be **moderate** during construction and, following mitigation measures, **low** in the long-term.

West Alternative and Options

The northern portion of the West Alternative (north of the Lewis River) is within potentially landslide-susceptible terrain and crosses mapped landslides. Where these would be unavoidable, towers and roads would be built to appropriate design standards, taking into account soil stability. In this same northern portion, the alternative would disturb about 211 acres of soil with severe erosion potential, the least of the action alternatives. Mitigation measures would keep erosion impacts during construction **low-to-moderate** in these areas. Along the rest of the alternative, erosion impacts during construction would be **moderate** where erosion potential is moderate and, south of the Lewis River, **low** where erosion potential is slight. Long-term erosion impacts from operations and maintenance would be **low** (same for all action alternatives). Soils along this alternative have generally low-to-moderate resistance to soil compaction. There would be a long-term **high** impact on about 238 acres of soil that would be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **West Option 1:** Same erosion impacts (**low**) as the route segments it replaces and same compaction impacts (**high** under towers and roads; **low** elsewhere). Would cross slightly less soil (-5 acres) with severe erosion potential, but slightly more (+1 acre) with low resistance to compaction.
- **West Option 2:** Slightly more **low-to-moderate** erosion impacts because it would cross slightly more soil (+12 acres) on steeper slopes with moderate-to-severe erosion potential. Would compact slightly more (+8 acres) soil with low resistance.
- **West Option 3:** More **low-to-moderate** erosion impacts because it would cross a mapped landslide area near Matney Creek and about 20 percent more soil (+44 acres) with severe erosion potential. Would compact slightly more (+13 acres) soil with low resistance.

Central Alternative and Options

Most of the Central Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides; towers and roads unable to avoid these would be built to appropriate design standards. The alternative would disturb about 596 acres of soil with severe erosion hazard, the second-highest among the action alternatives. Same erosion impacts during construction as the West Alternative (**low-to-moderate** with mitigation), as well as along the rest of the alternative. **Low** long-term erosion impacts. Soils along the northern and southern portions of this alternative have generally low resistance to soil compaction; soils along the middle portion have moderate resistance. There would be a long-term **high** impact on about 262 acres of soil that would be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **Central Option 1:** More **low-to-moderate** erosion impacts because it would cross more soil (+33 acres) with severe erosion potential near Castle Rock. Would compact slightly more (+3 acres) soil with low resistance.
- **Central Option 2:** Would have **low-to-moderate** erosion impacts where it would cross a mapped landslide near Longview and soil with severe erosion potential near Lexington, but would cross less (-38 acres) of this soil type overall. Would compact more (+31 acres) soil with low-to-moderate resistance.

- **Central Option 3:** Would have a **low-to-moderate** erosion impacts where it would cross mapped landslide areas near Amboy and the East Fork Lewis River and soil with moderate-to-severe erosion potential southeast of Amboy, but would cross less (-31 acres) of this soil type overall. Would compact slightly less (-3 acres) soil with moderate resistance.

East Alternative and Options

Proposed along the most remote and rugged route of the action alternatives, most of the East Alternative would cross potentially landslide-susceptible terrain. It would cross several mapped landslides; towers and roads unable to avoid these would be built to appropriate design standards. The alternative would disturb about 664 acres of soil with severe erosion hazard, the highest among the action alternatives. Same erosion impacts during construction as the Central Alternative (**low-to-moderate** with mitigation) along its entire route. **Low** long-term erosion impacts. Similar to the Central Alternative, soils along the northern and southern portions of the East Alternative have generally low resistance to soil compaction; soils along the middle portion have moderate resistance. There would be a long-term **high** impact on about 235 acres of soil that would be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **East Option 1:** Would have **low-to-moderate** impacts where it would cross mapped landslide areas near the Cowlitz River and soil with severe erosion potential near Lexington, but would cross less (-47 acres) of this soil type overall. Would compact more (+28 acres) soil with low resistance.
- **East Option 2:** Would have **low-to-moderate** impacts where it would cross mapped landslide areas along Salmon Creek and soil with severe erosion potential south of Yale Dam and east of Amboy, but would cross nearly 10 percent less (-60 acres) of this soil type overall. Would compact slightly less (-4 acres) soil with low-to-moderate resistance.
- **East Option 3:** Would have **low-to-moderate** impacts where it would cross soil with severe erosion potential east of the upper reaches of the Washougal River, but would cross only slightly more (+3 acres) of this soil type total. Would compact slightly less (-2 acres) soil with low resistance.

Crossover Alternative and Options

Most of the Crossover Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides; towers and roads unable to avoid these would be built to appropriate design standards. The alternative would disturb about 478 acres of soil with severe erosion hazard, mostly located along its middle and lower portions. Mitigation would keep erosion impacts during construction **low-to-moderate** in these areas and along the rest of the route; long-term erosion impacts would be **low**. Soils along the northern and southern portions of this alternative have generally low-to-moderate resistance to soil compaction; the middle portion has moderate resistance. There would be a long-term **high** impact on about 253 acres of soil that would be permanently compacted under towers and roads; temporary compaction impacts elsewhere during construction would be **moderate** and long-term impacts elsewhere, **low**.

- **Crossover Option 1:** Would cross slightly less soil (-3 acres) with severe erosion potential; same **low-to-moderate** impacts. Would compact more (+14 acres) soil with low resistance.
- **Crossover Option 2:** More **low-to-moderate** erosion impacts because it would cross about 14 percent more soil (+67 acres) with severe erosion potential near Castle Rock. Would compact less (-14 acres) soil with low resistance.
- **Crossover Option 3:** Would have **low-to-moderate** erosion impacts because it would cross about 12 percent more soil (+59 acres) with severe erosion potential near Castle Rock. Would compact less (-19 acres) soil with low resistance.

S.3.11 Water

S.3.11.1 Affected Environment

Watersheds: The action alternatives would cross three major watersheds in Washington: the Cowlitz, Lewis, and Salmon/Washougal. In Cowlitz County, the major sub-watersheds crossed include the Lacamas, Delameter, Lower Cowlitz, Ostrander, Lower Coweeman, Upper Coweeman, Lower Kalama, Middle Kalama, Cathlapotle, Lake Merwin, and Cougar. In Clark County, the major sub-watersheds crossed include the Yacolt, Cedar Creek, Chelatchie Creek, Canyon Creek, Fly Creek, Vancouver, Horseshoe Falls, Lacamas Lake, Rock Creek, Little Washougal, West Fork Washougal, and Mount Zion. In Oregon, the project crosses the Columbia River and two watersheds, the eastern end of the Columbia Slough-Frontal Columbia River watershed and the western edge of the Beaver Creek-Sandy River watershed. Both are sub-watersheds of the Lower Willamette watershed in Multnomah County. Watershed conditions vary among and within these sub-watersheds.

Riparian buffers: The action alternatives would cross forested and non-forested riparian buffers. Forested buffers containing conifers, common at higher elevations, provide the most stream shade; hardwood riparian buffers, most common at lower elevations, provide somewhat less shade. Non-forested riparian buffers, found mostly on developed and agricultural land and in existing transmission line corridors, provide little or no stream shade. Riparian buffer widths range from 0 to 200 feet in Cowlitz County and from 75 to 200 feet in Clark County, depending on stream flow (perennial or seasonal) and the presence or absence of fish.

Floodplains: In Washington, the action alternatives would cross 15 100-year floodplains of the following waterbodies: Leckler Creek, Cowlitz River, Coweeman River, Kalama River, Little Kalama River, Lewis River, East Fork Lewis River, Salmon Creek, Burnt Bridge Creek, Little Washougal River, Washougal River, Lacamas Creek, Ostrander Creek, Speelyai Creek, and Canyon Creek. The project would also cross the 100-year floodplain of the Columbia River in Washington and Oregon; it would not cross any other Oregon floodplains.

Surface water: In addition to the above rivers and streams, the action alternatives cross many perennial, intermittent and ephemeral streams. Thirteen rivers and streams crossed are listed as impaired in Washington: Arkansas Creek, Monahan Creek, Delameter Creek, Ostrander Creek, South Fork of Ostrander Creek, Coweeman River, Riley Creek, Lockwood Creek, Mason Creek, East Fork of Lewis River, Salmon Creek, Dwyer Creek, and Lacamas Creek. Most are listed for elevated water temperature. Riley and Lacamas creeks are listed for elevated levels of fecal coliform, and Lacamas and Dwyer creeks are listed for low levels of dissolved oxygen. No impaired streams in Oregon would be crossed. Some surface water is used as drinking water:

the City of Camas supplements its drinking water with water from two creeks and several landowners along the action alternatives use similar diversion dams for some or all of their drinking water.

Groundwater: Many aquifers serve domestic, municipal, commercial, agricultural and industrial customers throughout the project area. The Troutdale Aquifer in the southwestern portion of the project area is the only sole source aquifer, providing about 99 percent of available drinking water to Clark County. To protect groundwater, there are designated Critical Aquifer Recharge Areas (CARAs) and wellhead protection areas throughout the project area.

S.3.11.2 Impacts Common to Action Alternatives

Transmission line, access road and substation construction would disturb soil, temporarily or permanently clear vegetation and create hardened surfaces that could affect waterways, riparian buffers, floodplains and groundwater. Soil disturbance and vegetation removal could cause erosion and increased sediment delivery to streams, and new roads could increase surface runoff. Vegetation removal could also increase stream temperatures. Common impacts would include:

Watersheds: Low-to-high impacts from increased sediment delivery. Between 100 and 1,000 acres of vegetation would be cleared (depending on the action alternative) across 160,000-240,000 acres of watershed, representing a potential runoff and sediment delivery increase of less than 1 percent. With implementation of erosion control measures, long-term impacts on watershed function would generally be **low,** with some localized **high** impacts possible on steeper terrain or soil with high erodibility.

Riparian buffers and surface water quality: Low-to-high localized impacts (at the point where line or road right-of-way would cross a stream) on stream temperatures where riparian vegetation would be removed along fish-bearing or impaired streams. Highest impacts would occur where existing vegetation provides effective shade for stream cooling. **No** impact at existing right-of-way crossings or new crossings requiring little of no vegetation removal. Erosion control measures would minimize sediment delivery; no streams crossed are listed as impaired for turbidity. Except for one tower built on Ione Reef in the Columbia River, towers would be built outside waterways. However, where new access roads would cross waterways, including intermittent tributaries and drainages, culverts or bridges would be installed. With erosion control measures, impacts from tower and road construction in or near waterways would be **low**. Due to BPA's fueling and storage procedures, there would be **no-to-low** impacts from contamination by fuels or other hazardous materials during construction.

Floodplains: Low impact. Towers, substations, and access roads would be sited to avoid floodplains. Where unavoidable, towers constructed in a floodplain would be designed to allow water flow around tower legs. Access roads in floodplains would be built to existing grade.

Groundwater: No impact. Some municipal and domestic water rights and wells are likely within 0.125 mile of the action alternatives. Wells and surface water diversions potentially disturbed would be relocated or project activities would be adjusted to avoid them; mitigation measures would be implemented during tower and substation excavations to minimize potential contamination from fuels or other hazardous materials.

Once the line and substations are operating, use of access roads would continue to produce sediment throughout the life of the project. However, vehicle use of these roads would be infrequent (typically once a year) and all road drainage BMPs would be followed; long-term sediment impacts would be **low**. Maintaining riparian vegetation clearances along transmission line rights-of-way could potentially cause long-term, localized increases in water temperature, a **low-to-high** surface water quality impact depending on the stream's impairment status. BPA works with landowners to maintain vegetation on the right-of-way using a variety of methods including herbicides. Herbicide use would be restricted to areas outside appropriate buffers (164-foot no-spray buffers around well head locations) , creating **no-to-low** temporary, localized impacts on waterways or groundwater.

Sundial Substation Site. No impact from increased runoff and erosion, loss of riparian vegetation, or contamination of surface water and groundwater because the site is not near any water bodies except the Columbia River and storm water runoff would not be discharged into the river. **No** impact on floodplains because the site is outside the Columbia's 100-year floodplain. Wells within 1 mile of the Sundial site reach into the Troutdale Aquifer. Impacts to groundwater would be **moderate** if contamination from herbicides occurs because of the aquifer's moderate depth and high permeability; mitigation measures would be taken to avoid this. Construction dewatering (if required) would likely have **no** long-term impact on existing wells because there would be limited drawdown away from the dewatering site.

S.3.11.3 Impacts Unique to Action Alternatives

Castle Rock Area Substations

The Casey Road substation would be built over two intermittent, non-fishbearing streams, but subsurface water would likely continue to flow to nearby streams. Construction would have **low** impacts on surface water quality from potential added turbidity, **no** impact on stream temperatures because riparian vegetation has already been cleared along intermittent streams and no clearing would occur along other streams, and **no** impact on floodplains. Risk of groundwater contamination would be **low** because of moderate-to-deep, bedrock-sealed wells within 1 mile of the site and low soil permeability; construction dewatering (if required) would have **no** long-term impact on existing wells. During substation operation, storm water runoff would be discharged to a detention pond north of the site and released from the bottom of the pond to flow over land before reaching Rock Creek. Impacts on surface water quality from operations would be **low**.

Construction on the Baxter Road site would also have **low** impacts on surface water turbidity; most streams would be avoided and erosion control measures would minimize impacts to streams that flow to Baxter Creek. It would have **no** impact on stream temperatures because no riparian vegetation would be cleared, and **no** impact on floodplains. Same impacts as the Casey Road site on groundwater (**low** risk of groundwater contamination, **no** long-term impact on existing wells from construction dewatering). Similar to the Casey Road site, storm water runoff would be discharged to an on-site detention pond and released to flow over land before reaching Baker Creek, causing **low** impacts on surface water quality during substation operation.

Construction on the Monahan Creek site would have **low** impacts on surface water turbidity; nearby Monahan and Delameter creeks are 450-500 feet away and separated from the substation site by roads. Although both creeks are listed as impaired for elevated temperatures, there would be **no** impact on stream temperatures because no riparian vegetation would be cleared. About 1,100 square feet of the site is within the 100-year floodplain of Monahan Creek, but the substation would have **no-to-low** impact on floodplains. Same impacts as the two other sites on groundwater (**low** risk of groundwater contamination, **no** long-term impact on existing wells from construction dewatering. Similar to the other two sites, storm water runoff would be discharged to a detention pond (south of the site) and released to flow over land before reaching Delameter Creek, causing **low** impacts on surface water quality during substation operation.

West Alternative and Options

Transmission line clearing and road construction would result in about 84 miles (1,285 acres) of potential soil disturbance that could contribute sediment to streams, the least of the action alternatives because most of this alternative occupies existing right-of-way where clearing may have already occurred. It would cause the smallest increase in runoff (0.09 percent) but the greatest increase in sediment delivery to streams (0.25 percent) because it would cross more erodible terrain. However, this would occur across a watershed area of about 161,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**.

Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams, the least among the action alternatives. Most crossings (28) would occur where the existing shade level is already low and provides limited stream cooling; impacts would be **low**. Nineteen crossings would occur where existing shade level does provide effective stream cooling and where shade loss is more likely to result in temperature increases; impacts at these locations would be **high**. This is the fewest number of high riparian impacts among the alternatives.

The West Alternative would cross five streams listed as impaired: Riley Creek for fecal coliform and Lockwood Creek, East Fork Lewis River, Mason Creek and Salmon Creek for elevated temperature. However, riparian vegetation has already been removed at these crossings, which would have **no** impacts on stream temperature or fecal coliform levels; the crossings would have **low** impacts on stream turbidity (caused by erosion). Thirty-two towers (triple the amount of the other action alternatives) would be constructed within the 100-year floodplains of the Lewis River (1), East Fork Lewis River (6), Curtin Creek (1), Burnt Bridge Creek (4), Lacamas Creek (8), Leckler Creek (1), Coweeman River (2), and Columbia River (9). Six miles of access road would be constructed or improved within floodplains, about 5 miles more than the other action alternatives;. However impacts on floodplains would still be **low** (see common impacts section). The alternative would cross about 20 miles of wellhead protection areas, about two to three times more than the other action alternatives, but still have **no** long-term impacts on groundwater (see common impacts section).

The West Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **West Option 1:** Would cross 2 additional impaired streams where vegetation has already been removed, having **no** impacts on stream temperatures or fecal coliform levels and **low** impacts on stream turbidity. Net additions of 10 towers and 2 miles of access roads in floodplains, still a **low** impact.
- **West Option 2:** Would avoid clearing vegetation with "high shade function" along one creek. Net addition of one tower and marginally less roadway construction (-0.8 mile) in floodplains.

- **West Option 3:** Would clear vegetation with "high shade function" along one additional creek. Net addition of two towers and marginally less roadway construction (-0.7 mile) in floodplains.

Central Alternative and Options

Transmission line clearing and road construction would result in about 104 miles (1,503 acres) of potential soil disturbance that could contribute sediment to streams, the most of the action alternatives because most of this alternative occupies new right-of-way that must be cleared. It would cause relatively moderate increases in runoff (0.59 percent) and sediment delivery to streams (0.15 percent) because it would require clearing moderate levels of mature conifer vegetation but cross less erodible terrain. This would occur across a watershed area of about 218,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**, same as the West Alternative (and other action alternatives)**.**

Riparian vegetation would be cleared at 68 forested crossings of fish-bearing streams, the greatest among the action alternatives. Nineteen crossings would occur where the existing shade level is already low; impacts would be **low**. Most crossings (49) would occur where existing shade level does provide effective stream cooling; impacts at these locations would be **high**. This is the greatest number of high riparian impacts among the alternatives.

The Central Alternative would cross two rivers listed as impaired, the East Fork Lewis and Coweeman rivers. While most riparian vegetation has already been removed at these crossings, the project could require additional clearing. Impacts on river temperatures and turbidity would be **low**. Eleven towers would be built within the 100-year floodplains of a tributary to Chelatchie Creek (1), the Cowlitz River (1), and the Columbia River (9). About 1 mile of new or improved access roads would be built in floodplains. About 6 miles of wellhead protection areas would be crossed, same as the East Alternative and less than the other two action alternatives.

The Central Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **Central Option 1:** Would clear vegetation with "high shade function" along one additional creek.
- **Central Option 2:** Would avoid crossing the East Fork Lewis River and avoid clearing vegetation with "high shade function" along nine creeks. One less tower and marginally less roadway construction (-0.1 mile) in floodplains.
- **Central Option 3:** Would avoid crossing the Coweeman River and avoid clearing vegetation with "high shade function" along two creeks, with fewer high impacts on riparian function. Same number of towers and marginally more roadway construction (+0.2 mile) in floodplains.

East Alternative and Options

Transmission line clearing and road construction would result in about 98 miles (1,455 acres) of potential soil disturbance that could contribute sediment to streams, the second most of the action alternatives because, like the Central Alternative, most of this alternative occupies new right-of-way that must be cleared. It would cause the most increase in runoff (1.03 percent) because it requires clearing the greatest amount of mature vegetation, but would cause nearly no increase in sediment delivery to streams because it would cross the least erodible terrain. This would occur across a watershed area of about 209,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**, same as the other action alternatives.

Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams. Seventeen crossings would occur where the existing shade level is already low; impacts would be **low**. Most crossings (35) would occur where existing shade level does provide effective stream cooling; impacts at these locations would be **high**. This is the second greatest number of high riparian impacts among the alternatives.

The East Alternative would cross the same two impaired rivers as the Central Alternative, the East Fork Lewis and Coweeman rivers, and have the same **low** impacts on river temperatures and turbidity. Ten towers would be built within the 100-year floodplains of the Cowlitz River (1) and the Columbia River (9). About 1 mile of new or improved access roads would be built in floodplains. It would cross about 6 miles of wellhead protection areas, same as the Central Alternative.

The East Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **East Option 1:** Would cross two additional impaired streams, Ostrander Creek and the South Fork Ostrander Creek, but avoid clearing vegetation with "high shade function" along 11 creeks. One less tower and marginally less roadway construction (-0.1 mile) in floodplains.
- **East Options 2 and 3:** Both would clear vegetation with "high shade function" along additional creeks (five and four, respectively).

Crossover Alternative and Options

Transmission line clearing and road construction would result in about 95 miles (1,422 acres) of potential soil disturbance that could contribute sediment to streams. It would cause relatively moderate increases in runoff (0.47 percent) and sediment delivery to streams (0.17 percent) because it crosses a mix of mature and immature vegetation and both high and low erodible terrain. This would occur across a watershed area of about 184,000 acres. Isolated actions could cause **high** impacts on some streams, but long-term changes in watershed conditions would generally be minor and cause small changes in existing watershed functions. Impacts would be **low**, same as the West Alternative (and other action alternatives)**.**

Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams. Twenty-three crossings would occur where the existing shade level is already low; impacts would be **low**. Most crossings (32) would occur where existing shade level does provide effective stream cooling; impacts at these locations would be **high**.

The Crossover Alternative would cross one river listed as impaired , the East Fork Lewis River, with **low** impacts on that river's temperature and turbidity. Twelve towers would be built within the 100-year floodplains of Leckler Creek (1), Coweeman River (2), and the Columbia River (9).

Nearly 2 miles of new or improved access roads would be built in floodplains. It would cross just under 10 miles of wellhead protection areas.

The Crossover Alternative's options would have the same overall water impacts, with the following minor differences in specific areas:

- **Crossover Option 1:** Would clear vegetation with "high shade function" along one additional creek.
- **Crossover Options 2 and 3:** Both would cross two additional impaired streams, Arkansas and Monahan creeks, having **low** impacts because vegetation has already been cleared. Crossover Option 3 would also require clearing vegetation with "high shade function" along one additional creek.

S.3.12 Wetlands

S.3.12.1 Affected Environment

Both forested and non-forested wetlands occur within the project's study area (a 1,000-foot corridor, 500-feet either side of the transmission line). These include mixed coniferous and deciduous-forested wetlands, scrub-shrub wetlands, emergent wetlands and aquatic bed wetlands. Wetlands can be found on lands managed for timber harvest and agriculture, within rural areas, and on land within suburban and urban development primarily on the north and south sides of the Columbia River, including the cities of Longview, Vancouver, and Camas in Washington, and Portland and Troutdale in Oregon. Quality varies from relatively undisturbed wetlands with a high diversity of native plants that offer high-quality habitat, to smaller disturbed wetlands in active agricultural fields or interspersed throughout developed areas. Both Washington and Oregon have rating systems to determine the quality of wetland functions and several federal, state and local statutes exist to protect wetlands.

Wetlands also have buffers surrounding them that provide protection of wetland functions, including providing habitat for a variety of wetland-dependent or upland wildlife and plant species. Cowlitz and Clark counties and Washington State's Department of Ecology specify minimum buffer widths for wetlands, depending on their functions and values and surrounding land uses. Multnomah County in Oregon makes similar buffer width determinations.

S.3.12.2 Impacts Common to Action Alternatives

Towers, access roads and substations are generally sited to avoid wetlands. However, there would be some impacts where footings, roads or substations cannot avoid wetlands or where the line must span wetlands. Direct construction impacts would include vegetation removal (for right-of-way and towers, access roads, substations, and danger trees outside of the right-of-way), placement of fill, soil compaction, and contamination from accidental spills or oil from construction vehicles and equipment. Long-term indirect impacts would include habitat fragmentation and the introduction of invasive non-native or noxious weed species. Where unavoidable, filling of medium- or high-quality wetlands for tower footings and access roads would be a long-term **high** impact; fill placed in low-quality wetlands would be a **moderate** impact. Clearing trees and shrubs along rights-of-way and new access roads from medium- or high-quality forested and scrub-shrub wetlands and wetland buffers would also have long-term **high** impacts.

During construction, soil disturbance and compaction would have temporary **moderate-to-high** impacts on medium-or high-quality wetlands and **low** impacts on low-quality wetlands. Short-term wetland habitat fragmentation would also occur. Removal of danger trees next to rights-of-way would create **moderate-to-high** impacts depending on the number removed at a specific wetland site and the wetland's quality.

During operation and maintenance of the line and access roads, vegetation maintenance activities such as vegetation clearing or herbicide application for noxious weed control would periodically be required. If herbicide application is required, appropriate buffers would be used to keep herbicides out of wetlands. Use of access roads for structure maintenance during wet periods would indirectly affect wetlands by introducing sediment, potentially affecting water quality. Best management practices would be implemented to reduce the potential for sediment; impacts from maintenance activities would be **low-to-moderate**. Wetlands or wetland buffers near substations could receive dust or sediment and contaminants in surface runoff from the substation yard and roads. Exposure to these contaminants would be infrequent, temporary, and a **low** impact.

Sundial Substation Site. High impact on about 11 acres of emergent wetlands that could be filled. Although these wetlands are located in an industrial setting, they are of medium quality and functions such as water quality improvement would be lost.

S.3.12.3 Impacts Unique to Action Alternatives

Castle Rock Area Substations

The Casey Road site would have **no-to-low** impacts on wetlands because wetlands are outside the substation disturbance area, but there is the potential for operation and

maintenance activities to spread dust, sediment or contaminants in adjacent wetland buffers (a short-term **low** impact). The Baxter Road site would have a **high** impact—the highest wetlands impact of the three substation sites—because it could require filling 0.6 acre of mostly forested, medium-quality wetlands. The Monahan Creek site would have **no** impacts on wetlands.

West Alternative and Options

Right-of-way clearing would affect about 54 acres of forested wetlands and 62 acres of scrub-shrub wetlands (both **high** impacts), the most of the action alternatives. Fill for tower footings (and access roads) would impact an additional 25 acres of forested and non-forested (scrub-shrub, emergent and aquatic bed) wetlands in the following locations: two towers along the Coweeman River (**high** impact); 20 towers in the area north of the East Fork Lewis River south to Salmon Creek (**high** impact); 26 towers along Lacamas Creek and north of Lacamas (**high** impact, and a **moderate** impact from potential noxious weed introduction); 14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact, same for all action alternatives).

- **West Option 1:** Would require clearing more (+7 acres) scrub-shrub and forested wetlands and filling more (+5 acres) forested and non-forested wetlands to place 14 towers with access roads within the Lacamas Creek floodplain northwest of Lacamas Lake, affecting some high-functioning wetlands—a **high** impact.

- **West Options 2 and 3:** Would require clearing fewer (-11 acres and -7 acres, respectively) forested and scrub-shrub wetlands and filling fewer (-4 acres) forested and non-forested wetlands. However, clearing in scrub-shrub wetlands and fill in emergent and scrub-shrub wetlands would still occur in the Lacamas Creek floodplain, having a **high** impact where wetland functions are rated high. The options would cross more agriculturally disturbed wetlands where functions are rated low or medium. Clearing in forested and scrub-shrub wetlands northeast of Camas and along the Little Washougal River (for both options) and along Matney Creek (for West Option 3) would have **moderate-to-high** impacts.

Central Alternative and Options

Right-of-way clearing would affect about 69 acres of forested wetlands and 16 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 8 acres of forested and non-forested wetlands in the following locations: two towers near the Cowlitz River (**high** impact); two towers east of Amboy along the Chelatchie River (**high** impact); two towers near Big Tree Creek (**high** impact) northeast of Camas; 14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact).

- **Central Option 1:** Would require clearing more (+2 acres) medium-to-high quality forested and scrub-shrub wetlands near the southern end of the option, where it would have **moderate-to-high** impacts. Would fill slightly more (+<1 acre) forested and non-forested wetlands.
- **Central Option 2:** Would require clearing more (+5 acres) forested wetlands (but -1 acre scrub-shrub wetlands) and filling slightly more (+1 acre) forested and non-forested wetlands for four towers where the option would cross into Lexington near the Cowlitz River, a **high** impact.
- **Central Option 3:** Impacts similar to Central Option 2, although this option would require clearing fewer (-3 acres) forested and scrub-shrub wetlands and most likely avoid the alternative's potentially high impact along the East Fork Lewis River. Would fill slightly more (+1 acre) forested and non-forested wetlands, including forested wetlands at the southern end of the option. Clearing of forested wetland and construction of two towers would occur along Cedar Creek within high quality forested and emergent wetlands and in smaller scrub-shrub wetlands along drainages west and south of Amboy.

East Alternative and Options

Right-of-way clearing would affect about 61 acres of forested wetlands and 23 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 10 acres in the following locations: two towers near the Cowlitz River (**high** impact); seven towers east of Amboy (**high** impact); five towers northeast of Camas along the Washougal River (**high** impacts); 14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact).

- **East Option 1:** Would require clearing more (+10 acres) forested and shrub-scrub wetlands and filling more (+3 acres) of forested and non-forested wetlands to place eight towers with access roads in the Cowlitz River floodplain, a **high** impact.

- **East Option 2:** Would require clearing fewer (-3 acres) forested and scrub-shrub wetlands and filling fewer (-3 acres) forested and non-forested wetlands, but would still place five towers with roads in wetlands near Cedar Creek and the Little Washougal River—a **high** impact.
- **East Option 3:** Would require clearing slightly more (+1 acre) forested wetlands and fewer (-1 acre) scrub-shrub wetlands, and filling slightly less (-1 acre) forested and non-forested wetlands. Two towers with roads would be placed within a forested wetland south of the East Fork Little Washougal River– a **high** impact.

Crossover Alternative and Options

Right-of-way clearing would affect about 53 acres of forested wetlands and 35 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 13 acres in the same general locations as the East Alternative.

- **Crossover Option 1:** Would require clearing more (+9 acres) forested and scrub-shrub wetlands and filling more (+2 acres) forested and non-forested wetlands—**high** impacts—within the same wetlands described for West Option 3.
- **Crossover Options 2 and 3:** Would require clearing more (+4 acres and +5 acres, respectively) forested and scrub-shrub wetlands and filling more (+<1 acre) forested and non-forested wetlands near Baxter Creek—a **high** impact. Two to three towers with roads would be placed in or near wetlands between the Baxter Road and Monahan Creek substation sites.

S.3.13 Vegetation

S.3.13.1 Affected Environment

The project area is in the Western Hemlock Forest Vegetation Zone, which is dominated by western hemlock, Douglas-fir, and western red cedar. The southern portion of the project area transitions into the Interior (Willamette) Valley Vegetation Zone. Other plant community types include remnant patches of wet and dry prairie; Oregon white oak woodlands; and riparian woodlands dominated by black cottonwood and willow. Wetland plant communities are common, especially near rivers and streams and where hydric soils occur in lowland and floodplain areas.

Vegetation has been disturbed and altered by urbanization, forestry, and agriculture, causing habitat fragmentation, but higher quality plant communities still exist, particularly in the northern and eastern portions of the project area. The decline of some species has prompted their protection as threatened or endangered species under state or federal laws.

Seven general vegetation types were documented within 1,500 feet either side of the rights-of-way (the study area): mature forest, forest, production forest, shrubland, herbaceous (non-woody), rural landscaped, and urban/suburban landscaped. There are also some pockets of state-designated special-status plant habitats and special-status plant species with federal or state protection (none were identified within 1 mile of the project in Oregon). Noxious weeds also exist and would be documented and mapped for the preferred alternative before construction, to identify appropriate control measures.

Mature forest is typically dominated by coniferous trees over 80-years old with a diameter at breast height (dbh) exceeding 21 inches and includes old-growth forest (more than 200-years-old, more than 32 inches dbh) and mature forested wetlands. Tree species are predominantly conifers, but some deciduous species may be present. Oregon white oak dominates in a few areas. Mature forest is uncommon in the study area, but can be found in riparian areas where timber harvest has been limited and in areas near Yale Lake and Lake Merwin. It covers about 2 percent of the study area along the West Alternative, 1 percent of the Central and East alternatives, and 3 percent of the Crossover Alternative.

Forest is defined as a stand with at least 30 percent areal cover by trees younger than 80-years old and with less than 21-inch dbh, and includes forested wetlands. Forest stands may be dominated by conifers or have a mixture of coniferous and deciduous species, and have a more diverse understory than other forest types. Forest, both in small fragmented and larger stands, can be found throughout the study area, but is most prevalent around the Cowlitz River and southwest of Lake Merwin. It covers about 31 percent of the study area along the West Alternative, 24 percent of the Central Alternative, 16 percent of the East Alternative, and 27 percent of the Crossover Alternative.

Production forest (forest routinely harvested for wood products), dominated by Douglas-fir and western hemlock, is most concentrated in the study area's central portion, north and southeast of Lake Merwin and Yale Dam. It covers only about 10 percent of the study area along the West Alternative, but is the most common vegetation type along the other three action alternatives, covering 63 percent of the study area along the Central Alternative; 73 percent of the East Alternative, and 50 percent of the Crossover Alternative.

Shrubland is defined as having at least 30 percent areal cover by shrubs and tree saplings, and includes scrub-shrub wetlands. In the study area, shrublands are scattered throughout the forest and production forest habitats and are often connected to herbaceous habitat. Shrublands cover about 7 percent of the study area along the West Alternative, 2 percent of the Central and East alternatives, and 4 percent of the Crossover Alternative.

Herbaceous vegetation includes pasture and cropland, and native upland and wetland prairie. More than 99 percent of southwestern Washington prairies have been converted to pasture, cropland or other non-native uses. Scattered throughout forest and forest production areas, this vegetation type is more concentrated along the Cowlitz River and southwest of Lake Merwin. Herbaceous vegetation is more common along the West Alternative, providing about 21 percent of the cover within its study area. The remaining action alternatives have very little—about 4 percent for the Central Alternative, 3 percent for the East Alternative and 5 percent for the Crossover Alternative.

Rural landscaped vegetation includes that found in rural areas, such as in pastures or cultivated fields on small farms or around low-density residential development. It is highly fragmented and may include vegetation from the other categories. Rural landscaped vegetation is located primarily along the Cowlitz River, southwest of Lake Merwin, and in and around Castle Rock, Longview-Kelso and Vancouver. It covers about 12 percent of the study area along the West Alternative, 4 percent of the Central Alternative, 3 percent of the East Alternative, and 7 percent of the Crossover Alternative.

Urban/suburban landscaped vegetation includes that found in mid- to high-density development, including residential, commercial and industrial. In the study area, it occurs primarily in the north and south portions, near Castle Rock, the Longview-Kelso metro area, and Vancouver. It covers about 18 percent of the study area along the West Alternative, 3 percent of the Central and East alternatives, and 4 percent of the Crossover Alternative.

Special-status plant habitats are naturally occurring plant communities that are rare or have limited distribution. They may be designated as preserves, conservation areas, priority habits, or priority ecosystems by one of several Washington agencies. **Special-status species** are native species identified by federal or state authorities as having low or declining populations that could put them at risk at state, national and/or global levels. Occurrences of special-status habitats and species within 1 mile either side of the transmission line include:

Lacamas Prairie Natural Area east of Vancouver and northwest of Washougal (WDNR is pursuing protections as a preserve and conservation area), which would be crossed by the West Alternative and options and Crossover Option 1 (and is currently crossed by existing BPA transmission lines).

A WDNR forest riparian conservation easement within the right-of-way along Segment 9 of the West and Crossover alternatives.

WDNR research plots partially within the right-of-way and proposed routes for access roads along Segment 30 of Central Option 3.

Three priority ecosystems identified by the Washington Natural Heritage Program (WNHP): Oregon white oak woodlands (documented along the southern portion of all action alternatives in or near the Lacamas Prairie Natural Area, but crossed only by the West Alternative and its options); one tufted hairgrass/California oatgrass ecosystem (in the study area of the West Alternative and its options and Crossover Option 1), and one North Pacific herbaceous bald and bluff community (within the study area of the West Alternative, West Option 1 and Crossover Option 1, but not crossed). Six other herbaceous balds not documented by WNHP but identified by WDFW are found within the study area of several alternatives and options, but only one—on Larch Mountain—is directly crossed by the East and Crossover alternatives and East Option 2. An additional eight priority ecosystems are known to occur in the project area but were not found.

Nineteen federal and/or Washington state (listed or potential) special-status plant species, of which 11 were recently documented along at least one action alternative. No Oregon special-status species are documented although suitable habitat may be present.

Noxious weeds are those that can damage cultivated or natural vegetation, livestock or other resources. They include Himalayan blackberry, thistles, and scotch broom. Noxious weeds can be found throughout the project area along roadsides, within existing utility corridors, and in other disturbed areas. They are regulated at the state level in both Washington and Oregon and controlled through county programs.

S.3.13.2 Impacts Common to Action Alternatives

Project construction would require some vegetation to be permanently removed under towers, new access roads and substations and around improved access roads. New access roads would fragment plant habitat, creating greater edge exposure (to weeds or disease), reducing genetic diversity, and negatively affecting plant community recovery. While project components would be sited to avoid sensitive vegetation resources as much as possible, there could be **high** permanent impacts where special-status habitats or high-quality native habitats (include mature forest) would require removal. Likewise, impacts would be **moderate-to-high** on documented special-status species, **moderate** on forests (where trees would not be allowed to regrow), and **low** for all other vegetation types requiring removal. Other vegetation clearing within the transmission line right-of-way could also have **high** impacts on special-status habitats or high-quality native habitats, **moderate-to-high** impacts on documented special-status species and **moderate** impacts on forests. Clearing impacts would be **low** on production forest and shrublands and **no-to-low** on herbaceous, rural landscaped and urban/suburban landscaped vegetation. Construction activities such as digging and vegetation crushing would have temporary **no-to-low** impacts on vegetation where mitigation measures would ensure adequate restoration. If sensitive plant communities are permanently altered by these activities, however, impacts could be higher. The spread of weeds could cause **low-to-high** impacts, depending on the weed species. Permanent impacts on vegetation in staging areas, which are normally already highly disturbed, would be **no-to-low**.

When the transmission line is operational, maintenance in rights-of-way and along access roads would generally have temporary and infrequent **low** impacts on vegetation. Impacts would be higher if brushing, mowing or grading inadvertently harmed special-status species (**moderate-to-high** impacts), spread noxious weeds (**low-to-high** impacts), or introduced invasive weeds or otherwise damaged special-status plant habitats (**high impacts**).

Sundial Substation Site. Low-to-moderate impact; construction would permanently remove 40 acres of herbaceous vegetation, including 11 acres of disturbed, moderately functioning herbaceous emergent wetlands.

S.3.13.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

Development of the Casey Road site would have **low** impacts on already disturbed vegetation. About 38 acres of production forest, 24 acres of shrubland and 1 acre of rural landscape would be permanently removed. The Baxter Road site would have **low** impacts, requiring removal of predominantly (nearly all 47 acres) previously harvested production forest. The Monahan Creek site, requiring permanent removal of about 67 acres of vegetation, would have predominantly **low** impacts on 46 acres of rural landscaped vegetation, 18 acres of production forest and 1 acre of shrubland, but potentially **high** impact on 2 acres of mature forest. This site could also have **moderate-to-high** impacts on a special-status species, western wahoo, given documented occurrences near the site.

West Alternative and Options

Right-of-way clearing and tower, road and substation construction would have **high** permanent impacts on 27 acres of mature forest; **moderate** impacts on 345 acres of forest; **low** permanent impacts on 366 acres of shrubland, 106 acres of herbaceous vegetation and 13 acres of production forest; and **no-to-low** impacts on 241 acres of rural and urban/suburban landscape. It would have **no** impact on 342 acres of herbaceous vegetation crossed by right-of-way that would not require clearing.

The West Alternative would potentially have **high** impacts on some currently documented special-status plant habitats and species: where the line crosses 33 acres of the Lacamas Prairie Natural Area (within a proposed WDNR conservation area), and towers and roads convert an additional 11 acres of this area, requiring removal of some Oregon white oak woodlands; where the right-of-way would cross a WDNR Forest Riparian Conservation Easement and require tree removal; and where an improved access road would result in habitat loss for Bradshaw's lomatium (less than 0.1 acre). Right-of-way clearing and/or towers and roads construction would have **moderate-to-high** impacts on three additional special-status species, small-flowered trillium (4 acres), dense sedge (1 acre) and Nuttall's quillwort (0.5 acre), depending on whether these activities contribute to the need for federal listing. In addition, four other special-status species are documented in the study area; if affected, impacts could be **high** on Oregon coyote-thistle and **moderate-to-high** on Hall's aster, tall bugbane and western wahoo.

The West options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **West Option 1:** Added **moderate-to-high** and **high** impacts on special-status habitats and species. Right-of-way would cross more (+28 acres) of the Lacamas Prairie Natural Area (and proposed WNHP preserve) and towers and roads would remove more (+6 acres) of this special-status habitat, added **high** impacts where trees (particularly +1 acre of Oregon white oak) would be removed. Added **high** impacts on Bradshaw's lomatium (+4 acres) and small-flowered trillium (+20 acres). Added **moderate-to-high** impacts on three state-designated species: Oregon coyote-thistle (+0.4 acre), Hall's aster ((+0.2 acre), and Nuttall's quillwort (+3 acres). Would impact less forest land (-15 acres) than the alternative, but relatively little (+/- <10 acres) or no change in acreage and impacts on other vegetation types.
- **West Option 2:** Would disturb less (-18 acres) of the Lacamas Prairie Natural Area and avoid the WDNR Forest Riparian Conservation Easement and Oregon white oak woodland, reducing or eliminating **high** impacts in these areas. Would also avoid documented populations of dense sedge, having fewer **moderate-to-high** impacts. However, it would clear more (+5 acres) mature forest, an added **high** impact. Would have fewer **moderate** impacts on forest land (-9 acres) but affect more (+11 acres) production forest (a **low** impact) than the alternative; little or no change in impacts on other vegetation types.
- **West Option 3:** Same as West Option 2, except requires clearing of slightly less (+3 acres total) mature forest land, having less **high** impacts on this vegetation type. Would have added **moderate** impacts on forest land (+31 acres) and added **low** impacts on production forest (+33 acres), shrubland (+28 acres) and rural landscape (+32 acres); little or no change in impacts on other vegetation types.

Central Alternative and Options

Right-of-way clearing and tower, road and substation construction would have **low** permanent impacts on 1,261 acres of production forest (the predominant vegetation type) requiring removal. About 303 acres of forest would be disturbed, a **moderate** impact, and 13 acres of mature forest, a **high** impact. There would be **low** impacts on 74 acres of shrubland and 60 acres of permanently cleared herbaceous vegetation. There would be **no** impact on 55 acres of herbaceous vegetation that would not require clearing in the right-of-way, and **no-to-low** impacts on 71 acres of rural and urban/suburban landscape. There are no known special-status plant habitats potentially affected by the Central Alternative. Right-of-way clearing and towers and access roads could remove or alter habitats with current documented occurrences of two special-status species: hairy-stemmed checker-mallow (1 acre) and small-flowered trillium (5 acres)—**high** and **moderate-to-high** impacts, because this could contribute to their federal listing. In addition, two other special-status species are likely to occur; if affected, impacts could be **moderate** on soft-leaved willow or tall bugbane.

The Central options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **Central Option 1:** Would impact more production forest (+42 acres) and shrubland (+28 acres) than the alternative (both **low** impacts); little or no change in impacts on other vegetation types. Same or similar impacts on special-status plant habitats and species.
- **Central Option 2:** Would have added **high** impacts on mature forest (+7 acres), added **moderate** impacts on forest land (+60 acres), and added **low** impacts on rural landscape (+47 acres), but fewer **low** impacts on production forest (-136 acres); little or no change in impacts on other vegetation types. Same or similar impacts on special-status plant habitats and species.
- **Central Option 3:** Would have added **high** impacts on mature forest (+3 acres), added **moderate** impacts on forest land (+57 acres), added **low** impacts on rural landscape (+16 acres), but fewer **low** impacts on production forest (-208 acres); little or no change in impacts on other vegetation types. Could also impact a WDNR special-status plant habitat, which could be a **moderate-to-high** impact, but would also avoid a hairy-stemmed checker-mallow site, having fewer **high** impacts on this species.

East Alternative and Options

Right-of-way clearing and tower, road and substation construction would have **low** permanent impacts on 1,386 acres of production forest (the predominant vegetation type) requiring removal. About 214 acres of forest would be disturbed, a **moderate** impact, and 13 acres of mature forest, a **high** impact. There would be **low** impacts on 89 acres of shrubland and 65 acres of permanently cleared herbaceous vegetation. There would be **no** impact on 54 acres of herbaceous vegetation with rights-of-way that would not require clearing, and **no-to-low** impacts on 99 acres of rural and urban/suburban landscape. One special-status plant habitat—a potential North Pacific herbaceous bald and bluff priority ecosystem—could be affected along Segment O, a potential **high** impact. Right-of-way clearing and towers and access roads could remove or alter habitats with documented occurrences of one special-status species: small-flowered trillium (5 acres)—a **high** impact because this could contribute to the need for federal listing. In addition, two other special-status species are likely to occur; if affected, impacts could be **moderate** on soft-leaved willow or tall bugbane.

The East options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **East Option 1:** Would have added **high** impacts on mature forest (+7 acres), added **moderate** impacts on forest (+34 acres), added **low** impacts on rural landscape (+55 acres), and fewer **low** impacts on production forest (-114 acres) than the alternative; little or no change in impacts on other vegetation types.

- **East Option 2:** Would impact less mature forest (-8 acres), but have added **moderate** impacts on forest (+22 acres). Would also have fewer **low** impacts on production forest (-50 acres) and shrubland (-14 acres); little or no change in impacts on other vegetation types.
- **East Option 3:** Would have fewer **moderate** impacts on forest (-9 acres) but have added **low** impacts on production forest (+23 acres); little or no change in impacts on other vegetation types.

Crossover Alternative and Options

Right-of-way clearing and tower, road and substation construction would have **low** permanent impacts on 787 acres of production forest (the predominant vegetation type) requiring removal. About 315 acres of forest would be disturbed, a **moderate** impact, and 45 acres of mature forest, a **high** impact. There would be **low** impacts on 274 acres of shrubland and 63 acres of permanently cleared herbaceous vegetation. There would be **no** impact on 88 acres of herbaceous vegetation within rights-of-way that would not require clearing, and **no-to-low** impacts on 147 acres of rural and urban/suburban landscape. Like the East Alternative, one special-status plant habitat—a potential North Pacific herbaceous bald and bluff priority ecosystem –could be affected along Segment O, a potential **high** impact. Also like the East Alternative, one special-status species could be affected: small-flowered trillium (4.3 acres)—a **high** impact if this hastens federal listing. In addition, two other special-status species are likely to occur; if affected, impacts could be **moderate** on tall bugbane and **moderate-to-high** on bolandra.

The Crossover options would have the same overall impacts on vegetation as the alternative, with these slight variations affecting certain habitats or species:

- **Crossover Option 1:** Could disturb 8 acres of the Lacamas Prairie Natural Area, a **high** impact, but would not affect any known WNHP priority ecosystems in this area. Would have added **moderate** impacts on forest (+17 acres) and added **low** impacts on shrubland (+19 acres); little or no change in impacts on other vegetation types.
- **Crossover Option 2:** Would have added **low** impacts on production forest (+52 acres) and shrubland (+67 acres), but fewer **moderate** impacts on forest land (-13 acres); little or no change in impacts on other vegetation types.
- **Crossover Option 3:** Would have added **moderate** impacts on forest land (+14 acres) and added **low** impacts on production forest (+69 acres) and shrubland (+18 acres); little or no change in impacts on other vegetation types.

S.3.14 Wildlife

S.3.14.1 Affected Environment

Wildlife species that would be affected by the project include those that occur in mixed conifer/hardwood forest (forest and production forest), shrublands, open habitat, and urban/suburban habitats. In addition, wildlife using special-status habitats (summarized later in this section) would also be affected. To assess project impacts, general habitats within 1,500 feet either side of the action alternatives' centerline and special-status wildlife habitats within 1 mile either side of the centerline (the study area) were evaluated.

Forest wildlife. Forest habitats in the study area are generally 60 years old with a mix of conifers and hardwoods, but conifers dominating. They occur throughout the study area but are concentrated around the Cowlitz River and southwest of Lake Merwin. Mature forest, Oregon white oak woodlands, forested freshwater wetlands, riparian areas, herbaceous balds and caves—all considered WDFW priority habitats—may occur within this general wildlife habitat. Small and large stands of forest cover about 33 percent of the study area along the West Alternative, 25 percent of the Central Alternative, 17 percent of the East Alternative, and 30 percent of the Crossover Alternative. Common wildlife species found in forests include mammals such as coyotes, black bear, rabbits, squirrels, chipmunks, and Columbian black-tailed deer, and a variety of year-round and migratory bird species. Thirteen special-status species could also be found in study area forests, and additional ones in mature forests; however, only four have documented occurrences in the study area.

Production forest wildlife. Production forest is similar to forest habitat but can have less species diversity due to frequent disturbance and a different vegetation mix. This habitat type occurs throughout the study area, being somewhat less concentrated to the south and southwest of Lake Merwin. It is the most common vegetation type in the study area along three of the action alternatives: 63 percent of the Central Alternative, 73 percent of the East Alternative, and 50 percent of the Crossover Alternative. It comprises only 10 percent of the habitat along the West Alternative. The Casey Road and Baxter Road substation sites are also in production forest. Production forest is considered lower quality wildlife habitat than forest, but the same special-status species and habitats could occur in either. Eleven special-status species have been documented in the study area's production forests—most associated with WDFW priority habitats, including forested riparian areas, cliffs and talus, slopes and caves.

Shrubland wildlife. Shrublands include areas dominated by shrubs or tree saplings and typically occur in existing rights-of-way, on recently harvested production forest, and in fallow fields. Shrublands may include WDFW priority habitats, including freshwater (scrub-shrub) wetlands, riparian areas, herbaceous balds, and caves. In the study area, shrublands are mixed with forests and production forests and often connected to open habitats, with less concentration in the Vancouver area. The least occurring habitat type along the action alternatives, shrubland covers about 7 percent of the study area along the West Alternative, 2 percent of the Central and East alternatives, and 4 percent of the Crossover Alternative. One acre of the Monahan Creek substation site is in shrubland. Most shrubland in the study area is highly disturbed and dominated by weedy plant species, which can reduce wildlife habitat diversity. It can attract substantial numbers of birds and many of the same mammals as forest habitat. Five special-status species may be found; however, only two have been documented.

Open habitat wildlife. Open habitats are non-forested areas dominated by herbaceous plants. They may include WDFW priority habitats but are frequently disturbed by cultivation, mowing and grazing, and low-density residential and farm-related development. Because of this disturbance, they are dominated by weedy plant species that can reduce wildlife habitat diversity. Interspersed throughout the study area, open habitats are somewhat more concentrated along the Cowlitz River, southwest of Lake Merwin, and in Castle Rock, Longview-Kelso and Vancouver. Open habitats are more common along the West Alternative than the more forested Central, East, and Crossover alternatives. About 33 percent of the study area along the West Alternative crosses open habitat, compared to 8 percent of the Central Alternative, 6 percent of the East Alternative and 12 percent of the Crossover Alternative. Open habitat also comprises most of the habitat at the Monahan Creek substation site. Many species that use open habitats are habitat generalists and can include some of the same birds and mammals attracted to other habitats, as well as small prey mammals and raptors. Ten special-status species may be found; six have been documented.

Wildlife in urban/suburban habitat. Urban and suburban habitats are a mix of natural and developed environments that support a relatively low diversity and density of wildlife species. However, they can include small areas of WDFW priority habitats. Urban/suburban habitats occur primarily in the northern and southern portions of the study area, in and around Castle Rock, the Longview-Kelso metro area and Vancouver. More urban/suburban habitat occurs in the study area along the West Alternative, which is closer to population centers: 18 percent vs. 3-4 percent for the other three alternatives. The Sundial substation site is also in an urban/suburban habitat. Many wildlife species thrive in high-density inner city areas, where the built environment provide holes, crevices, and ledges for birds and small mammals. Wildlife species in both urban and suburban areas are habitat generalists and frequently are non-natives, such as opossum. Undeveloped patches in suburban areas next to rural areas may serve as wildlife corridors. Only one special-status species has been documented in this habitat, along the West Alternative.

Special-status wildlife habitats include WDFW priority habitats and Oregon Department of Fish and Wildlife (ODFW) strategy habitats. WDFW defines priority habitats as those "with unique or significant value to a diverse assemblage of species." Those found along the action alternatives include Oregon white oak woodlands, herbaceous balds, westside prairie, old-growth/mature forest, biodiversity areas and corridors, freshwater wetlands and fresh deepwater, riparian areas, caves, cliffs, talus, and snag-rich areas. In Oregon, strategy habitats are native habitats considered conservation priorities due to high losses in the past and the risk of future losses, and are categorized from 1 (highest) through 6 for their quality and importance to wildlife. Oregon strategy habitats in the project area include wetland and riparian habitats, most of which are highly disturbed and designated categories 5 or 6. This includes the herbaceous emergent wetlands around the Sundial substation site. A small portion of the transmission line and an access road for all action alternatives cross through the ODFW Sandy River Conservation Opportunity Area (COA), which may contain higher quality habitat.

Special-status wildlife species include those protected under the federal Endangered Species Act as threatened, endangered, or proposed species; those listed by the USFWS as candidate species or species of concern; and those listed for protection by the states of Oregon and Washington. Special-status species also include WDFW priority (non-listed) species and specific wildlife groups, such as waterfowl. Suitable habitat occurs along the action alternatives for one federally endangered species (Columbian white-tailed deer), although it is not likely found in the study area, and two federally threatened species (northern spotted owl and marbled murrelet). Documented occurrences of northern spotted owls are crossed by or occur within 1 mile of the East and Crossover alternatives and a Central Alternative access road. The eastern portion of the Western Washington Coast Range Conservation Zone for marbled murrelet (marbled murrelet conservation zone) is crossed by all action alternatives and the three Castle Rock substation sites and there is a documented occurrence 3 miles northeast of the Casey Road substation. However, the project's distance from the coast makes it unlikely marbled murrelet would be found in the small patches of mature forest that occur in the project's northwest portion. None of the action alternatives is within federally designated critical habitat for these federally listed species.

Forty-six other special-status species have the potential to occur in the study area, of which 21 have documented occurrences. These include bald eagles, great blue herons, sandhill cranes, mammals such as Columbian black-tailed deer, elk and Townsend's big-eared bat, and various amphibians and reptiles.

S.3.14.2 Impacts Common to Action Alternatives

Project construction would reduce or alter native forest and forest production habitats, shrubland, open habitats, urban/suburban habitats, and certain WDFW priority habitats. Right-of-way clearing would permanently remove all trees and shrubs taller than 4 feet, which would eliminate breeding, roosting, nesting, and foraging characteristics of forested habitats and alter the composition of wildlife within and along the edge of rights-of-way, substations and access roads. Habitat fragmentation would also occur. Permanent impacts on wildlife would be **low-to-high** in WDFW priority habitats, forested riparian areas and forested freshwater wetlands, depending on their habitat value and species present. (Three WDFW priority habitats would be affected by all action alternatives: riparian areas, wetlands, and old growth/mature forest. No Oregon strategy habitats would be impacted.) Right-of-way clearing impacts would generally be **low** in forest, production forest, shrubland, open habitat and other habitat areas, and on wildlife species that are habitat generalists (including listed species of deer and elk). Some species would benefit from the clearing.

Where towers, access roads and substations would be built, wildlife habitat would be permanently cleared, removing protective cover and decreasing prey populations and edible vegetation, but enhancing habitat for raptors (providing additional perches and nest sites). Consequently, potential mortality impacts would be **moderate** on small mammals and reptiles. Tower, road and substation construction would otherwise have **low-to-high** impacts on other wildlife, depending on species present (**low** impacts in most areas).

Project construction could also temporarily displace or elevate stress levels for many nearby wildlife species, as well as harm individual animals. Stress from noise and construction activities, including damaged habitat, could temporarily disrupt foraging, breeding, and other normal activities, a **low** temporary impact on most mobile species (e.g., birds and mammals, including the federally endangered Columbian white-tailed deer). Invertebrates, reptiles, and amphibians are not highly mobile and could disproportionately experience decreased reproduction, injury, and mortality—temporary **low-to-high** impacts depending on a species' status. Special-status species that are less mobile or actively breeding would have a greater likelihood of experiencing **moderate** impacts (although construction is usually scheduled around breeding seasons).

Right-of-way clearing impacts on two federally threatened species, specifically, would be **low** (marbled murrelet) and **low-to-moderate** (northern spotted owl). Ten to 16 other special-status species (documented within 1 mile of all action alternatives) could be impacted, particularly the California floater (**low-to-moderate** impact), purple martin (**moderate** impact) and western pond turtle (**moderate-to-high** impact).

Once built, the new transmission line could pose obstacles to birds in flight and cause fatalities. Of primary concern are riparian areas where the action alternatives would cross over the Cowlitz, Coweeman, Kalama, Lewis, East Fork Lewis, and the Columbia rivers, and in larger wetland areas. However, BPA routinely installs bird diverters on overhead ground wires spanning open water and in other high bird use areas. Impacts (risk of added bird collisions) would be **low** along most of the transmission line, but potentially **low-to-moderate** where the line is near water bodies or other areas of high bird use, and **moderate** where the line parallels existing lines of a different height.

Typical operation and maintenance activities would have **low** temporary impacts on most wildlife except where there is mortality, in which case the impact would be **moderate** (if mortality would contribute to a need for federal listing, the impact would be **high**).

Sundial Substation Site. Would require filling 40 acres of open habitat that includes 11 acres of disturbed freshwater wetland habitat within an industrial park. Temporary construction impacts and permanent loss of these low value habitats would have overall **low** impacts on most wildlife. In the wetland areas, less mobile species could experience injury or mortality, having overall **low-to-moderate** impacts on any one species. If state-listed western pond turtles are present (they are documented within 1 mile, but unlikely on site), construction could have a **moderate-to-high** impact on this species.

S.3.14.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

All three sites are in the northern portion of a marbled murrelet conservation zone, but only one site (Monahan) would have potential impacts on the species. The sites are also within the winter range of the Willapa Roosevelt elk herd, a WDFW priority area. About 47-68 acres of this priority habitat would be removed, depending on the site selected; this would be a **low** impact based on the elks' secure population and the proportionally small WDFW priority area affected. No special-status species are documented within 1 mile of the sites.

Development of the Casey Road site would permanently remove about 38 acres of production forest, 24 acres of shrubland and 1 acre of open habitat—having a **low** impact on most wildlife and **no** impact on the marbled murrelet or northern spotted owl (no suitable habitat present). At the Baxter Road site, where 47 acres of production forest would be cleared, wildlife impacts would be similar to the Casey Road site. Impacts on a small section (less than 1 acre) of scrub-shrub wetland, a WDFW priority habitat, could be **low-to-high** depending on the wetland's habitat value and the wildlife it supports. The Monahan Creek site would require clearing 46 acres of open habitat, 18 acres of production forest, 1 acre of shrubland and about 2 acres of mature forest. Wildlife impacts in all areas other than mature forest would be similar to the Casey Road site. Removing mature forest would have a potentially **high** impact on wildlife due to its importance as a WDFW priority habitat. While this habitat can provide suitable nesting for bald eagles and marbled murrelet, removal would have a **low** impact on both species because there are no documented occurrences, the amount of mature forest affected is small, and its inland location (affecting murrelets) and surrounding habitat (affecting eagles) make it unlikely the species would be present.

West Alternative and Options

Because 65 miles of the 68-mile-long West Alternative parallels existing transmission lines on existing right-of-way, it would not create new fragmentation, although it could expand existing fragmentation where the right-of-way would need to be widened, particularly in forested habitats. Because the new transmission line would be higher than parallel existing lines, it could increase the risk of bird collisions in many areas.

Where the line crosses 25 miles of open habitat, 17 miles of forest, 18 miles of shrubland and 5 miles of urban/suburban habitats, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts (such as on prey species of raptors or bird/transmission line collisions) would generally be **moderate**. Impacts would be the same (low from habitat loss; moderate on mortality risks) on most wildlife where towers, roads and substations would occupy 171 acres of open habitat and clearing for right-of-way, towers, roads and substations would affect 372 acres of forest, 13 acres of production forest, 366 acres of shrubland (only 59 acres permanently removed; 307 acres would be altered by right-of-way), and 97 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 308 acres of new habitat where forests would be cleared and low-level plants allowed to grow.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 160 acres of riparian habitat, **low-to-high** impacts; 61 acres of biodiversity areas and corridors, **high** impact; 175 acres of freshwater wetlands, **low-to-high** impacts (**moderate-to-high** impacts on the Coweeman Wetlands, given its habitat value; **low-to-high** impacts from increased bird collision risk in wetlands); 27 acres of mature forest, **high** impact; 6 acres of westside prairie in the Lacamas Prairie Natural Area, **high** impact (and potentially more bird mortality from collisions with transmission lines); and 3 acres of the Sifton/Lacamas Oregon White Oak and Washougal Oak woodlands, **high** impact.

Impacts on special-status species would be: **low** on the marbled murrelet where 377 acres of habitat within a marbled murrelet conservation zone (containing at most 27 acres of suitable old-growth/mature forest, but outside the species' general range) would be cleared; **low** on the northern spotted owl (the alternative runs within 0.4 mile of a northern spotted owl circle) from loss of potential nesting habitat (27 acres of old-growth/mature forest); **moderate** on bald eagles where the alternative crosses through a WDFW Bald Eagle Priority Area, requiring 13 acres of tree habitat to be cleared; **low** on elk and Columbian black-tailed deer, based on the species' secure populations and the small proportion of WDFW priority habitat permanently affected (same impact for all alternatives, but differences in acreage affected); and **low-to-moderate** or **moderate** impacts on other special-status species documented within 1 mile of the alternative (exception: Western pond turtle—**moderate-to-high** impact).

The West Alternative options would have slightly different impacts on wildlife near the Lacamas Prairie Natural Area, but with the same overall impacts as the alternative.

- **West Option 1:** Would remove or alter more freshwater wetlands (+11 acres), riparian habitat (+2 acres), and westside prairie (+6 acres). Would remove more WDFW wood duck priority areas (+7 acres, a **moderate** impact), but remove or alter less (-13 acres) biodiversity areas and corridors, avoiding the Columbian black-tailed deer population in this area.
- **West Options 2 and 3:** Would remove or alter more mature forest (+5 and +3 acres, respectively) and habitat within a biodiversity area and corridor that supports Columbian black-tailed deer (+12 and +11 acres), but less freshwater wetlands (-18 and -13 acres). West Option 3 would also remove or alter more riparian habitat (+14 acres) and forest (+34 acres).

Central Alternative and Options

Requiring mostly new right-of-way, the 77-mile Central Alternative would increase habitat fragmentation primarily in forested habitats; however most of the new line would not parallel existing lines and so pose less collision risk for birds (than the West Alternative).

Where it would cross 54 miles of production forest, 13 miles of forest, 5 miles of open habitat, 3 miles of shrubland, and 1 mile of urban/suburban habitat, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts along these areas would be the same or less than the West Alternative (due to lower collision risks for birds). Habitat and mortality impacts would also be the same on most wildlife where towers, roads and substations would occupy 82 acres of open habitat and clearing for right-of-way, towers, roads and substations would affect 1,261 acres of production forest, 316 acres of forest, 74 acres of shrubland (32 acres permanently removed; 42 acres altered by right-of-way), and 23 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 1,150 acres of new habitat due to tree clearing.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 116 acres of riparian habitat, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions with the line); 11 acres of biodiversity areas and corridors, **high** impact; 96 acres of freshwater wetlands, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions); 12 acres of mature forest, **high** impact; 2 acres of Washougal Oaks Woodland (Oregon white oak woodlands), **high** impact; and 3 acres of the WDFW North Fork Lacamas Snags priority habitat, **high** impact.

Impacts on special-status species would be: **low** on the marbled murrelet where 458 acres of habitat within a marbled murrelet conservation zone (containing 13 acres of suitable mature forest, but outside the species' general range) would be cleared; **low** on the northern spotted owl from the loss of 4 acres of marginal habitat (production forest) within a northern spotted owl circle circle and 13 acres of mature forest; **moderate** on bald eagles where the alternative crosses within 1 mile of a WDFW Bald Eagle Priority Area and three nests and requires clearing of 5 acres of habitat; **low** on elk and Columbian black-tailed deer; and **low-to-moderate** or **moderate** on all but one remaining special-status species documented within 1 mile of the alternative (**moderate-to-high** on Western pond turtle).

The Central Alternative options would have slightly different impacts on some wildlife, but the same overall impacts as the alternative.

- **Central Option 1:** Would alter or remove more riparian habitat (+4 acres) and WDFW Roosevelt Elk Winter Range Priority Area (+78 acres). An access road would cross riparian habitat within 1 mile of two documented occurrences of Dunn's salamander, a potential **moderate** impact.
- **Central Option 2:** Would remove more mature forest (+7 acres), forest (+68 acres) and riparian habitat (+10 acres).
- **Central Option 3:** Would remove more mature forest (+3 acres) and forest (+60 acres), but would alter less riparian habitat (-10 acres). Would cross a forested riparian area within 1 mile of a WDFW cavity-nesting duck priority area, a **moderate** impact, and avoid two of the five documented occurrences of Cascade torrent salamander, one of

three documented occurrences of western pond turtle (the one occurrence in Washington), and the one documented occurrence of Vaux's swift.

East Alternative and Options

Like the Central Alternative, the 76-mile East Alternative would require mostly new right-of-way, which would increase habitat fragmentation primarily in forested habitats but also reduce the collision risk for birds because most of the new line would not parallel existing lines.

Where it would cross 56 miles of production forest, 10 miles of forest, 5 miles of open habitat, 2 miles of shrubland, and 1 mile of urban/suburban habitat, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts along these areas would be the same as the Central Alternative. Habitat and mortality impacts would also be the same (**low** and **moderate**, respectively) on most wildlife where towers, roads and substations would occupy 114 acres of open habitat and clearing for right-of-way, towers, roads and substations would affect 1,386 acres of production forest, 227 acres of forest, 89 acres of shrubland (55 acres permanently removed; 34 acres altered by right-of-way), and 22 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 1,134 acres of new habitat due to tree clearing.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 107 acres of riparian habitat, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions with the line); 10 acres of biodiversity areas and corridors, **high** impact; 90 acres of freshwater wetlands, **low-to-high** impacts (**high** impact where parts of the Fraser Creek Wetland would be altered and removed; **low-to-moderate** impacts from bird collisions within wetlands); 45 acres of the WDFW Rock Creek Snag-Rich Area priority habitat near Yale Dam, **high** impact; 13 acres of mature forest, **high** impact; 2 acres of the Washougal Oaks Woodland, **high** impact; 1 acre of talus, **high** impact; 0.5 acre of the Larch Mountain SDFW herbaceous bald priority habitat, **low** impact; and 0.05 acre along the edge of a WDFW cave-rich priority area in production forest, **low** impact.

Impacts on special-status species would be: **low** on the marbled murrelet where 424 acres of marginal habitat within a marbled murrelet conservation zone (containing 13 acres of suitable mature forest, but outside the species' general range) would be cleared; **moderate** on the northern spotted owl from loss of 220 acres of habitat (mostly production forest) within four northern spotted owl circles and removal of 13 acres of mature forest, including trees within the WDFW Rock Creek Snag-Rich priority habitat near the western edge of a USFWS northern spotted owl Conservation Support Area; **moderate** on bald eagles where the alternative crosses within 1 mile of three documented nests and a WDFW bald eagle priority area—the Yale Tailrace Foraging Area, removing 37 acres of trees; **low** on elk and Columbian black-tailed deer; and **low-to-moderate** or **moderate** on all but one remaining special-status species documented within 1 mile of the alternative (**moderate-to-high** on Western pond turtle).

The East Alternative options would have slightly different impacts on some wildlife, but the same overall impacts as the alternative.

- **East Option 1:** Would remove more freshwater wetlands (+4 acres), old-growth/mature forest (+7 acres), and forest (+42 acres), and remove or alter more riparian habitat (+11 acres). Would avoid a WDFW waterfowl concentration priority area, but remove more WDFW bald eagle priority area (+3 acres)—the Cowlitz Bald Eagle Feeding

Habitat—and cross within the buffers of 2 additional bald eagle nests (although another nest would be avoided).

- **East Option 2:** Would remove or alter less freshwater (scrub-shrub) wetlands (-7 acres), mature forest (-8 acres), and habitat from northern spotted owl circles (-75 acres). Would avoid a talus slope, the Larch Mountain herbaceous bald and a cave-rich area, although it would remove more habitat in a snag-rich area (+3 acres). Would avoid crossing within 1 mile of several special-status species, including 3 of the 5 occurrences of Rocky Mountain tailed frog and 3 of the 6 occurrences of Cascade torrent salamander. Would remove less WDFW Columbian black-tailed deer priority area (-12 acres).
- **East Option 3:** No change in habitat acreage impacted except for wetlands (+<1 acre).

Crossover Alternative and Options

The 74-mile Crossover Alternative would require mostly new right-of-way along its southern half, but parallel existing transmission lines along much of its northern half, and so would pose greater collision risks to birds along the northern portion. Where it would cross 35 miles of production forest, 14 miles of forest, 9 miles of open habitat, 12 miles of shrubland, and 1 mile of urban/suburban habitat, construction disturbance and habitat loss or alteration would have **low** impacts on most wildlife. Potential mortality impacts along these areas would be similar to the West Alternative. Habitat and mortality impacts would also be the same (**low** and **moderate**, respectively) on most wildlife where towers, roads and substations would occupy 126 acres of open habitat and clearing for right-of-way, towers, roads and substations would affect 787 acres of production forest, 360 acres of forest, 274 acres of shrubland (66 acres permanently removed; 208 acres altered by right-of-way), and 21 acres of urban/suburban habitat. Wildlife using shrublands would benefit from the creation of 864 acres of new habitat due to tree clearing.

The alternative would remove or alter the following WDFW priority habitats, with these impacts: 149 acres of riparian habitat, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions in the southern portion); 10 acres of biodiversity areas and corridors, **high** impact; 87 acres of freshwater wetlands, **low-to-high** impacts (**low-to-moderate** impacts from bird collisions in the southern portion); and 45 acres of mature forest, **high** impact. The Crossover Alternative's impacts on the following would be the same as the East Alternative: 2 acres of the Washougal Oaks Woodland, **high** impact; 1 acre of talus, **high** impact; 0.5 acre of the Larch Mountain SDFW herbaceous bald priority habitat, **low** impact; and 0.05 acre along the edge of a WDFW cave-rich priority area in production forest, **low** impact.

Impacts on special-status species would be: **low** on the marbled murrelet where 377 acres of marginal habitat within a marbled murrelet conservation zone (containing at most 45 acres of suitable old-growth/mature forest, but outside the species' general range) would be cleared, same as West Alternative; **moderate** on the northern spotted owl from loss of 70 acres of habitat within a northern spotted owl circle and crossing within 1 mile of three others, and loss of 45 acres of old-growth/mature forest; **moderate** on bald eagles where the alternative crosses through three WDFW bald eagle priority areas—the Cowlitz Bald Eagle Feeding Habitat, the Lewis River Winter Eagle Habitat, and the Yale Tailrace Foraging Area—and within 1 mile of five bald eagle nests, removing 31 acres of trees; **low** on elk and Columbian black-tailed deer; and **low-to-moderate** or **moderate** on all but one remaining special-status species documented within 1 mile of the alternative (**moderate-to-high** on Western pond turtle).

The Crossover Alternative options would have slightly different impacts on some wildlife, but the same overall impacts as the alternative.

- **Crossover Option 1:** Would alter more riparian habitat (+8 acres) and remove or alter more freshwater wetland habitat (+11 acres). Would come within 1 mile of a WDFW wood duck priority area that is avoided by the Crossover Alternative, but not cross it, having a **low-to-moderate** impact.
- **Crossover Options 2 and 3:** Would remove less riparian habitat (-10 and -9 acres, respectively), but alter more of this habitat along the right-of-way (+9 and +7 acres). Would alter more WDFW Roosevelt Elk Winter Range Priority Areas (+70 and +66 acres).

S.3.15 Fish

S.3.15.1 Affected Environment

The project area includes rivers and streams that provide diverse habitat for anadromous fish species (such as salmon) and resident fish species (such as bull trout). Fish-bearing streams include the Columbia River and its Washington tributaries, including the Lower Cowlitz, Coweeman, Kalama, Lower North Fork Lewis, Upper North Fork Lewis, East Fork Lewis and Washougal rivers, and Salmon Creek.

Some of these Columbia River tributaries, and creeks that feed into them, provide habitat for special-status fish species (listed or candidates for listing as threatened or endangered on the federal level, or listed as species of concern on either federal or state levels). Special-status fish species present in tributaries include: Lower Columbia River coho, Chinook and steelhead; Columbia River chum; Eulachon (smelt); and Pacific and river lamprey. Some special-status species are also known to migrate through the Columbia River where the action alternatives would cross. These include Snake River sockeye and Chinook, Upper Columbia River Chinook and steelhead, and Middle Columbia River steelhead. In addition, coastal cutthroat trout uses the Columbia River for migration and is listed in Oregon.

Other fish species native to the project area include rainbow and cutthroat trout, largescale, bridgelip, mountain sucker, mountain whitefish, longnose and speckled dace, and northern pikeminnow. Nonnative species include large and small mouth bass, brook trout, crappie, bluegill, and brown bullhead.

S.3.15.2 Impacts Common to Action Alternatives

Clearing transmission line rights-of-way of vegetation and construction of towers, substations, and access roads across or near fish-bearing streams would cause increased surface runoff and release sediment that could cause direct impacts on water quality, fish habitat and fish. However, vegetation clearing (of 100 to 1,000 acres, depending on the action alternative) would occur across a watershed area of about 160,000-240,000 acres, resulting in increased runoff and sediment delivery rates of less than 1 percent—a **low** impact. BPA would also use erosion control measures to minimize the amount of sediment that would reach streams.

As discussed in water, vegetation removal would also remove shade and cause stream temperature increases. It could also reduce the amount of large woody debris entering streams, which is important to fish habitat. Forested vegetation would be cleared along about 2-3 miles of fish-bearing streams. Impacts on streamside shade and large woody debris potential would be **low-to-high**, depending on the quality of riparian vegetation removed. At existing right-of-way crossings where vegetation has already been removed and kept clear, there would be **no** impact on stream shade or woody debris potential.

Construction within floodplains has the potential to impact fish by changing floodplain dynamics and stream channel adjustments. However, given the minor amount of construction in floodplains, overall impacts on fish from floodplain changes would be **low**.

BPA would require fuel to be stored and vehicle refueling to occur at least 100 feet from any surface waters. With spill containment and clean-up procedures in place, the risk of accidental spills would be minimized and any occurring would be temporary and limited to small areas, with a potential **moderate** impact on fish.

Collectively, these changes have the potential to affect ESA-listed and other fish species. Action alternatives crossing more high-value fish streams pose more risk. However, analyses indicate none of the alternatives and options would pose substantial risk to ESA-listed salmonids (and therefore, to other fish and aquatic species). Based on the Integrated Fish Impact index, which identifies the percentage by which affect fish populations are liked to be reduced by project-related habitat changes, the net effect on anadromous fish populations for any alternative would be less than 0.2 percent, a **low** impact.

Once the line and substations are operating, maintenance staff would normally use established roads near rivers and streams unless an emergency required going off-road, which could cause temporary erosion. There would be **no** long-term sediment impacts on streams or fish. Continued vegetation maintenance along streams would prevent regrowth of forested riparian vegetation, maintaining less shade and woody debris potential and having **low-to-high** long-term impacts on fish. Vegetation maintenance could also affect floodplain function, but this impact would be low. Careful use of appropriate herbicides and adherence to stream buffers would minimize impacts on fish. Any adverse application would cause temporary and localized **moderate** impacts on fish.

Sundial Substation Site. No impact; the site is not close enough to any water bodies to affect water quality or fish habitat, and is located outside the Columbia River's 100-year floodplain.

> As noted in the Common Impacts section, watershed impacts – increased runoff and sediment delivery to streams and fish habitats caused by the project – are the same (low) for all action alternatives and options. Specific percentages for potential runoff and sediment delivery can be found in the earlier Water summary section. Remaining water impacts – on riparian function, floodplains, and ESA-listed fish – are also common for all alternatives and options, but specifics (such as number of high-impact stream crossings, acreage affected or Integrated Fish Index rankings) differ and are summarized below.

S.3.15.3 Impacts Unique to Action Alternatives

Castle Rock Area Substation Sites

All sites would have **no-to-low** impacts on fish. None is within floodplains, but each is in the vicinity of some creeks. The Casey Road site is about 1,800 feet upslope of Rock Creek, which has presumed presence of Lower Columbia River coho and potential occurrence of Lower Columbia River steelhead. The project would not remove any vegetation along the creek. The Baxter Road site is about 1,000 feet upslope of Baxter Creek, which has presumed presence of

Lower Columbia River coho and steelhead. Construction would remove vegetation from three non-fish-bearing streams only, with no vegetation removal along Baxter Creek. The Monahan Creek site is between Monahan and Delameter creeks, about 450-500 feet from each, separated by roads. These creeks have documented occurrence of Lower Columbia River coho, steelhead and Chinook salmon, and presumed presence of Columbia River chum, but no vegetation would be removed along these creeks.

West Alternative and Options

Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams. In addition to 19 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would also be **high** impacts at 10 crossings from loss of large woody debris potential. (These can both occur at the same crossing, but are considered separate high impacts.) This is the least amount of high impacts among the action alternatives. About 12.6 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 18 acres of floodplain impacted in total (by right-of-way clearing, roads and towers), the highest of the action alternatives. However, 86 percent of the total floodplain area has already been cleared; additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The West Alternative has the lowest impacts on ESA-listed and general fish populations (about 0.11 percent), because many stream crossings are in existing right-of-way that has already been altered. Because little clearing of highly functioning riparian vegetation would be required, the alternative would not pose a substantial risk to listed species; overall fish impacts would be **low**.

- **West Option 1:** Same overall impacts as the alternative.
- **West Option 2:** Same overall impacts as the alternative. Would affect one less stream with high shade function.
- **West Option 3:** Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (1) and high potential for large woody debris (2).

Central Alternative and Options

Riparian vegetation would be cleared at 68 forested crossings of fish-bearing streams. In addition to 49 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would also be **high** impacts at 46 crossings from loss of large woody debris potential. This is the greatest number of high riparian function impacts among the action alternatives. About 8.1 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 9.2 acres of floodplain impacted in total (by right-of-way clearing, roads and towers), among the lowest of the action alternatives. Because the total amount of floodplain area impacted is small and existing floodplains are already impaired, additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The Central Alternative's impacts on ESA-listed and general fish species falls between the East and Crossover alternatives; its net affect on anadromous fish populations would be about 0.15 percent based on the Integrated Fish Impacts index. Some clearing of highly functioning riparian vegetation would be required, but the alternative would not pose a substantial risk to listed species. Overall fish impacts would be **low**.

- **Central Option 1:** Same overall impacts as the alternative. Would cross one more stream with high shade function and high potential for large woody debris.
- **Central Option 2:** Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (9) and high potential for large woody debris (7).
- **Central Option 3:** Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (2) and high potential for large woody debris (3).

East Alternative and Options

Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams. In addition to 35 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would be additional **high** impacts at 38 crossings from loss of large woody debris potential. This is the second greatest number of high impacts on riparian function among the action alternatives. About 9.8 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 10.9 acres of floodplain impacted in total (by right-of-way clearing, roads and towers). Because the total amount of floodplain area impacted is small and existing floodplains are already impaired, additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The East Alternative has among the highest impacts on ESA-listed and general fish populations (about 0.19 percent), based on the Integrated Fish Impacts index, because although the number of stream crossings is relatively low, many crossings would require substantial clearing of relatively high-functioning riparian vegetation. However, the alternative would not pose a substantial risk to listed species and the net effect on fish would still be small; overall fish impacts would be **low.**

- **East Option 1:** Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (11) and high potential for large woody debris (11).
- **East Option 2:** Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (5) and high potential for large woody debris (6).
- **East Option 3:** Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (4) and high potential for large woody debris (4).

Crossover Alternative and Options

Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams. In addition to 32 crossings where loss of shade would have potential **high** impacts on stream temperatures and fish, there would be additional **high** impacts at 31 crossings from loss of large woody debris potential. About 7.3 acres of vegetation at fish-bearing streams that would be cleared is in floodplains, with 9 acres of floodplain impacted in total (by right-of-way clearing, roads and towers), least of the action alternatives. A large amount of existing right-of-way in floodplains has already been cleared. Because the total amount of floodplain area impacted is small and existing floodplains are already impaired, additional impacts to fish from project-related floodplain impacts by the alternative would be **low**.

The Crossover Alternative has the greatest potential impacts on ESA-listed and general fish populations (about 0.2 percent), based on the Integrated Fish Impacts index, because it would cross a greater number of productive anadromous fish-bearing streams and more highly functioning riparian vegetation would be cleared. However, given that only a fraction of potential fish production would be affected, the alternative would not pose a substantial risk to listed species; overall fish impacts would be **low.**

- **Crossover Option 1:** Same overall impacts as the alternative. Would affect one more stream with high shade function.
- **Crossover Option 2:** Same overall impacts as the alternative.
- **Crossover Option 3:** Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (1) and high potential for large woody debris (1).

S.3.16 Climate

S.3.16.1 Affected Environment

Temperatures and precipitation differ throughout the project area depending on location and elevation. The eastern portions of the project area get about 71 inches of snow and more than 85 inches of rain each year. Where the line would run at higher elevations in the western foothills of the Cascade Range (portions of the East and Crossover alternatives would be above 3,000 feet), it would be exposed to high winds, more prevalent heavy fog conditions, and frequent temperatures below 32°F during winter. Western portions of the project area are lower (less than 200 feet) and have a more moderate climate. About 46 inches of rain and less than 5 inches of snow occur each year, with only a few days of subfreezing temperatures. The lower elevations typically have fewer heavy fog days and lower winds.

S.3.16.2 Impacts Common to Action Alternatives

Climate could be directly affected by long-term, large-scale changes in physical parameters such as transpiration (loss of water vapor from parts of plants), albedo (solar reflectivity of the earth's surface), or changes in topography and atmospheric composition. At most, the project would affect these parameters over extremely small areas. **No** impact on climate would occur from the action alternatives.

Climate, specifically certain weather conditions (wind, rain, ice, fog), could have a a direct effect on construction as well as ongoing operation and maintenance activities, such as preventing construction equipment from accessing right-of-way, degrading access roads or icing (and stressing) conductors. However, these impacts would be **low** because transmission facilities would be engineered for climate conditions in the project area. Also, construction and maintenance activities would be scheduled to take advantage of favorable seasonal weather conditions, if possible.

S.3.17 Air Quality

S.3.17.1 Affected Environment

The airsheds in the project area are regulated by the Southwest Clean Air Agency (SWCAA) in Washington and the Department of Environmental Quality (ODEQ) in Oregon. Both agencies operate monitoring stations throughout their respective jurisdictional areas. Based on data collected, the action alternatives are within airsheds that are in “attainment or unclassified” for the national ambient air quality standards (NAAQS) for all pollutants, which include carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and particulate matter (PM). The Portland, Oregon, and Vancouver, Washington, areas are considered “maintenance areas” for carbon monoxide, meaning that, at one time, they were classified as “non-attainment” but now comply with the NAAQS (since 1996).

Portions of the West Alternative, and Segment 52 and the Sundial substation site (which are common to the action alternatives) are in the Portland-Vancouver metro area where there are more industrial sources of air pollution and higher traffic congestion. Longview, Washington is the second most populated portion of the project area (it is crossed by the West and Crossover alternatives and Central Option 2), experiencing moderate amounts of traffic and possible sources of air pollution from timber yards. For the remaining portions of the action alternatives, the landscape is rural with few or no sources of industrial air pollution. Local air pollutant emissions in the rural areas are limited primarily to windblown dust from agricultural or logging operations and tailpipe emissions from traffic along highways and local roads.

S.3.17.2 Impacts Common to Action Alternatives

Construction of the transmission line, substations and access roads would generate a temporary increase in some pollutants, such as particulate matter from fugitive dust and added exhaust emissions. However, because construction activities would be localized and short-lived, air quality impacts would be **low**. Maintenance of these facilities would generate infrequent fugitive dust and exhaust emissions when maintenance vehicles travel access roads, creating **low** impacts. During transmission line operations, high electric fields cause a breakdown of air at the surface of the conductors called corona, which can produce small amounts of ozone and nitrogen oxides. There would be **no** impact to regional air quality from corona because the amount of pollutants emitted would be small, temporary and not detectable above background levels.

S.3.18 Greenhouse Gases

S.3.18.1 Affected Environment

Greenhouse gases (GHGs) are chemical compounds found in the earth’s atmosphere that absorb and trap long-wave thermal radiation emitted by the land and ocean, and radiate it back to earth. The resulting retention and build-up of heat in the atmosphere increases temperatures, which causes warming of the planet through a greenhouse-like effect. GHGs are emitted into the atmosphere through both natural and manmade processes, although manmade emissions are responsible for rapidly increasing atmospheric concentrations of GHGs since the Industrial Revolution. Carbon dioxide (CO_2), the primary GHG emitted by human activities, is emitted through burning of fossil fuels, manufacturing processes and land-use changes, such as large-scale removal of trees and vegetation that absorb CO_2.

The EPA requires reporting of GHGs from large sources—those that emit 25,000 metric tons or more of carbon dioxide equivalent (CO_2e). Federal agencies are required to estimate, manage and reduce GHG emissions over time. Likewise, the states of Washington and Oregon both have mandates to reduce GHG emissions over the next 10 to 40 years.

S.3.18.2 Impacts Common to Action Alternatives

During the 30-month construction period, the use of gasoline- and diesel-powered vehicles and equipment would contribute to GHG emissions throughout the project area. During operations and maintenance, the use of gasoline- and diesel-powered vehicles and equipment, and permanent conversion of forested areas to cleared right-of-way or access roads, would also result in GHG emissions. However, when the direct contribution of GHGs is averaged over the operational life of the project (50 years), the result is annualized emissions of about 4,400 metric tons of CO_2e, a **low** impact.

S.3.19 Cumulative Impacts

Cumulative impacts are environmental impacts that result from the incremental impact of an action, such as one of the proposed action alternatives, when added to other past, present and reasonably foreseeable future actions.

Past actions that have affected natural and human resources in the project area include conversion of native prairie and floodplains to agriculture and pasture; timber clearing and harvest; settlements followed by residential, commercial and urban development (specifically in the Portland/Vancouver and Longview/Kelso metro areas, and including the many small towns and communities in Clark, Cowlitz and Multnomah counties); railroad, highway and road construction; establishment of ports and airports; development of power generation resources (including hydroelectric dams and coal- and natural gas-fired plants); and installation of transmission and distribution lines and related facilities.

Currently and in the reasonably foreseeable future, many of these activities will continue and grow. New development will continue as population growth and demand for resources increase. The regional road and highway system will likely expand as commercial and residential development encroaches into what are now rural areas. Utility infrastructure such as natural gas pipelines, electrical transmission and distribution lines, telecommunications, and cell towers will continue to develop. Marine terminals, ports, and commercial/industrial districts will be further developed to meet market demands for products and services. If a decision is made to build one of the action alternatives, the selected alternative would add to these impacts with construction and operation of additional transmission line facilities and the new substations.

The I-5 project's incremental contribution to potential cumulative impacts on resources would vary as follows:

Land: Minor incremental contribution to cumulative land use and ownership impacts from introduction of new utility facilities and removal of forested, agricultural and other uses permanently for right-of-way, towers and access roads. East Alternative would contribute the greatest potential impact; West Alternative the least.

Recreation: Minor incremental contribution, primarily affecting dispersed recreation, where the project would introduce a developed utility feature to a more natural landscape. Central and East alternatives would contribute the greatest potential impact; West Alternative the least.

Visual Resources: Minor incremental contributions where the West and Crossover alternatives would use existing right-of-way (more viewers, but more existing development); relatively high potential contributions by the Central, East and Crossover alternatives where they would run in newly cleared right-of-way in previously undeveloped areas.

Electric and Magnet Fields: Incremental increase in EMF along new right-of-way; incremental increase or decrease along existing right-of-way depending on the presence of another line and configuration of both lines.

Noise: Short-term adverse incremental contributions during construction at any given location along the line or at substation sites; minor incremental contributions from corona-generated noise when the line is operating.

Public Health and Safety: Minor incremental contributions possible during construction, from increased traffic and risks of electrocution, fire, toxic material spills and tree felling. The line would be designed to minimize the potential for safety issues once operating.

Socioeconomics: Small beneficial incremental contributions from project-related expenditures, employment, construction-related earnings, temporary lodging and work-crew spending in local communities. Minor incremental contributions to cumulative impacts on property values. No incremental contributions to public services or facilities.

Transportation: Temporary, but potentially significant, incremental contributions during construction from construction vehicles and traffic changes (lane closures, detours); temporary minor incremental contributions during semi-annual maintenance and infrequent repair activities; minor beneficial incremental contributions from new or improved access roads, particularly along the Central and East alternatives.

Cultural Resources: Adverse incremental contributions during construction and from intrusion on historic viewsheds.

Geology and Soils: Minor incremental contributions to cumulative soil erosion and compaction impacts (most would occur during construction and be temporary); no incremental contribution to landslide risk.

Water: Minor incremental contributions from runoff and sediment delivery to streams and decreased riparian shade along streams. The West Alternative has the smallest potential contribution because it has the fewest stream crossings; the Central and Crossover alternatives have the most.

Wetlands: Relatively high incremental contributions by the West and Crossover alternatives (affect more wetland acreage); minor incremental contributions by the Central and East alternative. (Caveat: wetlands along the East and Central alternatives may provide higher function and values than those along the other two alternatives.)

Vegetation: Incremental contributions where the project would clear forests and other native plant habitats (West Alternative would clear the least forest; Central and East alternatives the most); possible adverse incremental contributions to cumulative impacts on special-status plant habitat and species.

Wildlife: Incremental contributions from permanent loss of general wildlife habitat and WDFW priority habitat. The West and Crossover alternatives would contribute more to cumulative impacts on bird species and WDFW priority habitats; the Central and East alternatives would contribute more to cumulative impacts on general wildlife habitat (most of which is lower value production forest). Possible adverse incremental contributions to cumulative impacts on special-status species.

Fish: Adverse incremental contributions where the alternatives would require clearing along fish-bearing streams and reduce riparian functions (the Central Alternative crosses the most fish-bearing streams; the West Alternative the least). Negligible contributions to cumulative impacts on fish from floodplain incursions and erosion (sediment delivery to streams).

Air Quality: Temporary local incremental contributions during construction from dust or construction vehicle emissions; no incremental contributions from operation or maintenance of the line.

Greenhouse Gases: Negligible incremental contributions.

Climate: No cumulative impacts.

Chapter 1 Purpose of and Need for Action

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

Bonneville Power Administration (BPA) is proposing to build a 500-kilovolt (kV) lattice-steel tower transmission line that would run about 70 miles from a new 500-kV substation near Castle Rock, Washington to a new 500-kV substation near Troutdale, Oregon. The proposed transmission line and substations would increase the electrical capacity and transfer capability of BPA's transmission system in this area. BPA is considering four action alternatives (each with several options) that include transmission line routes, three sites for the proposed substation near Castle Rock, and one site for the proposed substation near Troutdale (see Map 1-1). This proposed action is referred to as the I-5 Corridor Reinforcement Project (I-5 project or project).

This chapter provides background information about BPA, its transmission system, and causes of congestion on this system, including local **load** growth, existing contractual obligations, and new requests for use of BPA's system. This chapter describes the need for BPA to increase the electrical capacity and **transfer capability** of its transmission system to respond to the increasing congestion on this system and growing system reliability concerns. This chapter also identifies the purposes that BPA is attempting to achieve in meeting this need, potential transmission system benefits from BPA's proposal, and the agencies involved in development of this environmental impact statement (EIS). Finally, the chapter provides a summary of the public scoping process conducted for the EIS, and information about the scope and organization of this EIS.

For proposed actions with the potential to affect the environment, BPA is required by the National Environmental Policy Act (NEPA) to identify, evaluate, and consider potential environmental consequences of the proposed action and reasonable alternatives before taking action, and to inform decision-makers and the public of these alternatives and their consequences. BPA prepared this draft environmental impact statement in accordance with NEPA, to address the proposed action to build the I-5 project.

1.1 Background

1.1.1 About BPA

BPA is a not-for-profit federal agency based in the Pacific Northwest. Although BPA is part of the United States (U.S.) Department of Energy (DOE), it is self-funded and covers its costs by selling its products and services. BPA markets wholesale electrical power from 31 federal hydroelectric projects in the Columbia River Basin, one nonfederal nuclear plant and several other small nonfederal power plants. The dams are owned and operated by the U.S. Army Corps of Engineers (Corps) and the Bureau of Reclamation (BOR). About one-third of the electric power used in the Northwest comes from BPA. BPA also owns, operates, and maintains about three fourths of the high-voltage (500-, 345-, 230- and 115-kV) transmission lines in its service territory. BPA's service territory includes Idaho, Oregon, Washington, western Montana, and small parts of California, eastern Montana, Nevada, Utah, and Wyoming.

BPA has an obligation to ensure that it has sufficient capability to serve its customers through a safe and reliable transmission system. The Federal Columbia River Transmission Act directs BPA to construct improvements, additions, and replacements to its transmission system that the BPA Administrator determines are necessary to provide service to BPA's customers, maintain electrical stability and reliability, and integrate and transmit power (16 U.S.C. § 838b).

1.1.2 BPA's Transmission System

BPA owns and operates more than 15,000 circuit miles of high-voltage transmission lines in the Pacific Northwest. BPA's transmission system moves most of the Northwest's high-voltage power from facilities that generate the power to customers in the Northwest. Besides the transmission system within the Northwest, BPA has large interregional transmission lines that connect to Canada, California, the Southwest and eastern Montana. BPA's lines carry electricity from federal and nonfederal generating resources to be used within and outside the Northwest.

1.1.2.1 Load Growth, Limited System Capacity, and Congestion

In southwest Washington and northwest Oregon, BPA's system primarily includes high-voltage transmission lines connected through substations to local utilities and generating facilities (see Map 1-2). Local utility customers served by BPA's transmission system include Clark Public Utilities, Cowlitz Public Utility District (PUD), PacifiCorp, and Portland General Electric (PGE).

The Portland, Oregon-Vancouver, Washington metropolitan area (metro area) is the major electric load center in northwest Oregon and southwest Washington. High concentrations of residential, commercial, and industrial loads are served by hydroelectric dams on the Columbia River, **thermal plants** along the Interstate-5 (I-5) corridor west of the Cascade Mountains and a few others in Canada, and wind turbines operating east of the Cascades in Washington and Oregon. Electricity flows from these generating resources to the metro area and beyond over BPA's and other utilities' high- and low-voltage (less than 115-kV) transmission lines throughout the West.

Utilities monitor these lines (or paths) to make sure that the transmission system is functioning safely and reliably. In and around the metro area, the high voltage lines together are known as the South of Allston (SOA) path. Allston is a BPA substation in northern Oregon, across the Columbia River from Longview, Washington (see Map 1-2). When all lines within this path are in service, that is, functioning and available with no outages for maintenance or emergencies, the SOA path can be operated within a range (in **megawatts** [MW]) called the path's system operating limit.

For the last 10 years, BPA studies have shown that this path has become more congested because of higher loads. BPA built the last major high-voltage line in the I-5 corridor area over 40 years ago. Over that same period, the population has grown from about 1 million to more than 2.2 million (Sprague and Picha 2010).

Higher loads create congestion because of the way electrons flow on a transmission line or path. The higher the loads in different areas, the more the power flows to these areas, and depending on the available line or path capacity, the line can become congested and physically unable to reliably accommodate the need for power to flow. The path is like an interstate highway, the higher the loads (or traffic) the more the path becomes crowded or congested.

Transmission lines can also be affected by surrounding air temperatures. Transmission lines are designed to operate up to a maximum temperature that includes a safety buffer so that the lines will not sag into objects on or near the right-of-way. In summer, higher air temperatures can cause conductors to expand and stretch, which increases the sag of the conductors. During these times, lines can reach their maximum operating limit quicker. This decreases the amount of power that could have been carried over the lines (reduced capacity) had the surrounding temperatures been cooler.

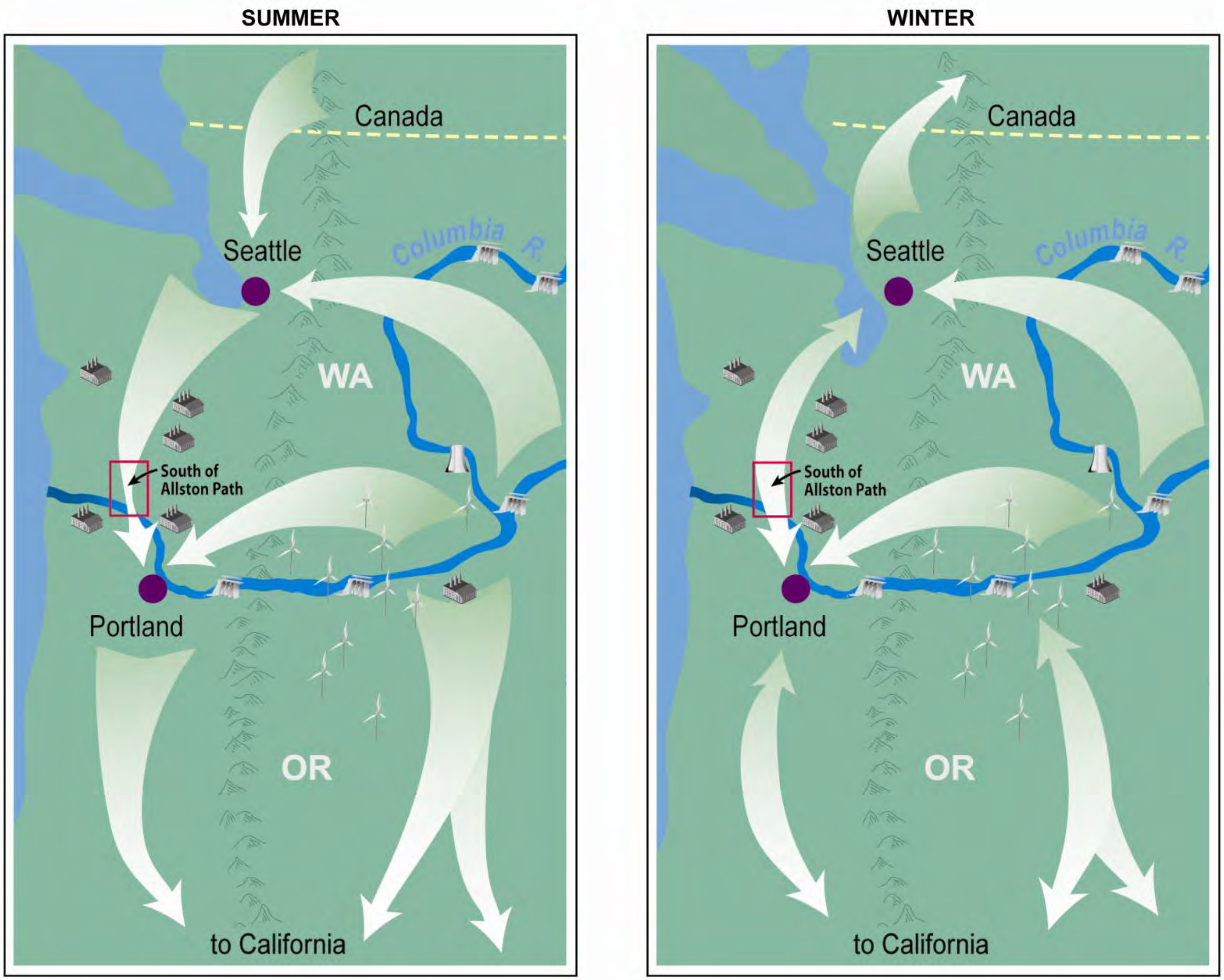
In the past, electrical use in the metro area peaked in the winter, often when a winter storm boosted the need for electric heat. Now, as new homes and commercial buildings are constructed, most have installed air conditioning, and that has increased the demand for energy in the summer. In general, peak electricity use in summer is about equal to winter peak levels.

Power flows in a different pattern in winter than it does in summer, using different transmission paths with different capacities (see Figure 1-1). In winter, power use is greater in the Northwest and Canada. This demand causes power to flow primarily from generation sources east of the Cascades to load centers in the west. Transmission system capacity is adequate to accommodate this flow. In summer, however, power use is concentrated in the Northwest and California, which causes power to primarily flow from north to south (see Figure 1-1). The north-to-south transmission capacity available in summer on the SOA path is about half of the system capacity in winter from east-to-west. This creates a system bottleneck for the summer pattern.

In summary, because of a variety of factors—including growing summer peak loads, new power plants that have interconnected to BPA's transmission system north of the SOA path, and, to a lesser extent, power transfers from Canada through the Northwest to load centers south of the metro area—the SOA path has become congested during the summer months.

With the current forecasts for load growth (up to 2 percent per year), BPA's analysis indicates that by spring 2016 the existing transmission system's capacity will likely be reached, which, in the absence of other measures, could require BPA to reduce power deliveries and this compromises the reliability of the transmission system to serve loads (see Section 1.1.2.2, Reliability and **Non-Wires Measures**).

Figure 1-1 Typical Power Flows **(Winter and summer flows vary depending on generation and load patterns)**



1.1.2.2 Reliability and Non-Wires Measures

Mandatory reliability standards and principles of good utility practice prohibit BPA from operating the transmission system beyond its capacity. Operating in this manner could **overload** the system and create **voltage** instability, potentially leading to **brownouts** or **blackouts**. When BPA determines that capacity on a particular path is insufficient to meet demand under certain conditions, BPA relies on non-wires measures to the extent possible to help maintain system reliability and maximize use of the existing system facilities before building a new transmission line. For the SOA path, BPA and other utilities have developed a non-wires measure called a remedial action scheme (RAS) that is carried out when needed. RAS uses a high-speed automatic control system designed to protect the transmission system in the event of an unexpected outage of a critical transmission facility. If such an outage occurs, the RAS is activated and rapidly disconnects (or “drops”) selected generation in the Northwest and Canada to reduce the flow of power and avoid overloading the lines that remain in service.

RAS has been used for many years to preserve the reliability of the SOA path. During the summer, as loading increases on the SOA path, successively higher levels of RAS are engaged, and greater amounts of generation are dropped as needed. Using RAS in this manner, however, has some undesirable consequences. BPA has had to prepare to drop up to 2700 MW of generation in the event of a critical outage on this path. To continue to serve the demand if generation is dropped, replacement power, if available, must be found and delivered over alternate paths. Even if replacement power is available, it may be difficult to deliver the replacement power due to constraints on the alternate paths. If replacement power cannot be found or delivered to serve the demand, this could lead to **load curtailments**, particularly in the metro area. As the projected gap between SOA capacity and demand grows, the likelihood of curtailments will increase as well. Furthermore, as the economy and population in the metro area continue to grow, using RAS will become more difficult and less effective.

Providing a high level of system reliability, and avoiding load curtailments, has become even more important in the Pacific Northwest in recent years as new industries that rely on steady, uninterrupted power have come to the area. In the past, Northwest industries, such as lumber mills and aluminum plants, could adjust to short power interruptions and sometimes received a special power rate for their flexibility. Today, high-quality (non-interruptible) power is critical to high-tech manufacturing of products, such as microchips. Power disruptions can ruin products in these plants, and plant operators can only tolerate fluctuations within a narrow range.

In addition to RAS, for the past 2 years BPA has been investigating the feasibility of using other possible non-wires measures to help maintain reliability of the SOA path. To determine how non-wires could help alleviate power flows on the SOA path, BPA contracted with Energy and Environmental Economics, Inc. (E3) to conduct non-wires studies (see inset box). The studies determined that non-wires measures could not eliminate the need for a new line. (See Section 4.7.1, Non-Wires Alternative, for a discussion of the consideration of non-wires measures in meeting the need for the project.) However, the studies did find that upgrades at BPA’s Pearl Substation could potentially defer the need for a new line for reliability purposes by about 2 years beyond spring 2016 (when the existing transmission system’s capacity is likely to be reached). In addition, the studies found that **generation redispatch** may be able to provide an additional deferral of up to about 4 years. Generation redispatch would turn off large generators located north of the metro area, while turning on generators located south of the metro area to reduce power flow on the SOA path. The E3 study did not consider the new commercial demand for transmission service over the SOA path discussed in Section 1.1.2.3, Existing Obligations and New Requests for Transmission Service.

Because of the potential for generation redispatch to help address reliability of the SOA path, BPA is continuing to separately evaluate the operational feasibility of generation redispatch, and whether contracts with regional generators would be cost effective.

If BPA finds that generation redispatch measures are cost effective and commercially and operationally feasible, those measures, along with upgrades at BPA's Pearl Substation, could be separately and independently implemented to maintain system reliability in the I-5 project area. This could delay the date a new line would need to be operational to satisfy reliability needs by 2 to 6 years.

Non-Wires Studies

BPA contracted with Energy and Environmental Economics, Inc. (E3) to conduct a screening study of possible non-wires measures for the I-5 project. The study focused on measures to address the reliability need for the project. E3 completed the Phase I study in January 2011 (see I-5 project website). The study identified four possible non-wires measures, estimated impacts to the SOA path, and determined that non-wires could potentially provide a short-term deferral of the energization date for the I-5 transmission line, but *could not* provide a long-term solution for future overloads on the SOA path. In April 2011, BPA convened the Non-Wires Round Table, a technical forum of non-BPA experts capable of providing external review of non-wires measures being considered as alternatives to transmission projects. The Round Table evaluated the E3 report and recommended a Phase II study be prepared to examine the implementation feasibility of the non-wires measures for a short-term I-5 project deferral. The Phase II study was completed in December 2011 (see I-5 project website) and concluded that upgrades at BPA's Pearl Substation and generation redispatch were the measures that showed the most potential for a short-term deferral of the I-5 project. The study also acknowledged the need for BPA to evaluate operational challenges that generation redispatch would create and the uncertainty as to whether commercial agreements with regional generators would be achievable and cost effective.

1.1.2.3 Existing Obligations and New Requests for Transmission Service

BPA has adopted an Open Access Transmission Tariff (OATT) for its transmission system. BPA follows the open access tariff as a matter of national policy. The tariff defines the terms and conditions of transmission services offered by BPA. This tariff, which is generally consistent with the Federal Energy Regulatory Commission's (FERC) **pro forma open access tariff**, has procedures that provide access to BPA's transmission system for all eligible customers, consistent with all BPA requirements (including the availability or development of sufficient transmission capacity) and subject to an environmental review under NEPA. More information about the tariff is available on BPA's Transmission Services website: http://www.transmission.bpa.gov/business/ts_tariff/.

For many years even before BPA adopted its OATT, BPA provided access to its transmission system to both federal and nonfederal power generators. As a result, BPA and other utilities currently have existing contracts with several power generators (including wind generators and power marketers) in Canada, the Pacific Northwest east and west of the Cascades, and surrounding states to move power across BPA's transmission system. Much of the available capacity for firm transmission service that remains on BPA's transmission system is already under contract.

At the present time, BPA, PacifiCorp, and PGE are the entities that have allocated capacity on the SOA path. PGE and PacifiCorp likely use their allocations to meet their customers' needs for power. BPA's share of that capacity is provided to BPA's **firm transmission service** customers (see inset box). Because of BPA's obligations to serve loads and provide firm capacity on this path, BPA cannot provide firm transmission service to other customers at certain times of the year, because the path has reached the limit of its capacity. Accordingly, BPA can only offer **conditional firm** or **non-firm** service to these other customers at this time (see inset box).

Firm transmission service is more expensive to users of the system, but it is more desirable because the capacity is available to the power generator or marketer at any time when it is needed, but subject to outages. Non-firm customers, on the other hand, pay less for power, knowing that their power could be first to be interrupted in an emergency or outage.

BPA has received new requests from other utilities and power generators for long-term firm transmission service on the SOA path. Under its OATT, BPA maintains a request queue for long-term, firm transmission service. By the mid 2000s, this queue had become overloaded with requests, and BPA became aware that many requests were speculative. In March 2008, to help manage the queue and identify the new transmission infrastructure that would be needed to provide service that customers had requested, BPA began its first Network Open Season (NOS) process. During this NOS process, utilities and power generators were given the opportunity to submit requests for use of BPA's transmission system to transmit their power. More information about the NOS process is available at BPA's Transmission Services website: http://www.transmission.bpa.gov/customer_forums/open_season/default.cfm.

Firm, Conditional, and Non-Firm Transmission Service

Firm transmission service is reserved and/or scheduled for a specific term (usually a year or longer) that is of the same priority as BPA's use of the transmission system.

Conditional firm transmission service is long-term transmission service that BPA may be able to provide when there is not enough firm transmission service, but conditional firm service has constraints that give BPA additional curtailment rights. Conditional firm service has a lower priority than firm service, but is a higher priority than non-firm service.

Non-firm transmission service is not guaranteed to be available and is only available after commitments for firm and conditional firm service have been met.

During the 2008 NOS process, and the subsequent 2009 and 2010 NOS processes, BPA identified firm transmission service requests that would use the SOA path. BPA has no more firm capacity available on the SOA path to accommodate these new requests to transfer power (see Section 1.1.2.1, Load Growth, Limited System Capacity, and Congestion).

In spring 2011, BPA announced its plans to delay the next NOS to conduct a regional discussion on more effective ways to meet the transmission needs of the Northwest and to ensure BPA's policies support those needs. This delay will not affect BPA's work to serve requests received in the 2008, 2009 and 2010 open seasons.

1.1.3 Planning for Transmission Additions in the I-5 Corridor

Load growth and transmission service requests have combined to increase flows on the SOA transmission path to levels that the path cannot accommodate without adding transmission capacity. BPA has taken several steps to reduce congestion on the transmission system without building new lines. BPA has upgraded many facilities to maximize the use of existing transmission lines. To allow new generation facilities to move power on the transmission system, BPA initiated operational procedures such as RAS to maximize usage of the transmission system rather than building new substations and transmission lines (see Section 1.1.2.2, Reliability and Non-Wires Measures). However, increasing RAS and other operational procedures does not create additional capacity on the system and cannot effectively mitigate the stresses on the system without causing other problems.

Under its OATT, BPA must investigate actions it could take, including adding infrastructure, to provide access to the transmission system in response to requests for service.

Accordingly, BPA studied the transmission system in the area and identified where the system needed reinforcements to meet forecasted load growth. BPA's studies found that if an additional transmission line is not built in this area, continued congestion will jeopardize transmission system reliability and, eventually, lead to power interruptions or blackouts in the area. Based on these results, combined with planning studies that began in late 2006 and continued through 2007, BPA developed a plan that included a major infrastructure addition in this area.

In conducting its studies and undertaking transmission planning, BPA follows the reliability standards established by the North American Electric Reliability Corporation (NERC) and Western Electricity Coordinating Council (WECC) (see inset boxes). NERC, the national electric reliability organization, and WECC, the regional reliability organization, help coordinate the operation and planning of the bulk transmission system throughout the region. Electric utilities are required to meet the standards of both organizations when planning new facilities.

BPA also sought review of the I-5 project through WECC's Project Coordination process (formerly known as the Regional Planning Project Review, or "Regional Review," process). The Project Coordination process is part of the initial development phase of a project. BPA coordinated the review through ColumbiaGrid (see inset box) and worked with other utilities and interested parties throughout the Northwest in developing the project.

During the Project Coordination process, BPA shared study results and alternate plans of service with other Northwest utilities. This provided other utilities with an opportunity to review and comment on BPA's plans with the goal of developing the best plan of service with respect to regional benefits and impacts. The Project Coordination process concluded in March 2008 with regional approval for the project.

About the North American Electric Reliability Corporation

NERC is an organization that has been delegated the responsibility to regulate bulk power system users, owners, and operators through the adoption and enforcement of standards for fair, ethical, and efficient practices.

NERC develops and enforces reliability standards; assesses adequacy annually via a 10-year forecast and winter and summer forecasts; monitors the bulk power system; and educates, trains, and certifies industry personnel. NERC is subject to oversight by FERC and governmental authorities in Canada.

As of June 18, 2007, FERC granted NERC the legal authority to enforce reliability standards with all U.S. users, owners, and operators of the bulk power system, and made compliance with those standards mandatory and enforceable. More information is available on NERC's website: http://www.nerc.com (NERC 2010). BPA is required by law to comply with these reliability standards.

About the Western Electricity Coordinating Council

WECC is the regional entity responsible for coordinating and promoting bulk electric system reliability in the West. WECC's service territory extends from Canada to Mexico. It includes the provinces of Alberta and British Columbia, the northern portion of Baja California, Mexico, and all or portions of the 14 western states.

In addition to coordinating system reliability, WECC ensures open and non-discriminatory transmission access among members, provides a forum for resolving transmission access disputes, and provides an environment for coordinating the operating and planning activities of its members as set forth in its bylaws.

Membership in WECC is open to all entities with an interest in the operation of the bulk electric system in the West. All meetings are open and anyone may participate in WECC's standards development process. More information is available on WECC's website: http://www.wecc.biz/ (WECC 2009).

About ColumbiaGrid

ColumbiaGrid is a non-profit membership corporation formed in 2006 to improve the operational efficiency, reliability, and planned expansion of the Pacific Northwest transmission grid. The corporation itself does not own transmission, but its members and the parties to its agreements own and operate an extensive network of transmission facilities. Northwest members include BPA, Avista Corporation, Puget Sound Energy, Snohomish PUD, Tacoma Power, Chelan PUD, Grant PUD, and Seattle City Light.

ColumbiaGrid has substantive responsibilities for transmission planning, reliability, the Open-Access Same-Time Information System (OASIS), and other development services. These tasks are defined and funded through agreements with members and other participants. Development of these agreements is carried out in a public process with broad participation. More information about ColumbiaGrid is available on its website: http://www.columbiagrid.org/ (ColumbiaGrid 2009).

1.2 Need for Action

BPA needs to increase the electrical capacity and transfer capability of its 500-kV transmission system between the Castle Rock area in Washington and the Troutdale, Oregon area, in response to growing local demand for electricity and firm transmission requests that BPA has received to move power across this portion of its system.

A new 500-kV transmission line would increase the 500-kV transmission capacity in the southwest Washington/northwest Oregon area and allow BPA to provide for local load growth, maintain reliable power, and accommodate requests for long-term, firm transmission service. These new facilities would eliminate a transmission capacity constraint for this area, provide an additional electrical pathway, and increase system capacity (see Section 1.4, Transmission System Benefits, for other transmission system benefits related to a new line). Continuing to use BPA's existing transmission system in this area without a new transmission line would eventually cause BPA's transmission system to become overloaded at certain times of the year.

1.3 Purposes

In meeting the need for action, BPA will attempt to achieve the following purposes:

- Use ratepayer funds responsibly and efficiently.
- Minimize impacts to the natural and human environment.
- Maintain BPA transmission system reliability and performance.
- Meet BPA's statutory and contractual obligations.

1.4 Transmission System Benefits

In addition to meeting the need for the project (see Section 1.2, Need for Action), the project would have several benefits for operation of BPA's transmission system. The proposed new line and substations would help redistribute the flow of power, which would generally increase the capacity of the region's transmission system. Reinforcing the transmission system would also provide the transmission flexibility required to bring more renewable wind power from the east to population centers along the I-5 corridor.

In addition, the project would allow BPA to schedule outages on existing lines, which is necessary to perform critical maintenance. Because the existing system is so heavily used, it is difficult for BPA to schedule these outages to work on equipment. If critical maintenance is deferred, the reliability of the equipment is jeopardized. Reinforcing the transmission system with another line in this area would considerably improve BPA's ability to perform needed maintenance safely and keep the system functioning reliably.

This project would also reduce overall transmission system **line losses** and reduce BPA's reliance on RAS. Although RAS has provided a means to maximize the use of existing transmission facilities, as demands on the system grow, RAS is becoming more complex yet less effective at mitigating system problems. Reducing reliance on RAS by reinforcing the transmission system would help promote greater reliability for this area. All of these additional benefits would make the transmission system more efficient and reliable.

1.5 Agency Roles

1.5.1 Lead and Cooperating Agencies

BPA is the lead agency responsible for preparing this EIS under NEPA. BPA will use the EIS, along with comments from the public, other stakeholders and interested and affected agencies, to inform the following BPA decisions:

- Whether to build a new 500-kV transmission line to meet the need.
- If the decision is to build a transmission line, which route would be constructed to a new substation near Troutdale, Oregon, and which substation site near Castle Rock, Washington would be constructed at the north end of the line.

The Council on Environmental Quality (CEQ) regulations implementing NEPA allow for the designation of other federal, state, and local agencies and Indian Tribes as cooperating agencies for an EIS where appropriate.

The Corps is a cooperating agency in this process. The Corps' role is primarily to implement the requirements of the federal Clean Water Act (33 CFR) and Section 10 of the Rivers and Harbor Act of 1899 (33 U.S. C. 403). This role includes reviewing and making permit decisions on proposals, such as this project, that may require discharge of dredged or fill material into waters of the U.S., and work within navigable waters of the U.S. The Corps assists with identification of appropriate mitigation under these statutes. The Corps will use the EIS to help meet the requirements for the ongoing Clean Water Act Section 404(b)(1) alternatives analysis process. Under the Section 404(b)(1) Guidelines developed by the Environmental Protection Agency, the Corps may only permit discharges of dredged or fill material into waters of the U.S. that represent the least environmentally damaging practicable alternative, so long as the alternative does not have other significant adverse environmental consequences (see Section 27.10, Clean Water Act).

In furtherance of existing cooperative agreements between BPA and the states of Washington and Oregon, the Washington Energy Facility Site Evaluation Council (EFSEC) and the Oregon Department of Energy (ODOE) are participating in preparation of this EIS as cooperating agencies under NEPA. Among other things, these state agencies are assisting BPA in the environmental evaluation of transmission line routes, developing possible mitigation measures, and identifying state interests that should be addressed in the EIS.

Clark and Cowlitz counties are also cooperating agencies in this process. They are providing knowledge, information, and expertise to BPA about their respective jurisdictions.

1.5.2 Other Agencies That May Use this EIS

Chapter 27 of this EIS identifies other federal agencies that may have permitting, review, or other approval responsibilities related to certain aspects of the project. Certain state, regional, and local agencies also may use all or part of this EIS to fulfill their applicable environmental review requirements for any actions they may need to take for the proposed project (see Chapter 27, Consultation, Review, and Permit Requirements; Chapter 28, Consistency with State Substantive Standards; and Appendix A, Washington Department of Natural Resources Lands Analysis).

Before Washington state agencies can take action to authorize use of state-managed lands or issue permits, they must comply with the requirements of the Washington State Environmental Policy Act (SEPA), Chapter 43.21C Revised Code of Washington (RCW). BPA is coordinating with the state of Washington so that environmental issues relevant to the Washington state agencies and their SEPA needs are addressed to the fullest extent practicable in BPA's NEPA process. These agencies will use relevant information from this EIS to help fulfill their SEPA requirements for their actions related to the project.

Oregon does not have a similar SEPA process, but ODOE and other agencies will review the EIS to ensure that their relevant environmental issues are addressed in the EIS.

1.6 Public Involvement and Major Issues

Early in the development of this EIS, BPA solicited comments from the public; Tribes; federal, state, regional, and local agencies; interest groups; and others to help determine what issues should be studied in this EIS. Because these issues help define the scope of the EIS, this process is called "scoping." As the I-5 project has developed, there have been many opportunities for public involvement and participation to continue.

1.6.1 EIS Scoping Outreach

During the scoping period for the EIS, BPA used several ways to request comments.

BPA published a Notice of Intent to prepare an EIS for the project in the Federal Register in October 2009 (74 Federal Register 52482, October 13, 2009). The scoping period was originally scheduled to close November 23, 2009. On November 18, 2009, in response to requests for more time to submit comments, BPA extended the comment period to December 14, 2009.

BPA notified more than 9,500 landowners within a 500-foot (either side of existing BPA rights-of-way) to 1-mile buffer or study area (greater in some areas) under consideration by BPA engineers for siting a new transmission line, substations, and access roads. BPA also notified other interested individuals, Tribes, elected officials, organizations, and agencies. The notification packet included a letter announcing the project and scoping period, a project fact sheet, project map, comment form, and return envelope. A separate letter and Permission to Enter Property (PEP) form was sent to landowners with property within the notification buffers described above. BPA also posted information, including interactive maps, on the project website: http://www.bpa.gov/go/i5. The website also had an electronic comment form allowing the public to submit comments online.

BPA sent a press release to local media, and placed paid ads in the following newspapers about the scoping period and public scoping meetings:

- Battle Ground Reflector – October 13 and October 18, 2009
- Camas-Washougal Post-Record – October 13 and October 21, 2009
- The Columbian – October 14, October 18 and October 26, 2009
- Gresham Outlook – October 14 and October 28, 2009

- Longview Daily News – October 13 and October 18, 2009
- The Oregonian – October 14 and October 28, 2009

BPA invited comments through a variety of methods, including online, through a dedicated voice messaging system, comment forms mailed or faxed, and written and verbal comments collected at the public scoping meetings. BPA posted all comments it received on the project website.

1.6.2 Public Scoping Meetings

BPA held a series of six open house-style public scoping meetings at six different locations (see Table 1-1).

Table 1-1 Public Scoping Meetings

Meeting Date	Meeting Location	Meeting Attendance[1]
October 27, 2009	Amboy, WA	547
October 28, 2009	Vancouver, WA – Clark College	465
October 29, 2009	Longview, WA	614
November 3, 2009	Camas, WA	480
November 5, 2009	Gresham, OR	47
November 7, 2009	Vancouver, WA – Hazel Dell	344

Note:
1. This column reflects the number of people who signed the meeting sign-in form. Some members of the public declined to sign the form.

Each meeting featured eight stations with topic-specific project information and BPA staff available to answer questions. Maps were available to help landowners locate their property in relation to the notification buffers and multiple transmission line route segments that BPA had identified as part of the buffers. BPA staff recorded verbal public comments in their notes and also on flip charts positioned at each station. A comment station also provided members of the public an opportunity to complete a comment form.

1.6.3 EIS Scoping Comment Summary

Over 2,500 people attended the public scoping meetings. Each meeting was summarized, and meeting summaries were posted to the project website the next work day after each meeting. People expressed opinions about a wide range of issues for BPA to consider, including the following:

- Project purpose and need
- Project decision-making process
- Public involvement
- Regulatory obligations, coordination, and documentation
- Draft EIS approach and content
- Transmission tower, substation, and line design and transmission rights-of-way

- Undergrounding lines
- Transmission technology
- Transmission line and access road construction
- Access road siting and rights-of-way
- Nuisance, safety, and maintenance issues
- Project monitoring and mitigation
- Route segments and alternatives
- Threatened, endangered, and sensitive plant and animal species, and wildlife and wildlife habitat
- Socioeconomics, including cost to landowners, eminent domain and compensation, and environmental justice
- Quality of life issues
- Health and safety including noise and **electric and magnetic field** (EMF) effects
- Aesthetics
- Cumulative impacts
- Existing and planned land uses
- Transportation
- Recreation
- Mining
- Surface and ground water resources, wetlands, and floodplains
- Native and non-native vegetation
- Air quality and climate
- Cultural and historic resources
- Geology and soils

This is a partial list of issues identified from the comments received. All comments received were logged in and forwarded to resource specialists to consider when preparing their environmental impact analyses for the EIS, and to engineers to consider as they continued working on the preliminary project design.

Over 3,000 communications and over 7,000 individual comments were received during the scoping period. A summary of the comments received during the scoping period is available on the project website: http://www.bpa.gov/corporate/i-5-eis/documents/I-5_ScopingSummary.pdf.

BPA continued to take comments on the project after the scoping period ended and will take comments throughout the environmental process. Additional summaries of comments received after the scoping period ended are available on the project website.

1.6.4 Post-Scoping BPA Public Meetings

In August and September, 2010, BPA hosted additional public meetings to present updated project information (see Table 1-2):

Table 1-2 Post-Scoping Public Meetings

Meeting Date	Meeting Location	Meeting Attendance[1]
August 30, 2010	Castle Rock, WA	225
August 31, 2010	Vancouver, WA – Skyview High School	110
September 8, 2010	Amboy, WA	275
September 12, 2010	Camas, WA	130

Note:
1. This column reflects the number of people who signed the meeting sign-in form. Some members of the public declined to sign the form.

BPA sent a press release to local media, and placed paid ads in the following newspapers about the meetings:

- Battle Ground Reflector – August 25, September 1, and September 8, 2010
- Camas-Washougal Post-Record – August 24, August 31, and September 7, 2010
- The Columbian – August 22, August 29, and September 5, 2010
- Longview Daily News – August 22, August 29, and September 5, 2010
- The Oregonian – August 22 and September 5, 2010

BPA also provided project updates and additional opportunities for public input at the following listening sessions:

- On November 3, 2010, BPA hosted a meeting for property owners along a small portion of Segment F where additional field work and modifications to the proposed design caused the notification buffer to be expanded in this area. Expansion of the notification buffer involved 29 new land parcels. Twenty-three people attended this meeting.
- On December 8, 2011, BPA presented a brief project update and took public comment at the Battle Ground Community Center. About 300 people attended this meeting. Thirty-seven people provided verbal comment.

1.6.5 Post Scoping Outreach and Public Comments

In addition to BPA's public meetings, BPA staff attended meetings organized by elected officials, neighborhood groups, community organizations, and others. BPA staff also held meetings with federal, state and local agencies; representatives of Tribes with interests in the area; and other interested parties and individuals. From the scoping period until the release of the draft EIS, BPA continued to update the project website with new information and interactive maps; mailed out frequent project updates and posted them on the website; attended local service club, civic group and neighborhood meetings as requested (or as resources allowed); provided information at local farmers' markets, fairs, community events, and local libraries; and continued to collect comments (see inset box). All BPA's post-scoping public outreach materials for the proposed project are available on the project website: http://www.bpa.gov/corporate/i-5eis/documents/cfm.

Comments received from the close of the scoping period to the release of the draft EIS are contained in supplemental comment reports posted on the project website. The issues included in these comments are similar to those received during scoping (see Section 1.6.3, EIS Scoping Comment Summary). These comments were also used by BPA staff in their engineering and environmental work.

1.7 Issues Outside the Scope of the I-5 Project or this EIS

Most issues raised during the scoping process are considered to be within the scope of the project and are addressed in this EIS. However, a few issues are considered to be either beyond the scope of this EIS or are outside the scope of the project. Issues outside the scope of this EIS are not addressed further in this EIS. Issues outside the scope of the project are not considered in the evaluation of the project itself, but may be further addressed in other EIS chapters (e.g., Chapter 26, Cumulative Impacts).

1.7.1 Regional Generation Development

Some comments received during scoping asked that BPA undertake a programmatic review of all energy generation projects, including new and proposed wind development that may occur throughout the region related to any increased capacity on BPA's transmission system. Generation projects are not proposed, constructed, or operated by BPA. Instead they are proposed and undertaken by private entities and their siting and development is controlled by state or local jurisdictions and other regulating entities. BPA's role is typically limited to deciding whether to interconnect these proposed projects, in compliance with its OATT, after an evaluation of the environmental effects of the proposed interconnection is done under NEPA. As a result, BPA does not have a region-wide program or plan related to wind or other generation projects, and does not dictate or direct where these projects are proposed.

Furthermore, decisions by BPA on whether to interconnect a particular proposed generation project to its transmission system are made independently of a decision on whether to construct the project. More specifically, a decision to interconnect any generation project is not dependent on construction of this transmission line. This transmission line is being proposed to respond to increasing load growth, requests for transmission service from a variety of existing and proposed generation sources, as well as from entities seeking to move their electrical power from one point to another. These requests are already in BPA's queue for transmission service. A decision to proceed with the I-5 project would not be dependent on decisions related to interconnection of any new or proposed generation development projects in the region.

Therefore, new and proposed generation development projects are not considered to be within the scope of the project analyzed in this EIS. However, to the extent that the potential environmental impacts of any reasonably foreseeable new or proposed generation projects in the vicinity of the I-5 project are cumulatively added to the potential environmental impacts of the project, these impacts are discussed and considered in the cumulative analysis in this EIS (see Chapter 26, Cumulative Impacts).

Additional Public Participation Opportunities

Direct mail, email and phone contacts

The I-5 project is one of the largest public involvement efforts BPA has undertaken. Since announcing the project in 2009, BPA has mailed, emailed, met, and spoken with thousands of interested stakeholders. Our mailing list includes more than 11,000 addresses and more than 2,400 email addresses. The project team has sent 11 mailings (available on the project website: www.bpa.gov/goto/i5), and hosted 12 public meetings attended by more than 4,000 people (see Sections 1.6.2, Public Scoping Meetings, and 1.6.4, Post-Scoping BPA Public Meetings).

Local media

Regular local media outlets, such as newspapers and TV stations, have helped us share news and inform the region about project developments and key issues. On several occasions, BPA contacted the media to share elements of the environmental review and other project developments. A BPA representative also was interviewed by staff of the website Couv.com and answered questions about the project and its environmental review. Couv.com is a local website that focuses on issues affecting Vancouver and Clark County, Washington.

Developing newsletters

Using the feedback we received from a survey at our August 2010 public meetings, we learned that most people wanted to receive project information through print and email updates. Project staff then developed a newsletter to provide updates and address key questions and concerns raised by community members and leaders. Between October 2010 and June 2012, BPA mailed seven newsletters that provided new project information and schedule updates; results of exploring suggested changes to the project; and contact information for questions, comments or summaries of public meetings and comments.

Public comment helped shape this Draft EIS

The agency has responded to public comments about this project. We heard many suggestions about alternatives for BPA to consider; these are discussed in Chapter 4 (see Section 4.7, Alternatives Considered but Eliminated from Detailed Study). Comments also shaped our evaluation of the project's potential affect on communities in general, and in specific geographic areas. Because people requested more detail and a web-based mapping tool, we created an interactive map, available on our website for the public to use to see how the project would affect their communities. This and other materials available on the website helped address questions from thousands of property owners and interested citizens.

Additional offers to meet

Given the level of interest in the project, BPA extended several offers, through meetings and mailings, to attend group meetings to discuss the project and answer as many questions as possible. Staff attended meetings with local community groups, rotary clubs, cities, counties, neighborhoods and citizen groups. Clark & Cowlitz County Farm Forestry Association hosted a meeting in September 2010 to discuss how BPA would address access and security issues along newly constructed roads, how BPA would value timber lands, and how future crops would be factored into the value calculation. BPA staff attended to answer questions and listen. In November 2010, Clark and Cowlitz county commissioners hosted a public meeting to hear why BPA is no longer considering options to Pearl Substation in Oregon. BPA Administrator Steve Wright attended and answered a wide range of questions.

Citizen group formation and engagement

Several citizen groups formed since BPA announced the project. BPA began attending meetings organized by groups as early as November 2009. These groups created and maintained their own websites and outreach lists, held meetings and rallies, and purchased or posted hundreds of signs throughout Clark and Cowlitz counties (including billboard space) to share their views. Members or their boards had opportunities to speak with BPA transmission executives and the BPA Administrator about their concerns and ideas. BPA attended and spoke at more than 14 meetings, rallies or community events hosted or organized by citizens. The largest was held at Prairie High School in Battle Ground (between 800 and 1,000 participants). We also attended meetings at other schools, libraries and fire stations.

We will continue our public involvement efforts throughout the life of the project.

1.7.2 Regional Transmission Development

Some comments received during scoping asked that BPA undertake a programmatic review of all of its proposed transmission infrastructure projects in the region. Transmission infrastructure projects are proposed by BPA on a project-specific basis when needed to address various transmission reliability and service issues on portions of BPA's transmission system. Increases in capacity that may occur on BPA's existing transmission system from proposed BPA improvements would be in response to existing requests for transmission service, rather than designed to provide significant additional, unsubscribed capacity. While there may be synergies among the various proposed BPA transmission infrastructure projects in the region, no project is wholly dependent on any other project for its viability or success. Other proposed BPA transmission infrastructure projects in the region are therefore outside of the scope of the I-5 project. Nonetheless, any reasonably foreseeable transmission infrastructure projects with cumulatively additive environmental impacts to the I-5 project are discussed and considered in the cumulative analysis in this EIS (see Chapter 26, Cumulative Impacts).

1.8 Organization of this EIS

The remainder of this EIS is organized as follows:

- Chapter 2 describes how BPA system planners, engineers and other specialists developed potential routes for the transmission line and sites for the new substations. It includes a summary of the route segments that make up the action alternatives.
- Chapter 3 describes the transmission components that make up the project, and construction and maintenance requirements. It also includes mitigation measures that are included as part of the project.
- Chapter 4 describes the action alternatives, the No Action Alternative, and alternatives eliminated from detailed consideration.
- Chapters 5 through25 describe, for each resource, the existing environment that could be affected by the project, environmental consequences of the action alternatives and the No Action Alternative, and mitigation measures that could be used to minimize impacts to resources.
- Chapter 26 discusses cumulative impacts.
- Chapter 27 discusses the permits and other approvals that must be obtained to implement the project.
- Chapter 28 discusses the project's consistency with state substantive standards.
- Chapters 29 through 32 list the references used, individuals who helped prepare the EIS, the individuals, agencies, and organizations notified of the availability of this EIS, and a glossary.
- Chapter 33 contains the document index.
- Supporting technical information is provided in appendices or referenced on the project website: http://www.bpa.gov/go/i5.

Chapter 2 Facility Siting, Route Segments, and Action Alternatives

This chapter describes how BPA system planners, engineers, and other specialists propose locations for new transmission facilities, such as the proposed I-5 Project. It describes the general factors that BPA considers in siting potential new facilities. It then discusses how potential transmission line route segments and substation sites for the project were developed and refined over time. It also explains how these route segments were combined into the action alternatives for this project.

2.1 Facility Siting

Transmission Facility Siting → **Developing Route Segments and Substation Sites** → **Creating Alternatives from Route Segments**

BPA is proposing to build a 500-kV lattice-steel tower transmission line that would run about 70 miles from a new 500-kV substation near Castle Rock, Washington to a new 500-kV substation near Troutdale, Oregon. A transmission project of this size requires many components (see Table 2-1). These components are discussed in detail in Chapter 3, Project Components and Construction, Operation, and Maintenance Activities.

Table 2-1 Project Components

Components	Description
Transmission towers	Single-, double- or triple-circuit towers depending on location; 60 to 280 feet tall depending on voltage and location.
Right-of-way easements	Generally 150 feet wide depending on location.
Wires (lines; conductors)	Conductors to transmit power, ground wire for lightning protection, fiber optic cable for communications.
Access roads	New or improved roads depending on location, and existing roads for access to each tower for construction and maintenance.
Vegetation clearing	Vegetation cleared from the right-of-way, access roads, and substation sites and danger trees outside the right-of-way.
Staging areas	Material and vehicle storage for construction.
Pulling and tensioning sites	Areas to string wire and tighten wires after they are placed on the towers.
Removal of existing structures/towers and lines and rebuilding some towers	Removal of existing transmission structures/towers and lines in some locations to provide room for the new line. Some towers would be removed and rebuilt as double- or triple-circuit towers with the new line and the existing line strung on the new towers.
Substations	A new 500-kV substation at each end of the transmission line. About 25-50 acres would be required for each substation and stormwater retention pond design depending on location.

BPA considers many factors when siting proposed new transmission lines. Once the need for a new line in a particular area or region is identified, BPA's transmission system planning engineers begin developing potential routes for a proposed new line. They determine the size or voltage needed and the beginning and end points for the transmission line based on the needs of the electrical transmission system. Design engineers then determine the type of towers and the amount of right-of-way necessary for safety clearances for the size of line. In general, a 500-kV transmission line has a 150-foot-wide right-of-way. Each tower location must also be accessible for construction and for maintenance, so road access is generally required.

With the technical requirements outlined, including the desired beginning and end points of the line, siting engineers use available information to consider how a new line and substations might be placed effectively to provide for cost-effective construction and reliable operation. The siting engineers also consider potential impacts to people; plants and animals; land use; farms and other businesses; and important local, cultural, and regional features. They look for ways to site new transmission facilities to avoid or minimize these potential impacts to the extent practicable. Some factors considered in this initial transmission facility siting effort include the following:

- Electrical feasibility: New electrical facilities must be compatible with the operation of the existing transmission system. In some areas where there are existing lines, new transmission lines may not be allowed immediately adjacent to these existing lines (see bullet below on line separation). The line length between substations may be limited due to effects the length can have on electrical performance and power distribution across the system. Substations are strategically placed to provide efficient, flexible operation of the system and enhance the flow of power. For this project, the proposed substation sites are in locations that would provide the maximum system performance together with a new transmission line.
- Existing transmission corridors and roads: Engineers determine if BPA or other utilities have any existing corridors with vacant rights-of-way or whether a new line could parallel another existing or proposed line, facility, or road. Building in an established corridor tends to have different impacts to visual resources, land use, wildlife habitats, and people than creating a new corridor. Existing access roads may be able to be used, though they often need to be improved. Building next to an existing line may be less expensive where there is extra right-of-way to accommodate a new line, with little or no need to purchase new easements, but as discussed below, there may be line separation issues. Some maintenance, such as vegetation clearing, could be less expensive when two lines are next to each other, rather than being in different areas.
- Line separation: While use of existing transmission corridors has its advantages, there are situations in which BPA cannot build next to existing lines for reliability reasons. If utilities want to build a transmission line next to an existing line, they are required by WECC and NERC reliability criteria (see Section 1.1.3, Planning for Transmission Additions in the I-5 Corridor) to consider the consequences of an outage that could affect both lines. Utilities consider the following events, among others, that could cause a simultaneous outage of lines:
    - An aircraft flying into both lines
    - Fire in the right-of-way producing smoke, which can cause a flashover between lines

- Sequential lightning strikes
- A tower or conductor failing and falling into an adjacent line
- A landslide taking out towers on more than one line in a corridor
- A localized high wind or heavy ice event

The consequences of an outage are greater with the simultaneous loss of two critical lines in an area. These outages could be beyond what the system can withstand and greatly increase the chances for a blackout of the system. To reduce the chances of a blackout from outages of multiple critical lines in an area, BPA limits capacity to reduce the degree to which a part of the system is relied upon (see Section 1.1.2.2, Reliability and Non-Wires Measures).

If BPA determines that the likelihood and consequence of an outage would not meet WECC and NERC reliability criteria, special design considerations are required. A new line would be required to be separated by at least one span length (about 1,200 feet) from the adjacent line.

For this project, BPA studied placing the proposed line next to an existing high-voltage 230-kV transmission line. Though WECC reliability criteria require BPA to plan for the simultaneous loss of a new 500-kV line and the existing line, BPA determined that the impacts of such an outage could be mitigated by using RAS (see Section 1.1.2.2, Reliability and Non-Wires Measures), and that placing a new line next to the existing 230-kV transmission line could be considered for the project.

- Houses, other structures, and sensitive cultural resources: Homes, schools, businesses, historic structures and sensitive cultural resource areas are generally avoided during line routing. Because structures (houses, buildings, sheds) are not allowed within the right-of-way for safety reasons, BPA looks to avoid structures while selecting a right-of-way so they need not be removed.
- Existing land uses: In addition to existing houses and structures, land use is an important consideration. Siting engineers try to find compatible land uses, while trying to minimize impacts to residential land, parks and preserves, and any special districts or areas of local or regional interest. Gravel pits are avoided, because pit operators often extract material up to the tower legs, leaving them exposed, unstable, and without maintenance access to the tower. BPA also prefers to avoid airstrips if possible; tries to follow fence lines; and spans agricultural fields, orchards, or vineyards where practical.
- Terrain: BPA looks for gentle terrain if available. Transmission towers and access roads placed on steep slopes are harder to construct and maintain, and may be more susceptible to failures due to erosion or landslides.
- Visual impacts: The size of transmission towers and the potential need to clear trees and develop new roads can increase the visibility of a new line. BPA considers avoiding locations such as homes and roads, river crossings, and parks and other recreation areas, from which people would likely view a new line and substations.
- Sensitive habitats: Engineers consider potential impacts to plants and animals and try to avoid wetlands, nesting sites, threatened and endangered species' habitats, and other sensitive areas wherever practical.
- Costs: BPA tries to develop the most cost-effective alternatives. Shorter transmission line routes usually decrease overall project costs. Straight transmission lines are less costly than lines that turn because when lines turn, stronger, heavier, and more

expensive towers are needed. Level routes are less costly than routes across steep terrain because less grading is required. Included in project costs are the purchase of land for substations and possibly substation access roads, and transmission line and access road easements. Easements across agricultural or forest lands are usually less expensive than easements across residential land.

2.2 Developing Route Segments and Substation Sites

Transmission Facility Siting → **Developing Route Segments and Substation Sites** → **Creating Alternatives from Route Segments**

After the general location of a proposed new transmission line is identified, BPA's siting engineers begin the process of more specifically identifying potential sites for the necessary substations at either end of the proposed transmission line, and developing potential routes for the transmission line between these substation sites. The siting engineers use a variety of information sources to further refine the route segments and potential substation sites. They consider the identified transmission system needs and numerous siting factors discussed in Section 2.1, Facility Siting. They take into account the location of existing generating facilities, transmission lines, and substations in the area (see inset box and Figure 2-1). They consult maps and conduct field checks of potential routes and substation sites.

For this project, BPA first identified potential route segments and substation locations in the early 2000s, when the potential need for the I-5 project was initially identified. However, because rising gas prices caused proposed generation plants to be put on hold (delaying expected congestion) and BPA took actions to avoid building new lines in this area (see Sections 1.1.2.2, Reliability and Non-Wires Measures, and 1.1.3, Planning for Transmission System Additions in the I-5 Corridor), BPA was able to put the proposal to build the I-5 project on hold at that time, and work ceased on developing route segments and potential substation sites.

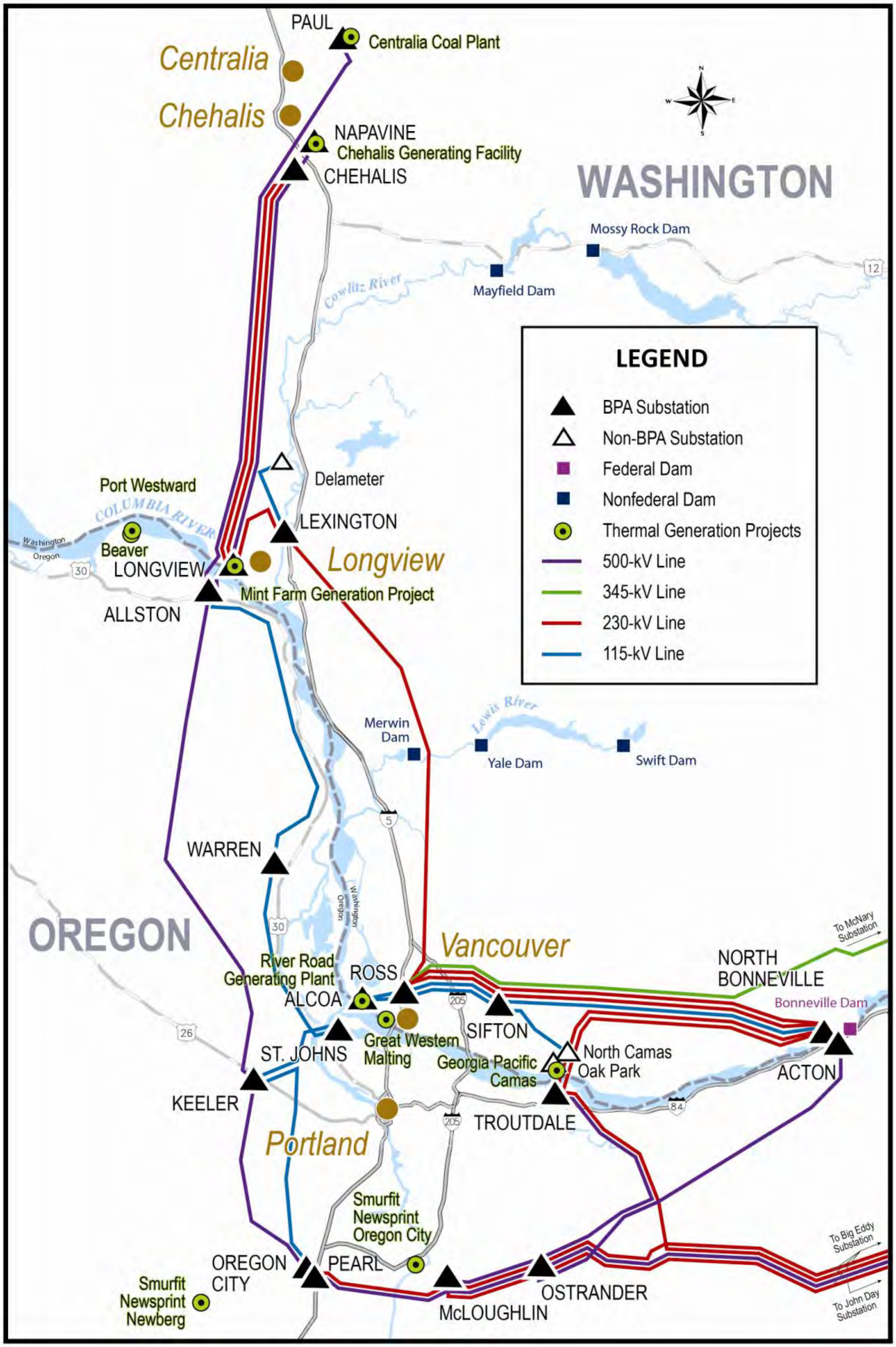
When the need for the project began to re-emerge in the late 2000s, BPA's siting engineers reinitiated work to further develop route segments and potential substation sites. The siting engineers identified an area near existing transmission lines in the vicinity of Castle Rock, Washington for one of the new substations, and a site near BPA's Troutdale Substation in Troutdale, Oregon for the other new substation (see Map 2-1). BPA then began to look at potential routes for a new transmission line between these two endpoints. In theory, there are an almost unlimited number of potential routes between the Castle Rock area and the Troutdale area. Using the information sources discussed above, however, BPA's siting engineers identified a variety of potentially feasible transmission line route segments between the two endpoints. These segments can be combined in many ways that provide a reasonable range of alternate routes to get from one endpoint to the other (see Section 2.3, Creating Alternatives from Route Segments).

BPA and Non-BPA Transmission Lines and Substations in the Project Area

There are many existing transmission lines and substations in the project area (see Map 1-2). Figure 2-1 is a schematic of general line and substation locations. Not all lines listed below are shown on the figure; conversely, not all substations or lines shown on the figure are listed below. In general, lines are named by where they begin and end at substations. For example, the Lexington-Delameter line begins at Lexington Substation and ends at Delameter Substation. Lines and substations are owned by BPA unless noted by an *.

- Lexington-Delameter No. 1 115-kV single-circuit line (BPA leases to Cowlitz PUD)
- Longview-Chehalis No. 1 230-kV single-circuit line
- Lexington-Longview No. 2 230-kV single-circuit line
- Napavine-Allston No. 1 500-kV single-circuit line
- Longview-Chehalis No. 3 230-kV single-circuit line
- Paul-Allston No. 2 500-kV single-circuit line
- Ross-Lexington No. 1 230-kV single-circuit line
- Sifton-Ross No. 1/Bonneville-PH1-Alcoa No. 2 115-kV double-circuit line
- McNary-Ross No. 1 345-kV single-circuit line
- North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 115-kV double-circuit line
- North Bonneville-Ross No. 1/North Bonneville-Ross No. 2 230-kV double-circuit line
- North Bonneville-Ross No. 1 230-kV single-circuit line
- North Bonneville-Ross No. 2 230-kV single-circuit line
- North Bonneville-Troutdale No. 1 230-kV single-circuit line
- North Bonneville-Troutdale No. 2 230-kV single-circuit line
- North Camas-Oak Park 115-kV single-circuit line
- Cowlitz-County PUD Lexington-Corduroy 115-kV single-circuit line
- Georgia Pacific James River East 115-kV single-circuit line*
- Georgia Pacific James River West 115-kV single-circuit line*
- PacifiCorp 230-kV double-circuit line*
- PacifiCorp 115-kV single-circuit line*
- Troutdale Substation
- Paul Substation
- Lexington Substation
- Allston Substation
- Ross Substation

Figure 2-1 Schematic Location of Existing Transmission Lines and Substations



When BPA formally proposed to build the I-5 project in 2009, BPA used the refined route segments and substation locations it had developed to identify landowners and other interested parties, to aid in determining land use and other initial resource information, and to allow the public, Tribes, agencies, and others to comment on the initial proposal (see Section 1.6, Public Involvement and Major Issues). As BPA moves through the planning, preliminary design, and environmental process for this project, these route segments and substation locations are being further refined and adjusted as new information is obtained. The following sections describe changes to the location and number of route segments and substation sites since the project was first proposed. (See Section 4.7, Alternatives Considered but Eliminated from Detailed Study, for additional suggested route locations and alternatives considered but eliminated from further consideration.)

2.2.1 Transmission Line Route Segments

Between the areas identified near Castle Rock, Washington and in Troutdale, Oregon for new substations, BPA's engineers identified 52 preliminary transmission line route segments that could be combined in various ways to form different potential routes for the transmission line. These route segments varied in length and were composed of existing and new rights-of-way or paralleled existing rights-of-way. The preliminary public notification area for each route segment was from 500 feet to greater than 1 mile wide, depending on the terrain and land use. The actual area needed for the transmission line right-of-way is generally 150 feet wide, and about 25 to 50 acres for each new substation.

After hosting public meetings, reviewing comments received during and after the scoping period, and months of study and extensive field work, BPA refined the route segments that would be considered. Changes made between October 2009 and November 2010 included refining segments, removing some segments and portions of others from consideration, and adding segments farther to the north and east (identified with letters) (see Map 2-1). New substation sites near Castle Rock were also developed (see Section 2.2.2, Substation Sites), and segments were developed to extend the transmission line to those sites. (See Section 4.7, Alternatives Considered but Eliminated from Detailed Study, for a description of the segments removed.) After a series of refinements, BPA identified 60 route segments to be analyzed in the EIS (see Map 2-2).

2.2.2 Substation Sites

As discussed earlier in this section, the northern end of the transmission line would connect to a proposed new substation near Castle Rock, Washington. BPA initially considered one general area for a new substation at this location. After public comment, extensive field work, and preliminary substation design work, BPA expanded its substation site alternatives and is now considering three sites for a new substation near Castle Rock: Monahan Creek, Baxter Road, and Casey Road (see Map 2-2). The Monahan Creek site would use an open area at the intersection of existing BPA lines. The Baxter Road and Casey Road sites are alternate sites considered because of their relative remoteness and proximity to BPA lines.

The southern end of the transmission line would connect to a proposed new substation near BPA's existing Troutdale Substation in Troutdale, Oregon. Since this site is located along Sundial Road, it is referred to as the Sundial substation site.

Chapter 4, Proposed Action and Alternatives, describes the work specific to each substation site that would be required to construct a substation at each location.

2.3 Creating Alternatives from Route Segments

Transmission Facility Siting → **Developing Route Segments and Substation Sites** → **Creating Alternatives from Route Segments**

After the refined route segments and potential substation sites were developed, BPA worked to create a range of action alternatives using these project components. In creating these alternatives, BPA continued to consider the many environmental, technical, social and economic siting factors used in developing the route segments (see Section 2.1, Facility Siting). BPA also considered comments received from the public during the various public outreach activities conducted for the project (see Section 1.6, Public Involvement and Major Issues).

BPA has identified four action alternatives for detailed evaluation in this EIS: the West Alternative, the Central Alternative, the East Alternative, and the Crossover Alternative (see Maps 2-3 through 2-6). For each action alternative, three options have also been identified that involve use of slightly different route segments (i.e., where some line segments are replaced with different ones), different substation sites, or a combination of both. Through these action alternatives and options, BPA was able to ensure that each of the 60 identified route segments, and each of the three Castle Rock area substation sites, was used in at least one of the alternatives considered in this EIS. In addition, some of the route segments and substation sites are included in more than one action alternative.

In creating action alternatives, BPA sought to develop a range of alternatives with different considerations. Accordingly, the West Alternative would be located in more urban and developed areas and would use mostly existing right-of-way. The Central and East alternatives would be located in more rural and undeveloped areas on mostly new right-of-way and would be located in generally distinct geographic areas north to south and west to east. The Crossover Alternative would use a combination of existing and new right-of-way.

Each action alternative includes a new substation near Castle Rock, a 500-kV transmission line between 67 and 80 miles long, and the new Sundial Substation near Troutdale, Oregon. All action alternatives cross the Columbia River in the same location. All include fiber optic cable on the towers to provide a communication link between the substations, and equipment changes inside control houses at various BPA substations. The following provides an overview of route segments and substation sites used in each of the four action alternatives and their options. Chapter 4, Proposed Action and Alternatives, describes the alternatives in more detail.

2.3.1 West Alternative and Options

2.3.1.1 West Alternative

The West Alternative begins at the Monahan Creek substation site, then extends south on route segments 2, 4, 9, 25, 36B, 41, 45, 50, and 52 and connects to the Sundial substation site (see Map 2-3 and Table 2-2). The West Alternative is about 67.5 miles long.

Table 2-2 West Alternative and Options

Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
West Alternative	Monahan Creek, 2, 4, 9, 25, 36B, 41, 45, 50, 52, Sundial		
West Option 1		36B, 41, 45	36, 40, 46
West Option 2		36B, 41, 45, 50	36, 36A, 37, 38, 43, 48, 51
West Option 3		36B, 41, 45, 50	36, 36A, 37, 38, 39, T, 49, 51

2.3.1.2 West Option 1

West Option 1 includes route segments 36, 40, and 46 instead of segments 36B, 41, and 45 (see Map 2-3 and Table 2-2). West Option 1 is about 3.4 miles long and replaces segments 3.3 miles long, so it is 0.1 mile longer.

2.3.1.3 West Option 2

West Option 2 includes route segments 36, 36A, 37, 38, 43, 48, and 51 instead of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). West Option 2 is about 9 miles long and replaces segments that are 7.4 miles long, so it is about 1.6 miles longer.

2.3.1.4 West Option 3

West Option 3 includes route segments 36, 36A, 37, 38, 39, T, 49, and 51 instead of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). West Option 3 is about 13 miles long and replaces segments 7.4 miles long, so it is about 5.6 miles longer.

2.3.2 Central Alternative and Options

2.3.2.1 Central Alternative

The Central Alternative begins at the Baxter Road substation site, then extends south on route segments B, F, G, H, 10, 12, 15, 23, L, 18, 28, V, P, 35, T, 49, 51, and 52 and connects to the Sundial substation site (see Map 2-4 and Table 2-3). The Central Alternative is about 77.3 miles long.

Table 2-3 Central Alternative and Options

Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
Central Alternative	Baxter Road, B, F, G, H, 10, 12, 15, 23, L, 18, 28, V, P, 35, T, 49, 51, 52, Sundial		
Central Option 1		Baxter Road	Casey Road, A
Central Option 2		Baxter Road, B, F, G	Monahan Creek, 1, 4, 5, 8, 11
Central Option 3		L, 18, 28, V	M, 26, 30

2.3.2.2 Central Option 1

The Central Option 1 route begins at the Casey Road substation site instead of the Baxter Road substation site and includes route Segment A (see Map 2-4 and Table 2-3). Central Option 1 is about 2.5 miles long and does not replace any other segments.

2.3.2.3 Central Option 2

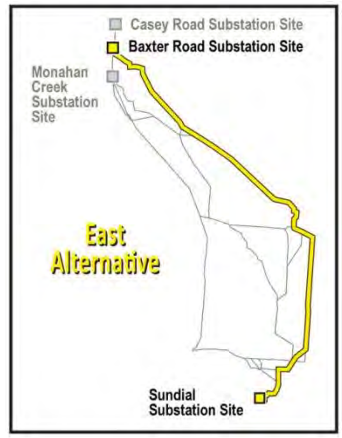
Central Option 2 begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes route segments 1, 4, 5, 8, and 11 instead of segments B, F, and G (see Map 2-4 and Table 2-3). Central Option 2 is about 15.7 miles long and replaces segments that are 18 miles long, so it is about 2.3 miles shorter.

2.3.2.4 Central Option 3

Central Option 3 includes route segments M, 26, and 30 instead of segments L, 18, 28, and V (see Map 2-4 and Table 2-3). Central Option 3 is about 15 miles long and replaces segments that are about 21 miles long, so it is about 6 miles shorter.

2.3.3 East Alternative and Options

2.3.3.1 East Alternative



The East Alternative begins at the Baxter Road substation site, then extends south on route segments B, F, I, K, W, O, Q, S, 49, 51, and 52 and connects to the Sundial substation site (see Map 2-5 and Table 2-4). The East Alternative is about 75.5 miles long.

Table 2-4 East Alternative and Options

Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
East Alternative	Baxter Road, B, F, I, K, W, O, Q, S, 49, 51, 52, Sundial		
East Option 1		Baxter Road, B, F, I	Monahan Creek, 3, 7, 11, J
East Option 2		O, Q, S	U, V, P, 35, T
East Option 3		Q	R

2.3.3.2 East Option 1

The East Option 1 route begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes route segments 3, 7, 11, and J instead of segments B, F, and I (see Map 2-5 and Table 2-4). East Option 1 is about 17.6 miles long and replaces segments that are 19.4 miles long, so it is about 1.8 miles shorter.

2.3.3.3 East Option 2

East Option 2 includes route segments U, V, P, 35, and T instead of segments O, Q, and S (see Map 2-5 and Table 2-4). East Option 2 is about 23.5 miles long and replaces segments that are 22.5 miles long, so it is about 1 mile longer.

2.3.3.4 East Option 3

East Option 3 includes route segment R instead of segment Q (see Map 2-5 and Table 2-4). East Option 3 is about 3.7 miles long and replaces a segment that is 2.6 miles long, so it is about 1.1 miles longer.

2.3.4 Crossover Alternative and Options

2.3.4.1 Crossover Alternative

The Crossover Alternative begins at the Monahan Creek substation site, then extends south on route segments 2, 4, 9, 14, 15, 23, L, 18, N, W, O, Q, S, 49, 51, and 52 and connects to the Sundial substation site (see Map 2-6 and Table 2-5). The Crossover Alternative is about 74 miles long.

Table 2-5 Crossover Alternative and Options

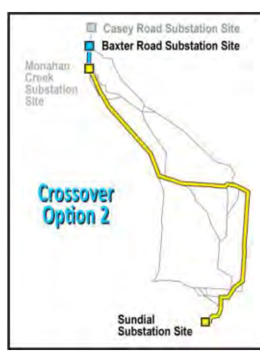
Alternative and Options	Substations and Segments Used to Form Alternative (North to South)	Segments or Substation Site Removed to Form Option	Segments Added to Form Option
Crossover Alternative	Monahan Creek, 2, 4, 9, 14, 15, 23, L, 18, N, W, O, Q, S, 49, 51, 52, Sundial		
Crossover Option 1		51	47, 48, 50
Crossover Option 2		Monahan Creek	Baxter Road, C, E
Crossover Option 3		Monahan Creek	Baxter Road, D, E

2.3.4.2 Crossover Option 1

Crossover Option 1 includes route segments 47, 48, and 50 instead of segment 51 (see Map 2-6 and Table 2-5). Crossover Option 1 is about 7.3 miles long and replaces a segment that is 2.1 miles long, so it is about 5.2 miles longer.

2.3.4.3 Crossover Option 2

Crossover Option 2 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes route segments C and E (see Map 2-6 and Table 2-5). Crossover Option 2 is about 4.3 miles long and does not replace any other segments.



2.3.4.4 Crossover Option 3

Crossover Option 3 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes route segments D and E (see Map 2-6 and Table 2-5). Crossover Option 3 is about 4.2 miles long and does not replace any other segments.

Chapter 3 Project Components and Construction, Operation, and Maintenance Activities

This chapter provides an overview of the components of the proposed project and the typical area of disturbance created by these components. This chapter also discusses project design activities; and construction, operation, and maintenance requirements for the project, including removing and replacing existing transmission lines; and lists mitigation measures included as part of the project (see Table 3-2 at the end of this chapter).

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

3.1 Easements and Land Purchases

Much of the project area is private property, with some federal and state ownership, and municipal lands such as land owned by cities, counties, and the Port of Portland. Construction of the project would require easements (rights for use and access) for transmission line rights-of-way and access roads in some locations, and land purchases for the substations and possibly the substation access roads.

In general, BPA would need a 150-foot-wide right-of-way easement for the new 500-kV transmission line and a 50-foot-wide easement for new access roads, and would purchase 25 to 50 acres for each new substation. In addition, BPA would purchase rights where needed to remove vegetation off the right-of-way that could interfere with the safe operation of the proposed transmission line (see Section 3.11, Vegetation Clearing). The 150 feet required for the transmission line right-of-way is BPA's standard width for 500-kV transmission line rights-of-way, and is intended to ensure that the line is a safe distance from other objects and structures such as trees and buildings. The entire 150-foot-wide right-of-way required for a transmission line could be disturbed by construction and operation of a new line depending on the existing land use, vegetation, roads, and other elements found in the right-of-way area.

The action alternatives require varying amounts of new right-of-way and are described in more detail in Chapter 4, Proposed Action and Alternatives. Each alternative has specific right-of-way requirements and configurations, including existing right-of-way widths available for a new line, and whether and how a new line could be placed next to, or in place of, an existing line. These configurations would affect how much new right-of-way would need to be acquired, and consequently how many acres might be occupied by proposed transmission facilities. For example, some portions of the West Alternative have space available for a new line within existing BPA right-of-way next to existing lines, so no new right-of-way would be needed. In another section of the West Alternative, an existing line could be torn down (removed) and the new line could be built in its place. No new right-of-way would be needed in this case.

There are other possible configurations for the action alternatives. In some areas, only a small amount (such as about 12 feet) of new right-of-way would be needed to fit the new line into existing BPA right-of-way that is now vacant (BPA has an easement, but no line exists). In other areas, one or more existing lines would need to be completely removed, and different towers for these lines and for the new transmission line would be built. In these cases, the existing and new lines could be carried together on **double**- or **triple-circuit towers** instead of the typical **single-circuit tower** (see Section 3.2, Transmission Towers).

In locations where the new transmission line right-of-way (typically 150-feet wide) and access roads would be outside an existing BPA right-of-way, BPA would purchase easements from the underlying landowner. Easements for the transmission line would give BPA the rights to construct, operate, and maintain the line in perpetuity. Although the underlying landowner would still own and use the property, BPA would not permit any uses of the transmission line right-of-way that are unsafe or might interfere with constructing, operating, or maintaining the transmission facilities. These restrictions would be part of the legal rights that BPA would acquire for the transmission line. Easements for transmission line access roads would give BPA legal rights to use the roads to access the line when needed for maintenance and emergencies.

BPA would purchase the land for the proposed substations at each end of the line. BPA would acquire about 25 to 50 acres for each of the proposed substations, with exact acreage depending on the parcel selected and the substation design. BPA would purchase fee (absolute) title to each substation property so that it has full ownership rights for the property. BPA may do the same for the substation access road or it may just purchase an easement with shared rights to the use of the road.

3.2 Transmission Towers

3.2.1 Tower Types

Generally, BPA is proposing to use single- or double-circuit 500-kV lattice-steel towers for the proposed transmission line (see Figure 3-1 and inset box). In some locations, triple-circuit towers are proposed. Typically, the single-circuit 500-kV tower would be between 120 and 150 feet tall, depending on terrain and right-of-way configuration. Double- or triple-circuit towers between 180 and 200 feet tall are proposed where removing and replacing existing lines would make room for the new 500-kV line on existing right-of-way.

Tower Types

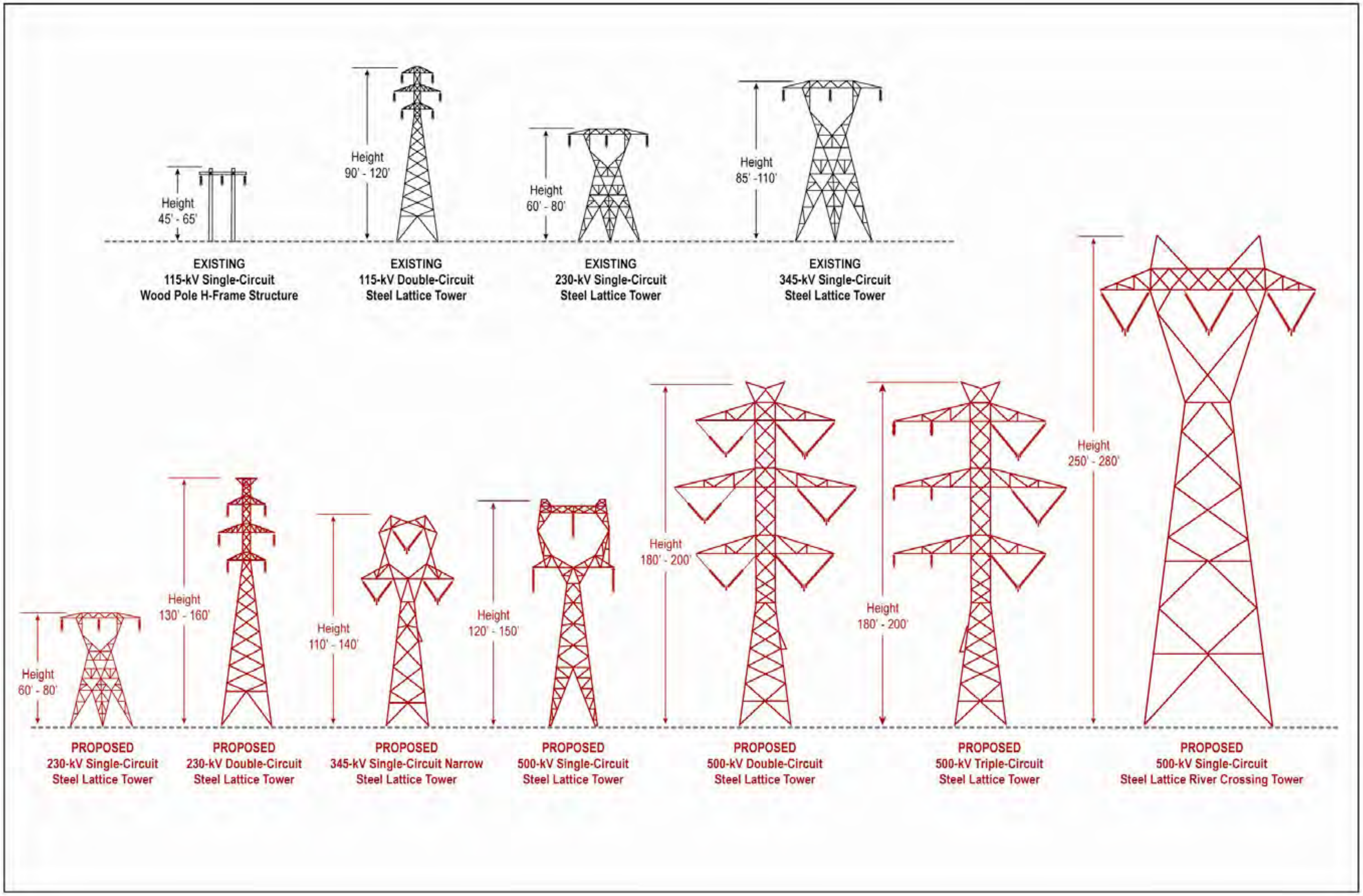
Six types of lattice-steel towers could be constructed for this project (see Figure 3-1):

- single-circuit (SC) 500-kV
- double-circuit (DC) 500-kV
- triple-circuit (TC) 500-kV (would hold one 500-kV line and two 115-kV lines)
- SC 345-kV
- SC 230-kV
- DC 230-kV

Spans between individual towers are typically about 1,150 feet, with about five towers needed for each mile of line. Towers would be made of galvanized steel and may appear shiny for 2 to 4 years before they dull from weathering. About 375 to 390 transmission towers would be needed for the new transmission line. The actual number of towers would depend on the length of the action alternative selected and the actual span length between towers.

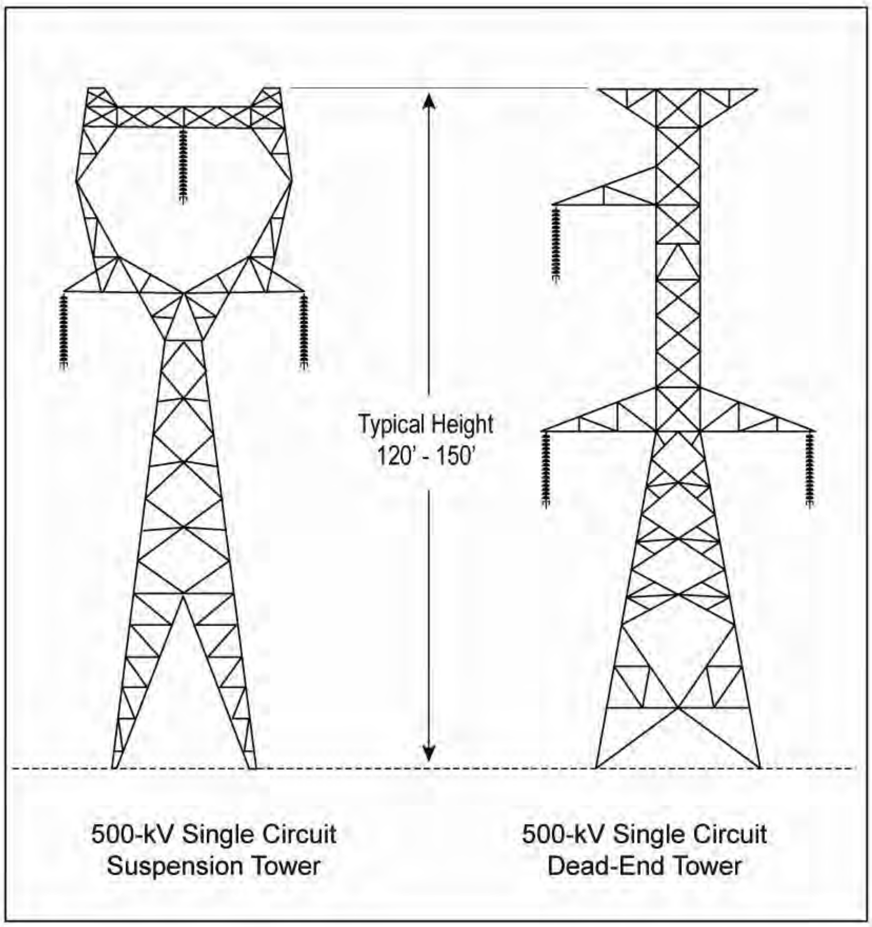
The single-circuit transmission line towers (except for the few river crossing towers) would have a delta configuration where one set of conductors hangs above the other two (see Figure 3-1). Double-circuit towers would have three sets of conductors on either side of the tower. Using the single-circuit delta configuration towers or using double-circuit towers helps reduce electric and magnetic field levels (see Chapter 8, Electric and Magnetic Fields) and uses less right-of-way.

Figure 3-1 Existing and Proposed Structure and Tower Types



Two types of towers would be used for both single- and double-circuit towers: **suspension towers** and **dead-end towers** (see Figure 3-2). Suspension towers would be used to hold the conductors along a straight path. Dead-end towers would be used where the line takes a turn or enters a substation. Dead-end towers are stronger and heavier than suspension towers, and more expensive. Most towers proposed for this project would be suspension towers.

Figure 3-2 500-kV Suspension and Dead-End Towers



Towers at the Columbia River crossing could be up to 280 feet tall (see Figure 3-1). Any towers taller than 200 feet (generally, double-circuit towers and towers used at river crossings) and transmission lines exceeding that height may be considered an obstruction by the Federal Aviation Administration (FAA). Shorter towers and lines can also be considered obstructions depending on their proximity to airport runways. As obstructions, they must be marked according to FAA rules, which may require lighting on each tower and installation of marker balls on the wires that span the space between the tall towers (see Section 3.4, Overhead Ground Wire and Counterpoise and 3.7, Obstruction Lighting and Marking). Specific areas that may require marking are discussed under each alternative (see Chapter 4, Proposed Action and Alternatives).

3.2.2 Tower Footings

Transmission towers would be securely attached to the ground with footings. Footings are assemblies of metal in the ground at each of the four tower corners. Five types of footings could be used to secure the towers: plate, grillage, rock anchor, concrete shaft, and pile footings. Most towers on this project would use either plate or grillage footings.

Plate footings are used for suspension towers. They consist of a 4-foot by 4-foot steel plate buried about 11 feet deep for each tower foot.

Grillage footings are used for dead-end towers. They consist of a 15-foot by 15-foot assembly of steel I-beams that have been welded together and buried 14 to 16 feet deep for each tower foot.

Spread footings with rock anchors are required when suspension towers are built on solid bedrock located less than 2 feet below the surface. Six-inch-diameter holes are drilled into the bedrock about 11 feet deep and steel anchor rods are secured within the hole with concrete.

Concrete shaft footings are used at river crossings or in areas where towers must sustain a higher load and require additional support. Concrete shaft footings can be built on solid bedrock or in soils unfavorable for grillage footings. Concrete shaft footings are engineered columns of concrete reinforced by steel rods about 4 to 10 feet in diameter. Footing depth depends on site-specific engineering requirements.

Micropile footings are used in rare situations where the typically larger excavation for plate and grillage footings is not appropriate. Four to five 4- to 12-inch-diameter holes are augured for each footing so that steel rods can reinforce the base. Those rods are then grouped together and capped with a reinforced concrete pile cap. The tower can then be placed atop the concrete piles.

For plate and grillage footings, a track hoe would be used to excavate an area for the footings. The excavated area would be at least 2 feet larger than the plate or grillage footings to be installed (if the soil is loose or sandy, then a wider hole may be necessary). If the soil and rock removed for plate or grillage footings is suitable, it would be used to backfill the excavated area once the footings are installed. Otherwise, suitable soil would be brought in from another location for backfill.

For spread footings or concrete shaft footings, a drill would be used to make appropriately sized vertical shafts for the footings. Soil and rock removed for rock anchor or concrete shaft footings would either be spread out onto an approved location or removed from the project area. Once foundations are set and cured, each tower would be assembled in multiple sections off-site. The tower sections would be flown in and installed via helicopter or by a large crane.

3.2.3 Tower Disturbance Areas

Typical tower disturbance areas per tower regardless of footing type have been calculated (see Table 3-1). These amounts assume suspension towers are used. Dead-end towers would slightly increase the acreage. The total area could include disturbance from vehicles, construction equipment, crane pads, etc. Compacted soils in most of this disturbance area would be broken up and reseeded after project construction to reestablish close to original conditions. While the area directly below and immediately next to the tower is also reseeded, it is considered unavailable for other uses and therefore a permanently disturbed area and a permanent impact.

Table 3-1 Transmission Tower Estimated Disturbance Areas (Acres)

Tower Type	Type of Disturbance			
	Total Tower Disturbance (Clearance Area) during Construction	Permanent Tower Impact after Construction	Temporary Tower Disturbance during Construction	Extraction Footprint/ Teardown Disturbance
500-kV Single-circuit	0.52	0.08	0.44	0.52
500-kV Triple- or double-circuit	0.69	0.08	0.61	--
345-kV Single-circuit	0.52	0.08	0.44	0.52
230-kV Single-circuit	0.69	0.08	0.61	0.43
230-kV Double-circuit	0.52	0.15	0.37	0.52
115-kV Single-circuit	--	--	--	0.11
115-kV Double-circuit	--	--	--	0.23

Notes:
-- Indicates a tower type that would not be removed or constructed as part of this project.

Along existing right-of-way in the Camas/Vancouver and Lexington areas, some existing wood pole H-frame 115-kV structures, double-circuit 115-kV, single-circuit 354-kV, and single-circuit 230-kV steel towers would be removed and replaced with a new tower configuration to make room for the new line. In most cases, new towers would be constructed on the centerline of the existing line, but not necessarily at the same location as the existing structures or towers, depending on site conditions and land use.

If existing lines are removed, the entire structure or tower footing would only be removed if the footing interfered with placement of the new tower. Otherwise, when the structure or tower is removed, that portion of the footing up to a foot below the surface would be removed (up to 3 feet deep in agricultural areas). The area disturbed when wood pole structures are removed would be about 0.1 acre, and would be about 0.4 acre for lattice-steel towers (see Table 3-1).

3.2.4 Tower Construction in the Columbia River

The Columbia River crossing would include in-water construction activities. Two types of tower footing foundations are proposed: spread footings with rock anchors and micropile-supported footings. For each footing type, construction would likely require a shallow **coffer dam** enclosure to allow **dewatering** of the work zone inside. Work would be conducted from barges stationed near lone Reef (a reef in the middle of the Columbia River at the river crossing where existing towers are located), out of the navigation channel. Barges could be stabilized by gravity weights or rock anchors. All spoils would be collected from within the sealed coffer dam and transferred to a spoils barge.

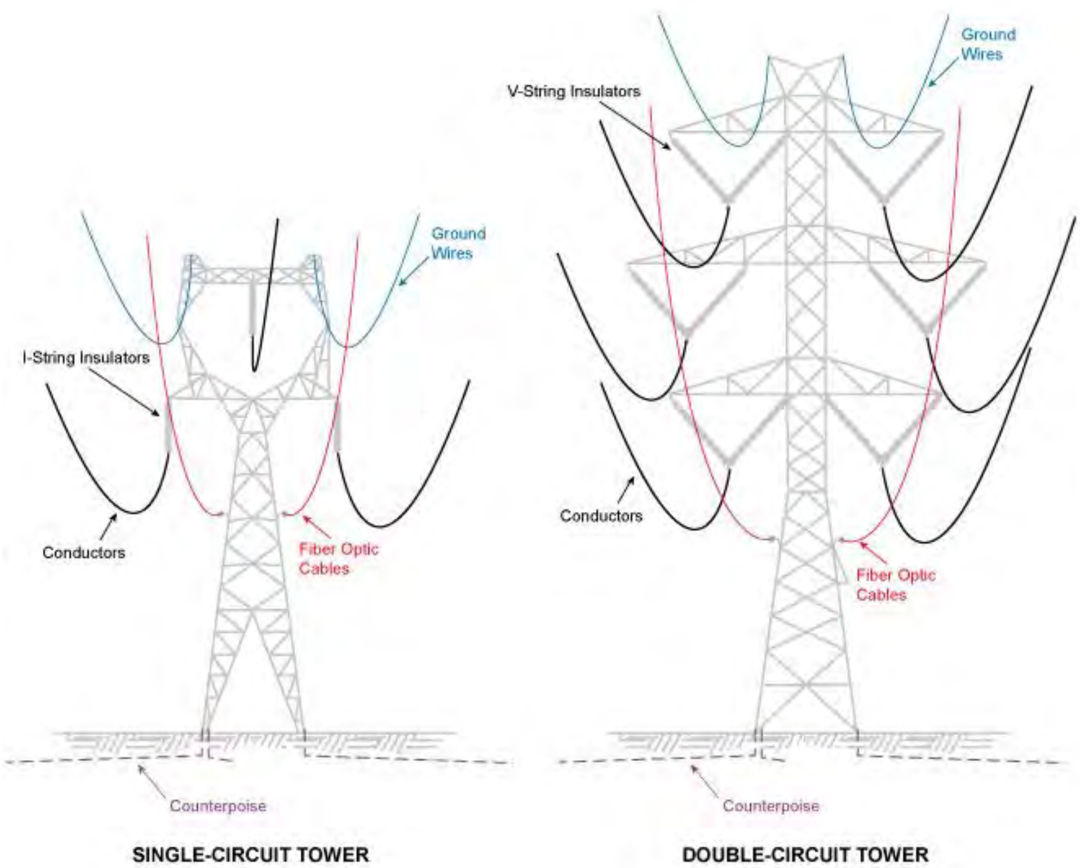
Tower columns would be about 50 feet apart. The cross section would be open to stream flow and round column shapes would allow for large debris passage. Column and framing beam design would accommodate debris impacts (large trees) and impacts from small vessel collisions.

3.3 Conductors

The wires that carry the electrical current on the transmission line are called conductors. The line carries three sets of conductors, called phases. Each phase consists of a bundle of three 1.3-inch-diameter conductors held in a triangular configuration by spacer brackets 16 to 20 inches apart. From a distance, a bundle looks like a single wire.

Conductors are made of steel and are often modified to reduce their reflectivity and brightness. The conductors are attached to the towers using insulators (see Figure 3-3). Insulators are bell-shaped devices that prevent the electricity from jumping from the conductors to the tower and down to the ground. The insulators are made of porcelain or fiberglass and are non-reflective. The conductor would need to be fitted together where one reel of conductor ends and a new reel begins. Conductor fittings would be made using hydraulic compression. Hydraulic compression uses a press that compresses the fittings on the conductor. Nine conductors (three bundles each with three conductors) would need to be fitted once about every 1.5 to 2 miles, depending on the length of conductor on the reel.

Figure 3-3 Conductor, Insulator, Ground Wire and Fiber Optic Cable Positions on a Typical 500-kV Tower



For safety reasons, BPA has established minimum conductor heights above ground and other obstacles that meet or exceed National Electrical Safety Code (NESC) clearance requirements. For the proposed 500-kV line, standard minimum clearance of the conductor above the ground is 29 feet. The clearance requirement over highways is 45.5 feet; other clearances (logging areas, railroads, rivers, trees, etc.) are determined on a case-by-case basis. The line would be designed to meet or exceed these requirements.

3.4 Overhead Ground Wire and Counterpoise

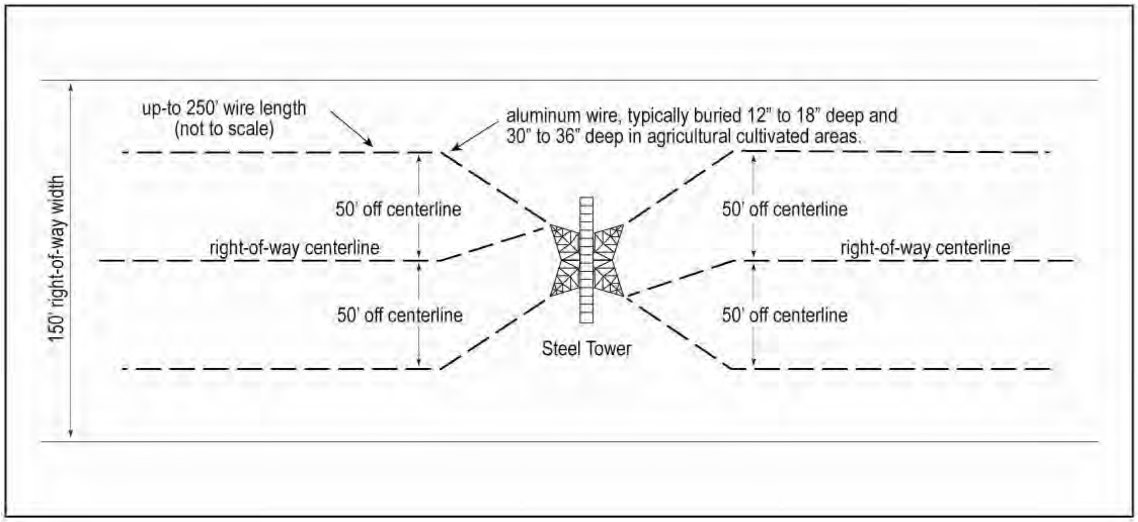
Two small wires (0.5-inch diameter), called overhead **ground wires**, would be attached to and strung between the tops of each transmission tower (see Figure 3-3). Ground wires are used for lightning protection. When lightning strikes, the overhead ground wires take the charge instead of the conductors.

Wires that exceed certain height criteria (such as when spanning rivers or deep ravines) or are within a certain distance of airports are required by the FAA to be marked with marker balls to make them more visible to aircraft in the area. For this project, marker balls would be required on the uppermost ground wires crossing the Columbia River and could be required in other locations where the action alternatives cross deep ravines. The marker balls would be 36 inches in diameter and orange, white, and yellow in varied sequences on the line. They would be placed 400 feet apart on each of the two overhead ground wires, but would be staggered on the two lines about 200 feet apart.

To take the lightning charge from the overhead ground wire and dissipate it into the earth, a series of wires called **counterpoise** would be buried in the ground at the base of the towers. Counterpoise could be needed at most towers, depending on the soil types present. Counterpoise designs vary and are dependent on tower type and site conditions. The most common design would include six runs of wire that extend up to 250 feet from the tower (three counterpoise ahead-on-line and three back-on-line (see Figure 3-4). BPA would use aluminum wire (3/8-inch diameter) typically buried 12 to 18 inches deep, except in cultivated areas where it is buried about 30 inches deep or deeper where farmers use deeper plowing methods. When three counterpoise wires run in the same direction, one counterpoise will run down the centerline of the right-of-way with the other two extending at a 45-degree angle away from the tower, then turning and running along the right-of-way at a distance of 50 feet off centerline. When obstructions or environmentally sensitive areas are encountered, the counterpoise can be redesigned to avoid these areas.

During construction, the counterpoise can be installed in several ways. Installers could use backhoes, trenchers, vibrating plows, or occasionally hand dig trenches depending on the depth, soils, terrain and size of buried rock. With a backhoe, the trench would be 12 or more inches wide. Removed soil and rocks would be piled to the side and placed back in the trench to cover the counterpoise. A trencher would open up a 4- to 6-inch wide trench and lift up the soil to the side, which would be pushed back into the trench after the counterpoise is installed. Large tractors use a vibrating plow to force a blade into the ground. The counterpoise would then run through a hole in the blade and trail out behind the blade at a specified depth. In areas where a tower would be built on solid rock, the counterpoise would be placed in crevices where possible; otherwise counterpoise would not be used.

Figure 3-4 Typical Counterpoise Placement



3.5 Communications and Control Equipment

Fiber optic cable would also be strung on the steel towers (see Figure 3-3) from the new Castle Rock area substation to the existing Troutdale Substation, and from the existing Troutdale Substation to the nearby new Sundial Substation. The cable would be used as part of a communication system that can gather information about the system (such as whether the line is in service, the amount of power being carried, meter readings at interchange points, and status of equipment and alarms). The fiber optic cable allows voice communications between power dispatchers and line maintenance crews and provides instantaneous commands that control power system operation.

The fiber cable would be less than 1 inch in diameter and would be mounted under the conductors. Every 3 to 5 miles there would be a splice box/reeling location that allows tension to be placed on the fiber optic cable. The splice box would be about 22 inches by 8.5 inches by 6 inches and would be installed in a vault in the ground between the tower legs, mounted on the towers, or placed on the ground next to the tower and covered with rock. Vault boxes would be about 4 feet by 4 feet by 4 feet. There would also be fiber vaults outside the fences at the substations and possibly fiber optic wood poles near these vaults to help transition the fiber cable from overhead to underground inside the substations. Once inside the substation, the fiber cable would be underground in conduit and trenches to the substation control house. Changes would be made to equipment inside existing substation control houses to accommodate the new cable.

Between towers that cross the Columbia River, fiber optic cable would be installed above the conductors because the typical placement of the cable below the conductor for safety during maintenance does not meet minimum clearances for ship navigation. The fiber optic cable would also act as the overhead ground wire and is reinforced to be strong enough for the long span required to cross the river.

3.6 Pulling and Tensioning Sites

Pulling and tensioning sites are those areas from which the conductor and fiber optic cable are pulled and tightened to the correct tension once they are mounted on the transmission towers. Conductor is packaged and transported on reels that can hold up to 9,500 feet of conductor. Depending on the size of the reel, pulling and tensioning sites (or reel sites or conductor tensioning sites) can be from 1.75 to 3.5 miles apart. These sites are also dependent on the topography and typically disturb about 0.7 acre each (about 300 feet long by 100 feet wide). A flat area is needed at each pulling site for the large flatbed trailer with the reels of conductor and tensioning machine. Pulling sites are generally placed within the right-of-way; however, where the line takes a turn (at angle points), sites are often outside of the right-of-way. The appropriate areas are determined by the construction contractor using environmental and land use information provided by BPA. Depending on conditions, the site could be graded, graveled with crushed rock, reseeded, or a combination of these activities. Additional environmental review would be conducted for these areas when they are identified, if necessary.

When stringing conductor, a **sock line** (thick rope) is placed in the travelers (small wheels hung from the towers) by hand or by helicopter from tensioning site to pulling site (one pull). The end of the sock line is then attached to a hard line (wire thinner than conductor but stronger than sock line) and pulled back to the end of the pull where the conductor is sitting in a reel. The hard line is connected to a “gator” plate that holds the three wires in each bundle (a phase). Each gator and triple bundle is pulled through the travelers to the other end of the pull and before the conductor is pulled to its final tension, it is often “snubbed.”

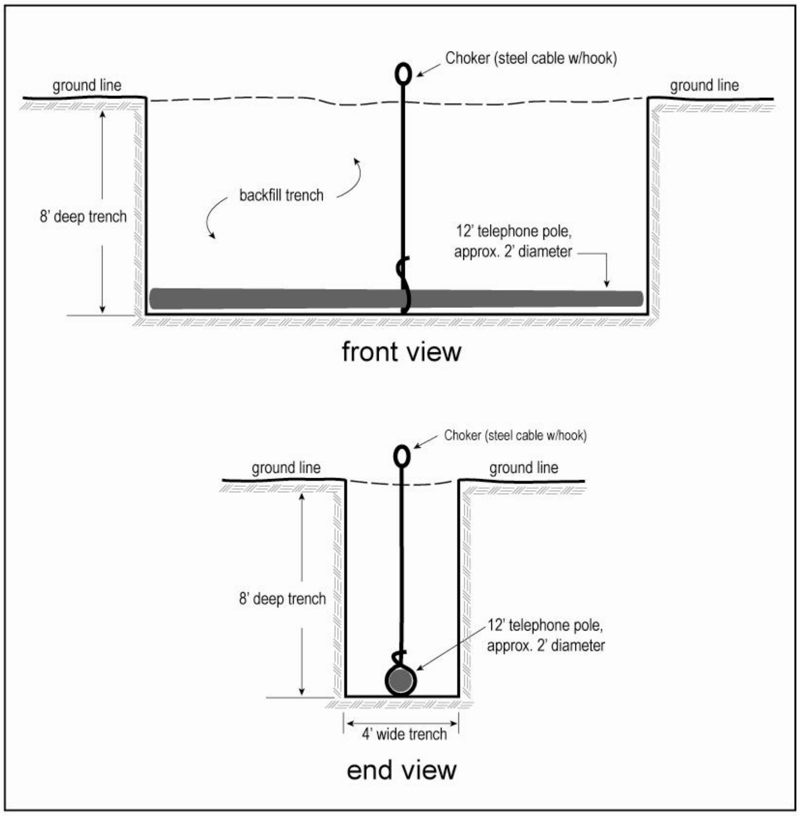
Snubs are trenches about 8 feet deep by 4 feet wide by 12 feet long used to tie off the conductor after it is pulled through the towers and before it is strung under tension (see Figure 3-5). These trenches are excavated and then backfilled to weigh down the snub so line tension can be maintained without breaking. In some instances, a concrete slurry mix is added to the top 2 feet of the trench to add density to hold the tension. After the snubs are used, the choker (a steel cable with a hook) is snipped below the surface and the wood pole is left behind. In some instances, such as in agricultural fields, the pole is reclaimed and the trench is backfilled.

In areas where conductor is strung over existing roads, highways, railroads, or water, guard structures are installed as a safety precaution. Guard structures are similar to 115-kV H-frame wood structures and are usually installed within the right-of-way on either side of the road, highway, etc. during construction and then removed once the conductor stringing is complete. The temporary disturbance area is about 0.11 acre. Additional environmental review would be conducted for these areas when they are identified and if they need to be positioned outside of the proposed right-of-way.

Conductors are not put under designed tension until all conductors are hung. When all conductors have been installed (hung) on the line and one end of the conductor has been connected to a tower (usually a dead-end tower), the conductor is pulled by equipment (usually a bulldozer or tractor) on the other end of the conductor (up to 3 or more miles away depending on the location of the next dead-end tower or the end of the conductor, whichever is closest) to the correct amount of tension (conductor sag). The correct conductor sag ensures proper ground clearance, and that supporting towers are not overloaded under ice and wind.

Jumpers are then installed. Jumpers are wires that connect conductors on one side of a dead-end tower to conductors on the other side of the same tower. Putting tension on the fiber optic cable would occur at the same pulling sites used for the conductor and would require smaller equipment to pull the cable (no "snubs" required) because the fiber optic cable has a smaller diameter and is lighter than the conductor.

Figure 3-5 Typical Snub Placement



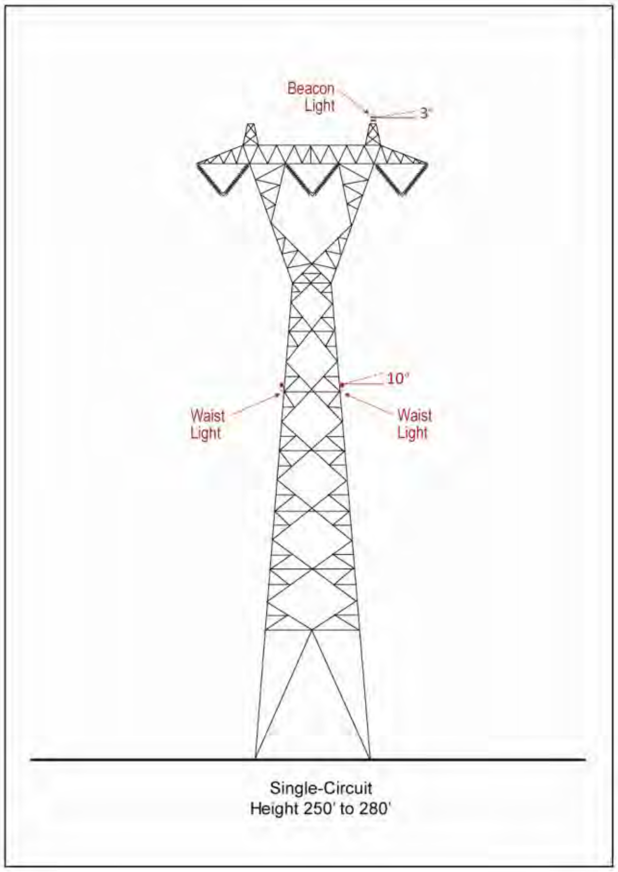
3.7 Obstruction Lighting and Marking

The FAA requires transmission structures, such as steel towers, that exceed certain criteria to have lighting and/or marking. These criteria are usually based on (but not limited to) the structure's height, proximity to an airport, river crossing, or a combination of these factors depending on the situation. The lighting and marking of structures and the conductors between them serve as a visual aid to help pilots avoid accidents. In the past few years, BPA has carried out a lighting program that uses the latest technology for structure lights to meet FAA's requirements, while minimizing visual impacts to landowners and others on the ground.

The most common lighting scheme BPA uses is a dual color (white/red) "medium- intensity" beacon on top of the structure and two red "low-intensity" waist lights mid-structure (see Figure 3-6). The top beacon flashes white during daylight hours and red when daylight diminishes to a level defined by the FAA. When the light turns red the intensity is reduced, but the light remains visible to pilots.

The beacon is designed to emit light straight out horizontally from the structure and upwards at a 3 degree angle. This means that most of the light emitted is visible from only above the towers. The low-intensity waist lights do not operate during daylight hours. At night they burn red steadily and at a lower intensity than the top beacon. The low-intensity lights are also designed to emit light straight out horizontally, and upwards at a 10 degree angle. Similarly, they are not typically seen except when level with the lights or from above the tower.

Figure 3-6 Example of Beacon and Waist Lighting for a Typical 500-kV Tower[1]



[1] Single-circuit 500-kV towers used to cross the Columbia River may be different (see Figure 3-1).

An alternative lighting solution sometimes required by the FAA is known as a "Catenary" scheme. This configuration has a dual color (white/red) medium-intensity beacon at the top, middle, and bottom levels. This eliminates the low-intensity lighting at the middle level. This lighting scheme is usually installed on two structures forming a crossing of some type (i.e., river or canyon) alerting pilots of an obstruction between the two structures.

Occasionally, the FAA requires marking spheres (balls) be installed on the conductors between two structures. These are often required in addition to structure lighting. The FAA has approved 36-inch spheres in three colors (orange, white and yellow), specifically patterned based on the length of the crossing, with a certain spacing between each one. The spheres emit no light and serve strictly as a daytime warning.

3.8 Substations

Substations are vital hubs for transmission lines. Among other things, they can connect different transmission lines together, allow switching between lines and isolate lines when necessary. The substations proposed for this project would not be traditional substations, that is, they would not have transformers. Instead they would operate as switching stations and would have equipment for controlling power flow only.

About 25 to 50 acres would be required for each substation, depending on the site and design used. Each substation area would include the substation yard (equipment within the fence) and grading outside of the fence. Construction crews would first clear and grade the substation site.

Conduits, drainage pipes, and the grounding system would be trenched or dug several feet into the ground. Footings for the equipment and the foundation for the control house would be dug up to 8 feet into the ground (substation dead-end tower footings would be deeper). All equipment would then be placed in appropriate positions. A chain-link fence would be installed around the substation. About 6 inches of rock would be laid, with a 10-foot gravel buffer extending outside the substation fence.

The 500-kV equipment that would be installed at the substations includes the following:

- Power circuit breakers: A breaker is a switching device that can automatically interrupt power flow on a transmission line at the time of a fault, such as a lightning strike, tree limb falling on the line, or other unusual events. The breakers would be installed at the substation to redirect power as needed. Several types of breakers have been used in BPA substations over the years. The breakers planned for this project, called gas breakers, are insulated by special non-conducting gas (sulfur hexafluoride). These breakers would contain no oil, but would contain a small amount of hydraulic fluid. Power circuit breakers are about 24-feet tall and about 22-feet long.
- Generator and coupling capacitor voltage transformers (CCVT): A CCVT is used to step down high voltage signals to low voltage signals for the purpose of measurement or to operate a protective relay. A **protective relay** is a safety measure designed to calculate operating conditions on an electrical circuit and to trip circuit breakers when a fault is detected.
- Shunt reactor: A shunt reactor is an electromagnetic device used to absorb reactive power (**capacitance**) and to lower system voltage. Shunt reactors need oil containment. If required, a shunt reactor would be constructed at the Sundial substation site to maximize the electrical performance of the transmission system.
- Series capacitor bank: A capacitor is a device that stores electrical energy and releases it back into the power system when required. Transmission lines, like any other wire, have an inherent property called **impedance**, which causes some resistance to the flow of power. Series capacitor banks compensate for some of this impedance, reducing power losses and allowing the line to carry more power. A series capacitor bank would be used at Sundial Substation.
- Surge arrestors: A surge arrestor is an electrical device used to protect equipment from lightning.
- Buswork: Buswork is a series of flat strips of copper or hollow tubes of aluminum that conduct large currents of electricity and allow heat to dissipate more efficiently over short distances. They are not insulated.

- Switches: These devices are used to mechanically disconnect or isolate equipment. Switches are normally located on both sides of circuit breakers. Switches are about 23 feet tall and about 16 feet long.
- Substation dead-end towers: These are the towers within the substation where incoming or outgoing transmission lines end. Substation dead-ends are typically the tallest structure within the substation.
- Substation rock surfacing: A 6-inch layer of rock (extending about 10 beyond the fence line), selected for its insulating properties, is placed on the ground within the substation to protect operation and maintenance personnel from electric shock during substation electrical failures.
- Control house: The substation control house contains electrical panels, meters, relays, and other equipment needed to control the transmission line operation.
- Ground mat: A system of interconnected bare conductors arranged in a pattern or grid, normally buried below the surface of the substation, primarily to provide safety for workers by limiting voltage differences within its perimeter to safe levels. Also called a ground grid.
- Stormwater retention system: Stormwater management involves measures to prevent sediment and other pollutants from entering surface or groundwater, treatment of runoff to reduce pollutants, and flow controls to reduce the impact of altered hydrology. All Castle Rock substations would include a stormwater detention pond (a pond is not needed at Sundial Substation).
- Substation electrical service: Substations need local electrical service to power the lights, fans, and equipment in the substation. That service is provided by the local utility via a wood pole electric line similar to lines that provide service to local area homes and businesses.
- Back-up generator: The back-up generator has a 2,500-gallon diesel tank and would be used if the local substation electrical service fails.

3.9 Access Roads

Access roads are the system of roads that BPA's construction and maintenance crews would use to get to the towers or tower sites along the transmission line route and to substations. BPA has a policy and standards for access road design and construction. Engineers design the roads to be used by cranes, excavators, supply trucks, boom trucks, log trucks, and line trucks. Roads are built within the transmission line right-of-way as much as possible if terrain and land use allow. The road system used to access the transmission towers and substations would be a mix of public, private, and BPA access roads across public and private land. BPA typically purchases 50-foot-wide easements for new roads and access roads in areas off the right-of-way. Access roads typically require a 14-foot-wide travel surface (wider on curves). Typically, easements for existing private roads (such as driveways, farm roads, and timber roads) are about 20 feet.

Access roads to substations are wider and are built for a heavier weight load than those for the transmission line. Substation access roads would be graveled and would require a 30-foot-wide travel surface, with about a 75-foot-wide total area disturbed. A 75-foot-wide substation access road would typically be purchased in fee. In some cases, though, only an easement would be purchased for the road that would allow construction and maintenance activities (similar to roads that access towers).

A new transmission line would also require some improvements of existing roads and construction of new roads (including spurs to individual tower sites), with the following requirements:

- Road improvements: Roads would be graded, and rock would be placed where the soil is unstable. Vegetation removal could be required if roads have become overgrown or need to be widened. Improved roads typically require up to a 20-foot-wide disturbance area (including drainage ditches). Dirt roads often become slippery and impassible when wet. Depending on the season, roads would be graveled where needed for load bearing, stability, and dust abatement.
- New roads: New roads typically include up to a 30-foot-wide disturbance area (including travel surface and drainage ditches). New road sites are cleared and graded. Maximum road grades vary depending on the erosion potential of the soil: 6 to 8 percent on erodible soils, 10 to 15 percent for erosion-resistant soils, and steeper grades for access to towers where the road would have no joint use. When wet, the soil on most dirt roads in the project area becomes slippery and can become impassable; these roads would be graveled to make them passable. Where new roads cross year-round, seasonal, or fish-bearing streams, open bottomed culverts or bridges would be needed. **Drain dips** or **water bars** may also be needed on steep slopes or where access roads cross drainages that carry seasonal runoff. New stream and drainage crossings would be avoided where possible.

In coordination with landowners, BPA installs gates across entrances to access roads to prevent public access to private lands and the transmission line right-of-way. Gates in the project area are also used to separate animals or denote property lines. Swing gates would be installed or would replace barbed-wire or broken gates. Gate locks would be coordinated with the landowners to ensure that both BPA and the landowner could unlock the gates.

If towers are placed in agricultural fields, BPA would typically only build temporary access to the tower site to construct the line. Once construction is complete, the road would be removed and compacted soil would be broken up for continued agricultural use. If the tower needed to be accessed later for maintenance or emergency situations, and BPA affects crops, BPA would pay the landowner, as appropriate, for any crop damage resulting from BPA activities.

During construction, additional other private local roads or public roads and highways would be used to move materials, equipment and workers to the construction area. If these roads could accommodate construction vehicles and materials, these roads would not need to be improved. As mentioned previously, BPA would obtain rights to use private roads.

3.10 Staging Areas

Several temporary staging areas would be needed along or near the transmission line for construction crews to store materials and construction vehicles, and to assemble tower segments for helicopter erection. Staging areas can be from 5 to 15 acres depending on the amount of materials and number of locations needed. The contractors hired to construct the transmission line would be responsible for determining appropriate staging area locations.

Often the contractor rents empty parking lots or already developed sites for use as staging areas, which may be located within and outside of the right-of-way. Environmental review of staging areas would be conducted prior to approval for use.

3.11 Vegetation Clearing

BPA would develop contract specifications to guide the construction contractor hired for vegetation clearing. The specifications would identify the area within and next to the right-of-way and access roads where existing vegetation would need to be removed and specific types and locations of vegetation that could be left.

As a general rule, all tall-growing vegetation would be removed from the 150-foot right-of-way at the time of construction. All low-growing vegetation over 4 feet would typically be removed depending on the vegetation and specific construction, operation, or mitigation requirements. All vegetation in construction areas for substations and for access roads, pulling sites, and staging areas outside of the right-of-way would be disturbed or removed. At the tower sites, all brush below 4 feet and stumps more than 22 inches in diameter would be removed. This removal includes root systems from a typically 50-foot by 50-foot area.

Any tree (stable or unstable) outside of the acquired transmission line right-of-way deemed a present or future hazard to the transmission line is considered a **danger tree** and is removed prior to construction of the line. A tree would be identified as a danger tree if it could fall into, bend into, or grow into the conductor or be close enough to the conductor as it swings to cause a flashover of current from the conductor.

The greatest potential for the removal of danger trees for this project would be in cases where the line crosses forest lands with stands of trees over 20 years old. In these locations, danger trees could be taken from as far away as 200 feet from the edge of the right-of-way depending on the topography and condition of the trees. Tall-growing trees may be left or topped where the right-of-way crosses drainages or stream crossings if there is adequate safety clearance (considering a number of years of growth) between the trees and the transmission line. Fewer danger trees are cleared where the line crosses recent clearcuts or forests less than 20 years old, although scattered large trees or snags that may be hazards to the transmission line could be removed. Typically, about 80 percent of the trees that need to be removed are found within 20 feet of the edge of the right of-way.

When an existing stand of trees next to the right-of-way is found to be so highly compromised that it is unstable as a whole, all trees from outside the right-of-way from the last tree tall enough to hit a conductor to the edge of the right-of-way would be removed. This strip of removed trees outside the edge of the right-of-way is called a **safety backline**. Creating a safety backline ensures that no trees will fall into the line in the future and provides reliability for the line. A safety backline is used only when necessary. Unlike trees in the right-of-way, trees removed for a safety backline are allowed to grow back unless they are later determined to be a danger to the transmission line.

Because of this project's location west of the Cascades, existing trees would need to be cleared along new and existing rights-of-way, new and improved access roads, staging areas, pulling sites, and substations. Vegetation has been allowed to grow on vacant areas of existing right-of-way as long as it has not created hazardous conditions for existing lines.

For safe and uninterrupted operation of a transmission line, vegetation within a right-of-way is not allowed to grow above a certain height. If vegetation grows or falls close to a transmission line it can cause an electrical arc, which can start a fire, cause an outage of the line, and or injure or kill someone. Management of right-of-way vegetation varies depending on many factors, including line voltage; vegetation species, height, and growth rates; ground slope and topography; conductor elevation above ground and conductor swing; clearance distance required between the conductors and other objects; and electrical loading on the line.

Vegetation is not allowed to grow in substation electric yards or in the 10-foot buffer around the yard because it could interfere with the operation of the ground mat. A ground mat is a metal grid buried under the soil to "ground" the electrical equipment of the substation. A plant growing up through the ground mat could provide another grounding path for electricity. If a person were to touch the plant when there is a fault (like a short circuit) on the system in the substation he or she could be electrocuted.

3.12 Mitigation Measures

Mitigation measures are actions that can be taken to minimize or avoid potential impacts to the human and natural environment from a proposed project. A table of all mitigation measures that BPA has included as part of the project is at the end of this chapter (see Table 3-2 at the end of this chapter). Mitigation measures in this table are categorized by resource; some are repeated under more than one resource. All mitigation measures included as part of the project would be implemented prior to, during, or immediately after construction.

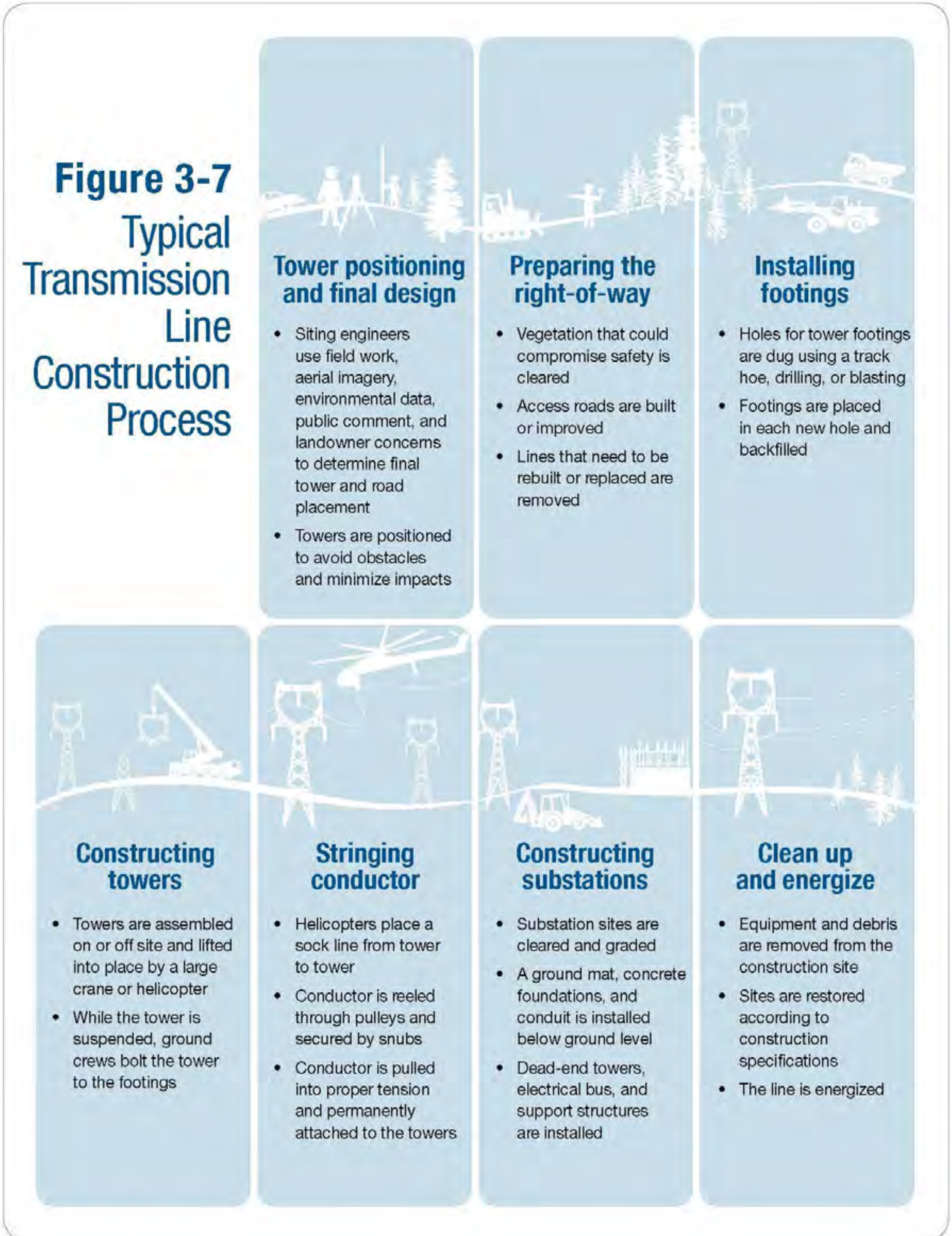
In addition to mitigation measures included as part of the project, other mitigation measures, including compensatory mitigation, have or will be identified through preparation of this EIS. These additional mitigation measures could also be implemented to reduce, eliminate, or offset potential adverse impacts of the project. These additional mitigation measures, if known at this time, are identified in the EIS resource chapter to which they apply (see Chapters 5 through 22).

If BPA decides to build the I-5 project, a Mitigation Action Plan (MAP) would be prepared for the project at the time of that decision and before implementing the project. The MAP would explain how mitigation measures identified for the project will be planned and implemented. Monitoring during and after construction would help ensure implementation and success of the mitigation measures.

3.13 Final Project Design and Construction Process

After completion of environmental review under NEPA, if a decision is made to construct the project, final design of the transmission line, including the precise location of towers, would be completed (see Figure 3-7). To determine exact tower locations along a transmission line right-of-way, BPA typically uses field information from siting engineers and collects terrain data using Light Detection and Ranging (LiDAR) data, a remote sensing technology employing eye-safe laser pulses originating from a helicopter or airplane. BPA augments these sources as necessary with other terrain data collection methods such as photogrammetry and survey crews working on the ground. High-resolution aerial imagery is also collected to aid in tower siting.

Figure 3-7 Typical Transmission Line Construction Process



Towers are positioned using the terrain data and aerial imagery to provide adequate conductor clearances above ground and avoid obstacles while generally minimizing the frequency, height, and impact of the towers. This same data is also used to locate access roads. Engineers also use environmental information and discussions with landowners to help determine tower and access road locations.

Construction begins with preparation of the right-of-way. Vegetation would be cleared as described in Section 3.11, Vegetation Clearing, and access to the right-of-way would be established or improved where necessary. If the proposed new line would be constructed by rebuilding an existing line, any existing wood pole structure or steel tower transmission line that needs to be replaced would be taken out of service and existing conductor and structures or towers removed. Existing poles would be cut off at ground level and removed. Guy anchors and counterpoise would be cut 1 foot below ground and removed. In instances where a new tower is placed in the same location as the old structure, the construction contractor would remove as much old pole, guy anchor and counterpoise as is necessary and the area then would be further excavated for the new tower footings.

Holes for tower footings would be dug with a track hoe (drilling or blasting may also occur if rock is present) and footings would be put in place at each tower site. Towers would be either assembled at the tower site and lifted into place by a large crane (30- to 100-ton capacity) or assembled at a staging area off site and set in place by a large skycrane helicopter. The towers or tower segments would then be bolted to the footings.

The conductor would then be strung from tower to tower through pulleys on the towers using a sock line (see Section 3.6, Pulling and Tensioning Sites). The sock line is placed in the pulleys and pulled through by a helicopter much smaller than the skycrane. The fiber optic cable would also be strung using a helicopter, with pulling sites on the ground to tighten the cable.

When one reel of conductor ends and a new one begins, the conductor has to be fitted together. Hydraulic compression is used to compress the fittings on the conductor. Three conductors would need to be fitted about once every 1.5 to 2 miles.

After the towers, conductors, and fiber optic cable are installed, the construction contractor would remove construction equipment and debris and restore the disturbed areas. Soils used for agriculture in the temporary disturbance area that become compacted would be restored and reseeded after project construction to reestablish close to original conditions.

At the substation site, several construction activities would occur. The site would be excavated to bring the topography to grade. Once a layer of soil material is laid down, the concrete foundations for all the high voltage equipment and structures would be installed. The stormwater retention system and ground mat and conduit for control cables would also be installed.

After all the below grade substation work is completed, the above grade construction work would begin with the erection of the dead-end towers and aluminum pedestals to support the electrical bus. Then, other support structures would be installed for the high voltage equipment. The high voltage equipment would be bolted on the support structures and connected to the electrical bus by seismic flexible jumpers. Control cables would be attached to the high voltage equipment and routed to the control house.

3.14 Construction Schedule and Work Crews

The timeframe needed for construction of the project is about 30 months. Under the current schedule, if a decision is made to proceed with the project after completion of the NEPA process, construction could begin as early as 2014. Line construction generally would occur after road construction. Construction work would be staged with one type of activity taking place in one area (such as road construction) and another activity taking place in another area where roads exist (such as vegetation removal and tower construction). A typical crew can usually construct about 10 miles of transmission line in 4 months. In areas where terrain is steep, progress may be slower. Construction of roads and tower pads (if required) usually takes about 3 to 5 months including close-out repairs of any roads damaged during construction. The remainder of the construction period would include substation work including connecting the new line and other existing lines into the substations, and tower site restoration work.

Helicopters could be used for clearing and would be used intermittently for 6 to 7 months during removal of existing lines and construction of new lines. A small helicopter would be used to remove wood poles in inaccessible areas and for stringing the sock line.

The transmission line and substations would be constructed by two or more construction contractors. A typical transmission line construction crew and equipment for a 500-kV line would include the following:

- 50 to 60 construction workers (70-100 at the peak of construction; actual workforce numbers would vary over time)
- 45 vehicles (pickups, vans, trucks)
- 3 bucket trucks
- 1 conductor reel machine
- 3 large excavators (bulldozers, backhoes)
- 1 line **tensioner**, 1 puller, 1 reel trailer
- 2 helicopters (small helicopter and skycrane; size dependent on lifting required)
- 1 to 2 large (210-ton) and mid-sized (50-ton) cranes
- Road construction equipment (dump trucks, rollers, graders, dozers, excavators, water truck)

A typical substation construction crew and equipment for a 500-kV line would include the following:

- 20 to 30 construction workers (40-50 at the peak of construction)
- 5 vehicles (pickups, vans, trucks)
- 2 bucket trucks
- 3 scrapers
- 2 large excavators (bulldozers, backhoes)
- 2 water trucks
- 1 mid-sized (50-ton) crane

A crew can typically construct a 500-kV substation in 13 to 24 months in three phases. The first phase would include site leveling and bringing in appropriate ground materials such as soil and rock, then completing work below ground (ground mat, footing, drainage and foundations). The second phase would complete outdoor work (set structures and equipment, install bus between equipment, build control house, and run cable to control house). The third phase would complete indoor work (install electronic controls, install telecommunications system, and perform testing on all substation equipment).

3.15 Maintenance

During the life of the project, BPA would perform routine, periodic maintenance and emergency repairs to the transmission line. For lattice-steel towers, maintenance usually involves replacing insulators.

BPA typically conducts routine inspection patrols of its transmission lines throughout the Pacific Northwest by helicopter. BPA has conducted these types of inspection patrols by helicopter since 1950. Patrols are essential to determine where line maintenance is needed and ensure the continued reliability of the transmission system. Helicopter teams look for damaged insulators, damaged support members, washed-out roads, hazardous vegetation, encroachments, and problems indicating that a repair may be needed. Helicopter inspection of the new line would occur twice annually.

BPA's aerial inspections of its lines are typically followed by annual ground inspections for each line. Maintenance vehicles would use access roads where established and maintenance workers may walk through agricultural fields to avoid damage to crops. In emergencies and some other situations, vehicles and equipment would need to be driven through fields and could cause damage to crops, vegetation, and other property. BPA determines the damages and, if appropriate, compensates landowners for these damages.

Vegetation also would be maintained along the line for safe operation and to allow access to the line. The project area would need continual vegetation maintenance because of its location west of the Cascades. BPA's vegetation management would be guided by its Transmission System Vegetation Management Program EIS (available at http://efw.bpa.gov/environmental_services/Document_Library/Vegetation_Management). BPA adopted an integrated vegetation management strategy for controlling vegetation along its transmission line rights-of-way. This strategy involves choosing the appropriate method for controlling the vegetation based on its type and density, the natural resources present at a particular site, landowner requests or agreements, regulations, and costs. BPA may use a number of different methods: manual (hand-pulling, clippers, chainsaws), mechanical (roller-choppers, brush-hogs), biological (insects or fungus for attacking noxious weeds), and herbicides.

Herbicides used at substations would likely be applied in granular form or with a backpack sprayer to spot treat individual plants. As with any BPA herbicide use, label instructions for application rates and weather conditions would be adhered to, which would eliminate potential run-off or air drift issues. Prior to controlling vegetation, BPA would send notices to landowners and request information that might help in determining appropriate methods and mitigation measures (such as herbicide-free buffer zones around springs or wells).

Noxious weed control is also part of BPA's vegetation maintenance program. In general, BPA controls weeds on BPA fee-owned rights-of-way (mostly substations and some transmission lines), except where agricultural easements exist. Along easements, the underlying landowner is responsible for noxious weed control, but BPA works with landowners and county weed control districts and incorporates weed control measures into regularly scheduled maintenance.

Table 3-2 Mitigation Measures Included as Part of the Project[1]

Resource	Mitigation Measures
Land and Recreation	• Compensate landowners for any new BPA land rights required for right-of-way or access road easements. • Compensate landowners for any damage to property during construction. • Compensate landowners for reconfiguration of irrigation systems due to placement of towers or access roads. • Provide relocation services and benefits pursuant to Public Law 91-646 and other related regulations to affected owner occupants, tenants, and businesses, ensuring that the eligible parties have a clear understanding of the relocation process and assist these parties in filing claims for relocation benefits. • Provide compensation to restore compacted cropland soils, as needed. • Reseed disturbed areas (see mitigation measures in Vegetation). • Implement measures to reduce the possible spread of noxious weeds (see mitigation measures in Vegetation). • Implement measures to control dust (see mitigation measures in Geology and Soils). • Implement measures to control construction noise (see mitigation measures in Noise). • Minimize or eliminate public access to project facilities through postings and installation of gates and barriers at appropriate access points, and at the landowner's request. • Stay on established access roads and designated access road areas across agricultural fields during routine operation and maintenance activities. • Submit final tower locations and conductor heights to the FAA for review. Install lights and/or marker balls as required (see mitigation measures in Transportation).
Visual Resources	• Implement construction site maintenance and clean-up. Keep construction areas free of debris. • Provide regular maintenance of access roads and gates within and leading to the corridor. • Reseed disturbed areas (see mitigation measures in Vegetation). • Implement measures to reduce the possible spread of noxious weeds (see mitigation measures in Vegetation). • Implement measures to control erosion and dust (see mitigation measures in Geology and Soils, and Greenhouse Gas). • Use non-reflective conductors. • Use non-reflective insulators (i.e., non-ceramic or porcelain). • Locate new access roads within previously disturbed areas wherever possible. • Revegetate disturbed areas with approved species (see mitigation measures in Vegetation).
Public Health and Safety, EMF	• Notify landowners located along the corridor prior to construction activities, including blasting. • If blasting is required, take appropriate safety measures and follow all state and local codes and regulations. Lock up or remove all explosives from work sites at the end of the workday.

Resource	Mitigation Measures
Public Health and Safety, EMF (continued)	• Hold crew safety meetings at the start of each construction workday to review potential safety issues. • Prepare and implement a Spill Prevention and Control (SPC) plan (see mitigation measures in Water) to manage hazardous materials and respond to emergency situations. • Prepare and maintain an on-site safety plan in compliance with state requirements. • Prepare for fire control (see mitigation measures in Vegetation).Fueling of construction vehicles and equipment on-site will be done in accordance with applicable construction permits, regulated construction practices, and state and local laws. Helicopters will be fueled and housed at local airfields or at staging areas. • Secure the site at the end of each workday to protect equipment and the general public. Ensure that BPA contractors flying helicopters prioritize public safety during flights. • Implement appropriate airport safety measures. • Clear vegetation according to BPA standards to avoid contact with transmission lines. • Manage construction waste through reuse and recycling. • Report possible hazardous materials, toxic substances, or petroleum products discovered within the transmission line or access road right-of-ways that would pose an immediate threat to human health or the environment, including large dump sites, drums of unknown substances, suspicious odors, stained soil, etc. • Adhere to appropriate specifications for grounding fences and other objects on and near existing and proposed rights-of-way. • Construct and operate the new transmission line according to the NESC. • Use established access roads during routine operation and maintenance activities. • As part of the Storm Water Pollution Prevention Plan (SWPPP), an SPC plan will be prepared to address petroleum and hazardous materials handling and emergency spill response (see mitigation measures in Water). • Use transmission line designs that keep EMF levels and corona generation as low as reasonably practical. • Restore reception quality if radio or television interference occurs as a result of constructing the transmission line so that reception is as good as or better than before the interference.
Noise	• Ensure standard sound-control devices, including mufflers, are on all construction equipment and vehicles. • Notify landowners located along the corridor prior to construction activities, including blasting.
Socioeconomics	• Compensate landowners at market value for any new BPA land rights for right-of-way or access road easements. • Compensate landowners for damage to property or crops during construction or operation and maintenance activities. • Compensate landowners for irrigation systems that must be reconfigured to accommodate new transmission infrastructure. • Prepare for fire management (see mitigation measures in Vegetation). • Initiate discussions with local fire districts prior to construction and work with the districts and other appropriate emergency response entities to develop a Fire and Emergency Response Plan that addresses potential wildland fires and other emergencies.

Resource	Mitigation Measures
Transportation	• Coordinate with county road departments where upgrades of county roads are necessary. • Coordinate routing and scheduling of construction traffic with state and county road staff, Columbia River operators, and railroad operators. • Employ traffic control flaggers and post signs warning of construction activity and merging traffic, when necessary for short interruptions of traffic. • Conduct regular maintenance on access roads and gates within and leading to the corridor. • Prepare and implement a SWPPP to prevent sediment from being transported onto adjacent roadways (see mitigation measures in Geology and Soils). • Limit tracking of soil onto paved roads (see mitigation measures in Geology and Soils). • Design roads to limit erosion (see mitigation measures in Geology and Soils).Restore public roadways to preconstruction conditions upon completion of project construction activities. Coordinate with the Washington State Department of Transportation (WSDOT) Aviation Division and comply with FAA regulations for marking or lighting (including painting and/or lighting towers and installing marker balls on overhead ground wires in specific locations). • Ensure standard sound-control devices, including mufflers, are on all construction equipment and vehicles. • Notify landowners located along the corridor prior to construction activities, including blasting. • Obtain a Haul Road Agreement and any additional permits or approvals from state and local agencies prior to construction. These documents will identify any special conditions to be addressed by BPA and their contractors during construction and operation of the project. • Route traffic around affected intersections if construction vehicles cause temporary traffic blockages on local roadways. • Comply with applicable seasonal road restrictions for construction traffic, where practicable.
Cultural Resources	• Locate transmission line towers and access roads to avoid cultural resources and minimize the potential for trespass access, where possible. • Use existing access roads where possible to limit possibility of new disturbances. • Develop an Inadvertent Discovery Plan that details crew member responsibilities for reporting in the event of a discovery during construction. This plan should include directives to stop work immediately and notify local law enforcement officials (if appropriate), appropriate BPA personnel, Tribes, and the Washington Department of Archaeology and Historic Preservations (DAHP) or Oregon State Historic Preservation Officer (SHPO) if cultural resources are discovered. • Plan for survey and review as needed of additional disturbance areas not identified during the NEPA process (e.g., staging areas, stringing and pulling sites, guard structure areas, etc.). • Improve the existing road system in a manner that minimizes new roads and avoids cultural resource sites. If improvements are needed on existing roads that cross through cultural resources sites, such improvements would be constructed in a manner to avoid/minimize impacts, such as using fabric and rock or other mitigation agreed to during the consultation process.

Resource	Mitigation Measures
Cultural Resources (continued)	• Consult with the Washington DAHP, the Oregon SHPO as applicable, the Confederated Tribes of the Chehalis, Cowlitz Indian Tribe, Confederated Tribes of Grand Ronde, Nez Perce Tribe, Quinault Indian Nation, Confederated Tribes of the Umatilla Indian Reservation, Confederated Tribes of the Warm Springs Reservation of Oregon, and Confederated Tribes and Bands of the Yakama Nation regarding NRHP eligibility of historic and cultural sites and if eligible, consult on addressing any adverse effects.
Geology and Soils	• Minimize the project ground disturbance footprint, particularly in sensitive areas (i.e., steep slopes and landslides areas). • Prepare and implement a SWPPP for construction activities to lessen soil erosion and control stormwater runoff. • For the SWPPP, use management practices contained in the Washington State Department of Ecology, Stormwater Management Manual for Western Washington (e.g., use silt fences, straw wattles, interceptor trenches, or other perimeter sediment management devices; place them prior to the onset of the rainy season and monitor and maintain them as necessary throughout construction) (http://www.ecy.wa.gov/pubs/0510030.pdf). • Use water trucks or BPA approved palliatives on exposed soil surfaces in areas disturbed during construction. • Construction materials and stockpiles will be managed to prevent impacts by the erosive forces of wind and rain. Stabilize access road surfaces in areas of sustained wind and potential dust erosion. • Ensure construction vehicles travel at low speeds on access roads and at construction sites to minimize dust. • Limit the amount of time soils are left exposed. • Design roads to limit water accumulation and erosion; install appropriate access road drainage (ditches, water bars, cross drainage, or roadside berms) to control and disperse runoff. • Design substations to accommodate seismic shaking, per BPA's seismic policy (STD-DS-000001). This policy references the International Code Council's International Building Code (IBC) (2009) for buildings in substations and the Institute of Electrical and Electronics Engineers (IEEE) 693(2005) for electrical equipment in the substations.
Water and Wetlands	• Minimize the project ground disturbance footprint, particularly in sensitive areas such as stream crossings and wetlands, and stream and wetland buffers. • Develop and implement a SPC plan to minimize the potential for spills of hazardous materials, including provisions for storage of hazardous materials and refueling of construction equipment outside of riparian zones, spill containment and recovery plan, and notification and activation protocols. • Prepare and implement a SWPPP to control stormwater runoff (see mitigation measures in Geology and Soils). • Properly manage drilling fluids, muds, and dewatering activities so as not to impact surface waters, including wetlands. • Properly manage concrete waste. • Take all necessary precautions to ensure that sediment, debris, petroleum products, chemicals, cement-like materials, or other contaminants do not enter wetlands and flowing or dry watercourses. • Install culverts or bridges for access roads in the dry season or during low-flow conditions if possible to minimize sediment delivery to streams.

Resource	Mitigation Measures
Water and Wetlands (continued)	• Limit tracking of soil onto paved roads by gravelling road approaches, washing vehicle wheels, and cleaning mud and dirt from paved roads to reduce sediment delivery to roadside ditches and nearby streams. • Avoid use of heavy equipment and vegetation removal, if possible, in wetlands and wetland buffer zones to avoid soil compaction, destruction of live plants, and potential alteration of surface water patterns. Use track equipment or matting, if appropriate. • Avoid placing staging areas in wetlands or stream buffers. • Fence, flag, or otherwise mark wetland buffer zones in the field to avoid inadvertent activity (e.g., parking and driving) in wetlands or buffers or streams. • Reseed disturbed areas (see mitigation measures in Vegetation). • Design culverts and drainage controls placed in non-fish bearing streams to preserve natural drainage patterns. • Maintain unobstructed passage for water at all culverts placed in non-fish bearing streams and promptly remove any blockages to protect the roadbed and prevent sedimentation of downstream water bodies. • Install and maintain water and sediment control measures at all water bodies (including dry water bodies) crossed by access roads or otherwise impacted by surface disturbance. • Regularly inspect and maintain the condition of access roads, culverts, and sediment control measures to prevent long-term impacts during operation and maintenance. Avoid storing, transferring, or mixing of oils, fuels, or other hazardous materials where accidental spills could enter surface or groundwater. Have spill response and clean-up materials on site and clean up all spills immediately. • Maintain, fuel, and repair heavy equipment and vehicles using spill prevention and control measures. Clean contaminated surfaces immediately following any spill incident. • Fixed bulk fuel storage facilities will be designed with impervious secondary containment berms capable of capturing spills that may occur during fueling operations. • All equipment fueling operations shall use pumps and funnels and absorbent pads. Refuel equipment away from natural or manmade drainage conveyance including ditches, catch basins, ponds, wetlands, and pipes. Additional fueling requirements apply in some sensitive resource areas. Do not store equipment near water bodies and secure equipment when not in use overnight.
Vegetation	• Limit tree removal in sensitive areas such as stream crossings to the extent possible. • Cut or crush vegetation rather than blade in areas that would remain vegetated to maximize the ability of native plants to resprout. • Conduct invasive weed surveys prior to and following construction to determine potential weed spread and appropriate corrective actions. • Use weed-free mulch, if mulch is used for erosion control. • Equip all vehicles with basic fire-fighting equipment, including extinguishers and shovels to prevent fires that could encourage weed growth. • Limit ground-disturbing activities to tower sites, access roads, staging areas, and other necessary construction sites.

Resource	Mitigation Measures
Vegetation (continued)	• Limit road improvements to the minimum amount necessary to safely move equipment, materials, and personnel into and out of the construction area. • Consult with the U.S. Fish and Wildlife Service (USFWS) concerning any federally listed threatened and endangered plant species that are identified and implement mitigation measures to eliminate or reduce adverse impacts to these species. • Limit herbicide application to hand spraying at least 100 feet from all fish-bearing stream channels and use only EPA-approved herbicides that are non-toxic to aquatic resources. • Maintain a 164-foot no-spray buffer around well head locations. These locations are identified on all BPA plan and profile drawings and identified in work instructions to vegetation maintenance contractors. • Seed all disturbed areas to prevent colonization by weeds and facilitate reestablishment of the preconstruction plant community. Use approved (local Farm Service Agency) native seed mixtures in high quality vegetation communities and a combination of native and non-native seed in disturbed vegetation communities. Include the dominant native species from the impacted community in the seed mix.
Wildlife and Fish	• Limit tree removal in sensitive areas such as stream crossings to the extent possible. • Reseed disturbed areas (see mitigation measures in Vegetation). • Equip all vehicles with basic fire-fighting equipment, including extinguishers and shovels to prevent fires that could potentially harm wildlife habitats. • Minimize the project's ground disturbance area, reseed disturbed areas, and install culverts during appropriate in-water work window (see mitigation measures in Vegetation and Water) to limit sedimentation affecting fish habitat. Prepare and implement a SWPPP and a SPC plan (see mitigation measures for Geology and Soils and Water) to protect wildlife, fish, and wetland habitats. • Consult with the USFWS and National Oceanic Atmospheric Administration (NOAA Fisheries) concerning any federally listed threatened and endangered wildlife species that are identified and implement mitigation measures to eliminate or reduce adverse impacts to these species.
Climate	• Design and construct transmission facilities for worst-case wind-, snow-, and ice-loading. • Design transmission facilities to accommodate sagging during prolonged hot weather. • Design and construct access roads to withstand predicted climatic events.
Air Quality	• Use water trucks and/or palliatives to control dust during construction operations where appropriate. • Stabilize construction materials if they are a source of blowing dust. • Limit the amount of exposed soil, including dirt piles and open pits, to a minimum. • Dispose of trees and brush by means other than burning. • Ensure construction vehicles travel at low speeds on gravel roads and at the construction sites to minimize dust. • Comply with applicable state tailpipe standards for all on-road vehicles. • Ensure all vehicle engines are in good operating condition to minimize exhaust emissions.

Resource	Mitigation Measures
Air Quality (continued)	• Use low sulfur fuel when available for on-road diesel vehicles.
Greenhouse Gases	• Implement vehicle idling and equipment emissions measures, where practicable. • Encourage carpooling and the use of shuttle vans among construction workers to minimize construction-related traffic and associated emissions. • Locate all staging areas as close to construction sites as practicable to minimize driving distances between staging areas and construction sites. • Locate staging areas in previously disturbed or graveled areas to minimize soil and vegetation disturbance where practicable. • Use the properly sized equipment for the job, when practicable. • Use alternative fuels for generators at construction sites, or use electrical power where practicable. • Reduce electricity use in the construction office by using compact fluorescent bulbs, and powering off computers every night. • Recycle or salvage non-hazardous construction and demolition debris. • Use locally sourced rock for road construction, where available. • During construction, all vehicles will comply with applicable federal and state air quality regulations for tailpipe emissions. • Maintain all construction equipment is in proper working condition according to manufacturer's specifications. • Train equipment operators in the proper use of equipment.

Notes:

1. For additional mitigation measures that have been identified through preparation of this EIS and that also could be implemented to reduce or eliminate potential adverse impacts of the project, please see Chapters 5 to 22 of this EIS.

Chapter 4 Proposed Action and Alternatives

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

This chapter describes the Proposed Action (the action alternatives), the No Action Alternative, and alternatives that were considered but eliminated from detailed study.

4.1 Proposed Action Alternatives

BPA considered a variety of environmental, technical, social and economic siting factors (see Section 2.1, Facility Siting), as well as comments from the public (see Section 1.6, Public Involvement and Major Issues), to develop a reasonable range of alternatives to evaluate in this EIS. For each potential alternative, BPA assessed whether the alternative would meet the identified need for the project and achieve the project's purposes (see Section 1.3, Purposes). BPA developed four action alternatives from combinations of the route segments and substation sites (see Chapter 2, Facility Siting, Route Segments and Action Alternatives).

Each alternative includes a new substation near Castle Rock, Washington, a new 500-kV transmission line, a new Sundial Substation near Troutdale, Oregon, and new and improved access roads to these facilities. Also common to the action alternatives are the following: fiber optic cable installation on the transmission line for communications and equipment changes inside control houses at various BPA substations. All action alternatives cross the Columbia River in the same location.

Each action alternative includes three options that use different route segments and substation sites to complete the transmission line route. In this chapter, options and substation sites are described under each action alternative. Tower configurations also differ among the action alternatives. For some alternatives, existing transmission lines in certain locations would be removed and replaced. In some cases, new towers would be built in the same location as the removed towers; in other cases the new towers would be in different locations.

The project elements being considered are as follows (preferred project elements are noted with an *; common elements are noted in the description):

- Transmission Line Routes:
    - West Alternative and Options
    - Central Alternative and Options*
    - East Alternative and Options
    - Crossover Alternative and Options
- Substations:
    - New substation near Castle Rock at one of the following sites:
        - Monahan Creek site
        - Baxter Road site
        - Casey Road site*

    - New Sundial Substation near Troutdale (common to all action alternatives, this includes tower removal and relocation of other utilities' lines)

- Access Roads (common to all action alternatives, this includes using existing access roads, improving existing roads, and constructing new roads)
- Communications and Control Equipment (common to all action alternatives):
    - Installation of fiber optic cable
    - Equipment changes inside existing control houses at various BPA substations

Maps and Figures

Maps of the alternatives referred to in this chapter can be found in Chapter 2. A table describing each action alternative, the actions that would occur within each alternative and option, and the resulting right-of-way configuration (the location of towers and lines on existing and proposed rights-of-way) for the different alternatives and options is included in Appendix B. Figures depicting the existing and proposed right-of-way configurations for the different alternatives and options are also referenced in the table and included in Appendix B. Figures of the designs proposed for different substation sites are included in this chapter. In addition, photomaps of all segments (that form the alternatives and options) and substations are included in Appendix C.

Tower Numbering

Tower numbers are based on the segment numbers. The first number of a specific tower is the segment number. For example, Tower 25/1 is the first tower in Segment 25. The first and last tower of each segment may have more than one number where segments intersect. For example, towers 1/18, 2/28 and 4/1 are the same tower, but have three designations because the tower is part of segments 1, 2, and 4.

Existing and New Right-of-Way

For portions of an action alternative where existing BPA right-of-way would be used, no new right-of-way would be needed unless noted in the text, tables, and figures. New right-of-way is typically 150-feet wide. There may be some areas where new right-of-way may be wider because of terrain, conductor swing, or other factors (see Appendix B).

4.2 West Alternative

The West Alternative begins at the Monahan Creek substation site in Cowlitz County, west of Castle Rock (see Map 2-3 and Section 4.2.4, Substation Sites). From the Monahan Creek site this alternative runs southeast along Segment 2. From towers 2/1 to 2/18, about 28 wood H-Frame structures of the existing 115-kV single-circuit Lexington-Delameter No. 1 line would be removed from existing BPA right-of-way and replaced with 500-kV single-circuit lattice-steel towers (see box). The route crosses Delameter Road, many drainages, Trout Lakes Road, and other local roads, and rolling forested land in this area.

From towers 2/18 to 2/27, about 15 wood H-frame structures of the Lexington-Delameter No. 1 line would be removed. The new 500-kV line would not be built in its place, but built on the other side of BPA's existing right-of-way in a forested area. From Tower 2/27 to about 265 feet past Tower 4/1, the line would require new 150-foot-wide right-of-way. From towers 4/2 to

4/3, the route crosses existing BPA property around BPA's Lexington Substation. Residential development surrounds the northeast side of Lexington Substation. From towers 4/3 to 4/5, the route parallels BPA's Ross-Lexington No. 1 230-kV line on existing right-of-way, and crosses the Cowlitz River.

BPA's Lexington-Delameter No. 1 115-kV Line

Cowlitz County PUD's Lexington-Corduroy 115-kV Line

BPA's Lexington-Delameter No. 1 115-kV line is on Segment 2 and would be removed in the West Alternative. The Lexington-Delameter No. 1 115-kV line is currently leased by Cowlitz County PUD. Cowlitz County PUD is upgrading its system. When the upgrades are completed, the PUD will no longer need this line and will terminate its lease with BPA. BPA has no other use for this line.

On Segment 9, Cowlitz County PUD leases BPA's right-of-way for the PUD's Lexington-Corduroy 115-kV line. This lease can be revoked by BPA with 2 years notice. The West Alternative would remove this line to make room for the 500-kV line. BPA has met with Cowlitz County PUD and the PUD is aware that removing this line is part of the West Alternative. BPA would give Cowlitz County PUD notice if a decision is made to build a new line, and if the West Alternative is chosen route. In that case, because this 115-kV line is an integral part of Cowlitz County PUD's system, Cowlitz County PUD would need to replace the line in a new location.

From towers 9/1 to 9/11, about 11 structures of the existing Cowlitz PUD 115-kV line would be removed so the 500-kV line could be built in existing right-of-way (see inset box). From towers 9/1 to 9/20, the route crosses the I-5 freeway and local roads, and continues on vacant, mostly forested, BPA right-of-way next to rural residential land and crosses the Coweeman River. Between towers 9/20 and 9/21, about 22.5 feet of new right-of-way would be required. From towers 9/21 to 9/82, the route continues through rural residential and forested land and some forested existing right-of-way, and parallels BPA's Ross-Lexington No. 1 230-kV line. The Washington Department of Natural Resources (WDNR) holds a forest riparian conservation easement near Tower 9/26. The route crosses the Kalama River, other smaller drainages, and many local roads.

From towers 25/1 to 25/18 the route continues to parallel the Ross-Lexington No. 1 230-kV line on existing right-of-way through forested, rural residential and agricultural land, crosses the Lewis River and State Route (SR) 503 near the city of Woodland, then turns due south. Between towers 25/18 and 25/19, about 12.5 feet of new right-of-way would be required as the route continues to parallel the Ross-Lexington line. At Tower 25/19 the transmission line route continues south paralleling the Ross-Lexington line in existing right-of-way through a mix of residential, agricultural, and forested land. It crosses the East Fork Lewis River, Salmon Creek, and other smaller drainages, SR 502, and many local roads, moves through a primarily residential area in Vancouver, crosses I-205, and turns west just north of Minnehaha.

Near BPA's Ross Substation in Vancouver at about Tower 25/106, the West Alternative transmission line route turns east on existing right-of-way and parallels the Sifton-Ross No. 1/Bonneville PH1-Alcoa No. 2 115-kV double-circuit line. Between towers 25/110 and 25/141, the existing McNary-Ross No. 1 345-kV line would be removed (about 32 towers) and rebuilt in the same location, but using narrower towers so the new line could be built on existing right-of-way. This portion of Segment 25 crosses I-205, and runs through industrial, commercial and residential development next to the existing right-of-way. Between towers 25/141 and 25/151, an additional 30 feet of new right-of-way on the north side would be needed for the 500-kV towers. The route runs through agricultural land and near residential areas. Between towers 25/151 and 25/152, on the south side of the right-of-way, the Sifton-Ross No. 1/Bonneville PH1-Alcoa No. 2 double-circuit line becomes the Bonneville PH1-Alcoa No. 2/North Camas-Sifton double-circuit line after the line enters and exits Sifton Substation.

Between towers 36B/1 and 36B/2, the route crosses existing right-of-way over agricultural land and 155 feet of new right-of-way would be required for the new line. Between towers 36B/2 and 36B/7, the route continues east in new 155-foot-wide right-of-way paralleling the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line. From towers 36B/7 to 36B/8 the new 500-kV line would parallel the existing double-circuit line for one span through forested area, then replaces the double-circuit line at Tower 36B/8 (also referred to as 41/1) with a triple-circuit tower.

Between towers 41/1 and 41/8, about 10 towers of the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line would be removed and replaced with triple-circuit towers that would carry the two 115-kV lines on one side and the new 500-kV line on the other. In this area, the route turns southeast and 50 feet of new right-of-way would be needed (25 feet on either side) for the new line. This area is forested, rural residential, and recreation land (golf course). From towers 45/1 to 45/3, 50 feet of new right-of-way would be needed (25 feet on either side) to accommodate new triple-circuit towers. About three towers would be removed.

Between towers 45/3 and 45/6, the route turns south and requires 150 feet of new right-of-way. The transmission line route crosses over two existing lines and through forested land near rural residential development. From towers 50/1 to 50/3, the route continues south, then turns east to Tower 50/5, and requires 150 feet of new right-of-way. At Tower 50/5, the route turns southeast and parallels the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line until Tower 50/13, and would require 130 feet of new right-of-way through agricultural and rural residential land.

From towers 50/13 to 50/21 about eight towers of the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit line would be removed and replaced with nine triple-circuit towers. Fifty feet of new right-of-way would be needed, 25 feet on either side of the existing right-of-way, to accommodate the new towers. From towers 50/21 to 50/26, the route parallels the North Camas-Sifton No. 1/Bonneville PH1-Alcoa No. 2 double-circuit line in 130 feet of new right-of-way. The route runs through rural residential and agricultural land.

The route turns south on Segment 52. From towers 52/1 to 52/17, about 34 towers of the North Bonneville-Troutdale Nos. 1 and 2 230-kV lines would be removed and replaced with about 17 double-circuit 230-kV towers to make room for the new 500-kV line. The existing two 230-kV lines would be carried on the new double-circuit 230-kV towers on the east side of the existing right-of-way. The new 500-kV line would be built in existing right-of-way on the west side of the right-of-way through agricultural land, across the Washougal River, and west onto Lady Island in the Columbia River close to industrial, commercial, and residential areas. From towers 52/17 to 52/24 on Lady Island, 150 feet of new right-of-way would be required for the line. The route crosses the Columbia River between existing utility lines. South of the Columbia River, the route turns and runs through an industrial area to the Sundial substation site. Larger towers would be needed to cross the river (towers 52/20 to 52/22). These towers and the new towers built to carry the line into Sundial and Troutdale substations would be marked according to FAA requirements to minimize risk to air traffic (see Sections 3.2.1, Tower Types and 3.7, Obstruction Lighting and Marking).

The West Alternative is about 68 miles long (see Table 4-1) and would cost about $385 million. Cost estimates for the action alternatives are preliminary and include engineering design; environmental analysis, compliance, and mitigation; easements; property acquisition; and materials and construction costs for all facilities, including substations.

Table 4-1 West Alternative and Options—Line Lengths (Miles)

Alternative and Options	Added	Removed	Total
West Alternative	--	--	**67.5**
West Option 1	+3.4	-3.3	+0.1
West Option 2	+9.0	-7.4	+1.6
West Option 3	+13.0	-7.4	+5.6

4.2.1 West Option 1

For West Option 1, segments 36, 40, and 46 are used in place of segments 36B, 41, and 45 (see Map 2-2 and Table 2-1). From towers 36/1 to 36/2, 30 feet of new right-of-way in agricultural land would be needed next to the north side of BPA's existing McNary-Ross 345-kV line to accommodate the new 500-kV line. From towers 40/1 to 40/11, the route immediately crosses two existing lines through agricultural land, and continues south within new 150-foot-wide right-of-way. Between towers 40/10 and 40/11, the route crosses two additional existing lines. Between towers 40/8 and 40/13, the route runs through a WDNR Natural Area Preserve that is part of a larger proposed Natural Resource Conservation Area. Additional new right-of-way of varying widths would be needed between towers 40/11 and 40/12 where the route turns east to an area where double-circuit towers would be used. From towers 40/11 to 40/14, about three towers of the North Bonneville-Troutdale No. 1 230-kV line would be removed and replaced with double-circuit 500-kV towers. From Tower 46/1 the route crosses Lacamas Creek and two towers of the North Bonneville-Troutdale No. 1 230-kV line would be removed and replaced with double-circuit 500-kV towers on existing right-of-way.

4.2.2 West Option 2

For West Option 2, segments 36, 36A, 37, 38, 43, 48, and 51 are used in place of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). Segment 36 is described under West Option 1. From towers 36A/1 to 36A/4, the route continues from Segment 36, with 30 feet of new right-of-way to accommodate the new line. Between towers 36A/4 and 36A/6, three towers of the McNary-Ross 345-kV line would be removed and replaced using a narrower tower design to accommodate the new line on the north side of the existing right-of-way. From towers 37/1 to 37/2, two towers of the McNary-Ross 345-kV line would be rebuilt using a narrower tower to accommodate the new line in existing right-of-way. A residential development is next to the existing right-of-way. From towers 37/2 to 37/4 and towers 38/1 to 38/5, the route parallels the McNary-Ross 345-kV line on the north side of the existing right-of-way through forested area. At Segment 43, the route heads southeast on new 150-foot-wide right-of-way through forested land (WDNR-owned land between towers 43/4 and 43/6 is proposed for school development) to Tower 43/5, then due south through agricultural and near rural residential land to Tower 43/9. At Tower 43/9, the route crosses two existing lines, then turns east, where new right-of-way of varying widths would be needed before it joins the existing right-of-way at about Tower 43/10. One tower of the existing North Bonneville-Ross No. 1 230-kV line would be removed and replaced with a double-circuit tower for the new line and the North Bonneville-Ross No. 1 line.

From towers 48/1 to 48/14, about 14 towers of the existing North Bonneville-Ross No. 1 230-kV line would be removed and replaced with a double-circuit tower for the new line and the North Bonneville-Ross No. 1 line. This area is rural residential land, with some development next to the right-of-way. Between towers 48/13 and 48/14, about 100 feet of new right-of-way on forested land would be required as the route approaches Tower 51/1 and turns south. Between towers 51/1 and 51/11, about 11 towers of the North Bonneville-Troutdale No. 2 230-kV line and 11 towers of the North Bonneville-Troutdale No. 1 line would be removed and replaced with double-circuit 230-kV towers on the east side of the right-of-way. The new 500-kV line would be built on the west side of the existing right-of-way through rural residential land.

4.2.3 West Option 3

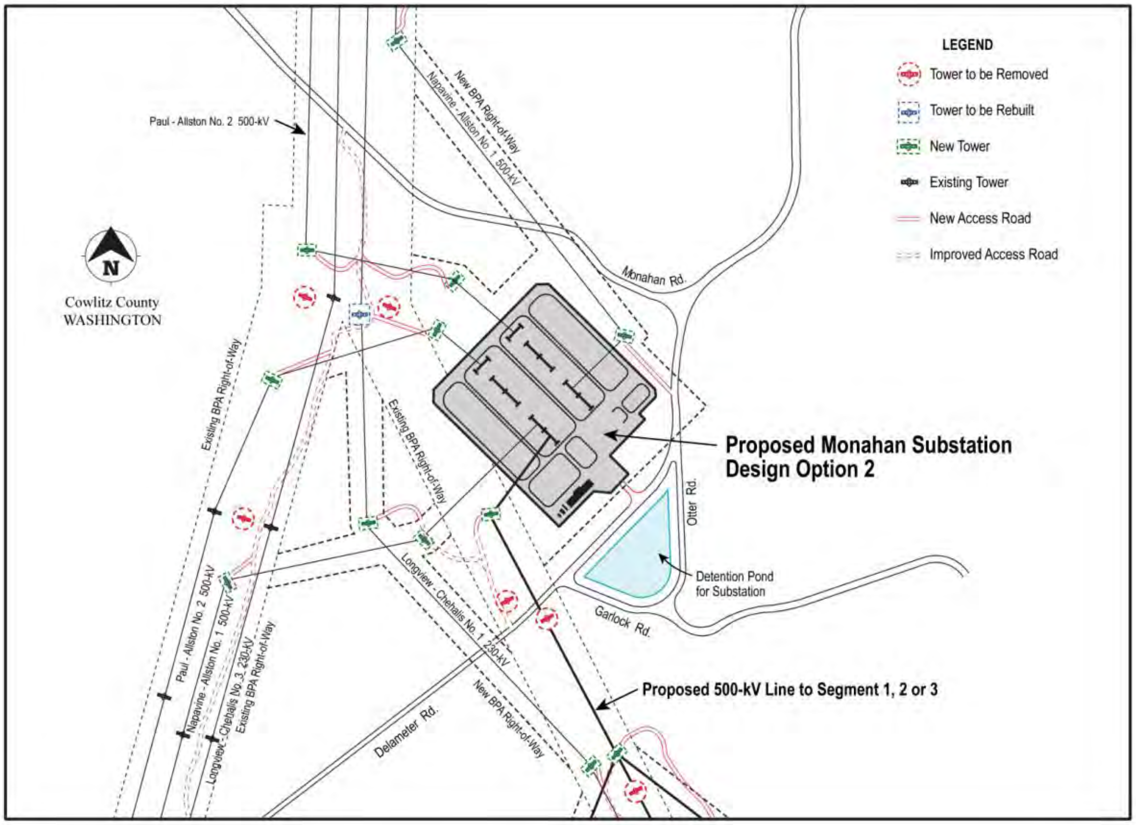
For West Option 3, segments 36, 36A, 37, 38, 39, T, 49, and 51 are used in place of segments 36B, 41, 45, and 50 (see Map 2-3 and Table 2-2). Segments 36, 36A, 37, and 38 are described under West Option 1 and 2. From towers 39/1 to 39/20, a new 500-kV line would be built next to the McNary-Ross 345-kV line on currently vacant right-of-way through rural residential and forested land. From towers 39/20 to 39/23, the route crosses the McNary-Ross 345-kV line and continues east on 105 feet of new right-of-way on forested land to Tower 39/27. From towers T/1 to T/3, 150 feet of new right-of-way would be needed to accommodate the new line on forested land. The route then continues southwest on 150 feet of new right-of-way to towers 49/1 through 49/7 through a rural area. From towers 49/7 to 49/10, 105 feet of new right-of-way would be needed north of the North Bonneville-Troutdale Nos. 1 and 2 230-kV lines. From towers 49/10 to 49/15, four towers of the North Bonneville-Ross No. 2 line towers would be rebuilt to double-circuit 500-kV towers to accommodate the new line on existing right-of-way.

4.2.4 Substation Sites

4.2.4.1 Monahan Creek

The Monahan Creek site is in Cowlitz County, about 3.5 miles west of Castle Rock, Washington (see Figure 4-1). The site is near the intersection of Monahan and Delameter roads on a gently sloping to fairly steep parcel of private property used for grazing. A few rural residences are near or next to the site. The site is next to a series of existing BPA lines, including the Paul-Allston No. 2 single-circuit 500-kV line, Longview-Chehalis No. 3 single-circuit 230-kV line, Longview-Chehalis No. 1 single-circuit 230-kV line, Napavine-Allston No. 1 single-circuit 500-kV line, and the Lexington-Delameter No. 1 single-circuit 115-kV line leased by Cowlitz PUD. (See Section 3.8, Substations, for a description of substation components.)

Figure 4-1 Monahan Creek Substation



The Monahan Creek substation site is about 806 feet by 780 feet, or about 14.4 acres. A 2.25-acre detention pond would be constructed at the intersection of Delameter, Garlock, and Otter roads to collect and filter substation water runoff. About 0.1 mile of new road would be constructed to access the substation from Delameter Road. No existing roads would be improved for the substation access road. Typically, when a new 500-kV substation is built and there are existing 500-kV lines in the vicinity, the lines are redirected into the new substation to further divide (or sectionalize) the system and ensure greater reliability so that in the event of an emergency or scheduled outage, different lines can be isolated. At this substation site, the Paul-Allston No. 2 and Napavine-Allston No. 1 500-kV lines would be redirected into and out of the new substation, which requires relocating these and other existing lines. The reconfiguration requires removing about 5 existing towers, rebuilding one tower, and constructing about 10 new towers. New spur roads would be needed and some existing access roads would need to be improved for the reconfiguration. The new 500-kV line would exit south of the new substation and continue to segments 1, 2, or 3, depending on the action alternative. If the project moves forward, redirecting the Paul-Allston No. 2 500-kV line could be done at a later time.

4.2.4.2 Sundial

The Sundial substation site is about 1 mile north of I-84 and just south of the Columbia River in Troutdale, Oregon (see Figure 4-2). The site is part of a light industrial complex owned by the Port of Portland. BPA's existing Troutdale Substation and non-BPA-owned substations are east of the site. The substation site is about 652 feet by 1,155 feet, or about 17.3 acres.

No detention pond would be required. The substation would be accessed by about 0.5 mile of new road.

Several BPA-owned and non-BPA-owned transmission lines are in or near the Sundial site. Some of these lines would be removed, relocated, or rebuilt to accommodate the new substation, substation access road, and the new 500-kV line (Segment 52) as it enters Sundial Substation. New spur roads would be constructed and some existing access roads would be improved to access towers. The existing North Bonneville-Troutdale Nos. 1 and 2 single-circuit 230-kV lines and the Big Eddy-Troutdale No. 1 single-circuit 230-kV line that enter Troutdale Substation would be unchanged.

The existing Ostrander-Troutdale No. 1 single-circuit 500-kV line that enters Troutdale Substation would be redirected into the new substation and would be renamed the “Ostrander-Sundial No. 1” line. This redirection would be done so that the 500-kV system can be further divided (or sectionalized). A small segment of new 500-kV transmission line named the “Sundial-Troutdale No. 1” line would then be built to connect Sundial Substation to Troutdale Substation.

4.2.5 Access Roads

About 63 miles of access roads would be needed for the West Alternative (see Table 4-2). Access roads would be a combination of new roads and improved existing roads.

Table 4-2 West Alternative and Options—Access Road Lengths (Miles)

Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
West Alternative	--	--	**29.5**	--	--	**33.5**
West Option 1	+1.8	-1.3	+0.5	+3.0	-4.1	-1.1
West Option 2	+5.7	-3.7	+2.0	+4.8	-6.4	-1.6
West Option 3	+6.8	-3.7	+3.1	+8.1	-6.4	+1.7

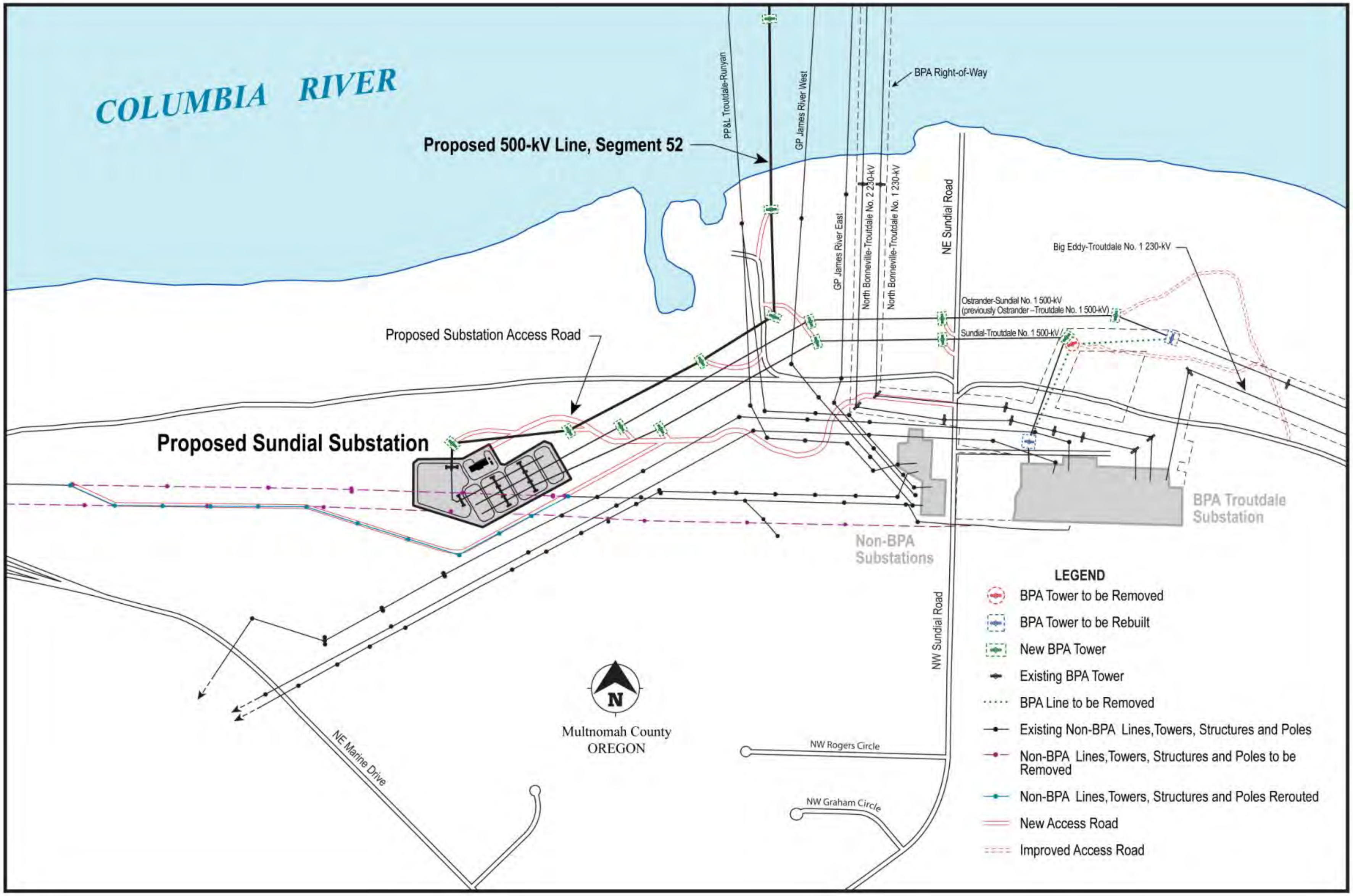
4.2.6 Communications and Control Equipment

Fiber optic cable would be strung on the steel towers (see Figure 3-3) from the new substation in the Castle Rock area to Troutdale Substation, and from Troutdale Substation to the new Sundial Substation (see Section 3.5, Communications and Control Equipment).

The following equipment changes would be made inside existing control houses at three BPA substations (these changes would not create any impacts):

- Modify relay and controls and add communications panels at Allston, Napavine, and Ostrander substations.
- Add line loss equipment at Ostrander Substation.

Figure 4-2 Sundial Substation



4.3 Central Alternative

The Central Alternative begins at the Baxter Road substation site in Cowlitz County, northwest of Castle Rock (see Map 2-4 and Section 4.3.4, Substation Sites). From the Baxter Road site, the route runs east along Segment B. From towers B/1 to B/5 the route runs southeast on new 150-foot-wide right-of-way through forested land. The route crosses local roads and small drainages and continues on new right-of-way from towers F/1 to F/10 through forested land. The route crosses Military Road and small drainages and turns south at Tower F/10. At Tower F/13 the route turns east near a residential area along Gassman Road, and crosses the Westside Highway, the Cowlitz River, railroad tracks and right-of-way, I-5, the old Pacific Highway, SR 504, and commercial and rural residential areas. At Tower F/23, the route heads southeast to Tower F/75 through forested land, across local roads and small drainages, and across Headquarters Road, Fir Lane Road, and the Coweeman River on new right-of-way. Clusters of rural residences and home sites are near Headquarters and Fir Lane roads.

From towers G/1 to G/8, the route heads southwest on new right-of-way through forested land. The route continues to Segment H near Mahafrey Road. Segment H heads southeast on forested land on new right-of-way from towers H/1 to H/8, then the route continues along Segment 10 from towers 10/1 to 10/34 through forested land owned by WDNR, Longview Timber Corporation, and Weyerhaeuser Company, and crosses small drainages and the Kalama River. From towers 12/1 to 12/20, the route turns due south and continues on new right-of-way through WDNR-owned forested land and crosses Aho Carson Creek Road. There are also some rural residences near where this route crosses major drainages.

Segment 15 turns to the east and southeast and crosses Tangen Road continuing on all new right-of-way from towers 15/1 to 15/9, then the route continues along Segment 23, crosses SR 503 and parallels the Lewis River until Tower 23/7. Segments 15 and 23 parallel an existing PacifiCorp line. From towers L/1 to L/5 the route crosses the Lewis River within a quarter mile of Merwin Dam recreational area owned by PacifiCorp. PacifiCorp also manages much of their land in this area for the benefit of wildlife. The route continues east through rural and forested land. From towers L/5 to L/9 the route parallels an existing PacifiCorp 115-V line on the south side. Between towers 18/1 and 18/22 the route continues east parallel to the existing PacifiCorp 115-kV line, and at Tower 18/22, it continues east on new right-of-way, crossing rural residential and forested land. The route for towers 28/1 to 28/27 heads southeast across SR 503 on new right-of-way through mixed forest, and crosses Healy Road and rural residential land.

From towers V/1 to V/20, the route crosses mostly forested land heading south across Weaver Creek Road, South Falls Road, and the East Fork Lewis River on new 150-foot right-of-way. At Tower V/20, the route heads southwest on new right-of-way, crosses Berry Road, and ends at Tower V/27. The route then heads south through forested land on towers P/1 to P/24 on new right-of-way and crosses the Yacolt Burn State Forest Road. From towers P/24 to P/39, the route turns southeast on new right-of-way through forested land. Segments V and P are mostly forested land with some rural residential development nearby.

At Segment 35, the route continues south on new right-of-way through forested land and along the edge of the City of Camas watershed, as well as scattered rural residential development, until it meets up with existing right-of-way and crosses over the McNary-Ross and North Bonneville-Ross No. 2 lines between towers 35/14 and 35/15. The route continues along Segments T, 49, 51, and 52 previously described under the West Alternative and West Option 3.

The Central Alternative is about 77 miles long (see Table 4-3) and would cost about $459 million.

Table 4-3 Central Alternative and Options—Lengths (Miles)

Alternative and Options	Added	Removed	Total
Central Alternative	**--**	**--**	**77.3**
Central Option 1	+2.5	--	+2.5
Central Option 2	+15.7	-18.0	-2.3
Central Option 3	+14.9	-20.8	-5.8

4.3.1 Central Option 1

Central Option 1 begins at the Casey Road substation site instead of the Baxter Road substation site and follows Segment A (see Map 2-4 and Section 4.3.4, Substation Sites). From towers A/1 to A/9 the route runs south out of the substation site through hilly, forested land on new 125-foot-wide right-of-way on the east side and next to existing BPA right-of-way. From towers A/9 to A/12, the new right-of-way would be 150 feet wide.

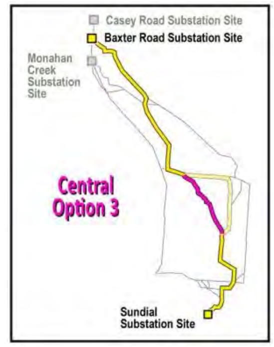
4.3.2 Central Option 2

Central Option 2 begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes segments 1, 4, 5, 8, and 11, instead of segments B, F, and G (see Map 2-4, Section 4.3.4, Substation Sites, and Table 2-3).

From towers 1/1 to 1/11, the route continues southeast through forested land on new 150-foot-wide right-of-way and crosses Delameter Creek, Leckler Creek and Delameter and McKee roads. At Tower 1/11 the route turns southeast through forested land. Between towers 1/16 and 1/17, the route crosses the Longview-Chehalis No. 1 and Lexington-Longview No. 2 230-kV double-circuit line and the Lexington-Longview No. 1 115-kV line on existing right-of-way. The route continues southeast through forested land to Tower 1/27, where it crosses existing right-of-way and the Lexington-Longview No. 2 230-kV line, the Lexington-Delameter No. 1 115-kV line, and the Lexington-Longview No. 1 115-kV line to Tower 1/28 near BPA's Lexington Substation. Segment 4 is already described under the West Alternative.

Segment 5 begins in existing right-of-way. Before it crosses I-5, new 150-foot-wide right-of-way would be required through forested land to Tower 5/10 where rural residences are located nearby. The route crosses Holcomb Road. From towers 8/1 to 8/9, the route crosses forested land on new 150-foot-wide right-of-way running northeast. Segment 11 heads southeast through forested land, with some scattered rural residences nearby, and crosses the South Fork of Ostrander Creek on new right-of-way. The route crosses the Coweeman River and Rose Valley Road between towers 11/14 and 11/15 and continues to Tower 11/21.

4.3.3 Central Option 3



Central Option 3 includes segments M, 26, and 30, instead of Segments L, 18, 28 and V (see Map 2-4 and Table 2-3). At Tower M/1, Segment M crosses the Lewis River near Merwin Dam and heads southeast on new right-of-way, crosses Pup Creek Road and Pup Creek through forested land to Tower M/11. Segment 26 crosses Cedar Creek and Cedar Creek Road on new right-of-way through forested and agricultural land and crosses SR 503 west of Amboy on rural residential and some agricultural land. Segment 30 continues southeast on new right-of-way, crosses Mystic Drive and the East Fork Lewis River, and continues across mostly forested land to Tower 30/31. Some rural residential development is scattered within these areas and WDNR has about 40 acres of land in forested genetic reserves near Tower 30/24.

4.3.4 Substation Sites

4.3.4.1 Baxter Road

The Baxter Road substation site is about 4 miles north of the Monahan Creek substation site, 4 miles west of the Westside Highway in Cowlitz County, northwest of Castle Rock, and next to existing BPA right-of-way (see Figures 4-4 and 4-5). The site is located on Sierra Pacific Industries-owned forested land surrounded by forested wetlands. (See Section 3.8, Substations, for a description of substation components.)

The substation site is about 813 feet by 904 feet, or 17 acres. A 2.5-acre detention pond south of the site would also be constructed to collect and filter substation water runoff. About 2 miles of existing road would need to be improved to access the new substation.

The Baxter Road site is next to four existing BPA lines: the Paul-Allston No. 2 single-circuit 500-kV line, Longview-Chehalis No. 3 single-circuit 230-kV line, Longview-Chehalis No. 1 single-circuit 230-kV line, and the Napavine-Allston No. 1 single-circuit 500-kV line. To further divide (or sectionalize) the system, the Paul-Allston No. 2 and Napavine-Allston No. 1 500-kV lines would be redirected into and out of the new substation. To accommodate this change, some towers would be removed or rebuilt. To make room for new lines crossing over the right-of-way, some towers on the Longview-Chehalis No. 3 and Longview-Chehalis No. 1 lines would be removed and rebuilt, depending on the action alternative. New spur roads would be constructed and some existing access roads would be improved to access towers. The new 500-kV line would exit south of the new substation to continue along segments B, C or D, depending on the action alternative (see Figures 4-4 and 4-5).

Figure 4-3 Baxter Road Substation—Segment C

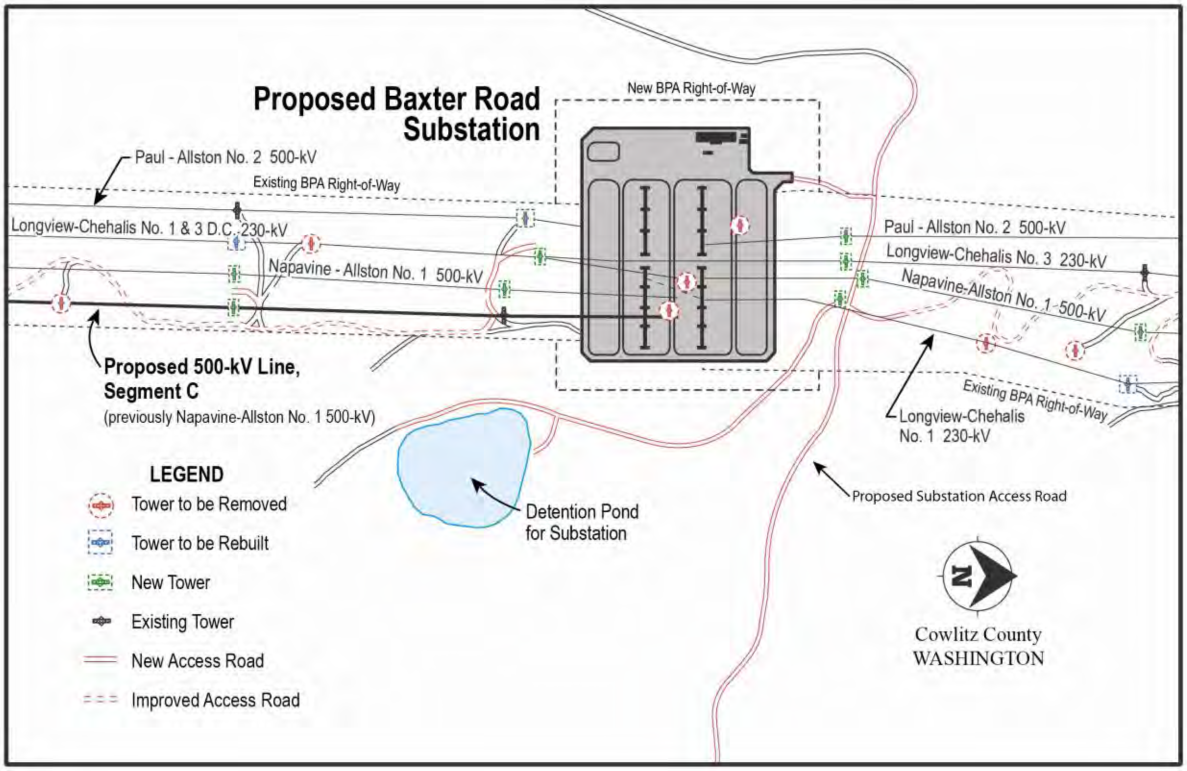
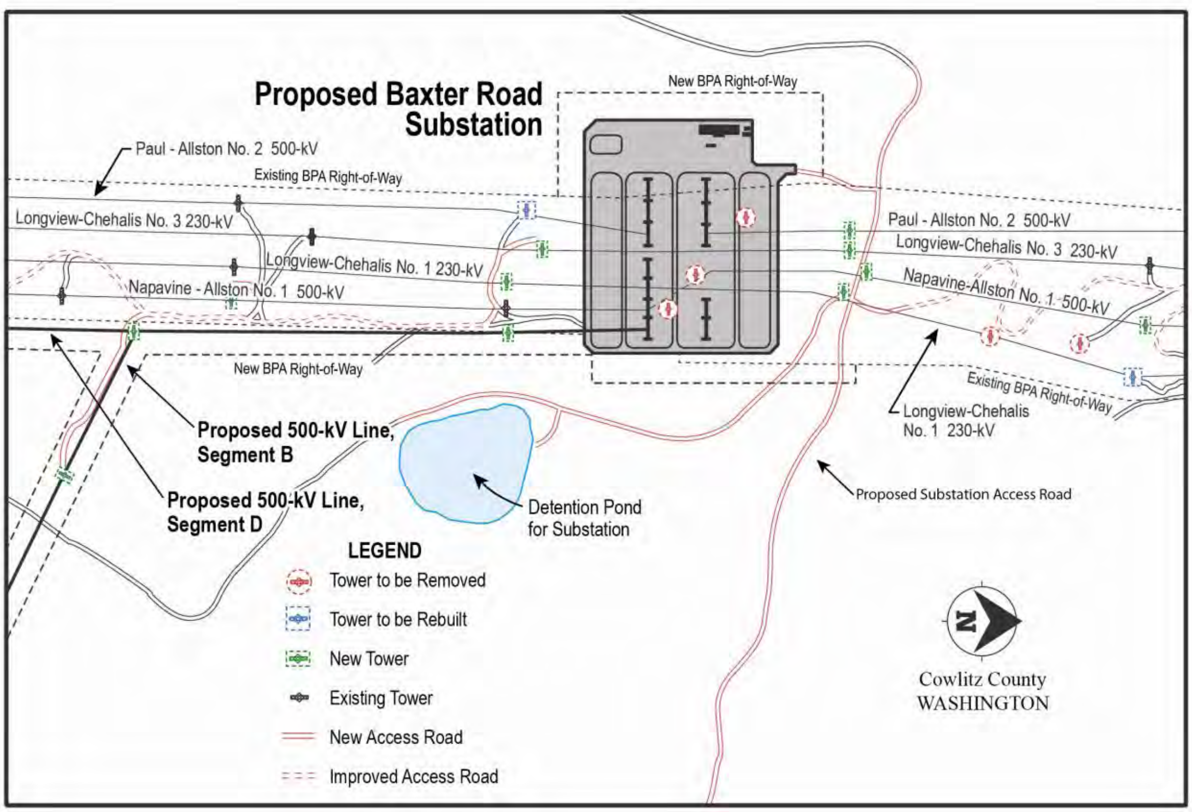


Figure 4-4 Baxter Road Substation—Segment B and D

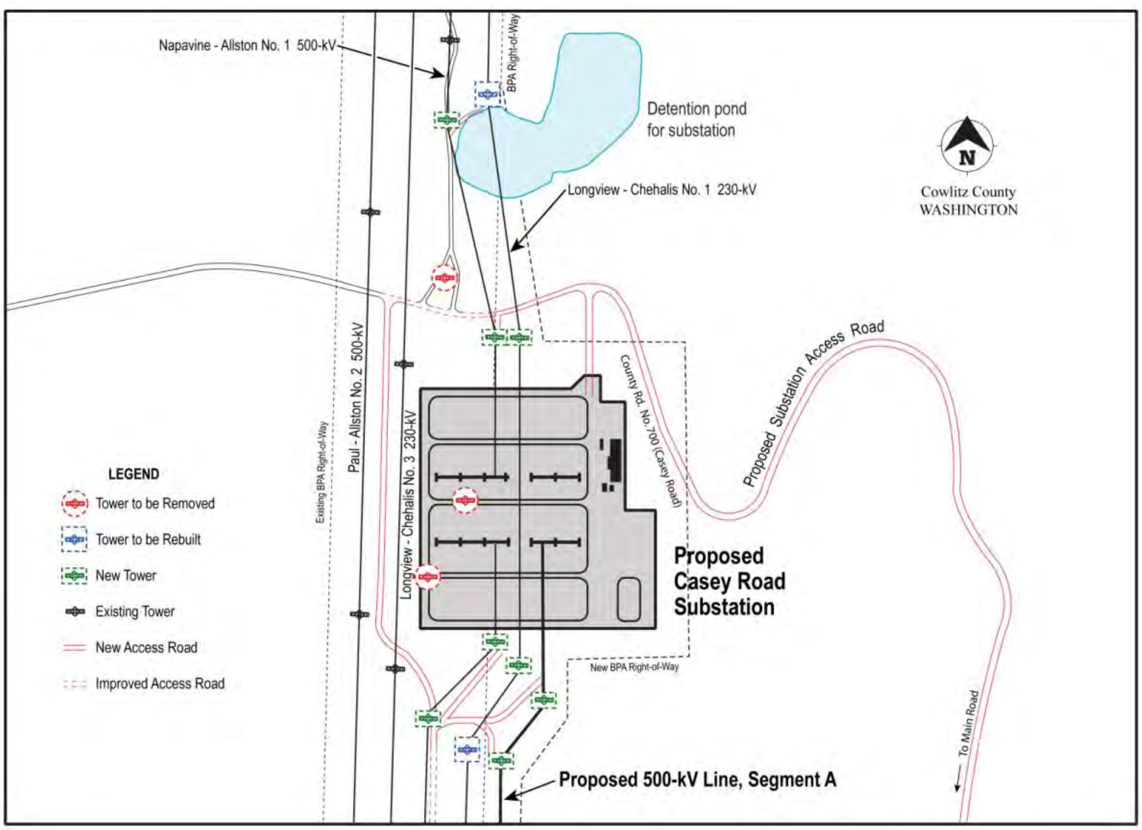


4.3.4.2 Casey Road

The Casey Road substation site is about 2 miles west of the Westside Highway in Cowlitz County, Washington, northwest of Castle Rock, next to existing BPA right-of-way (see Figure 4-6). The substation site (825 feet by 773 feet) is on about 14.6 acres of WDNR-owned property in a recently cleared, hilly area. Just north of the site, a 2.5-acre detention pond would be constructed to collect and filter substation water runoff. About 2.8 miles of existing road would need to be improved to access the new substation site.

The substation site is next to four existing BPA lines: the Paul-Allston No. 2 single-circuit 500-kV line, Longview-Chehalis No. 3 single-circuit 230-kV line, Napavine-Allston No. 1 single-circuit 500-kV line, and the Longview-Chehalis No. 1 single-circuit 230-kV line. To further sectionalize the system, the Napavine-Allston No. 2 500-kV line would be redirected into and out of the new substation. The Longview-Chehalis No. 1 230-kV line would be redirected over the substation, but would not be connected electrically. This change would require removing about three existing towers, rebuilding two existing towers, and constructing eight new towers. New spur roads would be constructed and some existing access roads would be improved to access towers. The new 500-kV line would exit south of the new substation to connect to Segment A.

Figure 4-5 Casey Road Substation



4.3.4.3 Sundial

Sundial Substation is described under the West Alternative (see Section 4.2.4.2, Sundial).

4.3.5 Access Roads

About 160 miles of access roads would be needed for the Central Alternative (see Table 4-4). Access roads would be a combination of new roads and improved existing roads.

Table 4-4 Central Alternative and Options—Access Road Lengths (Miles)

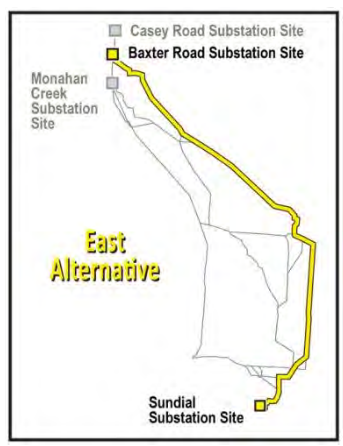
Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
Central Alternative	--	--	**41.4**	--	--	**117.9**
Central Option 1	+1.4	-0.4	+1.0	+13.3	-5.3	+8.0
Central Option 2	+10.3	-6.5	+3.8	+27.8	-37.4	-9.6
Central Option 3	+8.9	-9.5	-0.5	+11.8	-20.0	-8.2

4.3.6 Communications and Control Equipment

The installation of fiber optic cable on the transmission line for communications and the equipment changes inside control houses at various BPA substations described for the West Alternative (see Section 4.2.6, Communications and Control Equipment) also would occur under this alternative.

4.4 East Alternative

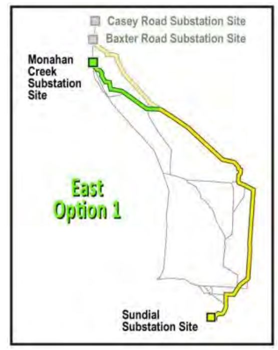
The East Alternative begins at the Baxter Road substation site and extends south along segments B and F, which are discussed in the Central Alternative (see Map 2-5 and Section 4.3.4, Substation Sites). From towers I/1 to I/13 the route is on new right-of-way through private forested land. The route continues southeast through state and private timber land on new right-of-way from towers K/1 to K/94. Between towers K/23 and K/24 the route crosses Gobar Creek, between towers K/28 and K/29 the route crosses Bear Creek, and between towers K/41 and K/42 the route crosses the Kalama River. Between towers K/78 and K/79, the route crosses SR 503 and continues through a rural residential area and forested land. At Tower K/93 the route crosses the Lewis River and PacifiCorp lands to K/94. From towers W/1 to W/6 the route continues southeast on new right-of-way and crosses Canyon Creek and forested land owned by PacifiCorp and Weyerhaeuser. All the PacifiCorp lands surrounding the crossing of the Lewis River are managed for wildlife. From towers O/1 to O/9 the route continues southeast over forested and private timberland and again crosses Canyon Creek. At Tower O/9, the route heads due south through forested land and crosses many small drainages. The route crosses Little Fly Creek between towers O/32 and O/33. Near O/46, it crosses the East Fork Lewis River, after which it crosses mostly WDNR land.



Between towers Q/1 and Q/13, the route would be on new right-of-way through forested land and the City of Camas watershed. The route crosses NE Boulder Creek Road near Tower Q/9. Between towers S/1 and S/2, the route crosses over the McNary-Ross single-circuit 345-kV line and the North Bonneville-Ross Nos. 1 and 2 double-circuit 230-kV lines that are on existing right-of-way; after crossing the existing right-of-way, the route continues to Tower S/3 on new 150-foot-wide right-of-way through forested land. The route continues to segments 49, 51, and 52 already described under the West Alternative and West Option 3. The East Alternative is about 76 miles long (see Table 4-5) and would cost about $489 million.

Table 4-5 East Alternative and Options—Line Lengths (Miles)

Alternative and Options	Added	Removed	Total
East Alternative	--	--	**75.5**
East Option 1	+17.6	-19.4	-1.8
East Option 2	+23.5	-22.5	+1.0
East Option 3	+3.7	-2.6	+1.1



4.4.1 East Option 1

East Option 1 begins at the Monahan Creek substation site instead of the Baxter Road substation site and includes segments 3, 7, 11, and J instead of segments B, F, and I (see Map 2-5 and Section 4.2.4, Substation Sites). Segment 3 begins on new right-of-way and heads southeast through forested land (with some scattered rural residences nearby), crosses Hazel Dell Road, heads southwest and then southeast, and at Tower 3/22 heads due east. The route crosses SR 411 (also referred to as the Westside Highway) and the Cowlitz River and heads south through rural residential and agricultural lands, then heads east and crosses Pleasant Hill Road and I-5. The route crosses Ostrander Road and continues southeast over forested land on new right-of-way. From towers 7/1 to 7/10, the route crosses forested land on new right-of-way and crosses the South Fork of Ostrander Creek. Segment 11 is described under Central Option 2. From towers J/1 to J/13 the route crosses forested land on new right-of-way.

4.4.2 East Option 2

East Option 2 includes segments U, V, P, 35, and T instead of Segments O, Q, and S (see Map 2-5 and Table 2-4). Segment U heads due south in private forested land east of Tumtum Mountain. The route crosses Canyon Creek, heads southwest and crosses Cedar Creek, and continues until Tower U/26. Segments V, P, 35, and T are described under the Central Alternative.

4.4.3 East Option 3

East Option 3 includes Segment R instead of Segment Q (see Map 2-5 and Table 2-4). The route heads south along Segment R on WDNR-owned forested land on new right-of-way and crosses the Yacolt Burn State Road. At Tower R/10, the route meets existing BPA right-of-way and parallels the McNary-Ross single-circuit 345-kV line and the North Bonneville-Ross Nos. 1 and 2 double-circuit 230-kV lines on the north side of the right-of-way on 105 feet of new right-of-way to Tower R/19.

4.4.4 Substation Sites

The Monahan Creek and Sundial sites are described under the West Alternative (see Sections 4.2.4.1, Monahan Creek and 4.2.4.2, Sundial). Baxter Road is described under the Central Alternative (see Section 4.3.4.1, Baxter Road).

4.4.5 Access Roads

About 207 miles of access roads would be needed for the East Alternative (see Table 4-6). Access roads would be a combination of new roads and improved existing roads.

Table 4-6 East Alternative and Options—Access Road Lengths (Miles)

Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
East Alternative	--	--	**34.2**	--	--	**173.2**
East Option 1	+8.8	-6.3	+2.6	+31.0	-41.6	-10.6
East Option 2	+12.7	-13.9	-1.2	+25.2	-52.0	-26.8
East Option 3	+1.1	-2.0	-0.8	+2.7	-2.4	+0.3

4.4.6 Communications and Control Equipment

The installation of fiber optic cable on the transmission line for communications and the equipment changes inside control houses at various BPA substations described for the West Alternative (see Section 4.2.6, Communications and Control Equipment) also would occur under this alternative.

4.5 Crossover Alternative

The Crossover Alternative begins at the Monahan Creek substation site in Cowlitz County, west of Castle Rock (see Map 2-6 and Section 4.2.4, Substation Sites). The route follows segments 2, 4, and 9, all discussed previously under the West Alternative. From towers 14/1 to 14/7, the route travels east on new 150-foot right-of-way and crosses Davis Peak Road over hilly, forested land. The route follows segments 15, 23, L, and 18, all discussed previously under the Central Alternative.

From towers N/1 to N/9, the route heads northeast before continuing east parallel to Merwin Lake within PacifiCorp lands managed for recreation and wildlife. The route crosses SR 503 and rural residential and forested land. The route follows segments W, O, Q, and S, previously discussed under the East Alternative.

The route continues along segments 49, 51 and 52 already described under the West Alternative and options. The Crossover Alternative is about 74 miles long (see Table 4-7) and would cost about $442 million.

Table 4-7 Crossover Alternative and Options—Line Lengths (Miles)

Alternative and Options	Added	Removed	Total
Crossover Alternative	**--**	**--**	**74.0**
Crossover Option 1	+7.3	-2.1	+5.2
Crossover Option 2	+4.3	--	+4.3
Crossover Option 3	+4.2	--	+4.2

4.5.1 Crossover Option 1

Crossover Option 1 includes segments 47, 48 and 50 instead of Segment 51 (see Map 2-6 and Table 2-4). From towers 47/1 to 47/4 about four towers of the North Bonneville-Ross No. 1 line would be removed and rebuilt with a 500-kV double-circuit line. Between towers 47/1 and 47/2, the route crosses the North Camas-Sifton/Bonneville PH1-Alcoa No. 2 double-circuit 115-kV line. Segments 48 and 50 are described under the West Alternative and West Option 2.

4.5.2 Crossover Option 2

Crossover Option 2 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes segments C and E (see Map 2-6, Section 4.3.4, Substation Sites, and Table 2-4). The Baxter Road substation site is described under the Central Alternative. From towers C/1 to C/17, about 26 towers of the Longview-Chehalis Nos. 1 and 3 230-kV lines would be removed and rebuilt to double-circuit, and the new 500-kV line would be built where the Longview-Chehalis No. 1 line is now on existing right-of-way. From towers E/1 to E/6, about 10 towers of the Longview-Chehalis Nos. 1 and 3 230-kV lines would be removed and rebuilt to double-circuit, and the new 500-kV line would be built where the Longview-Chehalis No. 1 line is now on existing right-of-way. The route crosses Monahan Road between towers E/5 and E/6. From towers E/6 to E/7, the route parallels the existing Longview-Chehalis No. 1 line in existing right-of-way.

4.5.3 Crossover Option 3

Crossover Option 3 begins at the Baxter Road substation site instead of the Monahan Creek substation site, and includes route segments D and E (see Map 2-6, Section 4.3.4, Substation Sites, and Table 2-4). The route along Segment D requires 125 feet of new right-of-way in forested land on the east side of existing BPA right-of-way to accommodate the new 500-kV line. The new line would be next to Growler's Gulch Spur Road, and between towers D/16 and D/17 the line would cross the Napavine-Allston No. 1 500-kV line. Segment E is described under Crossover Option 2.

4.5.4 Substation Sites

The Monahan Creek and Sundial sites are described under the West Alternative (see Sections 4.2.4.1, Monahan Creek and 4.2.4.2, Sundial). The Baxter Road site is described under the Central Alternative (see Section 4.3.4.1, Baxter Road).

4.5.5 Access Roads

About 127 miles of access roads would be needed for the Crossover Alternative (see Table 4-8). Access roads would be a combination of new roads and improved existing roads.

Table 4-8 Crossover Alternative and Options—Access Road Lengths (Miles)

Alternative and Options	New Roads			Improved Roads		
	Added	Removed	Total	Added	Removed	Total
Crossover Alternative	**--**	**--**	**34.0**	**--**	**--**	**92.8**
Crossover Option 1	+5.3	-1.9	+3.4	+2.6	-1.2	+1.4
Crossover Option 2	+1.2	-0.1	+1.1	+9.4	--	+9.4
Crossover Option 3	+1.6	-0.1	+1.5	+9.6	--	+9.6

4.5.6 Communications and Control Equipment

The installation of fiber optic cable on the transmission line for communications and the equipment changes inside control houses at various BPA substations that are described for the West Alternative (see Section 4.2.6, Communications and Control Equipment) also would occur under this alternative.

4.6 No Action Alternative

Under the No Action Alternative, BPA would not construct the proposed project. Accordingly, BPA would not build the proposed substation near Castle Rock, the proposed Sundial Substation, or a new 500-kV transmission line between these two substations. BPA also would not construct new access roads, improve existing access roads, install fiber optic cable, or make project-related changes to existing facilities.

Under this alternative, BPA would not increase the electrical capacity of its transmission system along the SOA path to respond to increasing congestion on the system, load growth, and new requests for transmission service. Although BPA would continue to implement RAS and other operational procedures for the SOA path, transmission system congestion along this path would be expected to continue to increase (see Section 1.1.2, BPA's Transmission System, for more information about the reasons for increasing congestion in this area). As discussed in Chapter 1, Purpose of and Need for Action, the SOA path is critical in supporting Vancouver and Portland area loads. If the transmission system in the SOA path is not upgraded, BPA would have difficulty preserving system reliability along this path, which could lead to unplanned outages (brownouts or blackouts) as the system is stressed as loads continue to grow. Unplanned outages could cause damage to equipment and the loss of load service in some areas. In addition, BPA would likely need to curtail path flows to keep the system within operating limits, which would make it difficult for local utilities to schedule power to their customers. This could lead to the curtailment of load.

4.7 Alternatives Considered but Eliminated from Detailed Study

This section describes alternatives that were considered by BPA but eliminated from detailed study in this EIS. In developing this EIS, BPA has considered a number of potential alternatives to the action alternatives. These include alternatives developed by BPA and alternatives that either were suggested or responded to concerns raised during and after the scoping process for this EIS. For each potential alternative, BPA assessed whether the alternative was reasonable under NEPA and warranted further detailed evaluation in this EIS, or was unreasonable and should be eliminated from detailed study.

In determining which alternatives to evaluate further and which should be eliminated from detailed study, BPA considered whether the potential alternative would meet the identified need for the project and achieve the project's purposes (see Section 1.3, Purposes). BPA also considered whether an alternative would have obvious, potentially greater adverse environmental effects than other alternatives. Because an almost unlimited number of alternatives could be created, BPA cannot consider in depth every conceivable alternative suggested. Consistent with CEQ guidance, BPA focused on evaluating a reasonable range of alternatives considering the purpose and need for the project, and environmental, technical, social, and economic factors. In so doing, BPA has sought to ensure that the EIS contains a reasonable range of alternatives to permit a reasoned choice.

4.7.1 Non-Wires Alternative

BPA considered whether there could be a solution to the project need that would not require the construction of a transmission line, otherwise referred to as a "non-wires" alternative. As described in Section 1.1.2.2, Reliability and Non-Wires Measures, BPA has historically used a non-wires measure called RAS to maintain reliability in emergency situations and maximize use of existing SOA path facilities. However, continuing to use RAS for this path is becoming more difficult and less effective as the local economy and population grow.

BPA contracted with Energy and Environmental Economics, Inc. (E3), to conduct a screening study of possible non-wires measures for the I-5 project (see Section 1.1.2.2, Reliability and Non-Wires Measures). The possible non-wires measures identified in E3's studies for consideration included the following:

- Energy efficiency—increasing efficiency of existing buildings or appliances to reduce electricity use
- Demand response—managing when power is used at its source
- Distributed generation—using small diesel generators or solar power at or close to the source of load
- Generation redispatch—changing which large generation source(s) serves the load

E3's studies determined that these non-wires measures potentially could defer the need for the proposed new line for up to a few years. However, these measures could not eliminate the need for this new line. The following discussion summarizes the key findings of the E3 studies related to each of the potential non-wires measures. E3's studies are available on the project website: http://www.bpa.gov/corporate/I-5-EIS/documents.cfm.

The energy efficiency measures considered in E3's studies would increase the efficiency of existing buildings and electrical appliances, and reduce electricity use in the metro area during summer peak periods. The Northwest Power and Conservation Council's (NWPCC) Sixth Power Plan identifies energy efficiency targets and measures (such as the recent partnership with North Pacific Paper Corporation), which are then evaluated and verified through the NWPCC's Regional Technical Forum. Examples of measures include the installation of more efficient cooling systems, insulation, electronic equipment power save modes, and lighting controls. BPA considered working with local utilities to accelerate the installation of measures that would most directly reduce summer peak power demand. The measures would have been installed in residential, commercial, and industrial facilities in the metro area and service territories of Clark Public Utilities, PGE, and PacifiCorp, and would have required agreements and cooperation from these utilities.

Demand response is a way to manage the amount of power that is being used at its source. E3 studied demand response through direct local control — where devices would be placed on water heaters or air conditioners in the metro area so they automatically turn off or are turned down during high peak times to lessen the need for power. E3's studies also considered demand response through adjusting electrical rates to make them more expensive during peak times (summer daytime during the week), so users are motivated to postpone electrical use for non-peak hours (e.g., doing laundry in the evenings or on weekends).

For distributed generation, small generators are used at the source of need or load, such as solar panels on a house or business, or diesel generators at buildings, grocery stores, or local utility substations (these diesel generators are often used as back-up emergency generators). These generators could be switched on by a central system operator during summer peak load to help serve local power needs, reducing the amount of power that would need to flow over the SOA path from the north. Distributed generation would be required 5 to 20 days per year, depending on the weather. Local utilities in the Portland area have a number of distributed generators installed. However, BPA would likely be unable to use these existing generators because the number of hours and days they can be used are highly regulated, and these generators are used by local utilities, often for the same reasons and during the same time frames that BPA would need them. The installation of new generators, which would be used on hot summer days when air quality concerns are greatest, may be inconsistent with BPA's overall environmental objectives because of air quality impacts.

Based on the numbers from E3's report, the combined impact from these non-wires measures (energy efficiency, distributed generation, and demand response) is relatively small. By 2016 (when the existing transmission system's capacity is likely to be reached), the cumulative effect of these measures is estimated to be only about 5 percent of the forecasted total load for the metro area. This amount is insufficient for long-term congestion relief on the SOA path.

Generation redispatch would require turning off large generators located north of the metro area, while turning on generators located south of the metro area to reduce the power flow on SOA. Generally, this would allow loads in the metro area to be served from the south or east, and power serving loads in California would not have to flow through the area. E3's studies showed that generation redispatch could offer the greatest relief to the SOA path and would only need to be implemented 5 to 20 days per year. However, generation redispatch could only potentially help defer the I-5 Project's energization date for 2 to 6 years.

Overall, the non-wires studies revealed that even with aggressive implementation of all four non-wires measures, the amount of power reduced on the SOA path would not be enough to meet the need after 2020. Also, as described in Section 1.1.2.2, Reliability and Non-Wires Measures, the studies did not address the commercial requests for new transmission service on the SOA path. Because the Non-Wires Alternative would not meet the need for the project, it was eliminated from further study as a long-term solution. However, since generation redispatch may help delay a new line energization date by 2 to 6 years, BPA is continuing to separately analyze the operational and commercial feasibility of generation redispatch to help maintain short-term system reliability (see Section 1.1.2.2, Reliability and Non-Wires Measures).

4.7.2 Transmission Line Routing Alternatives

4.7.2.1 Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon (Pearl Routes)

Early in the project planning process, BPA considered a number of potential transmission line routes that extended from the Castle Rock area generally south to BPA's existing Pearl Substation near Wilsonville, Oregon (Pearl Routes). These routes were divided into over 40 route segments. BPA reviewed these routes and found they had several constraints that affected the reasonableness of using these segments for a new transmission line route.

No existing BPA right-of-way was vacant and available for any of the segments in the proposed Pearl Routes. All Pearl Route segments would require new rights-of-way through rural and heavily populated areas in Washington and Oregon, and would likely require removing private homes, significantly increasing projects costs and social impacts.

The Pearl Routes also would require a new Columbia River crossing near Longview, Washington with much different conditions than the proposed crossing into Troutdale, Oregon. For example, it would require a new crossing with new marine and air transportation safety issues as compared with alternatives that use the existing Columbia River crossing. At the location needed for the Pearl Routes, the river is wide and new towers would need to be much higher, possibly over 400 feet tall—more than twice the height of standard 500-kV towers. In addition, towers would be located on islands currently managed for wildlife habitat. Environmental impact to wildlife species, habitat, and visual resources could be high at this crossing.

Pearl Substation is surrounded by mostly industrial buildings. Though there would be space to bring in a new 500-kV line, there is no space available for future expansions. BPA typically purchases additional space around substations for such expansions to prepare for potential future activities and development.

Although the Pearl Routes could address the transmission capacity issue, the inability of these routes to use any existing vacant transmission rights-of-way, the high social impacts of housing removal, the technical issues with a new Columbia River crossing, the likely higher environmental impacts, and the limitations at the Pearl Substation combined to make these routes not reasonable alternatives. These routes, therefore, were considered but eliminated from detailed study in this EIS.

4.7.2.2 Castle Rock to Troutdale Route Segments

In December 2009, 52 route segments were proposed for the transmission line (see Chapter 2 and Map 2-1). In response to public input and further BPA study, the following segments were partially or wholly eliminated from consideration for the following reasons.

- **Segments 10 and 6**: The northern half of Segment 10 was eliminated from consideration due to prohibitively steep terrain and proximity to homes (compared to northern portion of Segment 11). Segment 6 was originally selected to connect to the northern half of Segment 10. Because that portion of Segment 10 was eliminated from consideration, Segment 6 was no longer needed and was also eliminated from consideration.
- **Segment 11:** The southern half of Segment 11 crossed steep terrain, went through two parks/recreation areas at Merwin Lake including campgrounds, proceeded through a large old growth timber stand important to bald eagles, went through spotted owl habitat and would be visible to the recreation areas and many homes. The lower portion of Segment 11 was replaced with Segment K.
- **Segment 13**: This segment was originally located as a more direct route to Segment 17. Segment 13 is on WDNR and Weyerhaeuser land, and crosses very steep terrain with no homes nearby. Segment 13 crossed near Davis Mountain on WDNR property where a cluster of communication towers could be affected by high-voltage interference. Segment 13 has steep terrain and slopes greater than 35 percent that would increase construction costs and negatively impact WDNR's timber harvest practices by blocking access to large areas down slope outside of the potential right-of-way locations. BPA determined Segment 12 could instead be used to reach middle and far eastern routes, because it crosses gentler terrain and would create fewer impacts to logging practices than Segment 13. Segment 13 was eliminated from consideration.
- **Segment 17**: This segment is almost entirely located on PacifiCorp land and crosses the Lewis River just above and upstream of Merwin Dam. It was originally included to provide a direct route to Segment 26 and to take advantage of Segment 13's more direct path. Segment 17 is in direct view of the popular Merwin Dam recreation area and crosses critical wildlife habitat on the south side of the reservoir where old-growth trees provide bald eagle habitat and structure for a known osprey nest. With Segment 13 removed from analysis, and because of potential impacts to wildlife and recreation, Segment 17 was eliminated from further consideration.
- **Segment 16**: Segment 16 runs parallel to an existing PacifiCorp transmission line. It was originally located to connect segments 12 and 15 to Segment 17. Because Segment 17 was dropped from consideration, Segment 16 was no longer needed and was eliminated from further consideration.
- **Segment 24**: This Segment was initially proposed as a means of connecting Segment 17 to Segment 26. Because Segment 17 was eliminated from consideration, Segment 24 was also eliminated from further consideration.
- **Segments 19, 20, 21, and 22**: These four segments were modified into Segment N.

- **Segments 29, 32, 33, and 34**: In response to public input, Segment 29 was eliminated from further consideration as the easternmost segment, and Segment O was developed farther east away from homes. Segments 32, 33, and 34 were eliminated from further consideration because new segments O and P were developed. Segments O and P were located to mostly follow property and section lines to minimize potential impacts to logging practices, affect fewer recreation resources, and avoid a potential wind generation area.
- **Segments 28, 30 and 35**: Portions of segments 28, 30, and 35 were eliminated from consideration because the segments to which they were connected had changed and those portions were no longer needed. The newer segments Q, R, S, and T allowed new segments P and O to connect back to the Sundial substation site.
- **Segments 27, 31, 42, and 44**: These four segments used an existing PacifiCorp right-of-way that was suggested to BPA early in the process. Upon investigation, however, BPA discovered that this existing right-of-way is only 100 feet wide along these segments. These segments also cross a developed community, and many homes have been built up to the edge of the existing right-of-way and some homes are within the existing right-of-way at many locations. Because a 150-foot-wide right-of-way is required for the project, BPA would have needed to buy an additional 50 feet of right-of-way to use those segments, which would have required removing many homes. For this reason, those segments were eliminated from further consideration.

4.7.2.3 Reconfigure Existing 500-kV lines near Longview, Washington

BPA received a suggestion to separate existing 500-kV lines that are now parallel to each other in the Longview, Washington area and across the Columbia River. Under this alternative, BPA would increase the separation between the existing parallel 500-kV lines in the Longview area and at the existing Columbia River multi-line crossing at Longview so that they could be allowed to operate at full capacity (which varies by season and operating patterns). The suggestion stated that this realignment could help relieve congestion in the Longview vicinity, eliminate the need for a new substation at Castle Rock, and allow BPA to move the northern end of the transmission line to BPA's existing Allston Substation in Oregon and reconsider the route to Pearl Substation (see Section 4.7.2.1, Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon [Pearl Routes]).

Separating the existing 500-kV lines would require extensive reconfiguration, including tearing down a set of existing towers, foundations, and conductors for about 12 miles from Castle Rock to the Columbia River, and building a new set of 500-kV towers, foundations and conductors with added line crossings, transition towers, and line swapping. This alternative also would require extensive work at the Columbia River crossing at Longview, Washington. To create adequate separation distance between the 500-kV transmission lines, a new river crossing about 3,000 feet downstream would be needed. This crossing would have similar impacts as the river crossing described for the Pearl Routes (see Section 4.7.2.1, Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon [Pearl Routes]). This reconfiguration would require six special towers and two new unique river crossing towers over 450 feet tall. BPA would need to design these non-standard towers for the specific location and height. This would require extensive design work, and unique towers for which no backup tower or replacement tower would be available. The environmental and visual impacts of this option would be greater than under the action alternatives.

The operating limit of this alternate path would be lower when compared to the direct routes proposed from Castle Rock to Troutdale. The only way to achieve a comparable operating limit would be to reconfigure the existing 230-kV lines in the Longview vicinity and build a new 230-kV line into Longview Substation, in addition to the extensive work already described.

Although this alternative could eliminate the need for a new Castle Rock substation, Allston Substation would still need to be expanded to accommodate a new 500-kV line to Pearl Substation. The expansion would require new right-of-way in an area that does not have vacant right-of-way available. Any route originating at Allston Substation would need to connect to Pearl Substation. However, the routes to Pearl Substation were determined not to be reasonable alternatives and were eliminated from further consideration (see Section 4.7.2.1, Alternate Routes from Castle Rock, Washington to near Wilsonville, Oregon [Pearl Routes]). For these reasons, this alternative was eliminated from further consideration.

4.7.2.4 Northeastern Alternative, North of Silver Lake, Washington

Several comments suggested using a transmission line route heading east from the proposed Casey Road substation site north of Silver Lake, Washington, then heading south to Troutdale, Oregon. Comments suggested that this alternative would reduce impacts to private landowners and homes. BPA conducted an initial evaluation of this suggestion in late 2010 and provided this analysis in a project update newsletter in February 2011 (available at the project website: www.bpa.gov/corporate/i-5-EIS/documents.cfm). Subsequently, BPA received additional, more specific comments and suggestions about developing this route and decided to study the suggestion in more detail.

Over several months, BPA studied this route using public input, aerial photography, helicopter reconnaissance, field trips, and meetings with public and private owners of large timberland parcels and affected utilities. After careful study, BPA concluded that although this route may relieve one set of landowners from impacts, it would affect a new population of landowners instead, particularly just east of Cougar, and to some degree north of Castle Rock along the Cowlitz River. In addition, this route would be longer (10 to 15 miles), cross very steep terrain, require more miles of new access roads, and constrain timber management/harvests. It could also impact critical habitat for endangered species and wetlands.

Impact tradeoffs between the suggested route and already proposed routes tend to generally be the same, and for some project components such as cost, constructability, and the environment, this suggested route would likely have greater impacts than the action alternatives because of its length and the terrain it would cross. For these reasons, this alternative was eliminated from further consideration (see *Evaluation of Northeastern I-5 Route* at: www.bpa.gov/corporate/I-5-EIS/documents/Decision-northeastern-route-Jan2012.pdf).

4.7.2.5 Interstate 5 Highway Median Alternative

Several comments suggested that the I-5 freeway median be used to accommodate the new line. BPA engineers considered this suggestion. The median is extremely narrow in most areas, with little or no room to accommodate 500-kV towers or a 150-foot right-of-way. Due to extensive development along much of the freeway, there is no path available from the freeway to connect to any other existing transmission line corridor or segment. To build a 500-kV transmission line in the median, BPA would have to obtain rights from the Federal Highway Administration (FWHA) to use the land, and also schedule traffic closures to build and maintain the line. In general, FHWA seeks to accommodate utility facilities within the rights-of-way of federal highways such as I-5, when such use and occupancy of the highway right-of-way do not adversely affect highway or traffic safety, or otherwise impair the highway or its aesthetic quality, and do not conflict with the provisions of federal, state or local laws or regulations (see 23 CFR 645 subpart B). The new transmission towers would create a new safety hazard for motorists and potentially aircraft, and interfere with future highway expansion. For these reasons, BPA eliminated this alternative from consideration.

4.7.2.6 Trojan Nuclear Plant Facilities

During the scoping period, BPA received comments that suggested using existing facilities including transmission lines that were constructed for PGE's Trojan Nuclear Plant in Rainier, Oregon.

Though PGE decommissioned and removed the Trojan Nuclear Plant, PGE essentially replaced the resource with an equivalent amount of thermal generating plants owned and operated by PGE to serve their local load. PGE added a gas-fired generation plant (Port Westward) in 2007, and has an existing gas-fired generator (Beaver), both interconnected at Trojan. Together, both facilities have a combined output of about 900 MW of generation. The facilities in this area are still used to transport power to loads. PGE's generation near Trojan Substation reaches loads in Longview, Washington through two of PGE's 230-kV lines that are connected to BPA's Allston Substation. The PGE 230-kV lines are critical transmission lines, serving loads in the Portland/Vancouver metro area. Because the lines that connect to Trojan Substation are owned by PGE, and because they are already being used, this alternative was eliminated from further consideration.

4.7.2.7 Transmission Line Routes Bordering U.S. Forest Service and WDNR Land East of the Project Area

BPA considered line routes bordering U. S. Forest Service (USFS) Gifford Pinchot National Forest and WDNR land east of Segment O, which was added in August 2010 in response to requests to develop a route farther east. These routes are less reasonable when compared to Segment O. Segment O was proposed after discussions with large landowners such as Weyerhaeuser, Longview Timber, USFS, and WDNR. Routing options farther east than Segment O would cross the Silver Star Scenic Area (Gifford Pinchot National Forest), a popular recreation area near Silver Star Mountain; be longer; cross prohibitively steep terrain; require more turns and dead-end towers to stay close to the WDNR/USFS border; and require longer access roads in an area with limited accessibility and poor road conditions during winter. These routing options would also cross land designated or proposed for roadless areas. These lands could also be designated as wilderness areas in the future. For these reasons, BPA eliminated this alternative from consideration.

4.7.2.8 Transmission Line Route East to Bonneville Dam

During the scoping process, several comments suggested routing a line farther east from Castle Rock to a location near Bonneville Dam in the Columbia River Gorge. A route that could adequately reinforce the project area from a Castle Rock substation site to Bonneville Dam would be at least 99 miles long, much longer than any route currently under consideration. Because the load center is not in the Bonneville Dam area, BPA would still have to build a new line back to either Troutdale or Ostrander substations, which would add another 24 to 32 miles of line. The additional line length would increase construction and operation costs, and would reduce technical performance. With a Bonneville Dam route, a loss of about 350 MW of capacity could be expected because of the longer route. **Series compensation** could recover some of the lost capacity (at additional cost), but this alternative would shorten the time before the next major reinforcement was needed in the area.

A route from Bonneville Dam to the Troutdale area would also require building a portion of the line through the Columbia River Gorge National Scenic Area (NSA), an area of federally protected land managed by the USFS. The area is valued for its scenery and recreational opportunities. This alternative was eliminated due to the added cost needed for additional transmission line length, and reduced capacity and diminished technical performance.

4.7.3 Lower Voltage Line Upgrades

BPA considered upgrading lower voltage lines to meet the need for the project. The cumulative amount of required line upgrades needed to adequately reinforce the system exceeds 200 miles and would require upgrades to lines beyond BPA's jurisdiction that are owned by other utilities. Some of the lines that would need upgrades are already high-capacity lines and would require bundled conductors (more than one conductor per phase of the line) to increase the capacity further. Because adding more wires per phase would make the line heavier, it would likely require completely rebuilding the line with stronger towers to support the bundled conductors. Ultimately, upgrading existing lines would not provide the voltage support that the current proposal provides and could result in much higher costs because of the miles of line that would need to be upgraded. For these reasons, upgrading lower voltage transmission lines was eliminated from further consideration.

4.7.4 Reynolds Aluminum Plant Facilities

During the scoping period, BPA received comments that suggested using existing transmission facilities that served the Reynolds Aluminum plant in Longview, Washington. The Reynolds Aluminum plant closed several years ago and equipment has been removed from the site. The plant's closure provided some relief for the need to reinforce the transmission system in the Longview/Vancouver/Portland area. However, load growth (more people moving into the area and increased installation and use of air conditioning) is expected to use up the available capacity by 2016 (see Chapter 1, Purpose of and Need for Action). Because this available capacity could not meet the need for the project, this suggestion was eliminated from further consideration.

4.7.5 High Voltage Direct Current (HVDC) Technology

Some commentors suggested using HVDC technology for the entire line instead of the High Voltage Alternating Current (HVAC) 500-kV line proposed. HVDC is generally used to move large amounts of power over long distances. HVAC lines used over long distances need to be heavily compensated, that is, have devices such as capacitors or voltage regulators to improve performance of the system, and that could be more expensive. However, HVDC is also expensive because it would require DC terminals at each end of a line, which are also expensive. Because of these competing costs, HVDC is generally used when the length of the line (in kilometers) exceeds the voltage of the line (in kilovolts), which is a general guideline that accounts for these costs. In our case, the line length (about 120 kilometers) is much less than the 500 kilovolts needed for the line and so this project does not meet this general guideline.

HVDC is a reliable tool for transmitting power over long distances, but because of its prohibitively high cost for the length of the proposed project, and because BPA would still need to build a transmission line with similar impacts as the proposed project, it is not considered a reasonable alternative and was eliminated from further consideration.

4.7.6 Columbia River Underwater Alternative

Some comments suggested using underwater cables for the whole length of the line from Longview, Washington to Troutdale, Oregon or just across the Columbia River where the proposed project crosses from Washington into Oregon. Underwater cables are often considered where an overhead route is impossible, such as for long water crossings. For example, BPA's uses 2- and 5-mile sections of 115-kV alternating current underwater transmission cables in the San Juan Islands. Underwater cables are required because there is no ability to string overhead lines across the water.

For this project, we have several overhead route options, including one on mostly existing BPA right-of-way. For the Columbia River crossing, we have the opportunity to locate the new line among existing overhead transmission lines in an existing utility corridor, with an island in the middle that makes the span lengths between towers reasonable and relatively short.

Manufacturing and installing underwater cable in the Columbia River would cost several times more than going overhead. In addition, if damage or failure occurs, since the line is buried underwater and cannot be inspected directly, it can be difficult and time consuming to determine where the problem has occurred and the length of damaged cable. Uncovering and replacing the buried submarine cable is a specialized process and takes much longer than repairing an overhead line. For these reasons, outages on buried submarine cables tend to be much longer and can compromise the reliability of the system.

There are environmental tradeoffs also. With overhead lines, towers can typically be placed 1,000 to 1,500 feet apart and can span sensitive natural or manmade areas. Burying submarine cables requires continuous trenching and continuous access, resulting in potentially more impacts to the environment. The line would be located in parts of the river where large ships can disturb the river bottom with their propellers and prop wash, and in areas where dredging is done on a regular basis to accommodate ship traffic. Both issues make it risky and difficult to locate and bury a cable deep enough to avoid damage from ships or dredging, and yet not so deep that it cannot be removed and replaced in the future should a problem occur. Locating outside the ship traffic and dredging area involves disturbing sensitive riparian and wildlife habitat along the shore.

Placing one or more portions of the 70-mile new line under water would have the same reliability and environmental issues, plus higher per mile cost due to the initial design and set-up requirements for manufacturing a shorter length of cable. In addition, expensive transition facilities would be required at each end of any section of submarine cable. For these cost, reliability and environmental reasons, placing the transmission line underwater has been considered but eliminated from detailed study in this EIS.

4.7.7 Undergrounding the Transmission Line

During the scoping process, comments suggested burying the new transmission line underground either for its entire length or for certain lengthy portions such as through the Camas and Washougal areas. In response to scoping comments, BPA updated its information about the technical requirements and feasibility, and potential environmental impacts of using an underground cable system for its high-voltage transmission line projects (see Appendix D). This section summarizes the information contained in Appendix D.

Underground distribution cables of lower voltage are fairly common, but underground transmission cables of higher voltage such as that needed for the proposed project are not. In addition, underground high-voltage transmission cables typically are used only for relatively short distances in areas where it is physically impossible to install towers for overhead transmission lines. BPA is not aware of any instances where a utility has placed a transmission line of the proposed project's length and voltage (i.e., 70 miles of 500-kV line) underground.

There are several reasons why underground transmission lines of this length and voltage have not been built. The cost of underground is typically 10 to 20 times more expensive than overhead lines. It is also difficult to keep high voltage underground transmission cables from overheating. When they get overloaded and overheat, the insulation material used can breakdown quickly and cause a failure at the time of overheating, or later from damage caused by overheating. Since the line is buried and cannot be inspected directly, it can be difficult and time consuming to determine where the damage has occurred and the length of damaged cable. Uncovering and replacing the buried cable is a specialized process and can take much longer than repairing an overhead line. For these reasons, outages on underground cables tend to be much longer and can compromise the reliability of the system.

There are environmental tradeoffs also. With overhead lines, towers can typically be placed 1,000 to 1,500 feet apart and can span sensitive natural or manmade areas. Placing lines underground requires continuous trenching and a continuous access road system, resulting in potentially more impacts to the environment.

Placing portions of the 70-mile new line underground would have the same reliability and environmental issues, plus higher per mile cost due to the initial design and set-up requirements for manufacturing a shorter length of cable. In addition, expensive transition facilities would be required at each end of any section of underground. For these cost, reliability and environmental reasons undergrounding the transmission line has been considered but eliminated from detailed study in this EIS.

4.8 Comparison of Alternatives

BPA has evaluated the action alternatives and the No Action Alternative, and has compared the alternatives based on the information found in the chapters and appendices in this EIS. The results of the comparison are summarized in Tables 4-9, 4-10, and 4-11.

All action alternatives (West, Central, East, and Crossover and their options) would meet the need for the project; the No Action Alternative would not.

4.9 Preferred Alternative

BPA has evaluated the alternatives and options, considered the purpose of and need for the proposed project, the affected environment, and environmental consequences, and based on these factors, BPA's preferred alternative at this time is the Central Alternative, using Central Option 1.

Table 4-9 Comparison of Alternatives to Project Purposes

Alternatives	Use Ratepayer Funds Responsibly And Efficiently	Minimize Impacts To The Natural And Human Environment	Maintain BPA Transmission System Reliability And Performance	Meet BPA's Statutory And Contractual Obligations
West Alternative	About $385 million. Would be the least expensive because existing right-of-way is available for most of the length of the line. Some existing lines would need to be removed and replaced, which adds costs.	The project has been designed to minimize impacts to the environment where feasible, and mitigation measures are identified to avoid or reduce these impacts. Please see Table 4-10 for a comparison of the environmental impacts of the alternatives.	1. The project would increase the ability to serve the Portland/Vancouver metro area during summer and increase system flexibility should there be an interruption in the operation of one of the area's other transmission lines. It would also allow BPA to grant requests for transmission service while maintaining reliability of the electrical grid to BPA and industry standards. 2. Adds inherent risk to system reliability by placing the new line in the same corridor as other BPA lines transmitting power north-south.	Though BPA has no expressed contractual or statutory obligation to build the proposed project, the project would help BPA further its statutory mandates and tariff provisions that direct BPA to construct additions to the transmission system to integrate and transmit electric power and maintain system stability and reliability, as appropriate.
Central Alternative	About $459 million	Same as West Alternative	1. Same as West Alternative 2. N/A	Same as West Alternative
East Alternative	About $489 million. Would be the most expensive because it would be the longest route, and would require new right-of-way for most of its length.	Same as West Alternative	1. Same as West Alternative 2. N/A	Same as West Alternative
Crossover Alternative	About $442 million	Same as West Alternative	1. Same as West Alternative 2. Same as West Alternative	Same as West Alternative
No Action Alternative	No immediate costs would be incurred if the project is not built.	This alternative has the least environmental impacts. Please see Table 4-10.	Benefits of the project (increased system flexibility and capacity to Portland/Vancouver metro area in the summer) would not be gained. It would limit BPA's ability to provide service to new transmission requests because the capacity of existing lines in the area cannot accommodate the requests without compromising reliability of the system.	By not constructing the project, BPA would not be acting in furtherance of its applicable statutory mandates or tariff provisions.

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Table 4-10 Summary of Environmental Impacts by Alternative[1]

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Land	***Land Ownership***: Up to 401 acres of new easement would be acquired for right-of-way and new or improved roads - least of the alternatives. **Low-to-moderate** impacts where line or roads would be built on existing BPA easements. **High** impact in areas that require new right-of-way that would restrict land use. Because the alternative occupies 98% existing right-of-way, it would have the least high impacts on landowners among the alternatives. ***Land Use***: About 1,097 acres of existing right-of-way for about 66 miles would be used and 127 acres would be converted to new right-of-way. The alternative crosses the most urban/suburban, rural, agricultural, and open space land of the action alternatives (7%, 7%, 14%, and 68%, respectively). The alternative crosses the least timber production land (1%) of the action alternatives. See Chapter 5 for impacts on these individual land uses.	***Land Ownership:*** Up to 2,113 acres of new easement would be acquired for right-of-way and new or improved roads. Same impacts in existing and new right-of-way as the West Alternative, but greater amount of new right-of-way (90%) means potentially more high impacts on landowners. ***Land Use:*** The alternative follows existing right-of-way for about 8 miles. About 1,287 acres would be converted to new right-of-way and new and improved access roads, most on timber production land. The alternative crosses 1% urban/suburban land, 2% rural land, 67% timber production land, 2% agricultural land, and 26% open space land. See Chapter 5 for impacts on individual land uses.	***Land Ownership:*** Up to 2,376 acres of new easement acquired for right-of-way and new or improved roads. Same impacts as Central Alternative (90% new right-of-way). ***Land Use:*** The alternative follows existing right-of-way for about 8 miles. About 1,255 acres would be converted to new right-of-way and new and improved access roads, most on timber production land. The alternative crosses 1% urban/suburban land, 2% rural land, 72% timber production land (most of the alternatives), 3% agricultural land, and 22% open space land. See Chapter 5 for impacts on individual land uses.	***Land Ownership:*** Up to 1,420 acres of new easement acquired for right-of-way and new or improved roads. Slightly more high impacts on landowners than the West Alternative (55% new right-of-way), but less than the Central and East alternatives. ***Land Use:*** The alternative follows existing right-of-way for about 33 miles. About 772 acres would be converted to new right-of-way and new and improved access roads. The alternative crosses 1% urban/suburban land, 7% rural land, 48% timber production land, 3% agricultural land, and 43% open space land. See Chapter 5 for impacts on individual land uses.	**No** impact on land use.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same overall impacts on land ownership and land use as the alternative, but in different locations. See Chapter 5.	Same overall impacts on land ownership and land use, but in different locations. See Chapter 5.	Same overall impacts on land ownership and land use, but in different locations. See Chapter 5.	Same overall impacts on land ownership and land use, but in different locations. See Chapter 5.	
Recreation	Tower placement would permanently impact 0.9 acre of park land; new and improved roads would permanently impact 7.4 acres of park and <0.1 mile of trail. This is the most recreation land impacted by any alternative. **Low** impacts on <0.1 acre each of Oak Park and the Port of Camas-Washougal Marina and **moderate** impact on 0.3 acre of Washougal River Greenway converted to right-of-way and access road. (The preceding are impacts common to all alternatives.) **Moderate** impact on Green Meadows Golf Course (3 acres) and Camp Currie (2 acres) where towers and roads would occupy existing rights-of-way. **High** impact on East Fork Lewis River Greenway, WSU Vancouver campus trail and Ellen Davis Trail where just over 3 miles of new and improved access roads would be built. **No-to-low** impact where the line would cross Northern Clark County Scenic Drive in existing right-of-way.	Tower placement would permanently impact 0.1 acre of parks; new and improved roads would permanently impact <0.4 acre of park and <0.2 mile of trail. This is the least recreation land impacted by any alternative. **Low** impacts on <0.1 mile each of Bells Mountain Trail and Riverfront Trail (East) by access roads. Some visual intrusion where right-of-way would cross Spirit Lake Memorial Highway (SR 504) or be seen from Merwin Park, Goot Park, and the Western Yacolt Burn Forest; **no-to-low** impacts. Same impacts on Oak Park, Washougal River Greenway and a marina as the West Alternative.	Tower placement would permanently impact about 0.1 acre of park land and <0.1 mile of trail. New and improved access roads would permanently impact <0.4 acre of park and <0.5 mile of trail. **Low** impact on <0.1 mile of Riverfront Trail (East) where an access road would be improved. **Moderate** impact where about 0.2 mile of road would be improved along the Jones Creek Trail, potentially improving trail experience for ATV users. **Moderate** visual impact on hikers along the Silver Star Trail on Silver Star Mountain. **Moderate-to-high** impact on Tarbell Trail, which would be crossed 8 times and paralleled for about 1 mile; <0.3 mile of trail would be permanently converted to towers or roads. Same impacts on Oak Park, Washougal River Greenway and a marina as the West Alternative. Same impacts on recreationists using Merwin Park, Goot Park, Western Yacolt Burn Forest, and Spirit Lake Memorial Highway (SR 504) as the Central Alternative.	Same park acreage permanently impacted as East Alternative. Slightly less trail mileage impacted (<0.1 mile of Riverfront Trail [East] is avoided). Same impacts as East Alternative because the alternative follows a similar path across recreation land.	**No** impact on recreation resources.

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Recreation (continued)	**West Option 1**	**Central Option 1**	**East Option 1**	**Crossover Option 1**	**No** impact on recreation resources.
	Net reduction in permanent impacts on golf courses (about 2 acres), net increase in permanent impacts on trails (0.5 mile). **Moderate** impact on Camas Meadows Golf Club (0.5 acre) and Lacamas Heritage Trail (0.5 mile). Avoids Green Meadows Golf Course.	Same impacts as the alternative, but avoids crossing Spirit Lake Memorial Highway.	Net reduction in permanent impacts on trails (<0.1 mile). **Moderate** impact from visual intrusions around Riverside Park. Would avoid Riverfront Trail (East) and Spirit Lake Memorial Highway.	Net increase in permanent impacts on parks (1.2 acres). **Moderate** impact to 1.2 acres of Camp Currie from tower and access road placement.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Net increase in permanent impacts (0.2 acre). **Low** permanent impact on 5.2 acres of infrequently used Green Mountain Park. Avoids Green Meadows Golf Course and Camp Currie.	Net reduction in permanent impact on trails of <0.1 mile. Avoids Riverfront Trail (East) and Spirit Lake Memorial Highway.	Net reduction in permanent impacts on trails (<0.4 mile). **Moderate** additional impact on <0.1 mile of Bells Mountain Trail.	Same impacts as the alternative.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Net decrease in permanent impacts (1.2 acres). **Low** permanent impact on 3.8 acres of infrequently used Green Mountain Park. Avoids Green Meadows Golf Course and Camp Currie.	Net increase in permanent impact on about 0.8 acre of park and <0.2 mile of trail. **High** impacts where 0.8 acre of Moulton Falls Park and <0.2 mile of Lucia Falls/Moulton Falls Trail would be converted to towers or access roads. **Moderate** impact where it crosses the Northern Clark County Scenic Tour.	Net increase in permanent impacts on trails (<0.3 mile). **Moderate** additional impact to about 0.3 mile of Jones Creek Trail (Connector A) where right-of-way would cross the trail multiple times.	Same impacts as the alternative.	
Visual	**Moderate-to-high** impacts. The West Alternative's route has a low scenic quality rating but high viewer sensitivity. It would travel primarily in existing right-of-way where transmission lines already have affected views, although new towers would be taller than existing towers. It would have **moderate** impacts on visual resources for most of its length with localized areas of **high** impacts on some parks and natural areas and on residences near Longview/Kelso (including the West Side Highway neighborhood) and east of Vancouver.	**Low-to-moderate.** Because most of this alternative would run through sparsely populated land with few sensitive viewers and low scenic quality, most visual impacts would be **low**, with a few **moderate** impacts around Castle Rock, Ariel, Lake Merwin, the Lewis River and Camas and on residences close to the right-of-way.	**Low-to-moderate.** Because most of this alternative would run through sparsely populated or unpopulated land with few sensitive viewers and low scenic quality, most visual impacts would be **low**, with a few **moderate** impacts in and around the Cowlitz River and SR 504 on the north, Camas on the south and the Western Yacolt Burn State Forest.	Mostly **low-to-moderate**. While this alternative would share its northern portion with the West Alternative, which would have localized areas of **high** impacts, the rest of the route passes through sparsely populated or unpopulated land, such as around Ariel, Lake Merwin and the Lewis River, where it would have **low-to-moderate** impacts on most viewers.	**No** impact on visual resources.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same overall impact as the alternative. It would reduce impacts on a few residents and the Green Mountain Golf Course east of Vancouver and north of Camas, but cross Camp Currie, Camas Meadows Golf Course and pass near other residences and roads.	Same overall impact as the alternative. Starting the transmission line at the Casey Road substation site instead of the Baxter Road substation site would extend it through unpopulated land with few distinctive viewpoints.	Slightly higher overall impact than the alternative. Starting the transmission line at the Monahan Creek substation site means it would travel south of Castle Rock, crossing through largely sparsely populated or unpopulated areas. The option would remove visual impacts north of Castle Rock but introduce impacts where it crosses the Cowlitz River farther south. Monahan Creek substation would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.	Slightly higher overall impact than the alternative. The option would replace a small segment running north-south through rural residential areas north of Camas with a longer route running west along existing right-of-way and then southeast through open fields and more rural residential areas. The option moves visual impacts from one residential neighborhood to another, where taller towers could dominate surroundings.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Visual (continued)	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	**No** impact on visual resources.
	Slightly higher overall impact than the alternative. The option would avoid Green Mountain Golf Course, but have potentially high impacts on a greater number of residents and Green Mountain Park farther east due to required new right-of-way and longer line length.	Slightly higher overall impact than the alternative. Starting the transmission line at the Monahan Creek substation site means it would travel south of Castle Rock, crossing through sparsely populated or unpopulated areas except for the unincorporated community of West Side Highway, where it would have potentially high visual impacts. Monahan Creek substation would also have a slightly higher impact on viewer sensitivity (medium) than the other substation sites.	Same overall impact as the alternative. It would replace route segments between Yale and the rural residential areas north of Camas with similarly rated segments traveling farther to the west, removing visual impacts on outdoor and recreational users east of the alternative but introducing impacts on nearby rural residences.	Slightly lower overall impact than the alternative. The option would start the new transmission line farther north at the Baxter Road substation site (which has a lower visual impact rating than the Monahan Creek site). It would travel through sparsely populated land.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Same overall impact as West Option 2, although it affects slightly fewer residents.	Slightly higher overall impact than the alternative. It would move the Lewis River crossing near Ariel farther downstream to a visually sensitive area that attracts recreational users and would take a direct southeast route toward Venersborg on new right-of-way through more populated (rural residential) areas.	Same overall impact as the alternative. It would replace a very short route segment north of Camas traveling through unpopulated land.	Slightly lower impact than the alternative. The option would start at the Baxter Road substation site (which has a lower visual impact rating than the Monahan Creek site). It would travel through sparsely populated land but require additional right-of-way parallel to an existing line.	
EMF	Electric and magnetic field (EMF) impacts would be similar for each action alternative. Construction standards and grounding requirements would minimize potential nuisance shocks from electrical fields in the right-of-way. Electric fields would meet all BPA guidelines, ranging from 0.7 to 2.4 kV/m at edge of right-of-way and 8.7 to 9 kV/m directly under the line. Maximum magnetic fields at edge of right-of-way would range from 26 to 59 mG, or 3-15 mG under normal conditions, comparable to existing 500-kV lines in the area. All fields would dissipate to normal surrounding levels within a few hundred feet.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	**No** change in electric shock risk or potential radio and TV interference. Electric and magnetic fields near existing lines would increase as loads on those lines increase.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same overall impact as the alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	
Noise	**Low-to-moderate** temporary impacts during line construction activities, which would last a few days or weeks at a time at any one location. Temporary **moderate-to-high** impacts for residents near substation sites, because construction would occur over 13 months. Temporary **high** impacts if blasting is required in rocky areas. **No-to-low** long-term impacts. Some corona noise may occur along the conductors during foul weather events, but would not exceed BPA design criteria, statutory noise limits or USEPA guidelines. Maintenance activities would be infrequent. If chainsaws or other loud equipment must be used, there could be temporary **moderate** impacts.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	**No** noise impacts.

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Noise (continued)	**West Options 1, 2, 3**	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	**No** noise impacts
	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative.	Same overall impact as West Alternative, except for Crossover Option 2, which may exceed USEPA guidelines for corona noise at the edge of right-of-way by 1 dBA.	
Public Health and Safety	**Low** impact where the alternative would cross the Reynolds Metals Superfund site. EPA and ODEQ consider current health risk acceptable. **No** impact where about 600 feet of improved access road would impact BPA's Ross Complex control area. Restricted access and minimization of soil disturbance would mitigate impacts.	**Low** impact along Segment 28 where new towers and access road would be located on the eastern edge of the International Paper Company Mill site. The location is not likely within potentially contaminated areas. On-site investigation would determine risk and potential mitigation prior to construction.	**Low** impact where the alternative would cross the Reynolds Metals Superfund site. EPA and ODEQ consider current health risk acceptable.	**Low** impact where the alternative would cross the Reynolds Metals Superfund site. EPA and ODEQ consider current health risk acceptable.	**No** impact. However, if the transmission system's reliability is affected by growing loads, this could disrupt essential public safety services that rely on adequate and continuous electrical power.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Option 1, 2, 3**	
	Same impact as the alternative.	Same impact as the alternative.	Same impact as the alternative.	Same impact as the alternative.	
Socioeconomics and Environmental Justice	The project would cause long-term decreases in government revenues by diminishing the property tax base, reducing future timber-related revenue from state trust lands, and decreasing future revenue from taxes on private timber harvests—potential **high** impacts on Cowlitz or Clark counties in some years. Potential **low** impacts on farmers producing products for niche markets if impacted crops are not allowed to regrow, but **no** long-term impacts on the regional agricultural market. **No** long-term impacts on the private timber market or on environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands $2,386; increases in timber-harvest tax revenues, $941; increases in private timber production revenues $18,810; and decreases in agricultural production revenues, $820,000; Long-term decreases in trust revenues from forgone timber harvests $1,864; decreases in timber-harvest tax revenues $2,613; decreases in private timber production revenues $52,260; and decreases in agricultural production revenues $5.1 million.	**Same** impacts on government revenues, agricultural and private timber markets, and environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands, $2.3 million; increases in timber-harvest taxes, $65,950; increases in private timber production revenues, $1.3 million; and decreases in agricultural production revenues, $3,000. Long-term decreases in trust revenues from forgone timber harvests $1.8 million; decreases in timber-harvest tax revenues, $183,200; decreases in private timber production revenues, $3.7 million; and decreases in agricultural production revenues, $120,000.	**Same** impacts on government revenues, agricultural and private timber markets, and environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands, $1.2 million; increases in timber-harvest taxes, $94,340; increases in private timber production revenues, $1.9 million; and decreases in agricultural production revenues, $160. Long-term decreases in trust revenues from forgone timber harvests, $949,500; decreases in timber-harvest tax revenues, $262,100; decreases in private timber production revenues, $5.2 million; and decreases in agricultural production revenues, $5,300.	**Same** impacts on government revenues, agricultural and private timber markets, and environmental justice populations. Short-term increases in timber-harvest revenues on state trust lands, $1.6 million; increases in timber-harvest taxes, $37,300; increases in private timber production revenues, $746,200; and decreases in agricultural production revenues, $2,800. Long-term decreases in trust revenues from forgone timber harvests, $1.3 million; decreases in timber-harvest tax revenues, $103,600; decreases in private timber production revenues, $2.1 million; and decreases in agricultural production revenues, $110,000.	**No** impacts. In the long-term, reduced transmission system reliability would cause direct and indirect costs for electricity consumers and residents in Oregon and Washington due to electrical outages, and affect economic growth if businesses that rely on reliable power locate in other states.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same impacts as the alternative.	Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$255,600; and less increase in timber-harvest taxes, -$1,112; and private timber production revenues -$22,230. More long-term decreases in trust revenues from forgone timber harvests, +$199,700; and smaller decreases in timber-harvest tax revenues, -$3,088, and in private timber production revenues, -$61,750.	Same impacts as the alternative except: Smaller short-term increases in timber-harvest taxes, -$9,401, and private timber production revenues, -$188,030; and a slightly smaller decrease in agricultural production revenues, -$160. Smaller long-term decreases in timber-harvest tax revenues, -$26,110; private timber production revenues, -$522,240; and agricultural production revenues, -$5,100.	Same impacts as the alternative except: More short-term decreases in agricultural production revenues, +$650. More long-term decreases in agricultural production revenues, +$3,700.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Socioeconomics and Environmental Justice (continued)	**West Option 2** Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +52,410; and more short-term decreases in agricultural production revenues, +$650. Additional long-term decreases in trust revenues from forgone timber harvests +$40,950, and in agricultural revenues, +$4,700.	**Central Option 2** Same impacts as the alternative except: Smaller short-term increases in timber-harvest taxes, -$11,350, and private timber production revenues, -$227,030; and less short-term decreases in agricultural production revenues, -$160. Smaller long-term decreases in timber-harvest tax revenues, -$31,530; in private timber production revenues, -$630,570; and agricultural production revenues, -$5,100.	**East Option 2** Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$260,000; but less short-term increases in timber-harvest taxes, -$8,396, and private timber production revenues, -$167,930. More long-term decreases in trust revenues from forgone timber harvests, +203,100; but less long-term decreases in timber-harvest tax revenues, -$23,320, and private timber production revenues, -$466,410.	**Crossover Option 2** Same impacts as the alternative except: More short-term increases in timber-harvest taxes, +$4,020, and private timber production revenues, +$80,460. More long-term decreases in timber-harvest tax revenues, +$11,170, and private timber production revenues, +$223,500.	**No** impacts. In the long-term, reduced transmission system reliability would cause direct and indirect costs for electricity consumers and residents in Oregon and Washington due to electrical outages, and affect economic growth if businesses that rely on reliable power locate in other states.
	West Option 3 Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$36,650; timber-harvest tax revenues, +$2,040; and private timber production revenues, +$40,810; and more short-term decreases in agricultural production revenues +$790. Added long-term decreases in trust revenues from forgone timber harvests, +$28,630; timber-harvest tax revenues, +$5,667); private timber production revenues, +$113,300; and agricultural production revenues, +$4,300.	**Central Option 3** Same impacts as the alternative except: Smaller short-term increases in timber-harvest revenues on state trust lands, -$431,950; timber-harvest taxes, -$10,000; and private timber production revenues, -$200,010); and a larger short-term decrease in agricultural production revenues, +$35,000). Smaller long-term decreases in trust revenues from forgone timber harvests, -$337,450; timber-harvest tax revenues, -$27,780; and private timber production revenues, -$555,550; and a larger long-term decrease in agricultural production revenues, +$400,000.	**East Option 3** Same impacts as the alternative except: More short-term increases in timber-harvest revenues on state trust lands, +$170,900; but less short-term increases in timber-harvest taxes, -$1,137, and private timber production revenues, -$22,740. More long-term decreases in trust revenues from forgone timber harvests, +$133,500; but less long-term decreases in timber-harvest tax revenues, -$3,160, and private timber production revenues, -$63,150.	**Crossover Option 3** Same impacts as the alternative except: More short-term increases in timber-harvest taxes, +$5,620, and private timber production revenues, +$112,400. More long-term decreases in timber-harvest tax revenues, +$15,600, and private timber production revenues, +$312,000.	
Transportation	**No-to-low** impact during operation and maintenance of the line. New and improved roads built within rights-of-way would not be public, although they could encourage trespassing. Roads built outside the right-of-way may affect local transportation slightly by improving or adding to existing roads used for other purposes (by the landowner or public). The West Alternative would require the least mileage of roads, 10 miles new and 20 miles improved, outside the right-of-way. **Low-to-moderate** impact during construction due to temporary and intermittent traffic disruptions. The alternative crosses areas with more developed road systems meant to serve larger populations, which could partially mitigate impact from traffic disruption.	Same long-term impacts as the West Alternative. The Central Alternative would have the second highest mileage of new or improved roads outside the right-of-way (25 miles new, 109 miles improved). Same temporary construction impacts as the West Alternative. The alternative would cross more rural areas with fewer existing roadways; however there would be less traffic subject to disruption.	Same overall impacts as the Central Alternative. The East Alternative would have the highest mileage of new or improved access roads outside the right-of-way (21 miles new, 161 miles improved).	Same overall impact as the Central Alternative. The Crossover Alternative would have 19 miles new and 78 miles of improved access roads constructed outside the right-of-way.	**No** impact on transportation.
	West Option 1 Same overall impact as the alternative.	**Central Option 1** Same overall impact as the alternative. This option does not add any additional crossings of public roads although many logging roads would be crossed.	**East Option 1** Same overall impact as the alternative. Similar to Central Option 2, this option would cross West Side Highway but avoid crossing SR 504.	**Crossover Option 1** Same overall impact as the alternative. This option would add 3 miles of new access road, and 1 mile of improved access road.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Transportation (continued)	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	**No** impact on transportation.
	Same overall impact as the alternative.	Same overall impact as the alternative. This option would cross SR 411 (West Side Highway) but avoid crossing SR 504.	Same overall impact as the alternative. This option would require 2 fewer miles of new access roads and 27 fewer miles of improved access roads.	Same overall impact as the alternative. This option would cross additional roads mostly used for logging activities and would require improvements of 9 to 10 more miles of access road.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Same overall impact as the alternative.	Same overall impact as the alternative.	Same overall impact as the alternative.	Same overall impact as Crossover Option 2.	
Cultural	**Moderate-to-high** impacts. The West Alternative has the highest sensitivity score among the alternatives (498), likely because it would cross some large population centers that contain a greater number of known sites. Segments with the highest probability of cultural resources present are 25, 40, 46 and 52. Segments that have resources located at proposed tower sites are 2, 4, 9, 25, 36b, 41, 45, 50, and 52. Resources include trails, village sites, an ethnographic fishing location and prairie, a cemetery and other possible burial sites, an historic grave marker, an historic Northern Pacific Railroad site, the Ostrander Tunnel and Portal, village sites and lithic scatters. Segment 52, the southernmost segment shared by all alternatives, has a lithic scatter, a historic site and the NRHP-listed Parkersville site.	Save overall impacts as the West Alternative. The Central Alternative has the second lowest sensitivity score (435), partly because this alternative would run in a less-populated area with fewer previous surveys completed. Segments with the highest probability of cultural resources present are 4 and 52. Segments that have resources located at proposed tower sites are 10, 28, and 52, B and F. Resources include trails, villages and lithic scatters.	Save overall impacts as the West Alternative. The East Alternative has the lowest sensitivity score (394), because it would cross a less-populated area with more slopes and higher elevations that are less likely to have been used by Tribes. Segments with the highest probability of cultural resources present are 3 and 52. Six segments have resources located at proposed tower sites (52, B, F, K, O, W). Resources include historic military roads, trails, lithic scatters and ethnographic sites.	Save overall impacts as the West Alternative. The Crossover Alternative has the second highest sensitivity score (463), likely because a number of its segments cross highly populated areas where more surveys have been conducted. Segments with the highest probability of cultural resources present are 4 and 52. Seven segments have resources located at proposed tower sites (2, 4, 9, 52, N, O, W). Resources include trails, village sites and lithic scatters.	**No** impact on cultural resources.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Slightly higher sensitivity score (+21) than the alternative. It would remove 3 segments with known resources, but 2 of 3 replacement segments would also have resources. Segments 40 and 46 have an historic road and grave marker, among other resources.	Slightly higher sensitivity score (+12) than the alternative. It would add Segment A, which has the same trail at a tower location as segments B and F.	Slightly higher sensitivity score (+11) than the alternative. It would remove 2 segments where towers would impact resources, but 1 (3) of four replacement segments (3, 7, 11, J) has a known village site that may be affected by tower locations.	Higher sensitivity score (+57) than the Crossover Alternative. It would remove 1 segment and add 3 segments (47, 48, 50), 2 of which (47, 50) have towers located where they could impact ethnographic prairies and a village site.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Higher sensitivity score (+53). It would remove 4 segments where towers could impact resources, but add 4 more sensitive segments that also have resources at tower sites (segments 36, 36a, 37, 43), including a village and ethnographic prairie.	Higher sensitivity score (+51). It would remove 2 segments where towers could impact resources, but add 3 more sensitive segments with resources at tower sites (1, 4, 5), including a village site and ethnographic site likely to contain burials.	Higher sensitivity score (+31). It would remove three segments with known resources, but one (U) of five replacement segments (35, P, T, U, V) has a known cultural site (trail) that could be impacted by a tower.	Higher sensitivity score (+35) than the Crossover Alternative, because 1 (C) of 2 replacement segments (C, E) has a tower located where it could affect an historic military road.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Higher sensitivity score (+42) because it would remove 4 segments where towers could impact resources, but add 3 more sensitive segments (36, 36a, 37) that also have resources at tower sites.	Slightly lower score (-26). It would replace one segment with another (30) that has less impact on an ethnographic trail.	Nearly the same impact as the alternative (lower sensitivity score of -5). It would replace one segment with another, which contains no known sites at proposed tower locations.	Higher sensitivity score (+34) because 2 replacement segments (D, E) have towers located where they could affect the same historic military road as Option 2.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Geology and Soils	The northern portion of the West Alternative (north of the Lewis River) is within potentially landslide-susceptible terrain and crosses mapped landslides. The alternative would disturb about 211 acres of soil with severe erosion potential, the least of the action alternatives. Erosion impacts would be greatest during and immediately after construction; by using best management practices, impacts would be **low-to-moderate.** Longer term erosion impacts, such as from infrequent operation and maintenance activities, would be **low**. Soils along this alternative have generally low-to-moderate resistance to soil compaction. Construction would have temporary **low-to-moderate** impacts on soil compaction; long-term impacts would be **low** in areas not under towers and roads, but **high** on about 238 acres of soil that would be permanently compacted under towers and roads.	Most of the Central Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides. The alternative would disturb about 596 acres of soil with severe erosion hazard, the second highest among the action alternatives. However, temporary and long-term erosion impacts would be the same as the West Alternative. Soils along the northern and southern portions of this alternative have generally low resistance to soil compaction; soils along the middle portion have moderate resistance. Same temporary and long-term soil compaction impacts as the West Alternative, although more soil (262 acres total) subject to permanent compaction, a **high** impact.	The East Alternative would be constructed along the most remote and rugged route of the action alternatives. Most of the alternative would cross potentially landslide-susceptible terrain, including several mapped landslides. The alternative would disturb about 664 acres of soil with severe erosion hazard, the highest among the action alternatives. However, temporary and long-term erosion impacts would be the same as the West Alternative. Similar to the Central Alternative, soils along the northern and southern portions of the East Alternative have generally low resistance to soil compaction; soils along the middle portion have moderate resistance. Same temporary and long-term soil compaction impacts as the West Alternative, although slightly less soil (235 acres total) subject to permanent compaction, a **high** impact.	Most of the Crossover Alternative is within potentially landslide-susceptible terrain and would cross several mapped landslides. The alternative would disturb about 478 acres of soil with severe erosion hazard, mostly located along its middle and lower portions. Temporary and long-term erosion impacts would be the same as the West Alternative. Soils along the northern and southern portions of this alternative have generally low-to-moderate resistance to soil compaction; the middle portion has moderate resistance. Same temporary and long-term soil compaction impacts as the West Alternative, although more soil (253 acres total) subject to permanent compaction, a **high** impact.	**No** impact on geology and soil.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Would cross slightly less soil (-5 acres) with severe erosion potential, but slightly more soil (+1 acre) with low resistance to compaction, with the same overall erosion and compaction impacts as the alternative.	Would cross more soil (+33 acres) with severe erosion potential near Castle Rock, having **low-to-moderate** erosion impacts in these areas. It would permanently compact slightly more soils (+3 acres) with low resistance to compaction, with same compaction impacts.	Would cross mapped landslide areas near the Cowlitz River and soil with severe erosion potential near Lexington (a **low-to-moderate** impact), but would cross less soil (-47 acres) overall with severe erosion potential. It would permanently compact more soil (+28 acres) with low resistance to compaction, but have same compaction impacts.	Would cross slightly less soil (-3 acres) with severe erosion potential. It would permanently compact slightly more soil (+14 acres) with low resistance to compaction, but have same compaction impacts as the alternative.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Would cross slightly more soil (+12 acres) on steeper slopes with moderate-to-severe erosion potential than the alternative, having **low-to-moderate** erosion impacts in these areas. It would permanently compact slightly more soil (+8 acres) with low resistance to compaction, but have same overall compaction impacts.	Would cross a mapped landslide near Longview and soil with severe erosion potential near Lexington (a **low-to-moderate** impact), but would cross less soil (-38 acres) overall with severe erosion potential. It would permanently compact more soil (+31 acres) with low-to-moderate resistance to compaction, but have the same compaction impacts.	Would cross mapped landslide areas along Salmon Creek and soil with severe erosion potential south of Yale Dam and east of Amboy (a **low-to-moderate** impact), but would cross nearly 10% less soil (-60 acres) overall with severe erosion potential. It would permanently compact slightly less soil (-4 acres) with low-to-moderate resistance to compaction, with same compaction impacts.	Would cross about 14% more soil (+67 acres) with severe erosion potential near Castle Rock (a **low-to-moderate** impact). It would permanently compact less soil (-14 acres) with low resistance to compaction, but have same compaction impacts as the alternative.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Would cross a mapped landslide area near Matney Creek. It would cross about 20% more soil (+44 acres) with severe erosion potential than, having **low-to-moderate** erosion impacts in these areas. It would permanently compact slightly more soils (+13 acres) with low resistance to compaction, but have same compaction impacts.	Would cross mapped landslide areas near Amboy and the East Fork Lewis River and some soil with moderate-to-severe erosion potential southeast of Amboy (a **low-to-moderate** impact), but would cross less soil (-31 acres) overall with moderate-to-severe erosion potential. It would permanently compact slightly less soil (-3 acres) with moderate resistance to compaction, with same compaction impacts.	Would cross soils with severe erosion potential east of the upper reaches of the Washougal River (a **low-to-moderate** impact) but would cross only slightly more soil (+3 acres) overall with severe erosion potential. It would permanently compact slightly less soil (-2 acres) with low resistance to compaction, with same compaction impacts.	Would cross about 12% more soil (+59 acres) with severe erosion potential near Castle Rock (a **low-to-moderate** impact). It would permanently compact slightly less soil (-19 acres) with low resistance to compaction, but have same compaction impacts as the alternative.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Water	**Low** overall impact on watershed functions. Although isolated actions could cause **high** impacts on some streams (same for all alternatives), they would be spread over a watershed area of 161,000 acres. Would create 82 miles of newly exposed soil, causing the smallest increase in runoff (0.09%) but greatest increase in sediment delivery to streams (0.25%) of the action alternatives. Would require clearing riparian vegetation at 47 forested crossings of fish-bearing streams. **Low** impacts at 28 crossings where existing shade level is already low; **high** impacts at 19 crossings where loss of existing shade could result in temperature increases. This is the smallest number of riparian crossings and high riparian impacts among the action alternatives. **No** impacts on water temperatures (or fecal coliform levels) where it would cross 5 impaired streams because vegetation in the right-of-way has already been removed; potential **low** impacts on these streams from turbidity (caused by erosion). **Low** impact on 100-year floodplains where 32 towers and 6 miles of improved access roads would be built (this alternative has the greatest number of project components in floodplains). **No** long-term impacts on groundwater. It would cross about 20 miles of wellhead protection areas, the most of the action alternatives.	**Low** overall impact on watershed functions because impacts would be spread over 218,000 acres of watershed. Would create 103 miles of newly exposed soil, the most of the action alternatives, but cause relatively moderate increases in runoff (0.59%) and sediment delivery to streams (0.15%). Would require clearing riparian vegetation at 68 forested crossings of fish-bearing streams, with **low** impacts at 19 crossings and **high** impacts at 49 crossings. This is the greatest number of riparian crossings and high riparian impacts among the action alternatives. **Low** impacts on water temperatures and turbidity where it would cross 2 impaired rivers; most vegetation in the right-of-way has already been removed. **Low** impact on 100-year floodplains where 11 towers and about 1 mile of new or improved access roads would be built. **No** long-term impacts on groundwater where the project would cross about 6 miles of wellhead protection areas.	**Low** overall impact on watershed functions because impacts would be spread over 209,000 acres of watershed. Would create 96 miles of newly exposed soil and cause the most increase in runoff (1.03%), but cause nearly no sediment delivery to streams. Would require clearing riparian vegetation at 52 forested crossings of fish-bearing streams, with **low** impacts at 17 crossings and **high** impacts at 35 crossings. **Low** impacts on water temperatures and turbidity where it would cross the same 2 impaired rivers as the Central Alternative. **Low** impact on 100-year floodplains where about 10 towers and 1 mile of new or improved access roads would be built. **No** long-term impacts on groundwater where the project would cross about 6 miles of wellhead protection areas.	**Low** overall impact on watershed functions because impacts would be spread over 184,000 acres of watershed. Would create 93 miles of newly exposed soil, causing relatively moderate increases in runoff (0.47%) and sediment delivery to streams (0.17%). Would require clearing riparian vegetation at 55 forested crossings of fish-bearing streams, with **low** impacts at 23 crossings and **high** impacts at 32 crossings. **Low** impact on water temperatures and turbidity where it would cross 1 impaired river. **Low** impact on 100-year floodplains where about 12 towers and 2 miles of access road would be built. **No** long-term impacts on groundwater where the project would cross just under 10 miles of wellhead protection areas.	**No** impact on water.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same overall water impacts as the alternative. Would cross 2 more impaired streams, but have **low** impacts because vegetation has already been cleared. Net additions of 10 towers and 2 miles of access roads in 100-year floodplains, still a **low** impact.	Same overall water impacts as the alternative. Would clear vegetation with high shade function along 1 additional creek.	Same overall water impacts as the alternative. Would cross 2 additional impaired streams. However, it would avoid clearing vegetation with high shade function along 11 creeks. One less tower and slightly less access road construction (-0.1 mile) in floodplains.	Same overall water impacts as the alternative. Would clear vegetation with high shade function along 1 additional creek.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Same overall water impacts. Would avoid clearing vegetation with high shade function along 1 creek. Net addition of 1 tower and reduction in access roads (-0.8 mile) in floodplains.	Same overall water impacts as the alternative. Would avoid crossing the East Fork Lewis River and avoid clearing vegetation with high shade function along 9 creeks. There would be 1 less tower and less access road construction (-0.1 mile) in floodplains.	Same overall water impacts as the alternative. Would clear vegetation with high shade function along 5 more creeks.	Same overall water impacts as the alternative. Would cross 2 more impaired streams, having **low** impacts on both.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Same overall water quality impacts. Would clear vegetation with high shade function along 1 additional creek. Net addition of 2 towers and reduction in access roads (-0.7 mile) in floodplains.	Same overall water impacts as the alternative. Would avoid crossing the Coweeman River and avoid clearing vegetation with high shade function along 2 creeks. There would be slightly more access road construction (+0.2 mile) in floodplains.	Same overall water impacts as East Option 2. Would clear vegetation with high shade function along 4 more creeks.	Same overall water impacts as Crossover Option 2. Would cross the same 2 impaired streams. Would also require clearing vegetation with high shade function along 1 more creek.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Wetlands	Right-of-way clearing would affect about 54 acres of forested wetlands and 62 acres of scrub-shrub wetlands (both **high** impacts), the most of the action alternatives. Fill for tower footings (and access roads) would impact an additional 25 acres of forested and non-forested (scrub-shrub, emergent and aquatic bed) wetlands in the following locations: two towers along the Coweeman River (**high** impact); 20 towers in the area north of the East Fork Lewis River south to Salmon Creek (**high** impact); 26 towers along Lacamas Creek and north of Lacamas (**high** impact, and a **moderate** impact from potential noxious weed introduction); and14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact, same for all action alternatives).	Right-of-way clearing would affect about 69 acres of forested wetlands and 16 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 8 acres of forested and non-forested wetlands in the following locations: two towers near the Cowlitz River (**high** impact); two towers east of Amboy along the Chelatchie River (**high** impact); two towers near Big Tree Creek (**high** impact) northeast of Camas; 14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact).	Right-of-way clearing would affect about 61 acres of forested wetlands and 23 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 10 acres in the following locations: two towers near the Cowlitz River (**high** impact); seven towers east of Amboy (**high** impact); five towers northeast of Camas along the Washougal River (**high** impacts); 14 towers near Camas where the line would cross the Columbia River (**low-to-high** impact).	Right-of-way clearing would impact about 53 acres of forested wetlands and 35 acres of scrub-shrub wetlands (both **high** impacts). Fill for tower footings (and access roads) would impact an additional 13 acres in the same general locations as the East Alternative.	**No** impact on wetlands.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Would require clearing more (+7 acres) scrub-shrub and forested wetlands and filling more (+5 acres) forested and non-forested wetlands to place 14 towers with access roads within the Lacamas Creek floodplain northwest of Lacamas Lake, affecting some high-functioning wetlands—a **high** impact.	Would require clearing more (+2 acres) medium-to-high quality forested and scrub-shrub wetlands near the southern end of the option, where it would have **moderate-to-high** impacts. Would fill slightly more (+<1 acre) forested and non-forested wetlands.	Would require clearing more (+10 acres) forested and shrub-scrub wetlands and filling more (+3 acres) of forested and non-forested wetlands to place eight towers with access roads in the Cowlitz River floodplain, a **high** impact.	Would require clearing more (+9 acres) forested and scrub-shrub wetlands and filling more (+2 acres) forested and non-forested wetlands—**high** impacts—within the same wetlands described for West Option 3.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Would require clearing fewer (-11 acres) forested and scrub-shrub wetlands and filling fewer (-4 acres) forested and non-forested wetlands. However, clearing in scrub-shrub wetlands and fill in emergent and scrub-shrub wetlands would still occur in the Lacamas Creek floodplain, having a **high** impact where wetland functions are rated high. The option would cross more agriculturally disturbed wetlands where functions are rated low or medium. Clearing in forested and scrub-shrub wetlands northeast of Camas and along the Little Washougal River would have **moderate-to-high** impacts.	Would require clearing more (+5 acres) forested wetlands (but -1 acre scrub-shrub wetlands) and filling slightly more (+1 acre) forested and nonforested wetlands for four towers where the option would cross into Lexington near the Cowlitz River, a **high** impact.	Would require clearing fewer (-3 acres) forested and scrub-shrub wetlands and filling fewer (-3 acres) forested and non-forested wetlands, but would still place five towers with roads in wetlands near Cedar Creek and the Little Washougal River—a **high** impact.	Would require clearing more (+4 acres) forested and scrub-shrub wetlands and filling more (+<1 acre) forested and non-forested wetlands near Baxter Creek—a **high** impact. Two or three towers with roads would be placed in or near wetlands between the Baxter Road and Monahan Creek substation sites.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Impacts similar to West Option 2. Would require clearing fewer (-7 acres) forested and scrub-shrub wetlands and filling fewer (-4 acres) forested and non-forested wetlands. Same **high** impact in Lacamas Creek floodplain where wetland functions are rated high. Clearing in forested and scrub-shrub wetlands northeast of Camas and along the Little Washougal River and along Matney Creek would have **moderate-to-high** impacts.	Impacts similar to Central Option 2, although this option would require clearing fewer (-3 acres) forested and scrub-shrub wetlands and most likely avoid the alternative's potentially high impact along the East Fork Lewis River. Would fill slightly more (+1 acre) forested and non-forested wetlands, including forested wetlands at the southern end of the option. Clearing of forested wetland and construction of two towers would occur along Cedar Creek within high quality forested and emergent wetlands and in smaller scrub-shrub wetlands along drainages west and south of Amboy.	Would require clearing slightly more (+1 acre) forested wetlands and fewer (-1 acre) scrub-shrub wetlands, and filling slightly more (+1 acre) forested and non-forested wetlands. Two towers with roads would be placed within a forested wetland south of the East Fork Little Washougal River—a **high** impact.	Impacts similar to Crossover Option 2. Would require clearing more (+5 acres) forested and scrub-shrub wetlands and filling more (+<1 acre) forested and non-forested wetlands near Baxter Creek—a **high** impact. Same two or three towers with roads would be placed in or near wetlands between the Baxter Road and Monahan Creek substation sites.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Vegetation	**No-to-low** impacts on 241 acres of rural and urban/suburban landscape; **low** impacts on 366 acres of shrubland, 106 acres herbaceous vegetation (where it must be permanently cleared) and 13 acres of production forest; m**oderate** impact on 345 acres of forest vegetation; **high** impact on 27 acres of mature forest. Potential **moderate-to-high** impacts on 3 special-status species, small-flowered trillium (4 acres), dense sedge (1 acre) and Nuttall's quillwort (0.5 acre), depending on whether activities contribute to the need for federal listing. If present, potential **high** impact on Oregon coyote-thistle or **moderate-to-high** impacts on Hall's aster, tall bugbane or western wahoo. Potential **high** impacts on some special-status plant habitats: 44 acres in the Lacamas Prairie Natural Area, which requires removing some Oregon white oak woodlands; a WDNR Forest Riparian Conservation Easement; and <0.1 acre of Bradshaw's lomatium habitat.	**No-to-low** impacts on 71 acres of rural and urban/suburban landscape; **low** impacts on 1,261 acres of production forest, 74 acres of shrubland, and 60 acres herbaceous vegetation; **moderate** impact on 303 acres of forest; **high** impact on 13 acres of mature forest. Potential **high** and **moderate-to-high** impacts, respectively, on 2 special status species: hairy-stemmed checker-mallow (1 acre), and small-flowered trillium (5 acres). If present, potential **moderate** impacts on soft-leaved willow or tall bugbane. No known special-status plant habitats potentially affected by the alternative.	**No-to-low** impacts on 99 acres of rural and urban/suburban landscape; **low** impacts on 1,386 acres of production forest, 89 acres of shrubland, and 65 acres of herbaceous vegetation; **moderate** impact on 214 acres of forest; **high** impact on 13 acres of mature forest. Potential **high** impacts on 1 special status plant habitat, the North Pacific herbaceous bald and bluff priority ecosystem along Segment O; and on 1 special-status species, small-flowered trillium (5 acres). If present, potential **moderate** impacts on soft-leaved willow and tall bugbane.	**No-to-low** impact on 147 acres of rural and urban/suburban landscape; **low** impact on 787 acres of production forest, 274 acres of shrubland, and 63 acres of herbaceous vegetation; **moderate** impact on 315 acres of forest; and **high** impact on 44 acres of mature forest (most of the alternatives). Same potential **high** impacts on the North Pacific herbaceous bald and bluff priority ecosystem and small-flowered trillium (5 acres) as the East Alternative. If present, potential **moderate** impacts on tall bugbane and **moderate-to-high** on bolandra.	**No** impact on vegetation.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	More **moderate-to-high** and **high** impacts on special-status habitats and species than the alternative or its other options. Right-of-way and towers and roads would affect more (+34 acres) of the Lacamas Prairie Natural Area (and proposed WNHP preserve), additional high impacts where trees (particularly +1 acre of Oregon white oak) would be removed. Additional high impacts on Bradshaw's lomatium (+4 acres) and small-flowered trillium (+20 acres). Added moderate-to-high impacts on three state-designated species: Oregon coyote-thistle (+0.4 acre), Hall's aster ((+0.2 acre), and Nuttall's quillwort (+3 acres). Would impact less forest land (-15 acres) than the alternative.	Little or no change in moderate to high impacts on vegetation types. Same or similar impacts as the alternative on special-status plant habitats and species.	Would have additional **high** impacts on mature forest (+7 acres) and added **moderate** impacts on forest (+34 acres). Same or similar impacts as the alternative on special-status plant habitats and species.	Would have additional **moderate** impacts on forest (+17 acres) and could disturb the Lacamas Prairie Natural Area (+8 acres), a **high** impact, but would not affect any known WNHP priority ecosystems in this area.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Would disturb less (-18 acres) of the Lacamas Prairie Natural Area and avoid the WDNR Forest Riparian Conservation Easement and Oregon white oak woodland, reducing high impacts. Would also avoid documented populations of dense sedge, reducing moderate-to-high impacts. However, it would clear more (+5 acres) mature forest, an added **high** impact. Would reduce moderate impacts on forest land (9 acres).	Would have additional **high** impacts on mature forest (+7 acres) and additional **moderate** impacts on forest land (+60 acres). Same or similar impacts on special-status plant habitats and species.	Would have less high impacts on mature forest (-8 acres), but additional **moderate** impacts on forest (+22 acres). Same or similar impacts on special-status plant habitats and species.	Would reduce moderate impacts on forest land (-3 acres). Same or similar impacts as the alternative on special-status plant habitats and species.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	**No** impact on vegetation.
Vegetation (continued)	Mostly the same impacts as West Option 2, except this option reduces high impacts by clearing slightly less (+3 acres total) mature forest land and would have additional **moderate** impacts on forest land (+31 acres).	Similar to Central Option 2, this option would have additional **high** impacts on mature forest (+3 acres) and additional **moderate** impacts on forest (+57 acres). Could also impact a WDNR special-status plant habitat, which could be a **high** impact, but would also avoid a hairy-stemmed checker-mallow site, reducing high impacts.	Would reduce moderate impacts on forest (-9 acres) but have additional **low** impacts on production forest (+23 acres). Same or similar impacts on special-status plant habitats and species.	Would have additional **moderate** impacts on forest land (+14 acres). Same or similar impacts on special-status plant habitats and species.	
Wildlife	The West Alternative would create the least new fragmentation of wildlife habitat because it would require only 3 miles of new right-of-way; however, widening of existing right-of-way could expand existing fragmentation, particularly in forested habitats. Because the new transmission line would be higher than parallel existing lines, it could increase the risk of bird collisions in many areas. Impacts on most (non-special-status) wildlife would be **low** where habitat is lost to right-of-way clearing or towers and roads and **moderate** from increased mortality risks (e.g. prey species of raptors would be more visible; birds colliding with the line). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 27 acres of mature forest, 6 acres of westside prairie in the Lacamas Prairie Natural Area, 61 acres of biodiversity areas and corridors, and 3 acres of the Sifton/Lacamas Oregon White Oak and Washougal Oak woodlands. It could have **low-to-high** impacts on 160 acres of riparian habitat and 175 acres of freshwater wetlands, depending on habitat value and wildlife species present (**moderate-to-high** impact on Coweeman Wetlands). Special-status species that could be impacted include Western pond turtle (**moderate-to-high** impact), purple martin (**moderate** impact), California floater mussel (**low-to-moderate** impact); bald eagles (**moderate** impact), northern spotted owl (**low** impact) and marbled murrelet (**low** impact). (See full list in chapter.) Infrequent maintenance activities would generally have **low** impacts on wildlife habitats and species.	Requiring mostly new right-of-way, the Central Alternative would increase habitat fragmentation primarily in forested habitats; however most of the new line would not parallel existing lines and so pose less collision risk for birds than the West Alternative. Impacts on most wildlife would be similar to the West Alternative (**low** from habitat loss; **moderate** due to increased mortality risk). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 12 acres of mature forest, 11 acres of biodiversity areas and corridors, 3 acres of the WDFW North Fork Lacamas Snags priority area, and 2 acres of the Washougal Oak Woodlands. It could have **low-to-high** impacts on 116 acres of riparian habitat and 96 acres of freshwater wetlands, depending on habitat value and wildlife species present. Overall impacts on special-status species, and on all wildlife from maintenance activities, would be similar to the West Alternative.	Like the Central Alternative, the East Alternative requires mostly new right-of-way and would increase habitat fragmentation primarily in forested habitats, but pose less collision risk for birds than the West Alternative. Impacts on most wildlife would be similar to the West Alternative (**low** from habitat loss; **moderate** due to increased mortality risk). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 13 acres of mature forest, 10 acres of biodiversity areas and corridors, 45 acres of the WDFW Rock Creek Snag-Rich priority habitat near Yale Dam, and 2 acres of the Washougal Oak Woodlands and 1 acre of talus; and **low** impacts on 0.5 acre of the Larch Mountain SDFW herbaceous bald priority habitat and 0.05 acre along the edge of a WDFW cave-rich priority area in production forest. It could have **low-to-high** impacts on 107 acres of riparian habitat and 90 acres of freshwater wetlands, depending on habitat value and wildlife species present (**high** impact where parts of the Fraser Creek Wetland would be altered or removed). Overall impacts on special-status species, and on all wildlife from maintenance activities, would be similar to the West Alternative (exception: **moderate** impact on northern spotted owl).	The Crossover Alternative would require mostly new right-of-way along its southern half, but parallel existing transmission lines along much of its northern half, and so would pose greatest collision risks to birds along the northern portion. Impacts on most wildlife would be similar to the West Alternative (**low** from habitat loss; **moderate** due to increased mortality risk). The alternative would remove or alter some WDFW priority habitats, having **high** impacts on 45 acres of mature forest and 10 acres of biodiversity areas and corridors. It would have the same impacts on the following as the East Alternative: **high** impacts on 2 acres of the Washougal Oak Woodlands and 1 acre of talus; and **low** impacts on 0.5 acre of the Larch Mountain SDFW herbaceous bald priority habitat and 0.05 acre along the edge of a WDFW cave-rich priority area. It could have **low-to-high** impacts on 149 acres of riparian habitat and 87 acres of freshwater wetlands, depending on habitat value and wildlife species present. Overall impacts on special-status species, and on all wildlife from maintenance activities, would be similar to the West Alternative (exception: **moderate** impact on northern spotted owl).	**No** impact on wildlife.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Would remove or alter more freshwater wetlands (+11 acres), riparian habitat (+2 acres), and westside prairie (+6 acres) than the alternative. Would remove more WDFW wood duck priority areas (+7 acres, a **moderate** impact), but remove or alter less (-13 acres) biodiversity areas and corridors, avoiding the Columbian black-tailed deer population in this area.	Would alter or remove more riparian habitat (+4 acres) and WDFW Roosevelt Elk Winter Range Priority Area (+78 acres, a **low** impact) than the alternative. An access road would cross riparian habitat within 1 mile of 2 documented occurrences of Dunn's salamander, a potential **moderate** impact.	Would remove more freshwater wetlands (+4 acres) and forest (+42 acres), and remove or alter more riparian habitat (+11 acres) than the alternative. Would avoid a WDFW waterfowl concentration priority area, but remove more WDFW bald eagle priority area (+3 acres)—the Cowlitz Bald Eagle Feeding Habitat—and cross within the buffers of two additional bald eagle nests (although another nest would be avoided).	Would alter more riparian habitat (+8 acres) and remove or alter more wetland habitat (+11 acres) than the alternative. Would come within 1 mile of a WDFW wood duck priority area that is avoided by the Crossover Alternative, but not cross it, having a **low-to-moderate** impact.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Wildlife (continued)	**West Option 2**	**Central Option 2**	**East Option 2**	**Crossover Option 2**	**No** impact on wildlife.
	Would remove or alter more mature forest (+5 acres) and habitat within a biodiversity area and corridor that supports Columbian black-tailed deer (+12 acres), but fewer freshwater wetlands (-18 acres).	Would remove more mature forest (+7 acres), forest (+68 acres) and riparian habitat (+10 acres).	Would remove less freshwater wetlands (-7 acres), mature forest (-8 acres), and habitat from northern spotted owl circles (-75 acres). Would avoid a talus slope, the Larch Mountain herbaceous bald and a cave-rich area, although it would remove more habitat in a snag-rich area (+3 acres). Would avoid crossing within 1 mile of several special-status species, including 3 of the 5 occurrences of Rocky Mountain tailed frog, and 3 of the 6 occurrences of Cascade torrent salamander. Would remove less WDFW Columbian black-tailed deer priority area (-12 acres).	Would remove less riparian habitat (-10 acres), but alter more of this habitat along the right-of-way (+9 acres). Would alter more WDFW Roosevelt Elk Winter Range Priority Areas (+70 acres), a **low** impact.	
	West Option 3	**Central Option 3**	**East Option 3**	**Crossover Option 3**	
	Similar to West Option 2. Would remove or alter more mature forest (+3 acres) and habitat within a biodiversity area and corridor that supports Columbian black-tailed deer (+11 acres), but less freshwater wetlands (-13 acres). Would also remove or alter additional riparian habitat (+14 acres) and forest (+34 acres).	Would remove or alter more mature forest (+3 acres) and forest (+60 acres), but less riparian habitat (-10 acres). Would cross a forested riparian area within 1 mile of a WDFW cavity-nesting duck priority area, a **moderate** impact, and avoid 2 of the 5 documented occurrences of Cascade torrent salamander, 1 of 3 documented occurrences of western pond turtle (the 1 occurrence in Washington), and the 1 documented occurrence of Vaux's swift.	No change in habitat acreage impacted except for freshwater wetlands (+<1 acre).	Similar to Crossover Option 2. Would remove less riparian habitat (-9 acres) but alter more of this habitat along the right-of-way (+7 acres, and would alter more WDFW Roosevelt Elk Winter Range Priority Areas (+66 acres), a **low** impact.	
Fish	Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams, having **high** impacts at 19 crossings from shade loss and 10 crossings from loss of large woody debris potential (both impacts can occur along the same stream). This is the smallest number of high impacts on riparian functions among the action alternatives. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—18 acres of floodplains impacted by right-of-way clearing, towers and roads. **Low** overall impacts on ESA-listed and general fish populations—about 0.11% based on the Integrated Fish Index and the least of the action alternatives.	Riparian vegetation would be cleared at 68 forested crossings of fish-bearing streams, having **high** impacts at 49 crossings from shade loss and 46 crossings from loss of large woody debris potential. This is the greatest number of high impacts on riparian functions among the action alternatives. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—19.2 acres of floodplains impacted by right-of-way clearing, towers and roads. **Low** overall impacts on ESA-listed and general fish populations—about 0.15% based on the Integrated Fish Index.	Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams, having **high** impacts at 35 crossings from shade loss and 38 crossings from loss of large woody debris potential. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—10.9 acres of floodplains impacted by right-of-way clearing, towers and roads. **Low** overall impacts on ESA-listed and general fish populations—about 0.19% based on the Integrated Fish Index.	Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams, having **high** impacts at 32 crossings from shade loss and 31 crossings from loss of large woody debris potential. **Low** impacts on fish from runoff and potential sediment delivery to streams (see watershed impacts summary in Water section). **Low** impact on floodplain functions that could affect fish—9 acres of floodplains impacted by right-of-way clearing, towers and roads, least of the action alternatives. **Low** overall impacts on ESA-listed and general fish populations—about 0.2% based on the Integrated Fish Index, the highest among the action alternatives.	**No** impact on fish.
	West Option 1	**Central Option 1**	**East Option 1**	**Crossover Option 1**	
	Same overall impacts as the alternative.	Same overall impacts as the alternative. Would cross 1 more stream with high shade function and high potential for large woody debris.	Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (11) and high potential for large woody debris (11).	Same overall impacts as the alternative. Would cross 1 more stream with high shade function.	
	West Option 2	**Central Option 2**	**East Option 2**	**Crossover Option 2**	
	Same overall impacts as the alternative. Would cross 1 less stream with high shade function.	Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (9) and high potential for large woody debris (7).	Same overall impacts as the alternative. Would have more crossings that affect streams with high-functioning shade (5) and high potential for large woody debris (6).	Same overall impacts as the alternative.	

Resource	West Alternative and Options	Central Alternative and Options	East Alternative and Options	Crossover Alternative and Options	No Action Alternative
Fish (continued)	**West Option 3**	**Central Option 3**	**East Option 3**	**Crossover Option 3**	**No** impact on fish.
	Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (1) and high potential for large woody debris (2).	Same overall impacts as the alternative. Would have fewer crossings that affect streams with high shade function (2) and high potential for large woody debris (3).	Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (4) and high potential for large woody debris (4).	Same overall impacts as the alternative. Would have more crossings that affect streams with high shade function (1) and high potential for large woody debris (1).	
Climate	**No** impact on climate.	**No** impact on climate.	**No** impact on climate.	**No** impact on climate.	**No** impact on climate.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	
Air Quality	**Low** impact during construction and maintenance activities from exhaust emissions and airborne dust; **no** impacts from corona during operation because pollutants emitted would be very small, temporary, and not detectable above background levels.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	**No-to-low** impact. If emergency generators must be run in the region because the power transmission system is congested, this would contribute added diesel particulate emissions.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	
Greenhouse Gas	**Low** impact. Construction and maintenance activities would result in annualized emissions of about 4400 metric tons of CO_2 equivalent.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	**No-to-low** impact. If emergency generators must be run in the region, this would contribute to GHG emissions.
	West Options 1, 2, 3	**Central Options 1, 2, 3**	**East Options 1, 2, 3**	**Crossover Options 1, 2, 3**	
	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	Same impact as the West Alternative.	

Notes:
1. Permanent impacts, unless noted. Construction and maintenance impacts are temporary and only discussed in this summary table where relevant for some resources.

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Table 4-11 Summary of Environmental Impacts by Substation[1]

Resource	Sundial Substation Site	Castle Rock Substation Sites		
		Casey Road	Baxter Road	Monahan Creek
Land Use	**High** impact on land ownership; about 40 acres of Port of Portland property within the Troutdale Reynolds Industrial Park would be removed from future use. **No** impact on land use, which is already industrial.	**High** impacts on land ownership and land use. About 25-50 acres of WDNR property would be purchased and removed from timber production. **Moderate** impact on unauthorized target shooters, who would be displaced.	**High** impact on land ownership and land use. About 25-50 acres of Sierra Pacific Industries property would be purchased and removed from timber production.	**High** impact on land ownership and land use. About 25-50 acres of rural and open space property would be purchased and removed from private ownership. Grazing on-site may or may not continue.
Recreation	**No** impact on recreation resources.	**Potential low** impact on unauthorized dispersed recreation users.	**No** impact on recreation resources	**No** impact on recreation resources.
Visual	**Low** impact. The site is near many existing transmission lines and two existing substations in an industrial park.	**Low** impact. The site is in a remote area with low scenic quality adjacent to four transmission lines.	**Low** impact; same as Casey Road site.	**Low** impact. While also adjacent to a transmission corridor, the site is less remote and would likely be visible to a few surround residents and local motorists.
EMF	Electric and magnetic levels at the perimeter of the substation' yard would reflect fields generated by the new 500-kV line alone. Same overall impact as the selected alternative.	Electric and magnetic levels at the perimeter of the substation' yard would reflect fields generated by the new 500-kV line alone. Same impact as the selected alternative.	Same impact as Casey Road site.	Same impact as Casey Road site.
Noise	Because substation construction can take about 13 months, noise from construction activities could have **moderate-to-high** impacts on nearby residents. Once operating, any audible noise at the station perimeter would predominantly reflect foul weather corona noise from incoming and outgoing transmission lines. Same overall impact as the selected alternative.	Potential **moderate-to-high** impacts on some area residents during construction. Once operating, any audible noise at the station perimeter would predominantly reflect foul weather corona noise from incoming and outgoing transmission lines. Same overall impact as the selected alternative.	Same impacts as Casey Road site.	Same impacts as Casey Road site. (Construction noise may be heard by more people because of the surrounding residential area.)
Public Health and Safety	**Low** impact from potential hazardous waste disturbance. The substation and part of Segment 52 (common to all alternatives) would be built within the Reynolds Metals Superfund site in Troutdale, but special care would be taken during excavation, most contaminated soils have been removed, and health risk levels are considered acceptable by USEPA and ODEQ. **No-to-low** impact from toxic substances (including diesel and oil) used during construction and in substation equipment, due to strict adherence to all regulations and proper equipment design. **No-to-low** other impacts on the general public; only maintenance workers could gain entry.	**No-to-low** impact from toxic substances used during construction and in substation equipment, due to strict adherence to all regulations and proper equipment design. **No-to-low** other impacts on the general public; only maintenance workers could gain entry.	Same impacts as Casey Road site.	Same impacts as Casey Road site.
Socioeconomics and Environmental Justice	Potential for increases or decreases in revenue for the Port of Portland, depending on the effect of the substation on the value of remaining lots in the industrial park. **No** impact on environmental justice populations.	Timber harvested during construction would create a short-term increase in timber harvest revenues on WDNR state trust land ($159,000). Long-term decrease in state trust timber harvest revenues from forgone future harvests currently valued at $124,100, a **moderate** impact. **No** impact on environmental justice populations.	BPA purchase of site would cause a long-term decrease in property tax revenue for Cowlitz County ($7,900 or -0.001%) and state ($2,000). Timber harvested during construction would create short-term increases in Sierra Pacific timber harvest revenue ($71,300), and timber harvest tax revenues for Cowlitz County and the state ($2,900 and $700, respectively)). Converting the property permanently would cause a long-term decrease in revenue for Sierra Pacific from forgone future harvests currently valued at$198,000. **Moderate** impact on county, but **no** impact on timber market. **No** impact on environmental justice populations.	BPA purchase of site from multiple landowners would cause a long-term decrease in property tax revenue for Cowlitz County ($3,400 or -0.001%) and state ($900). Private timber producers would experience a short-term increase in timber harvest revenue ($30,900) with a corresponding increase in timber harvest tax revenues of $1,200 for Cowlitz County and $300 for the state. Long-term conversion of the property would decrease revenue for private timber producers of $86,000). Same impacts at Baxter Road site (**moderate** on county, **none** on timber market, **none** on environmental justice populations).

Resource	Sundial Substation Site	Castle Rock Substation Sites		
		Casey Road	Baxter Road	Monahan Creek
Transportation	Construction at the site would periodically disrupt local motorists and existing truck traffic and workers in the larger industrial park over 13-24 months, a temporary **moderate** impact. Infrequent maintenance activities would have **no-to-low** long-term impacts.	Construction vehicles could temporarily delay logging trucks in the area, a **low** impact, and interrupt traffic along Casey Road and West Side Highway (SR 411) for long periods, a **moderate** impact. Infrequent maintenance activities would have **no-to-low** long-term impacts on surrounding traffic and roads.	Construction vehicles could temporarily delay logging trucks and area residents along Beebe Road, a **moderate** impact. Same long-term impact as Casey Road site.	During construction, intermittent traffic delays on Delameter Road, possible detours, and increased traffic would cause short-term **moderate** impacts. Same long-term impact as Casey Road site.
Cultural	Cultural sensitivity score of 25. **Moderate** impact because the site has a high probability for disturbing historic resources due to the nearby Troutdale Substation, a historic property that has been determined NRHP-eligible. This site has a very low probability for disturbing archaeological or ethnographic resources, due to its location in a previously-disturbed industrial area near other substations and transmission lines.	Lowest cultural sensitivity score among the three Castle Rock area sites (15). The site is in a remote area that has been previously logged and is next to existing transmission lines that may have disturbed archaeological resources previously. However, logging activities and existing transmission lines may contribute to a higher possibility that historic resources are present (i.e., historic transmission lines and logging camps), resulting in a **moderate** impact.	Same impact as Casey Road site, despite a higher cultural sensitivity score of 24, which is likely due to its proximity to creeks.	Same cultural sensitivity score as the Baxter Road site because of nearby creeks, but same impact as Casey Road site.
Geology and Soils	**Low** soil erosion impacts; the site is flat and has only a slight erosion-hazard potential. **High** long-term impact on soil from compaction directly under the substation, but temporary **moderate** and long-term **low** compaction impacts beyond the substation footprint.	Due to the site's underlying geology, it is unlikely to be subject to liquefaction during earthquakes. No mapped landslides, but soil is considered to have severe erosion potential. Still, erosion impacts would be temporarily **low-to-moderate** during construction and **low** when the substation is operating, due to mitigation measures. **High** long-term impact on soil from compaction directly under the substation, but temporary **moderate** and long-term **low** compaction impacts beyond the substation footprint.	Same underlying geology, soil erosion potential and erosion/compaction impacts as Casey Road site.	Slightly less erosion potential (moderate-to-severe rating). However, same underlying geology and erosion/compaction impacts as Casey Road site.
Water	**No water** impacts; the site is not near any water bodies except the Columbia River, but storm water runoff would not be discharged into the river and the site is outside the river's 100-year floodplain. Potential **moderate** impact on groundwater if contamination (such as from herbicides) occurs because of the aquifer's moderate depth and high permeability; however, mitigation measures would be taken to avoid this.	The substation would be built over 2 intermittent, non-fish-bearing streams, but would not prevent subsurface water flow to nearby streams. **Low** impacts on surface water quality from potential added turbidity, **no** impact on stream temperatures because riparian vegetation has already been cleared, and **no** impact on floodplains. **No** long-term impacts on existing wells from construction dewatering (if required). **Low** risk of groundwater contamination because of moderate-to-deep, bedrock-sealed wells within 1 mile of the site and low soil permeability. Once operating, the substation would have **low** impacts on surface water quality; storm water runoff would be discharged to a detention pond north of the site.	Water impacts same as Casey Road site. Most streams would be avoided and erosion control measures would minimize impacts to streams that flow to Baxter Creek; no riparian vegetation would be cleared.	Water impacts same as Casey Road site except for **no-to-low** impacts on floodplains; about 1,100 square feet of the site is within the 100-year floodplain of Monahan Creek. Nearby Monahan and Delameter creeks, located 450-500 feet away and separated from the site by roads, are both listed as impaired for elevated temperatures, but no riparian vegetation would be cleared (having **no** impact).
Wetlands	**High** impact on about 11 acres of emergent wetlands that could be filled. Although these wetlands are located in an industrial setting, they are of medium quality and functions such as water quality improvement would be lost.	**No-to-low** impacts because wetlands are outside the substation disturbance area, but there is the potential for operation and maintenance activities to spread dust, sediment or contaminants in adjacent wetland buffers (a short-term **low** impact).	**High** impact—the highest wetlands impact of the three substation sites—because it could require filling 0.6 acre of mostly forested, medium-quality wetlands.	**No** impacts on wetlands.
Vegetation	**Low-to-moderate** impact on 40 acres of herbaceous vegetation that would be permanently removed, including 11 acres of disturbed, moderately functioning herbaceous emergent wetlands.	**Low** impact on already disturbed vegetation. About 38 acres of production forest, 24 acres of shrubland and 1 acre of rural landscape would be permanently removed.	**Low** impact on 47 acres of previously harvested production forest.	**Low** impacts on 46 acres of rural landscaped vegetation, 18 acres of production forest and 1 acre of shrublands, but **high** impact on 2 acres of mature forest that would be permanently removed. Potential **moderate-to-high** impacts on a special-status species, western wahoo, given documented occurrences near the site.

Resource	Sundial Substation Site	Castle Rock Substation Sites		
		Casey Road	Baxter Road	Monahan Creek
Wildlife	**Low** impacts on most wildlife from permanent loss of disturbed wetland habitat; potential **moderate-to-high** impact on state-listed western pond turtle if present (documented within 1 mile).	**Low** impacts on most wildlife from removal of production forest and shrubland habitat. **Low** impact on Willapa Roosevelt elk from removal of winter range. **No** impacts on marbled murrelet or northern spotted owl (no suitable habitat present) or other special-status species (none documented within 1 mile).	Same impacts on most general and special-status wildlife species as Casey Road site except where a small section (0.1 acre) of scrub-shrub wetland priority habitat would be cleared, a **low-to-high** impact depending on quality and wildlife supported.	Same impacts on most general and special-status wildlife species as Casey Road site except potential **high** impact where mature forest priority habitat must be cleared. However, impacts would be **low** to marbled murrelet and bald eagles because neither species has been documented within 1 mile, and location makes it unlikely the species would be present.
Fish	**No** impact; the site is not close enough to any water bodies to affect water quality or fish habitat, and is located outside the Columbia River's 100-year floodplain.	**No-to-low** impacts; the site is about 1,800 feet upslope of Rock Creek, which has presumed presence of Lower Columbia River coho and potential occurrence of Lower Columbia River steelhead. The project would not remove any vegetation along the creek.	**No-to-low** impact; the site is about 1,000 feet upslope of Baxter Creek, which has presumed presence of Lower Columbia River coho and steelhead. Construction would remove vegetation from 3 non-fish-bearing streams only, with no vegetation removal along Baxter Creek.	**No-to-low** impact; the site is between Monahan and Delameter creeks, about 450-500 feet from each, separated by roads. These creeks have documented occurrence of Lower Columbia River coho, steelhead and Chinook salmon, and presumed presence of Columbia River chum, but no vegetation would be removed along them.
Climate	**No** impact.	**No** impact.	**No** impact.	**No** impact.
Air Quality	**Low** impact during construction and maintenance activities from exhaust emissions and airborne dust; **no** impacts from operation.	**Low** overall impact during construction and maintenance activities from exhaust emissions and airborne dust; **no** impacts from operation.	**Same** impacts as Casey Road site.	**Same** impacts as Casey Road site.
Greenhouse Gas	**Low** impact on the atmosphere from construction and maintenance vehicles emitting GHGs.	**Low** overall impact on the atmosphere from construction and maintenance vehicles emitting GHGs and from permanent conversion of forested areas.	**Same** impact as Casey Road site.	**Same** impact as Casey Road site.

Notes:
1. Permanent impacts, unless noted. Construction impacts are temporary and only discussed in this summary table where relevant for some resources.

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Chapter 5 Land

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

This chapter describes existing land ownership and use in the project area, and how the project alternatives could affect these resources. Related information can be found in Chapters 6 through 22, which discuss individual resources on this land such as visual, recreation, cultural, soil, wetland, vegetation, wildlife, or air quality.

5.1 Affected Environment

For the purposes of this analysis, the project area consists of lands at and in the immediate vicinity of proposed project facilities in Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. This includes the unincorporated portions of these counties and the city of Kelso in Cowlitz County, the cities of Vancouver, Camas, and Washougal in Clark County, and the cities of Troutdale and Fairview in Multnomah County. This section describes existing general land ownership and use patterns in the project area, followed by more specific descriptions of land ownership and use along each of the proposed action alternatives.

5.1.1 Land Ownership

While there is a wide variety of land ownership in the general project area, land along the action alternatives is predominately privately owned, with some public ownership scattered throughout (see Maps 5-1A through 5-1D). Public owners include federal and state agencies, and city and county governments. There are also many large and small private landowners.

Most private land includes small parcels or holdings by individual landowners, and large parcels or holdings owned by PacifiCorp and private commercial timber companies including Longview Timberlands LLC (Longview Timber), Sierra Pacific Industries, and Weyerhaeuser Company. Public agencies that own or manage lands directly crossed by the project include WDNR, the city of Camas, and the Port of Portland. A more detailed analysis of WDNR lands in the project area is in Appendix A.

5.1.2 Land Use

In the counties and cities where the action alternatives are located, there are five general categories of existing land use: **urban/suburban**, **rural**, **timber production**, **agriculture**, and **open space** (which include both forested and non-forested areas) (see Maps 5-2A through 5-2D). Cowlitz County has large areas of mostly forested open space and timber production. Agriculture and rural residences are also scattered throughout the county. Clark County also has large areas of forested open space and timber production, but has more agriculture and rural residences than Cowlitz County. Higher density urban/suburban areas occur in and around the cities of Kelso and Longview to the north and in the greater Portland–Vancouver metropolitan area to the south, which includes land in Multnomah County.

5.1.2.1 Urban/Suburban

Urban and suburban land uses within the project area are mainly in the many incorporated cities in Cowlitz, Clark, and Multnomah counties. Incorporated cities in Cowlitz County include

Castle Rock, Kelso, Longview, Kalama, and Woodland. The urban and suburban land uses that make up these cities include typical mid- to high-density development, such as single and multi-family residential uses, commercial uses (e.g., retail space, restaurants, gas stations, and office buildings), public and municipal buildings, churches, parks, industrial uses, and associated utility facilities, roads, and impervious surfaces (e.g., parking lots).

Incorporated cities in Clark County include Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal, Woodland, and Yacolt. With the exception of Vancouver, these cities tend to be of similar scale and mix of land uses as the cities in Cowlitz County. Vancouver, the largest city in southwest Washington both in population and areal extent, has a broader spectrum of land uses, and more intensive land uses, than the other cities in the project area.

The southern portion of each action alternative after it crosses the Columbia River, including the proposed Sundial substation site, is within unincorporated Multnomah County, Oregon, and the cities of Troutdale and Fairview in Multnomah County. These two cities are within the urban growth boundary for the Portland metro area. These cities offer a combination of multi-family residential, single-family residential, commercial and industrial uses, parks, and open space areas. Public infrastructure in urban/suburban areas includes hospitals, roads and highways, and schools.

Clark County schools in the vicinity of the proposed action alternatives include Beacon Hill Elementary School, Burnt Bridge Creek Elementary School, Cedar Creek School, Covington Junior High School, Kings Way Christian School, Minnehaha Elementary School, Orchards Elementary School, Pleasant Valley Middle School, Pleasant Valley Primary School, Walnut Grove Elementary School, Pacific Junior High School, Sunnyside School, and Lacamas Heights Elementary School. Butler Acres Elementary School is in Cowlitz County.

5.1.2.2 Rural

Rural land uses within the project area are dispersed throughout Cowlitz and Clark counties. Rural, unincorporated communities in Cowlitz County include Yale, Lexington, Ariel, and Cougar. These areas are generally near the Lewis River and along transportation corridors, such as SR 503. Typical land uses in these and immediately surrounding areas include mostly low-density land uses, such as single-family residential uses on relatively large lots, small commercial areas, dispersed industrial uses, parks, churches, public and municipal buildings, and associated infrastructure. Schools in the rural areas of Cowlitz County include Yale Elementary School and Green Mountain Elementary School.

Rural, unincorporated areas in Clark County include Amboy, Brush Prairie, Chelatchie Prairie, Fargher Lake, Hockinson, and Meadow Glade. Clark County identifies these areas as **rural centers**. Rural centers are distinct areas that have small lot patterns for residential development, small-scale businesses that provide convenience shopping and services to nearby rural residents, access to arterial roadways, and are surrounded by protected rural landscapes of generally open land used for agriculture, forestry, large lot residential, recreation, and environmental protection. Rural areas typically have maximum densities of one unit per acre (Clark County 2010). No schools in the rural areas of Clark County are close to the project.

5.1.2.3 Timber Production

Lands used for timber production activities are predominately located in the northern and eastern portions of the project area. These lands are owned or managed by timber companies (Weyerhaeuser, Longview Timber, and Sierra Pacific), utilities (PacifiCorp), or the state (WDNR) and are mostly used for timber production, although other uses occur on these lands including mushroom, cedar bough, salal, and other floral products collection, conservation easements, wildlife management, recreation, and agriculture. (See Chapter 11, Socioeconomics for more information about the economics of timber harvesting and how WDNR manages its trust lands). These lands are forested (some with mature forests and forested wetlands), cleared, or have been replanted. Access roads that were built mainly for hauling cut timber are present within these areas.

5.1.2.4 Agriculture

Lands used for agriculture are scattered about the project area but mostly occur along the Cowlitz River, northeast of Amboy, and along northern portions of Segment 25. Crop production and livestock grazing are the current agricultural uses on these lands. The primary crops grown in the project area include nursery stock, vegetables, berries, Christmas trees, and forage, such as hay, for livestock. Livestock production within the project area includes poultry and cattle (Washington State Department of Agriculture 2010). Agricultural uses in existing BPA rights-of-way occur as allowed under existing easements or agreements between BPA and the underlying landowner (see Chapter 11, Socioeconomics).

Some agricultural land has been removed from production through the federal Conservation Reserve Program (CRP). Under this program, farmers receive annual rent payments to remove highly erodible or other sensitive land from production, and re-establish and maintain natural plant communities for a certain number of years (USDA 2011a). Of the 1,140 total square miles within the boundaries of Cowlitz County, about 15 acres are currently enrolled in the CRP (USDA 2011b). Of the 630 total square miles within the boundaries of Clark County, about 128 acres are currently enrolled in the CRP (USDA 2011b).

Prime Farmland and **Farmland of Statewide Importance** are abundant in the project area. Prime farmland is defined as land not already targeted for urban development or water storage that has the best physical and chemical characteristics for producing items such as food, feed, forage, fiber, and oilseed crops (Code of Federal Regulations [CFR] 730-733 Section 657.5). The designation is largely based on soils, slope, and irrigation availability. About 40,380 acres in Cowlitz County and about 117,450 acres in Clark County are prime farmland (NRCS 2009a, 2010a, 2010b).

Farmland of statewide importance, a distinct category from prime farmland, is land that may not meet prime farmland criteria, but that has the potential to economically produce high yields of crops as defined by state agencies. About 293,840 acres in Cowlitz County and about 66,800 acres in Clark County are farmlands of statewide importance (NRCS 2009a, 2010a, 2010b).

Designated prime farmlands and farmlands of statewide importance are also used for residential development and other uses. The designations do not prohibit other uses.

5.1.2.5 Open Space

Open space areas are not developed and have the potential to be used for both production and non-production forest, and for non-forest uses such as rural residential, agriculture or recreation.

Some forests within areas categorized as open space (identified as Open Space – Forested on Maps 5-2A through 5-2D) are being managed for commercial timber production, but by much smaller private landowners not included in the timber production category. Other forested areas within open space could be used for commercial timber production by individual landowners, but are not currently being used for this purpose. Existing vacant BPA rights-of-way cross areas that contain trees that could be harvested and sold as commercial timber. Wetland habitats, shrublands, and rivers and lakes also occur in non-forested open space.

Open space areas (both forested and non-forested) provide opportunities for recreation in the project area. Recreational activities within Cowlitz, Clark and Multnomah counties include boating, fishing, hunting, camping, hiking, bird and wildlife watching, all terrain vehicle (ATV) use, sightseeing, horseback riding, and mountain biking. General day-use activities, including swimming, picnicking, and sports games, also occur in the project area within developed areas such as designated parks and trails (see Chapter 6, Recreation). Open space areas provide opportunities for recreational activities on public lands in the eastern portion of the project area, such as on lands managed by WDNR. The western portion of the Yacolt Burn State Forest provides opportunities for camping, hiking, hunting, fishing, horseback riding, off-road vehicle use, and mountain biking. Open space areas on PacifiCorp lands along the Lewis River near Merwin and Yale dams are also used for recreation.

Open space areas are also used to manage natural resources. WDNR has trust lands set aside for research plots and **genetic reserves** (these areas have the same purpose as conservation areas plus a goal of maintaining and protecting the genetic diversity and integrity of a target species), forest riparian conservation easements, recreation, and habitat conservation for wildlife. Mitigation lands managed by PacifiCorp along the Lewis River provide habitat for and support many fish and wildlife species.

Open space areas are also used for utility and transportation corridors. There are existing transmission lines and rights-of-way within the western and southern parts of the project area. Major transportation corridors near the project include I-5, I-205, SR 14, SR 411 (Westside Highway), SR 500, SR 502, and SR 503. There are also railroad lines within the project area. Burlington Northern Santa Fe (BNSF) owns two mainline rail lines that carry freight and passengers (via Amtrak) through Clark County: the BNSF Seattle/Vancouver line and the BNSF Vancouver/Eastern Washington line. Clark County also owns the 33-mile-long short line Lewis and Clark Railroad (also known as the Chelatchie Prairie Railroad or the Clark County Railroad; see Chapter 12, Transportation).

5.1.3 General Land Ownership and Use—West Alternative and Options

The West Alternative begins at the Monahan Creek substation site in Cowlitz County, about 3 miles west of the city of Castle Rock. This site is on private land and the existing land use is a combination of rural, agriculture, and open space. The site is mostly used for grazing. Forested areas and buildings are on and next to the site. Several BPA transmission lines are located west of the site.

The West Alternative parallels existing transmission lines (mostly BPA lines) for about 66 miles of its length, which is almost 98 percent of the total distance. The West Alternative is almost entirely (99 percent) located on private land, and is only 1 percent public land (i.e., WDNR lands).

The West Alternative passes through the cities of Kelso, Vancouver, Camas, Washougal, Troutdale and Fairview, the Longview urbanized area, the Vancouver Urban Growth Boundary, the Camas North Urban Growth Area, the Washougal Urban Growth Boundary, and an urban reserve area in Multnomah County.

Commercial, single-family residential, and multi-family residential areas are crossed within the city of Kelso. The zoning in these residential areas allows maximum densities of 4 to 32 residential units per acre.

As the West Alternative crosses the Lewis River, it begins to pass through many neighborhood associations' boundaries in Clark County, both within and outside the cities of Vancouver, Camas, and Washougal. These include the North Fork Lewis River, East Fork Frontier, Ridgefield Junction, Fairgrounds, Pleasant Highlands, Ramblin' Creek Estates/South Salmon Creek Avenue, Sherwood, Northeast Hazel Dell, West Minnehaha, East Minnehaha, Andresen/St. Johns, Green Meadows, Maple Tree, Sunnyside, Sifton, North Image, Burnt Bridge Creek, Fisher-Mill Plain, Fern Prairie, and Washougal River neighborhood associations.

In the city of Vancouver, the alternative passes through single-family and multi-family residential areas (maximum density 2.2 to 35 residential units per acre), light industrial, and commercial areas (Golder 2011).

The West Alternative passes through residential, commercial, and industrial areas in the city of Camas. These areas are zoned for multi-family residential (maximum density 24 residential units per acre), single-family residential (maximum density 6 residential units per acre), industrial, business park, and commercial uses.

The West Alternative crosses residential and commercial areas of the city of Washougal. These areas are zoned for single-family residential (maximum density 8.7 residential units per acre) and both heavy and light industrial uses. Some areas next to the existing right-of-way have been developed, and some undeveloped areas have been set aside for residential development.

Within the Evergreen and Vancouver school districts (Segment 25), three schools (Orchards Elementary School, Covington Junior High, and King's Way Christian School) are within 500 feet of the edge of the right-of-way. Two state-licensed daycares in the city of Vancouver are also within 500 feet of the edge of the right-of-way.

Lands along the West Alternative outside of city boundaries are used for rural residential uses, schools, commercial areas, undeveloped uses, timber production, agriculture, recreation, and utility and transportation corridors. Agricultural areas are used to grow berries, Christmas trees, hay/silage, grapes, and nursery stock (Washington State Department of Agriculture 2010). WDNR land crossed by the alternative is mostly in the southern part of Cowlitz County. These lands are mostly used for timber production, but one area along Segment 9 has a forest riparian conservation easement. Recreation areas include parks, golf courses, Camp Currie, and the

Lacamas Prairie Natural Area. As the West Alternative approaches the Columbia River, it crosses the North Urban Growth Area for Camas, parks, marinas, and trails (see Chapter 6, Recreation).

As with all the action alternatives, the route crosses the Columbia River and ends at the Sundial substation site. This site is currently used as open space within the Port of Portland's Troutdale Reynolds Industrial Park (Port of Portland 2011), which has planned and existing developed industrial uses, such as existing transmission lines and light industrial businesses such as Federal Express. The site is within Troutdale's and Fairview's city limits in Multnomah County.

Because West Options 1, 2, and 3 are very close to the West Alternative, they generally cross the same land uses and ownership as the West Alternative. There are a few exceptions. West Options 1, 2, and 3 cross portions of Clark County within the urban areas of Vancouver, Camas, and Washougal, but not within these cities' limits. West Option 1 crosses the Camas Meadows Corporate Center and West Option 2 crosses WDNR land (Segment 43) where a school may be planned. The options do not cross the recreation areas closer to the Columbia River.

5.1.4 General Land Ownership and Use—Central Alternative and Options

The Central Alternative begins at the Baxter Road substation site in Cowlitz County, 4 miles northwest of the city of Castle Rock. This site and the surrounding area are on property owned by Sierra Pacific Industries and are used for timber production. Part of the site is within the existing BPA right-of-way and is already cleared.

The Central Alternative parallels existing transmission lines for about 8 miles of its approximately 77-mile length (about 10 percent of the alternative's total distance). Most urban and suburban areas crossed by the Central Alternative are near the northern and southern ends of this alternative, with mostly rural residential, forest, and agricultural areas in between. Most land (73 percent) is privately owned; WDNR (26 percent) and the city of Camas (1 percent) own the remainder.

Similar to the West Alternative, the Central Alternative passes through the cities of Camas, Washougal, Troutdale, and Fairview. Within these urban and suburban areas, land is zoned for commercial, industrial, and residential uses. Although the densities of residential units are similar to the West Alternative and in some cases are higher, the amount of urban and suburban areas is lower.

The Central Alternative passes through several neighborhood associations' boundaries including Proebstel, Washougal River, and Fern Prairie.

The Central Alternative passes through unincorporated areas of Cowlitz County zoned for single-family residential use (maximum density 7.26 units per acre). The alternative also passes through a number of unincorporated Clark County neighborhoods zoned for single-family (maximum density 7.3 units per acre) and multi-family (maximum density 18 units per acre) residential use (Golder 2011). No schools or state-licensed daycares are within 500 feet of the edge of the right-of-way for this alternative.

Rural lands along the route include scattered residences and a small number of agricultural uses. Forested lands cover most of the area crossed by this alternative and are used for recreation by rural residents. The same large timber companies identified for the West Alternative have extensive holdings both in the north and central parts of the alternative in Cowlitz County. Timber production also occurs on smaller private holdings in both counties (mostly in Clark County). PacifiCorp manages its lands along the Lewis River for both wildlife and recreation. Trails on public lands (WDNR land on Segment V and Riverfront Park closer to Longview on Segment F) are also crossed. The City of Camas owns land within a watershed that is sometimes used to supply a portion of the city's drinking water. Similar to all action alternatives, the Central Alternative crosses recreation areas as it approaches the Columbia River, then, crosses the Columbia River into the Sundial substation site (see Section 5.1.3, General Land Ownership and Use—West Alternative and Options).

Central Option 1 uses the Casey Road substation site instead of Baxter Road. This site is about 2 miles north of the Baxter Road substation site, northwest of the city of Castle Rock in Cowlitz County, on WDNR property used for timber production. Most of this site has been cleared for timber production activities. Land along the option between Casey Road and Baxter Road substation sites is owned by Sierra Pacific Industries and WDNR and is used for timber production.

Central Option 2 uses Monahan Creek substation site instead of Baxter Road (see Section 5.1.3). It crosses residential areas within the urbanized area of Longview. Outside of the urbanized area, it crosses timber production land owned by Longview Timber and Weyerhaeuser. It also crosses open space lands (some possibly being used for timber production by smaller landowners) with some scattered agricultural areas and rural residences.

Central Option 3 crosses mostly privately owned rural residential and open space land with some scattered agricultural land. This option crosses Moulton Falls State Park and Lucia Falls/Moulton Falls trail within the park. WDNR is a landowner along a smaller portion of this option and has a permanent research plot and genetic reserve along Central Option 3 (Segment 30) in the central part of Clark County.

5.1.5 General Land Ownership and Use—East Alternative and Options

The East Alternative begins at the Baxter Road substation site and parallels existing transmission lines for about 8 miles of its approximately 76-mile length (almost 11 percent of the total distance). Similar to the Central Alternative, it passes through some urban and suburban areas near the beginning and end of its length, but most land along the alternative is rural residential, agricultural, and forest land. About 85 percent of the land is privately owned, and WDNR (14 percent) and city and county governments (less than 1 percent) own the remaining land.

Similar to the West and Central alternatives, the East Alternative passes through the cities of Camas, Washougal, Troutdale, and Fairview. However, there is a smaller amount of urban and suburban areas along the East Alternative, and lower residential property densities due to a relatively greater amount of rural areas (Golder 2011).

The East Alternative passes through unincorporated areas of both Cowlitz and Clark counties, and the same neighborhood associations' boundaries and zoning districts discussed in the Central Alternative (see Section 5.1.4, General Land Ownership and Use—Central Alternative and Options). No schools or state-licensed daycares are within 500 feet of the edge of the right-of-way for this alternative.

Forested lands cover most of the area crossed by this alternative, and are managed mostly for timber production. Publicly owned forested lands are also managed for recreation (trails) and wildlife habitat, including the Yacolt Burn State Forest. PacifiCorp manages its lands along the Lewis River for both wildlife and recreation. The City of Camas owns land within a watershed that is used at times to supply a portion of the city's drinking water. Timber companies own large tracts in the north and central parts of the alternative in Cowlitz County. Rural land along the route is used for grazing or other agricultural uses, and small areas are developed with rural residences.

Similar to all action alternatives, the East Alternative crosses recreation areas closer to the Columbia River and crosses the Columbia River into the Sundial substation site (see Section 5.1.3, General Land Ownership and Use—West Alternative and Options).

East Option 1 uses the Monahan Creek substation site instead of Baxter Road (see Section 5.1.3). It crosses timber production land owned by Longview Timber and Weyerhaeuser. It also crosses open space lands (some possibly being used for timber production by smaller landowners) with some scattered agricultural areas and rural residences.

Similar to the East Alternative, forested lands cover most of East Option 2, and are managed mostly for timber production. Publicly owned forested lands (WDNR) are also managed for recreation (trails) and wildlife habitat, including the Yacolt Burn State Forest. The City of Camas owns land within a watershed that is used at times to supply a portion of the city's drinking water. Timber companies own large tracts along the northern part of the option and small tracts to the south in Clark County. Rural residences occur along the southwestern boundary of this option.

East Option 3 is on WDNR and a portion of existing BPA right-of-way and avoids the Camas City watershed.

5.1.6 General Land Ownership and Use—Crossover Alternative and Options

The Crossover Alternative begins at the Monahan Creek substation site and parallels existing transmission lines for about 33 miles of its approximately 74-mile length (almost 45 percent of the total distance). About 79 percent of the land is privately owned. The remaining land is owned by WDNR (20 percent) and city and county governments (less than 1 percent).

The Crossover Alternative follows the West Alternative from the Monahan Creek site and passes through forest lands to intersect with and follow the route of the Central Alternative. The Crossover Alternative runs northeast parallel to Merwin Lake, where it passes through rural residential and forest lands. Turning south, it follows the same route as the East Alternative. Most land is forested and managed for timber production. Forested lands not managed for timber production are used for recreation and wildlife habitat, including the Yacolt Burn State Forest. Rural lands support a small number of rural residences and agricultural uses.

Similar to all action alternatives, the Crossover Alternative passes through the cities of Kelso, Camas, Washougal, Troutdale, and Fairview, and the Longview urbanized area. The Crossover Alternative passes through unincorporated areas of both Cowlitz and Clark counties, and the same neighborhood associations' boundaries and zoning districts discussed in the Central

Alternative (see Section 5.1.4, General Land Ownership and Use—Central Alternative and Options) (Golder 2011).

No schools or state-licensed daycares are within 500 feet of the edge of the right-of-way for this alternative.

Similar to all action alternatives, the Crossover Alternative crosses recreational areas closer to the Columbia River and crosses Columbia River and into the Sundial substation site (see Section 5.1.3, General Land Ownership and Use—West Alternative and Options).

Crossover Option 1 crosses open space, agricultural, and rural residential areas in the Camas North Urban Growth Area, and several recreation areas including the Lacamas Prairie Natural Area and Camp Currie. It crosses the Fern Prairie neighborhood on existing BPA right-of-way.

Crossover Options 2 and 3 both begin at the Baxter Road substation site (see Section 5.1.4, General Land Ownership and Use—Central Alternative and Options). Land along the options between the Baxter Road and Monahan Creek substation sites is mostly owned by Sierra Pacific and Weyerhaeuser with some smaller, private landowners. Timber production is the primary land use with some rural residential area towards the south.

5.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative. Impacts specific to WDNR lands in the project area are also discussed in Appendix A.

5.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- A permanent change in land use that is incompatible with existing land use
- A permanent change to landowner property use where new right-of-way or easements are required
- A permanent change in land ownership
- A new unauthorized land use or access that may or may not be compatible with existing land use

Impacts would be **moderate** where project activities would cause the following:

- A permanent change in land use that is compatible with existing land use
- A permanent change to landowner property use within an existing easement
- Permanently limited access to agricultural or timber production areas (**stranded use**)
- An increase in unauthorized land use or access that may or may not be compatible with existing land use
- A temporary (more than one month at a time) change in or interruption to land use or access to existing land uses

Impacts would be **low** where project activities would cause the following:

- A temporary (one month or less at a time) change in or interruption to land use or access to existing land uses
- A temporary or permanent (but very minor) change in landowner property use within an existing easement or where new right-of-way or easements are required
- A temporary unauthorized land use or access that may or may not be compatible with existing land use

No impact would occur where existing land uses or ownership could continue as before.

5.2.2 Impacts Common to Action Alternatives

5.2.2.1 Construction

Urban/Suburban and Rural

During construction, everyday activities in urban/suburban and rural areas could be interrupted by construction workers, noise and dust from heavy equipment, helicopters, or rock blasting, and by land access restrictions for safety and security (see Chapter 10, Public Health and Safety; Chapter 12, Transportation; Chapter 20, Climate; and Chapter 21, Air Quality).

Project construction would take place over about 30 months. In general, crews could complete about 10 miles of transmission line in 4 months. Construction would occur at any one location for only a few weeks at a time, but multiple crews would simultaneously be working on different activities in different areas along the route over the 30-month period. Construction activities would include vegetation clearing and grubbing; construction of access roads, tower foundations and towers; and conductor stringing and tensioning (see Chapter 3, Project Components and Construction, Operation and Maintenance Activities). Road construction or improvements would occur before line construction, causing similar localized noise and dust. Materials and vehicles would be stored and staged at staging areas. Construction activities, and the interruptions they would cause to developed and rural land uses, would be temporary, a **low** impact.

Because most of the existing right-of-way proposed to be used by some alternatives has been vacant for decades, adjacent landowners and others have used the right-of-way for the activities described in Section 5.1, Affected Environment. In urban/suburban and rural areas, trails and other recreational facilities have been a popular and sometimes compatible and acceptable use within the existing right-of-way. Other compatible uses for the existing, vacant, right-of-way are commercial and industrial parking lots, and public road crossings.

Other existing uses, referred to by BPA as **encroachments,** occur but may not be a compatible or allowed use within the existing right-of-way, depending on existing easements and land use agreements. Types of encroachments on the existing right-of-way include tall-growing landscaped vegetation; unauthorized recreation such as ATV use; storage of RVs, cars and boats; permanent structures such as garages, sheds, shops, and detached apartments; fences through tower legs; decks; and swimming pools. These encroachments, while compatible with urban/suburban and rural land uses, would likely not be compatible with the project and would likely need to be removed prior to construction. BPA would notify landowners, and, consistent with existing easement and land use agreements, would require the right-of-way be cleared of encroachments, a permanent change to landowner property use and a **low-to-moderate** impact.

Timber Production

During construction, timber production areas would be cleared for the new right-of-way, roads, and substations. No timber production lands have been identified on vacant existing right-of-way. Danger trees or trees within a safety backline would also be cleared outside of the new right-of-way (see Section 3.11, Vegetation Clearing). Since these lands are being used for timber production, harvest of mature timber with fair compensation to the landowner would be consistent with the existing land use and would not affect this type of land use during construction. If timber is not ready for harvest, BPA would compensate the landowner for clearing timber earlier than planned. **No-to-low** impacts would occur during construction since construction activities would be temporary (see Section 5.2.2.2, Operation and Maintenance, for long-term, permanent impacts from clearing) and BPA would notify and coordinate with landowners regarding construction and harvest schedules. These areas are not populated and the typical interruptions from construction would not affect day-to-day activities. Construction staging areas and conductor pulling areas that were not within the right-of-way would be cleared, and owners would be compensated.

Agriculture

Depending on the time of year, crops could be damaged by construction activities. Heavy machinery, materials stored on the ground, trenches for counterpoise, and other activities could damage crops and compact soils, causing a temporary loss of soil productivity. The damage would depend on the type of crop (vineyards, orchards, or row crops), the season (during summer growing season, harvest, or winter when plants are dormant), and if the land was in use or fallow. Damage to crops and land disturbance during construction would be a **low** impact because construction activities would be temporary and BPA would compensate landowners for crop loss during construction.

Livestock grazing and farming in the area may need to be temporarily restricted to avoid conflicts between livestock or farm equipment and construction activities. This would be a **low** impact because it would be temporary, and BPA would provide compensation for losses and would notify and coordinate with landowners regarding construction schedules. As with most land uses, disturbance during construction and vegetation removal could introduce or spread noxious weeds (see Chapter 17, Vegetation).

Open Space

The presence of construction workers, noise and dust from heavy equipment, helicopters, or rock blasting could temporarily limit access to recreational areas (forested or non-forested) within open space areas, increase traffic on roads that are also used to access recreational areas, and intrude on recreational experiences. These types of intrusions into recreational experiences would be temporary and a **low** impact. Likewise, these types of intrusions could affect wildlife and wildlife habitat within open space areas (see Chapter 18, Wildlife).

Where non-forested open space areas close to rural residences are being used for agricultural purposes (for example, small or large gardens), impacts from construction would also be temporary and **low**, for the reasons described above for impacts to agricultural lands.

Most open space areas potentially affected by the project are forested. During construction, these forested areas would be cleared within the right-of-way and for the substations and access roads. Additional danger trees would likely be removed in some areas (see Section 3.11, Vegetation Clearing). As described for timber production lands, landowners would be compensated for timber harvested from these areas. In forested open space areas where the existing use is for timber production by small landowners or if the forested open space is not being used for timber production but is being used for the enjoyment of the landowner, **no-to-low** impacts to land use would occur from construction. In both cases landowners would be compensated for all clearing (see Section 5.2.2.2, Operation and Maintenance, for long-term permanent impacts from clearing in open space).

5.2.2.2 Operation and Maintenance

Unauthorized Access

If a decision is made to build a new line, new and improved access roads and new right-of-way could create an avenue for unauthorized public access and use of public and private land. At a landowner's request, BPA would place gates at the entrance of access roads to prevent public access onto public and private land and the right-of-way. Even with gates, unauthorized access and use of the right-of-way and nearby land could occur.

In general, unauthorized public access and use of public and private land could cause new uses and activities that may be incompatible with existing land uses. These new uses and activities could cause increased soil erosion, fire danger, introduction of noxious weeds, and illegal dumping. Increased soil erosion could occur from unauthorized uses such as driving off-road vehicles in unauthorized areas and disturbing the soil, which can lead to soil erosion. Over time, unauthorized use of gravel or dirt roads near the project could also lead to similar accelerated deterioration of these roads (see Chapter 14, Geology and Soils). Fire danger can increase when unauthorized users build campfires, discard lit cigarettes, or if vehicle exhaust systems contact dry vegetation (see Chapter 10, Public Health and Safety). Noxious weeds can be introduced to an area when unauthorized vehicles inadvertently transport and spread noxious weed seeds into the project area and nearby lands. If these vehicles also disturb soil, the potential for the noxious weeds to become established in these disturbed areas increases (see Chapter 17, Vegetation).

Unauthorized access and use could also disturb vegetation, wildlife and their habitat, and cultural resources. Vegetation and wildlife habitat can be disturbed by unauthorized vehicles driving over and crushing or uprooting plants, and by any vegetation clearing from an unauthorized use (see Chapter 17, Vegetation). Wildlife can be disturbed or displaced by noise and noise can increase stress, disrupt normal foraging and reproductive habits, cause abandonment of unique habitat features, and increase energy expenditures (see Chapter 18, Wildlife). Known or previously undiscovered cultural resource sites can be disturbed and damaged by the unauthorized collection of artifacts or other cultural resources (see Chapter 13, Cultural Resources).

According to scoping comments and conversations with landowners, existing access roads and rights-of-way are providing opportunities for unauthorized access and use that may be incompatible with the existing land uses. The degree to which this would continue into the future is unknown. It is also unknown to what degree improved and new access roads or new rights-of-way would increase or create new opportunities for unauthorized access and use. Location and frequency of unauthorized access is hard to predict, it could be a one-time temporary occurrence or it could become permanent if access is hard to prevent. For these reasons, impacts could be **low-to-high**.

Urban/Suburban and Rural

BPA would negotiate and purchase easements for new right-of-way (transmission line and access roads) from landowners with affected properties. These easement documents would describe right-of-way use limitations for the underlying landowner. BPA does not permit activities or land uses in the right-of-way that are unsafe or might interfere with constructing, operating, or maintaining transmission facilities. These restrictions are developed in accordance with NESC requirements and are part of the legal rights BPA acquires for its transmission line easements (see Chapter 3, Project Components and Construction, Operation and Maintenance Activities and Chapter 10, Public Health and Safety).

Use limitation within the right-of-way would require keeping it clear of all structures, fire hazards, tall-growing vegetation (generally taller than 4 feet) and any other use that may interfere with the safe operation or maintenance of the line. Landowners would be prohibited from placing tall-growing vegetation, permanent structures, or outbuildings, including swimming pools, fences, and decks, within the new right-of-way, and would be required to remove these uses currently within existing rights-of-way, a **low-to-moderate** impact (see Section 5.2.2.1, Construction).

Permanent use limitations created by BPA acquiring new easements for right-of-way in an area where none have existed before would be a **high** impact. Where these new easements might create use limitations off of, but adjacent to, existing right-of-way (e.g., removing danger trees that are part of a landowner's landscaped yard or limiting an existing recreation use) or cause a stranded use of the property, impacts would be **low-to-high** depending on the existing use and whether that use could continue. The transmission line could create other possible issues for residents, such as impacts on views from homes, or concerns about property values and electric and magnetic field exposure (see Chapter 7, Visual Resources, Chapter 11, Socioeconomics, and Chapter 8, Electric and Magnetic Fields).

For new and existing rights-of-way, the area between towers and roads are generally compatible with urban/suburban and rural land uses such as trails, sports fields, and roads (often used as a trail) (see Section 5.2.2.1, Construction), and permanent impacts would be limited to the land under the tower or road (substations are not proposed within this land use). New or improved access roads in urban/suburban areas off the right-of-way are unlikely to affect future development in the surrounding area because this type of development is typically located near roads. For this reason, development of new access roads or improvement of existing roads in urban/suburban land uses would be a **moderate** impact. This same type of road development in rural land uses would be **moderate-to-high** depending on the type of existing or planned development in the vicinity of the existing or planned roads.

Twice each year helicopter flyover inspections would create temporary noise along the transmission line. Annual ground inspections of the line may be noticeable to landowners as crews drive on access roads and walk the right-of-way. Vegetation management activities would also require personnel to drive along access roads or walk the right-of-way to determine vegetation clearing needs. Cutting trees with chainsaws and removing debris would cause noise and dust. Equipment noise during repairs may be noticeable but would be infrequent. Maintenance impacts on uses within urban/suburban and rural areas would be **low** because disturbances would be temporary and mostly limited to noise, dust, managing vegetation, and a small amount of vehicle traffic.

Timber Production

Timber production areas crossed by new rights-of-way and access roads, or under towers and substations would be permanently affected because trees would be prevented from growing within these areas, curtailing growing and harvesting activities and future revenue potential. Danger trees or trees within a safety backline outside of the right-of-way (see Section 3.11, Vegetation Clearing) would also be removed. In some cases, depending on location and local forest practices, a right-of-way or new access road could permanently disrupt forest practices on both sides of the right-of-way or road. This could occur if timber harvest requires crossing the right-of-way with equipment (cranes, derricks, and booms) or trucks moving or hauling harvested timber across right-of-way. A right-of-way can also make certain timber stands inaccessible or economically infeasible to harvest (stranded use). Permanent land removal from timber production would be a **high** impact (see also Chapter 11, Socioeconomics for the economic effects of timber production losses).

Staging areas and conductor pulling areas outside the right-of-way cleared during construction could be re-planted and used for timber production after the line is operating, as long as these trees would not become danger trees. Since compensation would be provided for clearing during construction and clearing in these areas is temporary, **no-to-low** impacts would occur. Maintenance activities would have **no** impacts on uses within timber production areas outside of cleared areas because BPA would communicate scheduling in advance with landowners.

Agriculture

Agricultural activities can occur within the right-of-way under certain conditions and at appropriate locations. In general, cultivated crops that do not require structural support and do not grow higher than 4 feet at mature height may remain in the existing right-of-way and are allowed in the new right-of-way between the towers and roads. These might include vegetable crops, strawberries, mint, and other low-growing crops. However, orchards, tall-growing natural or planted vegetation used for landscaping, or windrows, and crops supported by trellises or stakes (e.g., grapes or cane berries) would likely not be allowed within the right-of-way, a **high** impact if they already exist or are planned for these areas. Farm vehicles and large equipment that do not extend more than 14 feet high, such as harvesting combines, cranes, derricks and booms, could be operated safely under the line where it passes over roads, driveways, parking lots, cultivated fields or grazing lands.

Crop cultivation within the right-of-way would be negotiated when a new easement is purchased for new right-of-way. On existing right-of-way, BPA would review existing easement and land use agreements to determine if existing crops are compatible with the new line. Stranded use of agricultural land could also be caused by a new right-of-way or construction of the project on existing right-of-way, a **high** impact depending on whether existing uses could continue.

Working with the landowner, BPA would try to locate access roads along fences or property lines for access across fields. Towers would create an obstacle for mechanical tilling, and if irrigation is used, it may need to be modified such that pipes maneuver between or around the towers. Because the areas under towers and roads would not be tilled, they could become sources of noxious weeds, creating a seed source for contaminating a field (see Chapter 17, Vegetation). BPA works closely with underlying landowners to minimize weed infestations.

Grazing tends to be compatible with transmission lines, because livestock would be able to graze within the right-of-way. Although towers and roads would remove that area of vegetation from grazing, livestock (and wildlife) could still maneuver around the towers and roads. Depending on the size of the original property, how much land is available for grazing and how the project may limit or eliminate the original grazing use, impacts would be **low-to-high**. In some cases, grazing could increase because trees would be permanently removed. During line maintenance, workers would ensure that gates are closed to prevent livestock from escaping.

Maintenance of the transmission line would temporarily disrupt land use through noise, truck traffic, and vegetation management activities (see Urban/Suburban and Rural), a **low** impact.

Open Space

Operation and maintenance of transmission lines and access roads could create or increase unauthorized access to undeveloped rural areas (see Unauthorized Access).

Forested and non-forested open space within existing and new rights-of-way, and where roads and substations are proposed would permanently change to non-forested open space, a **moderate-to-high** impact, depending on whether existing uses within that open space could still occur, are altered or limited, or permanently prohibited. Compatible uses within forested or non-forested open space, such as recreational activities, while temporarily impacted (see Section 5.2.2.1, Construction), could continue even after project facilities are constructed, a **moderate** impact. In forested open space being used for timber production activities by small landowners, the same **high** impact on these uses would occur as described in Timber Production. Any stranded uses caused by the project that permanently discontinues that use would likely be a **high** impact.

Maintenance of the transmission line would disrupt recreation through noise, dust, truck traffic, and vegetation clearing, or herbicide application (see Urban/Suburban and Rural). Overall, operation and maintenance impacts on open space would be **low.** Impacts would generally be temporary and limited to noise, dust and a small amount of vehicle traffic during maintenance.

5.2.2.3 Sundial Substation

Sundial Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from Port of Portland ownership and the land would become BPA fee-owned property. In addition, some non-BPA transmission line and access road work would occur in the city of Fairview near this substation site.

Though the Port of Portland would be compensated for land acquired by BPA for the proposed project, this land would no longer be available to the Port for an industrial use development or for planned wetland mitigation, a **high** permanent impact.

> BPA would purchase about 25 to 50 acres for each of the proposed substations and substation access roads, with exact acreage depending on the parcel selected and the final substation and access road design.
>
> For purposes of the land use analysis, an estimated impact area was defined at each substation site to accommodate adjustments in substation and substation access road design and positioning that occur throughout the design process.

Because the site is within an existing industrial area, temporary noise, dust, and traffic impacts on existing land uses during construction would be **low**. Though the substation, access roads, and line changes would occur in mostly non-forested open space (40 acres; a portion is identified for Port of Portland wetland mitigation), the area is within an industrial complex with planned and existing industrial uses. Maintenance and operation of the substation and associated facilities would not be a change in planned use and would have **no** impact on existing and nearby land uses, which include a FedEx distribution center, a marine construction and repair company, a gravel company, a paper products company, an existing substation and transmission lines, and the Portland-Troutdale Airport.

5.2.3 Castle Rock Substation Sites

5.2.3.1 Casey Road

> Impacts common to action alternatives are in Section 5.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

Casey Road Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from WDNR ownership and the land would become BPA fee-owned property. This would be a **high** impact on land ownership though WDNR has large land holdings in the project area and in Washington in general.

The Casey Road site would permanently remove about 63 acres of WDNR land from mostly timber production use, causing a **high** impact. Final design of the substation would likely decrease the number of acres removed from timber production. The substation would be partially within the existing right-of-way and would not prevent access to surrounding timber production areas or create stranded uses. Target practice does occur at this site, an unauthorized use that would not be allowed to continue, a **moderate** impact.

5.2.3.2 Baxter Road

Baxter Road Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from Sierra Pacific Industries ownership and the land would become BPA fee-owned property, a **high** impact on land ownership.

The Baxter Road site would remove about 47 acres of Sierra Pacific Industries land from mostly timber production, a permanent conversion of land use and a **high** impact. Final design of the substation would likely decrease the number of acres removed from timber production. The substation would be partially within the existing right-of-way and would not prevent access to surrounding timber production areas or create stranded uses.

5.2.3.3 Monahan Creek

Monahan Creek Substation and its access road would remove about 25 to 50 acres (exact amount unknown until final design is complete) from private ownership and the land would become BPA fee-owned property, a **high** impact on land ownership.

The Monahan Creek site would affect about 67 acres of mostly rural and open space lands used for livestock grazing and rural residences. Final design of the substation would likely decrease the amount of acres removed from grazing. Though the substation and associated facilities would be located to avoid residences and existing transmission facilities, it would permanently convert existing land uses to utility use, a **high** impact. The substation would remove a large area of land from grazing, and grazing might be unable to continue depending on the landowners' holdings. Temporary **moderate** impacts from construction would occur to nearby residents and to residents who use Delameter Road to commute because substation construction would be longer in duration (13 months) than construction of any particular portion of the transmission line, and construction would be closer to residents in the general area.

5.2.4 West Alternative

Of the action alternatives, the West Alternative would cross the most urban and suburban and agricultural land use. This alternative would be closer to I-5 than the other action alternatives and would parallel substantially more existing transmission lines, about 66 miles (almost 98 percent of the total distance). The West Alternative would cross the highest percentage (99 percent) of private land and would be located on only 1 percent public land. This alternative also would cross more areas with high density, multi- and single-family residential units, and would have the largest number of homes within various distances from the edge of the right-of-way (see Table 5-1). For the action alternatives, the number of homes at various distances from the edge of the right-of-way generally decreases from west to east (see Table 5-1).

Table 5-1 Numbers of Homes from the Edge of the Right-of-Way

Distance from Edge of Right-of-Way[1]	West Alternative	Central Alternative	East Alternative	Crossover Alternative
500 feet	3,032	327	286	657
300 feet	1,526	173	157	320
100 feet	323	26	25	59
50 feet	174	14	15	29

Notes:
1. Assuming a 150-foot-wide right-of-way.

5.2.4.1 Land Ownership

The West Alternative would require some new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new right-of-way. BPA would acquire new easements on up to 401 acres for the transmission line right-of-way, and new and improved access roads (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement requirement would be less than 401 acres. Most land potentially requiring new easements in the West Alternative is privately held (391 acres) and about 10 acres is publicly owned (mostly WDNR).

Because most of the West Alternative would be built on existing right-of-way and use existing access roads, the West Alternative would require fewer new easements and have the least overall impact on landowners of the action alternatives. At the same time, there are more individual landowners who own smaller lots next to the existing right-of-way along the West Alternative than the other action alternatives. Portions of the line and roads built on existing easements would cause **low-to-moderate** impacts on landowners. The remaining portions that would require new right-of-way and easements that would restrict use would cause **high** impact on landowners.

5.2.4.2 Land Use

The West Alternative would use about 1,097 acres of existing right-of-way for about 66 miles (see Table 5-3; the 1,097 acres is the total of the acreages in the "Existing Right-of-Way" columns for each land use type for the West Alternative). About 127 acres of new right-of-way would be needed in certain areas along and adjacent to the existing right-of-way (see Table 5-2, Chapter 4, and Appendix B). The width of this new right-of-way would vary in these areas depending on how much existing right-of-way is available for the new line. Both towers and roads would be built within this new right-of-way. Most new right-of-way (104 acres) would be on open space lands likely being used for recreation by adjacent landowners and others who have enjoyed its natural and rural character since it is next to existing right-of-way that is not currently cleared of vegetation. Outside the new 150-foot right-of-way, an additional 131 acres would be affected on other, adjacent existing BPA rights-of-way where towers need to be removed or replaced and new and improved access roads are required. Over half of this acreage is open space, and the remaining is a mixture of urban/suburban, rural, timber production, and agricultural land.

Urban/Suburban

Urban/suburban land is about 7 percent of the area crossed by the West Alternative. This includes commercial, industrial, and residential areas.

About 2 acres of new right-of-way in urban/suburban areas would be needed for the new line, potentially causing a **high** impact on existing land uses because no tall vegetation, structures, or new development would be permitted within any new right-of-way. **Low-to-moderate** impacts would occur where existing uses would be compatible with project components (e.g., low-growing landscaping). New right-of-way could also affect planned development or use of property next to it, creating **no-to-high** impacts depending on whether a planned development complies with right-of-way restrictions, or an existing adjacent use becomes stranded. Restrictions would occur in few places (e.g., the northwest part of Segment 50).

Table 5-2 New Easements Required on Public and Private Land (Acres)[1,2]

Alternatives and Options	Private Land[3]			Public Land[4]			Total		
	New Transmission Line Right-of-Way	New Access Roads[5]	Improved Access Roads[5,6]	New Transmission Line Right-of-Way	New Access Roads[5]	Improved Access Roads[5,6]	New Transmission Line Right-of-Way	New Access Roads[5]	Improved Access Roads[5,6]
West Alternative	**119**	**102**	**170**	**8**	**1**	**1**	**127**	**103**	**171**
West Option 1	N/C	+2	-3	N/C	N/C	N/C	-	-	-
West Option 2	-64	-1	-10	+10	+<1	+2	-	-	-
West Option 3	-40	+11	+9	+6	+3	+1	-	-	-
Central Alternative	**861**	**125**	**516**	**427**	**39**	**144**	**1,287**	**165**	**661**
Central Option 1	+30	N/C	+10	+12	+5	+33	-	-	-
Central Option 2	-62	+14	-40	N/C	N/C	N/C	-	-	-
Central Option 3	-20	-4	-37	-86	+1	-9	-	-	-
East Alternative	**1,027**	**105**	**861**	**228**	**36**	**120**	**1,255**	**141**	**980**
East Option 1	-35	+4	-43	N/C	N/C	N/C	-	-	-
East Option 2	-32	-4	-146	+51	-11	-9	-	-	-
East Option 3	-12	N/C	-3	+21	-3	+6	-	-	-
Crossover Alternative	**456**	**92**	**424**	**316**	**41**	**92**	**772**	**133**	**515**
Crossover Option 1	+53	+<1	+7	N/C	N/C	N/C	-	-	-
Crossover Option 2	N/C	+4	+38	N/C	N/C	N/C	-	-	-
Crossover Option 3	+41	+5	+39	N/C	N/C	N/C	-	-	-

Notes:
N/C—No net change from the action alternative.
1. The value for each option represents the net change from the action alternative. It was calculated as the acres for the option minus the acres in the segments the option replaces.
2. Does not include area within existing transmission line right-of-way.
3. Private land includes parcels owned by large landowners, companies, and private individuals.
4. Public land includes state owned (including WDNR and local government).
5. New and improved access road easements (50 feet) outside of new and existing transmission line right-of-way.
6. All or a portion of improved access roads may have existing BPA easement rights.
Source: BLM 2009b

Table 5-3 Land Use (Acres)[1]

	Urban/Suburban			Rural			Timber Production[2]			Agriculture			Open Space[3]		
Alternatives and Options	**Existing Right-of-Way[4]**	**New Right-of-Way[4]**	**Towers 5 and Access Roads[6]**	**Existing Right-of-Way**	**New Right-of-Way**	**Towers and Access Roads**	**Existing Right-of-Way**	**New Right-of-Way**	**Towers and Access Roads**	**Existing Right-of-Way**	**New Right-of-Way**	**Towers and Access Roads**	**Existing Right-of-Way**	**New Right-of-Way**	**Towers and Access Roads**
West Alternative	**89**	**2**	**6**	**81**	**4**	**13**	**0**	**0**	**12**	**165**	**17**	**19**	**762**	**104**	**81**
West Option 1	N/C	N/C	N/C	-1	-<1	N/C	N/C	N/C	N/C	-2	-3	-1	+4	+4	+2
West Option 2	+<1	-<1	N/C	+11	-4	-<1	N/C	+10	+<1	+41	-11	-2	+31	-49	+9
West Option 3	N/C	-<1	N/C	+37	-4	N/C	N/C	+23	+9	+29	-15	-1	+76	-37	+5
Central Alternative	**8**	**13**	**2**	**20**	**7**	**6**	**0**	**974**	**240**	**23**	**12**	**6**	**66**	**281**	**108**
Central Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	+42	+10	N/C	N/C	N/C	+3	+<1	+10
Central Option 2	+2	-9	N/C	N/C	-<1	+3	N/C	-81	-9	+6	-10	N/C	+10	+38	-3
Central Option 3	N/C	-<1	N/C	N/C	+11	+5	N/C	-188	-19	N/C	+8	+<1	N/C	+63	-6
East Alternative	**8**	**12**	**2**	**20**	**10**	**12**	**0**	**1,020**	**319**	**23**	**12**	**11**	**66**	**201**	**132**
East Option 1	N/C	-8	-<1	N/C	+9	+2	N/C	-58	-9	N/C	-6	N/C	N/C	+29	+24
East Option 2	N/C	N/C	N/C	N/C	N/C	+<1	N/C	N/C	-51	N/C	N/C	-2	N/C	+18	-19
East Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C	+22	+1	N/C	N/C	N/C	+10	-13	-2
Crossover Alternative	**20**	**3**	**2**	**59**	**3**	**10**	**0**	**627**	**160**	**39**	**3**	**9**	**453**	**136**	**105**
Crossover Option 1	+1	N/C	N/C	-9	+4	+<1	N/C	N/C	N/C	+39	+14	+2	+11	+34	+<1
Crossover Option 2	N/C	N/C	N/C	+15	N/C	+3	N/C	N/C	+4	N/C	N/C	N/C	+65	N/C	+11
Crossover Option 3	N/C	N/C	N/C	+15	N/C	+3	N/C	+18	+4	N/C	N/C	N/C	+21	+23	+12

Notes:
N/C—No net change from the action alternative.
1. The value of each option represents the net change from the action alternative. It was calculated as the acres in the option minus the acres in the segments the option replaces.
2. Includes all large landowners that do timber production (commercial timber companies, PacifiCorp, and WDNR.
3. Includes Open Space – Forest (all forested land outside of the Timber Production category) and Open Space – Non Forested.
4. Transmission line right-of-way (up to150 feet). Also includes portions of new or improved access roads within the right-of-way.
5. Includes removed, rebuilt, or new towers on existing BPA right-of-way but outside of the 150 feet needed for the new transmission line.
6. Includes all new and improved access roads outside of new and existing right-of-way. New access roads assume 30-foot wide disturbance to land use, existing access roads assume 20-foot wide disturbance to land use.

Sources: Herrera 2010, USGS 2011

About 89 acres of existing right-of-way in urban/suburban areas would be potentially affected by the new line (see Table 5-3). This is the greatest amount of urban/suburban land potentially affected by the action alternatives. This acreage is on existing BPA right-of-way next to existing BPA lines. Although this existing right-of-way is owned by BPA or encumbered with existing easements, it has been vacant for decades and, as such, accessed or used for recreation and other activities or uses common in urban/suburban areas. One of the largest uses of the existing right-of-way by adjacent landowners has been for trees and other ornamental landscaping in residential or rural neighborhoods. Some landscaped vegetation is quite mature and would need to be removed. Many encroachments (see Section 5.2.2.1, Construction) have been identified along existing BPA rights-of-way both north and east of BPA's Ross Substation in the greater Vancouver area and would need to be removed.

Where existing incompatible uses would need to be removed both within and adjacent to the existing right-of-way, impacts to land use would be **low-to-moderate**. These uses would include commercial and industrial activities within the urban/suburban land use through the Minnehaha area and closer to the Columbia River. These activities are occurring within the vacant right-of-way (whether or not legally allowed through existing easements or land use agreements) and would not be allowed to continue.

Due to limitations on development in the right-of-way, the project could restrict planned new development or use of property next to the existing and new rights-of-way, a **no-to-high** impact, depending on whether the development planned is in compliance with right-of-way restrictions or whether an existing use is stranded because of the addition of new right-of-way. The West Alternative requires little new right-of-way, so these new development restrictions would occur in few places (the northwest part of Segment 50 is one example). In areas of existing right-of-way, there would be no change to existing restrictions on development.

An additional 6 acres of urban/suburban land outside the 150-foot right-of-way for the new transmission line would be affected by new and improved access roads and by tower removal or construction on adjacent BPA right-of-way. New roads require new right-of-way, similar to the new transmission line, causing similar impacts to those already described. Unlike a new transmission line, a new road in urban/suburban land use could aid future development. Improved access roads already exist within existing land uses and are likely being used by landowners. **No** additional impacts would occur to land use. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional impacts to land use.

Rural

Rural lands are about 7 percent of the land crossed by the West Alternative. This is the greatest amount of rural land crossed by the action alternatives.

About 4 acres of rural land would be crossed by new right-of-way, potentially causing a **high** impact on existing land uses because no tall vegetation, structures, or new development would be permitted within any new right-of-way. **No-to-high** impacts could occur on planned development or use of property adjacent to the new right-of-way, depending on whether development plans comply with right-of-way restrictions or whether an existing adjacent use is stranded because of the addition and placement of new right-of-way.

Where the new line would cross about 81 acres in existing right-of-way, impacts would be **low-to-moderate** because livestock grazing and most low-profile rural uses that do not interfere with safe operation of the line could continue. Similar to Urban/Suburban, recreation activities in rural areas, such as hunting or hiking, could continue. Where existing incompatible uses would need to be removed both within and adjacent to the existing right-of-way, impacts to land use would be **low-to-moderate**.

Although vegetation would need to be cleared from both existing and new rights-of-way (see Chapter 17, Vegetation) on rural land, these areas would remain rural in character after project construction and during operation and maintenance.

About 13 acres outside the new 150-foot right-of-way would be affected or changed from this use where tower removal or construction is required on adjacent BPA right-of-way, or where new and improved access roads are required.

New roads require new right-of-way, similar to the new transmission line, causing similar impacts to those already described. In general, access roads are common and compatible with rural land uses. They could also aid future development. Improved access roads already exist within existing land uses and are likely being used by landowners. **No** additional impacts would occur to land use. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional impacts to land use.

Timber Production

Timber production lands are 1 percent of the land crossed by the West Alternative. New right-of-way would not be needed on timber production land.

The existing right-of-way crosses lands owned by Weyerhaeuser Company, Longview Fiber, and WDNR; all in the northern portion of the alternative. Within the existing right-of-way, these lands are not being used for timber production and would need to be cleared. Landowners would be compensated according to existing easement documents or land use agreements, a **no-to-low** impact. Likewise, removing danger trees outside of the 150-foot right-of-way would have **no-to-low** impacts since compensation would be given. These areas outside the right-of-way would be allowed to be replanted and remain productive into the future.

Another 12 acres of timber production lands would be affected or changed from this use by road improvements and some new roads outside of the existing right-of-way. Improved access roads already exist and any improvements to these roads would likely benefit the underlying landowner and timber production activities. New roads require new right-of-way, similar to the new transmission line, causing a **no-to-low** impact during construction because landowners would be compensated for timber removed, and a **high** impact during operation and maintenance because timber production could not continue in these areas or if the new road causes adjacent stranded use.

Agriculture

Agricultural lands are about 14 percent of the land that would be crossed by the West Alternative.

New right-of-way would restrict agricultural practices on about 17 acres of agricultural land, a **high** impact where certain agricultural activities could not continue because of height restrictions under the new transmission line (for example, Christmas tree, apple, and peach farming, and cultivation of some types of berries such as highbush blueberries [*Vaccinium corymbosum*]). Some agricultural uses, however, such as grazing and cultivation of hay/silage or other row crops less than 4 feet tall (that maintain 25 feet of clearance between the maximum sag of the transmission line and the mature height of the vegetation), would be allowed to continue within new right-of-way in the areas between towers and roads. Impacts in these areas would be **low-to-moderate** because uses may be temporarily restricted during construction but over the long term, these uses would be compatible with the project and could continue, even if somewhat altered.

About 165 acres of existing vacant right-of-way is in agricultural use. Some agricultural activities, mostly in Clark County north and east of Vancouver, would not be permitted to continue within the existing right-of-way (tall-growing crops like those mentioned above). Because BPA owns most of the existing right-of-way in this area, similar to an encroachment, the agricultural activities that interfere with the safe operation of the line would be removed, a **low-to-moderate** impact. Agricultural activities that do not interfere with the safe operation of the line would likely be allowed to continue.

Another 19 acres outside the new 150-foot right-of-way would be affected or changed by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way. New roads require new right-of-way, similar to the new transmission line, causing a **no-to-low** impact during construction because landowners would be compensated for damaged crops. A **high** impact would occur during operation and maintenance because agricultural activities could not continue, or, a new road could cause adjacent stranded use. Typically, in agricultural areas, access roads would be temporary or would be located along field edges to avoid existing crops. Improved access roads already exist and any improvements to these roads would likely benefit the underlying landowner and agricultural activities. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional permanent impacts to agricultural land use.

The West Alternative would change both prime farmland and farmland of statewide importance to towers and roads on and off existing and new right-of-way. Towers and new and improved access roads would change about 61 acres of prime farmland and 79 acres of farmland of statewide importance, totaling about 16 percent of the area within the West Alternative with these state designations. However, only about 24 acres of the 139 acres with these designations are currently included in the agriculture land use, so the West Alternative would only remove about 3 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

Open Space

Open space lands are about 68 percent of the land crossed by the West Alternative. This is the greatest amount of open space among the action alternatives. Open space along the West Alternative includes forested areas (non-production and likely some in timber production by small landowners) and non-forested land. This open space also includes some designated recreation areas (see Chapter 6, Recreation).

New right-of-way would restrict the use of 104 acres of open space land. Another 762 acres of existing vacant right-of-way would be cleared; most has timber on it. In addition, 81 acres of open space outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA rights-of-way.

Impacts on all open space land use affected by the project would generally be **low-to-moderate** because most uses within open space lands would remain compatible with the project. There may be some areas along new right-of-way where small landowners are using lands for timber production. This use would not be able to continue, causing a **high** impact.

None of the open space along the West Alternative is part of a designated wilderness area or wildlife preserve, but a portion along segments 36, 36A, 36B, 40, 41, 45, 46, and 50 has recently been designated as a natural area by the Washington State Commissioner of Public Lands (see Sections 17.1.1.5, Herbaceous, and 17.1.2.1, WDNR Protected Areas). WDNR also owns a forest riparian conservation easement along Segment 9 that would likely be affected by clearing along the existing right-of-way and possibly off right-of-way for danger trees, a **moderate-to-high** impact depending on the exact location of the easement, and types of existing vegetation and extent of clearing needed.

5.2.4.3 West Option 1

West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. This portion of the alternative includes replacing one of the existing 230-kV lines with a new double-circuit 500-kV line. The existing 230-kV line and the new line would be placed on new 500-kV towers. West Option 1 would have a negligible decrease in private lands crossed by project components (see Table 5-2). The option would cross the same acreage of timber production land as the West Alternative. The option crosses 10 additional acres of open space land, about 2 fewer acres of urban/suburban and rural land, and 6 fewer acres of agricultural land (see Table 5-3). The option would reduce the prime farmland and farmland of statewide importance in agricultural use needed for the project by about 3 acres.

Impact levels on land ownership and land use would be the same as the West Alternative.

5.2.4.4 West Option 2

West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. West Option 2 would reduce private lands needed for project components by about 75 acres. A 12-acre section of public property on Segment 43 would be needed for new right-of-way and access road easements (see Table 5-2). The local school district has expressed interest in this land for a new school. The project would likely prohibit this use depending on design and placement of permanent buildings.

West Option 2 would add about 6 acres of urban/suburban and rural land, 11 acres of timber production land, and 28 acres of agricultural land to the area crossed by project components. The option would reduce the amount of open space cleared by about 9 acres (see Table 5-3). West Option 2 would increase the prime farmland and farmland of statewide importance in agricultural use needed for towers and roads by about 5 acres.

Impact levels on land ownership and land use would be the same as the West Alternative.

5.2.4.5 West Option 3

West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing rural residential and rural areas farther east. The option would reduce private lands crossed by project components by 20 acres and increase the area of public lands needed for new right-of-way and access road easements by 10 acres along segments T and 49 (see Table 5-2).

West Option 3 crosses about 32 additional acres of urban/suburban and rural land, 32 acres of additional timber production land, 13 acres of additional agricultural land, and 44 acres of additional open space. This option would cross the greatest amount of urban/suburban and rural land of the options, and the greatest amounts of timber production and open space land (see Table 5-3). West Option 3 would increase the amount of prime farmland and farmland of statewide importance in agricultural use needed for the project by about 3 acres.

Impact levels on land ownership and land use would be the same as the West Alternative.

5.2.5 Central Alternative

The Central Alternative would parallel existing transmission lines for about 8 miles (about 10 percent of the alternative's total distance), but would require new right-of-way for the remaining approximately 69 miles of its total 77-mile length. Most urban and suburban areas crossed by the Central Alternative are near the northern and southern ends of this alternative, with mostly rural residential, forest, and agricultural areas in between. Of the action alternatives, the Central Alternative would cross the second highest amount of land being used for timber production. Most land (73 percent) is privately owned; WDNR (26 percent) and the city of Camas (1 percent) own the remainder. This alternative also would cross areas with high density, multi- and single-family residential units, and would have the third highest number of homes within various distances from the edge of the right-of-way (see Table 5-1).

5.2.5.1 Land Ownership

The Central Alternative would require new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new transmission line right-of-way and new and improved access roads. BPA would acquire new easements on up to 2,113 acres for these project elements (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement requirement would be less than 2,113 acres.

Most land potentially subject to new easements in the Central Alternative is privately held (1,502 acres) by large landowners, including Sierra Pacific, Weyerhaeuser and Longview Timber. About 610 acres of public land (594 acres owned by WDNR and a small portion owned by the city of Camas) would also require easements. Portions of the line built on an existing easement would cause a **low-to-moderate** impact on landowners. The remaining portions that would require new right-of-way and easements restricting use would cause **high** impact on landowners.

5.2.5.2 Land Use

The Central Alternative would use about 117 acres of existing right-of-way for about 8 miles (see Table 5-3; the 117 acres is the total of the acreages in the “Existing Right-of-Way” columns for each land use type for the Central Alternative). In addition, about 1,287 acres of new 150-foot right-of-way would be needed for the new line and access roads that would be built within this right-of-way (see Table 5-2). New and improved access roads outside the 150-foot right-of-way for the new line and tower removal or construction on adjacent BPA right-of-way would affect an additional 362 acres. Most is open space or timber production land. The remaining is a mixture of urban/suburban, rural, and agricultural land.

Urban/Suburban

Urban/suburban lands are about 1 percent of the land crossed by the Central Alternative, which passes through commercial, industrial, and residential areas in Camas and Washougal.

About 13 acres of new right-of-way in urban/suburban areas would be needed for the project, with **low-to-moderate** impacts where existing uses would be compatible with project components (e.g., a garden or low-growing landscaped vegetation); in areas where existing development would not be permitted within new right-of-way, or where project components would not be compatible with existing uses (e.g., tall landscaped vegetation), impacts would be **high**. Restrictions on new development adjacent to new right-of-way would have **no-to-high** impacts, depending on whether a planned development is in compliance with right-of-way restrictions or whether an existing adjacent use is stranded because of the addition and placement of new right-of-way.

About 8 acres of existing urban/suburban right-of-way would be affected by the new line. This acreage is on existing BPA right-of-way next to existing BPA lines. Most is undeveloped or developed with industrial uses closer to the Columbia River. With a new line and roads, previous industrial uses within vacant existing right-of-way (whether or not legally allowed through existing easements or land use agreements), would not be allowed to continue, a **low-to-moderate** impact.

An additional 2 acres of urban/suburban land outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way. New roads require new right-of-way, similar to the new transmission line, causing similar impacts to those already described. Unlike a new transmission line, a new road in urban/suburban land use could aid future development. Improved access roads already exist within existing land uses and are likely being used by landowners. **No** additional impacts would occur to land use. All existing tower removals or rebuilds on existing transmission lines would occur on existing right-of-way and would cause **no** additional impacts to land use.

Rural

Rural lands are about 2 percent of the land crossed by the Central Alternative. Most is rural residential and is developed with low-density housing and related structures.

About 7 acres of rural land would be crossed by new right-of-way and about 20 acres near the Little Washougal River and northwest of the city of Washougal would be crossed by existing right-of-way. About 6 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on existing rural land uses and limitations on new development would be similar to the West Alternative.

Timber Production

Timber production lands are about 67 percent of the land crossed by the Central Alternative. Most is owned by large landowners such as Weyerhaeuser, Longview Timber, and WDNR.

About 974 acres of timber production land would be crossed by new right-of-way. During construction, trees would be removed and landowners would be compensated for the timber, a **no-to-low** impact. Over the long term, impacts would be **high** because timber production could not continue in the right-of-way. Also, placement of the new right-of-way could cause stranded uses for timber harvest. If danger trees need to be removed outside of the 150-foot right-of-way (see Section 3.11, Vegetation Clearing), a **no-to-low** impact would occur, since landowners would be compensated. After construction, these areas outside of the right-of-way would be allowed to be replanted and remain productive into the future.

Existing right-of-way does not cross timber production land.

About 240 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent existing BPA right-of-way. Improved access roads already exist and any improvements to these roads would likely benefit the underlying landowner and timber production activities. New roads require new right-of-way, similar to the new transmission line, causing a **no-to-low** impact during construction because landowners would be compensated for timber removed, and a **high** impact during operation and maintenance because timber production could not continue in these areas or if the new road causes adjacent stranded use.

Agriculture

Agricultural lands are about 2 percent of the land that would be crossed by the Central Alternative.

About 12 acres would be crossed by new right-of-way, and about 23 acres of existing right-of-way in agricultural use would be affected mostly north of Castle Rock and south of the Little Washougal River. Some of these agricultural activities would not be permitted to continue within the existing right-of-way. Like an encroachment, these activities would be removed, a **low-to-moderate** impact within existing right-of-way and a **high** impact if on new right-of-way. Some agricultural uses, however, such as cultivation of hay/silage and other crops under 4 feet tall), or grazing, would continue within the right-of-way. Impacts in these areas would be **low-to-moderate** because these uses would be compatible with the project and could continue though somewhat altered by the project.

Where 6 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way, impacts would be similar to that of the West Alternative, Agriculture.

The Central Alternative would change both prime farmland and farmland of statewide importance to towers and roads on and off existing and new right-of-way. Towers and new and improved access roads would change about 18 acres of prime farmland and 192 acres of farmland of statewide importance, totaling about 26 percent of the area within the Central Alternative with these state designations. However, only about 5 acres of the 210 acres are currently classified as agriculture, so the Central Alternative would only remove about 1 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

Open Space

Open space lands are about 26 percent of the land crossed by the Central Alternative. Open space along the Central Alternative includes non-production forested areas (non-production and likely some production by small landowners) and non-forested land. Open space also includes some designated recreation areas such as the Yacolt Burn State Forest (see Chapter 6, Recreation).

New right-of-way would restrict about 281 acres of open space land, and 66 acres of existing right-of-way would be cleared, most now covered with timber. In addition, 108 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on other adjacent, existing BPA right-of-way.

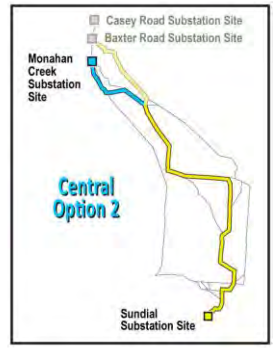
Impacts on all open space land use affected by the project would generally be **low-to-moderate** because most uses within open space lands would remain compatible with the project. There may be some areas along new right-of-way where small landowners are using lands for timber production. This use would not be able to continue, causing a **high** impact.

5.2.5.3 Central Option 1

Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated forest production and open space land. The option would increase private lands needed for project components by 40 acres. About 50 acres of additional public property would be needed for new right-of-way easements (see Table 5-2). Central Option 1 would affect about 52 additional acres of timber production land and 14 additional acres of open space land. The option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the Central Alternative.

5.2.5.4 Central Option 2



Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. This option would add a new route running southeast from the Monahan Creek substation site through sparsely populated land, crossing the unincorporated community of West Side Highway next to SR 411, the Cowlitz River and I-5, and running through largely unpopulated land toward the east. This option would reduce new right-of-way easement needed on private land by 88 acres (see Table 5-2). There would be no net change in public land needed.

Central Option 2 would add about 2 acres of rural land and 45 acres of open space land to the area affected by the project, most in the outskirts of the city of Lexington. This option would reduce the amount of urban/suburban land crossed by the project by a little less than 7 acres, removing urban/suburban impacts north of Castle Rock, but adding impacts within Lexington and Ostrander. About 4 fewer acres of agricultural land and 90 fewer acres of timber production land would be affected (see Table 5-3). The option would decrease the area of prime farmland and farmland of statewide importance in agricultural use needed for the project by less than 1 acre.

Impact levels to land ownership and land use would be the same as the Central Alternative.

5.2.5.5 Central Option 3

Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. This option would reduce new right-of-way easement needed on private land by 61 acres, and would decrease public land needed by 94 acres (see Table 5-2). Of the 94 acres, about 3 acres of public land at Moulton Falls Regional Park would be added north of the East Fork Lewis River on Segment 30.

Central Option 3 would add about 16 acres of impact on rural land west of Amboy and north of SR 503. About 9 acres of agricultural land and 57 acres of open space land would be added to the area affected by project components including an area set aside by WDNR for genetic reserves along Segment 30. Portions of this 40-acre plot are within the right-of-way and new and improved access roads (see Chapter 17, Vegetation). This option would reduce the amount of urban/suburban land crossed by almost 1 acre, and would clear about 207 fewer acres of timber production land in the eastern portion of the project area (see Table 5-3). Central

Option 3 would increase the area of prime farmland and farmland of statewide importance in agricultural use needed for the project by less than 1 acre.

Impact levels to land ownership and land use would be the same as the Central Alternative.

5.2.6 East Alternative

The East Alternative would parallel existing transmission lines for about 8 miles (almost 11 percent of the total distance), but would require new right-of-way for the remaining approximately 68 miles of its total 76-mile length. Similar to the Central Alternative, it passes through some urban and suburban areas near the beginning and end of its length, but there is a smaller amount of these areas and lower residential property densities due to a relatively greater amount of rural areas. Most land along the alternative is rural residential, agricultural, and forest land. Of the action alternatives, the East Alternative would cross the highest amount of land being used for timber production. About 85 percent of the land is privately owned, and WDNR (14 percent) and city and county governments (less than 1 percent) own the remaining land. The East Alternative would have the lowest number of homes within various distances from the edge of the right-of-way (see Table 5-1).

5.2.6.1 Land Ownership

The East Alternative would require new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new transmission line right-of-way and new and improved access roads. BPA would acquire new easements on up to 2,376 acres for these project elements (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement requirement would be less than 2, 376 acres. Most land potentially subject to new easements in the East Alternative is privately held (1,993 acres). About 387 acres of public land would also be subject to easements; 358 acres are owned by WDNR. About 18 acres of a municipal watershed managed by the city of Camas (City of Camas Watershed) would be impacted by new easement. Portions of the line built on an existing easement would cause a **low-to-moderate** impact on landowners. The remaining portions that would require new right-of-way and easements restricting use would cause **high** impact on landowners.

5.2.6.2 Land Use

The East Alternative would use about 117 acres of existing right-of-way for about 8 miles (see Table 5-3; the 117 acres is the total of the acreages in “Existing Right-of-Way” columns for each land use type for the East Alternative). In addition, about 1,255 acres of new right-of-way would be needed for the alternative (see Table 5-2). Most of this new right-of-way (1,020 acres) would be on timber production lands. Outside the new 150-foot right-of-way, new and improved access roads and tower removal or construction on adjacent existing BPA right-of-way would affect an additional 476 acres. Most is open space or timber production land. The remaining is a mixture of urban/suburban, rural, and agricultural land.

Urban/Suburban

Urban/suburban lands are about 1 percent of the land crossed by the East Alternative. The alternative passes through commercial, industrial, and residential areas in or near Castle Rock, Camas, and Washougal. The East Alternative would require about 12 acres of new right-of-way in urban/suburban areas. About 8 acres of existing right-of-way would be affected by the new line. An additional 2 acres of urban/suburban land outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way. Impacts would be similar to the Central Alternative (see Central Alternative, Urban/Suburban).

Rural

Rural lands are about 2 percent of the land crossed by the East Alternative; most is low-density rural residential or undeveloped land.

About 10 acres of rural land would be crossed by new right-of-way, and about 20 acres of rural land on existing right-of-way would be crossed by the project. An additional 12 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on rural uses and limitations on development in areas of new and existing right-of-way would be similar to the West Alternative (see West Alternative, Rural).

Timber Production

Timber production lands are about 72 percent of the East Alternative, a higher percentage than any other action alternative. Similar to the Central Alternative, most of the land cleared by the East Alternative is timber production land owned by large landowners such as Weyerhaeuser and Longview Timber. About 1,020 acres of timber production land would be cleared for new right-of-way. Existing right-of-way does not cross timber production land. An additional 319 acres outside the new 150-foot right-of-way would be affected by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on timber production and limitations on development, access, and potential for stranded use in areas of new and existing right-of-way would be similar to the Central Alternative (see Central Alternative, Timber Production).

Agriculture

Similar to the Central Alternative, agricultural lands make up about 3 percent of land crossed by the East Alternative. About 12 acres of agricultural land would be crossed by new right-of-way, and about 23 acres of existing right-of-way would be affected in the southern portion of the project area north of Washougal. An additional 11 acres outside the new 150-foot right-of-way would be affected or changed from this use by new and improved access roads and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts on agriculture, and limitations on development and to access would be similar to the Central Alternative (see Central Alternative, Agriculture).

The East Alternative crosses both prime farmland and farmland of statewide importance. The towers and new and improved access roads would require about 19 acres of prime farmland and 211 acres of farmland of statewide importance, totaling about 41 percent of the area within the East Alternative with these state designations. This is the greatest amount of this type of land crossed of the action alternatives. However, only about 6 acres of the 230 acres are currently classified as agriculture, so the East Alternative would only remove about 1 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

Open Space

Open space lands are about 22 percent of the land crossed by the East Alternative. Open space along the East Alternative includes non-production forested areas (non-production and likely some production by small landowners) and non-forested land. Open space also includes some designated recreation areas such as the Yacolt Burn State Forest (see Chapter 6, Recreation). New right-of-way required for the East Alternative would affect about 201 acres of open space land, and 132 acres outside the new 150-foot right-of-way would be affected or changed from open space use by new and improved access roads and by tower removal or construction on adjacent existing BPA right-of-way. In addition, 66 acres of existing right-of-way would be cleared.

Impacts to open space land would be similar to those discussed in the Central Alternative (see Central Alternative, Open Space).

5.2.6.3 East Option 1

East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. The option would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. The option would reduce the amount of private land needed for new right-of-way easements by 74 acres (see Table 5-2). There would be no net change for public land.

East Option 1 would affect an additional 11 acres of rural land and about 53 acres of open space land. The option would reduce the amount of urban/suburban land crossed by about 9 acres, agricultural land by about 6 acres, and timber production land by about 67 acres (see Table 5-3). The option would decrease the area of prime farmland and farmland of statewide importance in agriculture needed for the project by about 1 acre.

Impact levels to land ownership and land use would be the same as the East Alternative.

5.2.6.4 East Option 2

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. The option would decrease private land needed for new right-of-way easement by 182 acres but would increase public land needed by 31 acres (see Table 5-2). The option would decrease impacts on the City of Camas Watershed by 8 acres.

East Option 2 crosses a similar amount of urban/suburban, rural, and open space land. Impacts on timber production land cleared by the project would be reduced by about 51 acres and a little over 2 fewer acres of agricultural land would be crossed (see Table 5-3). The option would reduce the area of prime farmland and farmland of statewide importance in agricultural use needed for the project by less than 1 acre.

Impact levels to land ownership and land use would be the same as the East Alternative.

5.2.6.5 East Option 3

East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. The option would decrease the private land needed for new right-of-way by 15 acres, and would increase the WDNR land needed by 24 acres (see Table 5-2). The City of Camas Watershed would not be impacted by new right-of-way using this option.

East Option 3 crosses the same amount of urban/suburban, rural, and agricultural land as the East Alternative. The option would clear an additional 23 acres of timber production land. It would also cross about 5 fewer acres of open space land (see Table 5-3). This option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the East Alternative.

5.2.7 Crossover Alternative

The Crossover Alternative would parallel existing transmission lines for about 33 miles (almost 45 percent of the total distance) and would require new right-of-way for the remaining approximately 41 miles of its total 74-mile length. Similar to the Central and East alternatives, it passes through some urban and suburban areas near the beginning and end of its length, but there is a smaller amount of these areas and lower residential property densities due to a relatively greater amount of rural areas. Most land along the alternative is rural residential, agricultural, and forest land. Of the action alternatives, the Crossover Alternative would cross the third highest amount of land being used for timber production. About 79 percent of the land is privately owned. The remaining land is owned by WDNR (20 percent) and city and county governments (less than 1 percent). The Crossover Alternative would have the second highest number of homes within various distances from the edge of the right-of-way (see Table 5-1).

5.2.7.1 Land Ownership

The Crossover Alternative would require new right-of-way for transmission lines and new and improved access roads. BPA would need to purchase easement rights for the new transmission line right-of-way and new and improved access roads. BPA would acquire new easements on up to 1,420 acres for these project elements (see Table 5-2). Acreage amounts for new easements for improved roads would depend on whether BPA already owns easement rights on these roads. If BPA has existing rights on some of the improved roads, the new easement required would be less than 1,420 acres. Most land potentially subject to new easements in the Central Alternative is privately held (972 acres), and 449 of the affected acres are publicly owned. About 422 acres of public land crossed by the project is on WDNR property and the remaining is on county land. Similar to the Central and East alternatives, most land potentially subject to new easements is timber production or open space land, including designated open space. Portions of the line built on an existing easement would cause a **low-to-moderate** impact on landowners. The remaining portions that would require new right-of-way and easements restricting use would cause **high** impact on landowners.

5.2.7.2 Land Use

The Crossover Alternative would use about 571 acres of existing right-of-way for about 33 miles (see Table 5-3; the 571 acres is the total of the acreages in the “Existing Right-of-Way” columns for each land use type for the Crossover Alternative). In addition, about 772 acres of new right-of-way would be needed for this alternative (see Table 5-2). Most new right-of-way (627 acres) would be on timber production lands (see Table 5-2). An additional 286 acres outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way. The remaining land is a mixture of urban/suburban, rural, and agricultural land.

Urban/Suburban

Urban/suburban lands are about 1 percent of the area affected by the Crossover Alternative. Most of the urban/suburban land is residential and or developed with industrial uses areas near Lexington, Camas, and Washougal.

Almost 3 acres of new right-of-way would be needed, and about 20 acres of existing BPA vacant right-of-way would be affected by the new line. An additional 2 acres of urban/suburban land outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way.

Impacts on urban/suburban land uses and limitations on development in areas of new and existing right-of-way would be similar to the West Alternative (see West Alternative, Urban/Suburban).

Rural

Rural lands are about 7 percent of the land crossed by the Crossover Alternative; most is low-density rural residential or undeveloped.

About 3 acres of rural land would be cleared for new right-of-way. About 59 acres of existing right-of-way would be cleared as needed, and would remain rural in character after project construction. About 10 acres outside the 150-foot right-of-way for the new line would be affected by new and improved access roads and by tower removal, or construction on adjacent BPA right-of-way.

Impacts on rural uses and limitations on development in areas of new and existing right-of-way would be similar to the West Alternative (see West Alternative, Rural).

Timber Production

Timber production lands are about 48 percent of the Crossover Alternative; most is owned by large landowners such as Weyerhaeuser, Longview Timber, and WDNR.

About 627 acres of timber production land would be cleared for new right-of-way. Existing right-of-way does not cross timber production land. About 160 acres outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way.

Impacts on timber production and limitations on future timber harvest in those areas and on adjacent properties would be similar to the Central Alternative (see Central Alternative, Timber Production).

Agriculture

Agricultural lands are about 3 percent of the land crossed by the Crossover Alternative.

New right-of-way required for the Crossover Alternative would affect about 3 acres of agricultural land. About 39 acres of existing right-of-way would be affected. About 9 acres of agricultural land outside the 150-foot right-of-way for the new line would be affected by new and improved access roads, and by tower removal or construction on adjacent BPA right-of-way.

Impacts on agriculture, and limitations on development and to access would be similar to the Central Alternative (see Central Alternative, Agriculture).

The Crossover Alternative crosses both prime farmland and farmland of statewide importance. Towers and new and improved access roads would cover about 26 acres of prime farmland and 142 acres of farmland of statewide importance, totaling about 21.2 percent of the area within the Crossover Alternative with these state designations. However, only about 5 acres of the 168 acres are currently designated as agriculture, so the Crossover Alternative would only remove about 1 percent of agricultural lands designated as prime farmland and farmland of statewide importance.

Open Space

Open space lands are about 43 percent of the land crossed by the Crossover Alternative. Open space along the Crossover Alternative includes non-production forested areas (non-production and likely some production by small landowners) and non-forested land. Open space also includes some designated recreation areas such as the Yacolt Burn State Forest (see Chapter 6**, Recreation**).

About 136 acres of open space land would be crossed by new right-of-way. About 453 acres of existing right-of-way in open spaced lands would be cleared as needed. About 105 acres outside the new 150-foot right-of-way would be affected by new and improved access roads, and by tower removal or construction on adjacent, existing BPA right-of-way.

Impacts to open space lands would be similar to those discussed in the Central Alternative (see Central Alternative, Open Space).

5.2.7.3 Crossover Option 1

Crossover Option 1 would remove a portion of the alternative crossing north–south through rural residential areas north of Camas between NE Zeek Road and SE 23rd Street, and replace it with a route running west along an existing right-of-way until about NE 232nd Avenue, then southeast through open fields and more rural residential areas. The option would increase private land needed for right-of-way and access road easements by about 60 acres (see Table 5-2). There would be no change in public land required.

Crossover Option 1 would affect about an acre more of urban/suburban land, 55 more acres of agricultural land, and about 46 more acres of open space land near the Little Washougal River and north of Lacamas Lake. This option would not change the amount of timber production land cleared, and would reduce the amount of rural land crossed by about almost 4 acres (see Table 5-3). The option would increase the area of prime farmland and farmland of statewide importance in agricultural use needed by about 10 acres.

Impact levels to land ownership and land use would be the same as the Crossover Alternative.

5.2.7.4 Crossover Option 2

Crossover Option 2 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land. The option would increase private land required for right-of-way and easements by about 42 acres (see Table 5-2).

Crossover Option 2 would add about 4 acres of timber production land and 76 acres of open space land to the area crossed, most near the Baxter Road substation site. There would be no change to the amount of urban/suburban or agricultural land crossed, but there would be a 18-acre increase in the amount of rural land crossed (see Table 5-3). The option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the Crossover Alternative.

5.2.7.5 Crossover Option 3

Crossover Option 3 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land and require some additional new right-of-way. The option would increase private land needed for new right-of-way and easements by about 85 acres (see Table 5-2).

Crossover Option 3 would add about 22 acres of timber production land and 56 acres of open space land to the area crossed, most near the Baxter Road substation site. There would be no change in the amount of urban/suburban or agricultural land crossed, and there would be a little over 15-acre increase of rural land crossed (see Table 5-3). The option would not change the area of prime farmland and farmland of statewide importance in agricultural use needed for the project.

Impact levels to land ownership and land use would be the same as the Crossover Alternative.

5.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional land use mitigation measures have been identified to further reduce or eliminate adverse land use impacts by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction, unless otherwise noted.

- Build new permanent access roads along the edges of clearings, pastures or small farms to minimize disturbance.
- Closely coordinate with and notify landowners or land managers regarding work scheduling and associated impacts.
- Where cattle, horses, and other livestock are present, ensure gates and fences remain closed during construction and maintenance activities.
- Consider special agreements with rural landowners to allow growing ornamental and orchard trees or other crops that do not interfere with operation or maintenance of facilities on the right-of-way.
- Provide a schedule of construction activities to landowners that could be affected by clearing of and construction within the right-of-way.
- Work with private landowners and WDNR concerning a possible cooperative agreement to control unauthorized public access or use on private or public lands that could result from the project. The agreement could address various provisions related to unauthorized access, such as additional measures to be taken to discourage unauthorized use of right-of-way and access roads, periodic inspection for unauthorized access, and damages from unauthorized access.

5.2.9 Unavoidable Impacts

All existing land uses crossed by the new right-of-way that are inconsistent with right-of-way management and safety would be prohibited for the life of the project. All existing structures and activities currently located, or occurring, in the existing right-of-way to be used by the project that are not consistent with right-of-way management and safety would be removed or prohibited without compensation to the user.

New access roads would create a new land use that may be consistent with or similar to existing uses in urban and commercial areas, but may be inconsistent with residential or rural land uses, especially during construction. New or improved access roads could continue, increase, or create new opportunities for unauthorized access to, or use of, public or private land.

Operational maintenance and inspection activities would occur once or twice per year.

5.2.10 No Action Alternative

Under the No Action Alternative, the project would not be constructed and there would be **no** impact on land use. Similar land use activities would continue to occur in the project area including existing roads, substations and transmission lines and maintenance activities on those facilities. All other existing land uses would also continue to occur such as timber harvest, agriculture, recreation, and urban and rural development.

Chapter 6 Recreation

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

This chapter describes existing recreation resources in the project area, and how the project alternatives could affect these resources. Related information can be found in Chapter 5, Land and Chapter 7, Visual Resources. Economic values of recreation in the project area are discussed in Chapter 11, Socioeconomics.

6.1 Affected Environment

Recreation resources are found in both urban and rural portions of the project area within Cowlitz and Clark counties, Washington, and Multnomah County, Oregon. These resources include urban parks and greenways, developed facilities in rural areas such as campgrounds or trailheads, and undeveloped rural areas. Recreational activities within the three counties include boating, fishing, hunting, target practice, camping, hiking, swimming, picnicking, sports games, wildlife watching, ATV use, sightseeing, horseback riding, and mountain biking. These activities occur in dedicated areas such as parks and other developed recreation facilities, on motorized and non-motorized trails, and in dispersed areas such as open space (see Maps 6-1A through 6-1E).

Although these maps show recreation resources throughout the project area, for this analysis, a study area for recreation resources was identified to include a 2000-foot—wide corridor along the entire route of each action alternative, 1,000 feet on either side of the transmission line centerline. This study area includes all project facilities.

In the western and southern portions of the study area, recreation resources are closely spaced, urban, and generally more fragmented. In the eastern portion, recreation resources tend to be larger, more contiguous, and more rural. There are many recreation resources scattered throughout Cowlitz, Clark, and Multnomah counties outside of the study area (see Maps 6-1A through 6-1E).

Recreation resources within the study area are owned by public and private entities within Cowlitz, Clark, and Multnomah counties, and the cities of Castle Rock, Vancouver, Camas, Washougal, Fairview, and Troutdale. These resources are managed under the following plans:

- Cowlitz County Comprehensive Park Plan Update (Cowlitz County 2010b)
- Cowlitz Regional Trails Plan (Cowlitz-Wahkiakum Council of Governments (CWCOG) 2006)
- Vancouver-Clark Comprehensive Parks, Recreation and Open Space Plan (Vancouver-Clark Parks and Recreation Department 2007)
- Final Recreation Resource Management Plan, Lewis River Hydroelectric Projects Federal Energy Regulatory Commission (FERC) Project Nos. 935, 2071 and 2111 (EDAW, Inc. and PacifiCorp 2008)
- Western Yacolt Burn Forest Recreation Plan (WDNR 2010a)
- City of Troutdale, Parks Master Plan (City of Troutdale 2006)

- City of Camas; Park, Recreation and Open Space Comprehensive Plan (City of Camas 2007)
- City of Fairview Comprehensive Plan (City of Fairview 2004)
- City of Castle Rock and Castle Rock School District Park and Recreation Plan (CWCOG 2011a)
- Washington State Scenic and Recreational Highways Strategic Plan (Washington Department of Revenue 2010d)
- Portland-Vancouver Bi-State Trails System Plan (Intertwine Alliance 2010)
- Columbia River Gorge National Scenic Area Management Plan (Columbia River Gorge Scenic Area Management Plan 2007)

The remainder of this section describes existing recreation resources in the study area by general recreational category (see Table 6-1).

6.1.1 Parks and Recreation Facilities

Public recreation facilities in the study area are managed by public and private entities including Vancouver-Clark Parks, Cowlitz County, Washington State Department of Transportation (WSDOT), Washington State Department of Natural Resources (WDNR), and PacifiCorp.

Cowlitz County manages developed parks at 14 sites (**mini parks**, **neighborhood parks**, and **community parks**) in the rural areas of the county (Cowlitz County 2010a). Recreation areas within the southern part of the county are in developed areas (Castle Rock, Longview, Kelso, and the I-5 transportation corridor) and around lakes and rivers (Merwin, Yale, and Swift reservoirs; Cowlitz, Coweeman, Kalama, and Lewis rivers) (Cowlitz County 2010a). Riverside Park is along the Cowlitz River (see Table 6-1, Map 6-1A).

PacifiCorp provides public recreational opportunities along the Lewis River, below Merwin Dam and along the shores of Yale, Merwin, and Swift reservoirs. Recreation facilities begin at Island Access, about 2 miles east of Woodland, Washington on SR 503, and continue 45 miles upstream to Eagle Cliff Park at the east end of Swift Reservoir (PacifiCorp 2011). Parks and recreation facilities within the study area include Merwin Park (see Table 6-1, Map 6-1C).

The Vancouver-Clark Parks and Recreation Department (VCPRD) manages developed parks at 239 sites in Clark County and Vancouver (VCPRD 2007). The VCPRD also owns and manages a variety of recreation facilities, including sports fields, pools, gyms, community centers, a tennis center, skate parks, and off-leash dog park areas. Parks and recreation facilities in the study area include Pleasant Valley, Hazel Dell, East Minnehaha, Covington, Sifton, Goot, Walnut Grove, Green Mountain, Moulton Falls, Tenny Creek, and Oak parks; Sherwood Ridge and Sherwood Meadows open space/natural areas; Heritage Trail; and Washougal River Greenway (see Table 6-1; Maps 6-1D, 6-1E). Also in Clark County, the western portion of the Yacolt Burn State Forest (managed by WDNR and referred to in this chapter as the Western Yacolt Burn State Forest) provides opportunities for camping, hiking, hunting, fishing, horseback riding, off-road vehicle use, and mountain biking.

In Multnomah County, the 40-Mile Loop Land Trust manages the 40-Mile Loop Trail with the cities of Troutdale and Fairview, Multnomah County, and other local jurisdictions. In the study area, the 40-Mile Loop Trail includes planned trail segments in Troutdale and Fairview. In Fairview, the Metropolitan Service District (Metro), a regional government for the Portland metropolitan area, manages the Chinook Landing Marine Park, a public boating facility where Fairview plans to have a marine museum housed in the retired USS Ranger (see Table 6-2 for recreation areas planned or scheduled for improvements near the project).

Other facilities within the study area include public and private golf courses. Golf course facilities generally include amenities such as restaurants used to host events.

6.1.2 Sightseeing

Cowlitz and Clark counties have many natural environmental features that provide destinations for recreational activities. In the study area, these include views from the tops of mountains (e.g., Larch Mountain), views from lakes (e.g., Merwin and Yale), rivers (e.g., Lewis and Columbia), and waterfalls (Lucia and Moulton). Scenic drives include the Spirit Lake Memorial Highway, Northern Clark County Scenic Drive, Lewis and Clark Trail Scenic Byway, and Columbia River Gorge Scenic Byway (see Table 6-1). Spirit Lake Memorial Highway is a National Scenic Byway along SR 504 crossed by the Central and East alternatives. The Northern Clark County Scenic Drive, a 70-mile drive created by the Board of Clark County Commissioners, follows multiple roads through the county and is crossed by the West Alternative and Central Option 3. The Lewis and Clark Trail Scenic Byway and Columbia River Gorge Scenic Byway are Washington State Scenic Byways that follow SR 14 along the Columbia River and are crossed by all action alternatives.

6.1.3 Non-Motorized Trails

Non-motorized trails are used for walking, hiking, mountain biking, and horseback riding. Non-motorized trails within urban areas of Cowlitz, Clark, and Multnomah counties provide an on- and off-street network of recreation, transportation, and wildlife habitat viewing corridors. In the study area, non-motorized trails include Riverfront (East), Hazel Dell Park, Washington State University Vancouver Campus, Ellen Davis, Lacamas Heritage, Bells Mountain, and Lucia Falls/Moulton Falls trails, and trails within Riverside Park, East Fork Lewis River Greenway, and the Washougal River Greenway Park. Non-motorized trails also include a planned segment of the 40-Mile Loop Trail (see Tables 6-1, 6-2; Maps 6-1A, 6-1C, 6-1D, 6-1E). WDNR manages 35 miles of non-motorized trails within the Western Yacolt Burn State Forest including the Tarbell Trail (also known as Larch Mountain Trail), Jones Creek Trail, and Jones Creek Trail Connector A. The Silver Star Trail, within the Silver Star Scenic Area of the Gifford Pinchot National Forest, is outside of the study area and is not crossed by the action alternatives.

Table 6-1 Current Recreation Resources and Activities[1]

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Parks and Recreation Facilities					
Sherwood Ridge and Sherwood Meadows	Open space/natural areas managed for their natural value and low-impact recreational use.	Park/Recreation Facility	Vancouver-Clark Parks	Clark County, WA	West Alternative
Tenny Creek Park	An 8.25-acre park with playground areas, a 0.5-mile walking trail, a small skateboarding spot, benches, and picnic tables.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Pleasant Valley Park	A 40-acre community park next to Pleasant Valley Elementary and Middle Schools (14320 NE 50th Avenue). The park is partially developed and has asphalt and crushed rock trails, non-irrigated open grass areas, a gazebo, and access to Salmon Creek. Glenwood Little League and Prairie Soccer use the adjacent school site for league practices and games (VCPRD 2010).	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Hazel Dell Park and Hazel Dell Park Trail	A 20-acre neighborhood park, one of the first built in Clark County. This park includes play equipment, picnic shelters, an open lawn area, and trails within the park.	Park/Recreation Facility; Non-Motorized Trail	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Covington Park	A 4.2-acre park on the east side of I-205 in the Maple Tree/Five Corners area. The park contains a walking/biking trail, a playground, a multi-use sports court, and picnic tables and benches.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Walnut Grove Park	A 3.7-acre park with a playground, basketball half court, 0.3-mile trail, picnic tables, and benches.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Sifton Park	A 5-acre park with a playground, 0.5-mile walking trail, basketball half court, picnic tables, and benches.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Green Mountain Park	A 460-acre undeveloped, regional park (VCPRD 2007).	Park/Recreation Facility	Vancouver-Clark Parks	Clark County, WA	West Options 2 and 3

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Green Meadows Golf Course	A private recreation facility that features golf, tennis, athletic, and social amenities. The golf course has programs and activities, and dining and entertainment areas.	Park/Recreation Facility	Private	Vancouver, WA	West Alternative
Camas Meadows Golf Club	A public recreation facility that includes an 18-hole golf course, driving range, and restaurant.	Park/Recreation Facility	Private	Camas, WA	West Options 1 and 3
Goot Park	A park with an adult softball field, half basketball court, playground equipment, picnic areas, and restrooms.	Park/Recreation Facility	City of Camas	Camas, WA	West, Central, East, Crossover Alternatives
Oak Park	A 1.8-acre community park with a half basketball court, playground equipment, picnic tables, and a barbecue area.	Park/Recreation Facility	City of Camas	Camas, WA	West, Central, East, Crossover Alternatives
Washougal River Greenway and Trail	The 86.7-acre greenway along the lower Washougal River provides shoreline access, picnic areas, fishing, and trails.	Park/Recreation Facility; Non-Motorized Trails	City of Camas	Clark County, WA	West, Central, East, Crossover Alternatives
Moulton Falls Park	A 387-acre regional park at the confluence of the East Fork Lewis River and Big Tree Creek with two waterfalls and an arch bridge more than 30 feet high. The Chelatchie Prairie Railroad excursion train also passes through the park. Areas of interest include volcanic rock formations from early lava flows, historic Indian meeting grounds, the Murphy Grade, a swing bridge on Big Tree Creek, and access to the Bells Mountain Trail.	Park/Recreation Facility	Vancouver-Clark Parks	Yacolt, WA	Central Option 3
Riverside Park	A 58-acre community park along the Cowlitz River. The park has baseball and soccer fields, trails and walking pathways, playground equipment, picnic areas, basketball courts, and tennis courts. The park is used for picnicking, recreational activities for children from the Lexington area, and for fitness walking. It does not have access for fishing or launching boats.	Park/Recreation Facility; Non-Motorized Trails	Cowlitz County	Cowlitz County, WA	East Option 1

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Castle Rock High School	A 107-acre school park that includes the North County Recreation Sports Complex. The park has sports fields and facilities for school-related recreational activities.	Park/Recreation Facility	City of Castle Rock	Castle Rock, WA	Central, East Alternatives
Sightseeing					
Spirit Lake Memorial Highway	A 54-mile National Scenic Byway along SR 504. The highway begins in Castle Rock at Mt. St. Helens Way and ends on Johnston Ridge, with a view of the Mt. St. Helens crater.	Sightseeing	WSDOT	Cowlitz County, WA	Central, East Alternatives
Northern Clark County Scenic Drive	A 70-mile drive created by the Board of Clark County Commissioners. The drive goes through Battle Ground, Yacolt, La Center, and Ridgefield. Several parks are along the route, including Lucia Falls, Moulton Falls, Whipple Creek and Daybreak parks. Historic sites include the Henry Heisson House, the Cedar Creek Grist Mill, Allen House, and the Cathlapotle Plankhouse.	Sightseeing	Clark County	Clark County, WA	West Alternative, Central Option 3
Lewis and Clark Trail Scenic Byway	The Lewis and Clark Trail Scenic Byway is 572 miles long in Washington and extends from Clarkston on the Idaho border to Cape Disappointment on the Pacific Coast. It is designated as a Washington State Scenic Byway. Washington SR 14, which would be crossed by the project, is part of this byway.	Sightseeing	WSDOT	Cowlitz and Clark counties, WA	West, Central, East, Crossover Alternatives
Columbia River Gorge Scenic Byway	The Columbia River Gorge Scenic Byway follows SR 14 for about 100 miles between Maryhill and Vancouver, Washington along the Columbia River. The scenic byway is designated as a Washington State Scenic Byway. All action alternatives cross SR 14. Scenic attractions near the project include Captain William Clark Park in Washougal, Washington. Lewis and Clark camped here for 6 days during their 1806 expedition.	Sightseeing	WSDOT	Clark County, WA	West, Central, East, Crossover Alternatives

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Non-Motorized Trails					
East Fork Lewis River Greenway	The greenway includes more than 1,000 acres of waterfront property along both banks of the East Fork Lewis River between Paradise Point State Park north of La Center and Daybreak Park north of Battle Ground. It is part of an interconnected, 10-mile greenway system. Most of the undeveloped greenway is open to non-motorized use.	Non-Motorized Trail	Vancouver-Clark Parks	Clark County, WA	West Alternative
Castle Rock Riverfront Trail (East)	The trail is a 1.5-mile lighted, paved multi-use trail extending from Lion's Pride Park north to just past the PH10 (A Street) bridge. Trail amenities include viewing areas, benches, and picnic tables.	Non-Motorized Trail	City of Castle Rock	Castle Rock, WA	Central, East Alternatives
Ellen Davis Trail	A 2.5-mile crushed rock trail that connects Discovery Loop Trail at Leverich Park with St. James Road. The trailhead is at Leverich Park. The trail follows Burnt Bridge Creek through the BPA Ross Complex and the Minnehaha Neighborhood. It is a multi-use trail open to hikers and cyclists.	Non-Motorized Trail	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Washington State University Vancouver Campus Trail	Walking paths, jogging paths, and interpretive trails surrounding Washington State University's Vancouver Campus.	Non-Motorized Trail	Washington State University	Vancouver, WA	West Alternative
Lacamas Heritage Trail	Lacamas Heritage Trail is a shared-use trail in East Clark County on the west side of Lacamas Lake and Lacamas Creek. It provides opportunities to view birds, rock formations, and waterfalls, and offers picnicking areas, extensive waterfront access, and a children's play center. Clark County and the City of Camas own interconnected trail sections.	Non-Motorized Trail	Vancouver-Clark Parks	Camas, WA	West Option 1

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Bells Mountain Trail	A primitive, 4-foot-wide shared-use trail serves hikers, mountain bikers, and equestrians. The trail can be accessed from Moulton Falls Park at the Hantwick Road Trailhead. The trail can also be accessed from the Cold Creek Day Use Area, which is operated by WDNR. Its highest point near the north end is about 1,500 feet. The trail passes through fir and alder forests with glimpses of Mt. St. Helens and Mt. Adams.	Non-Motorized Trail	Vancouver-Clark Parks	Clark County, WA	Central Alternative, East Option 2
Tarbell Trail (Larch Mountain Trail)	A 35-mile non-motorized loop trail system open to the public year-round. Parts of the trail have existed for more than 100 years and continue to be a popular destination trail system for non-motorized trail riders. Originally, the Tarbell trailhead, north of the forest, was used exclusively by equestrians and hikers; mountain bikers and other non-motorized recreationists also frequent the trailhead. The trail provides access to Larch Mountain and Cold Creek.	Non-Motorized Trail	WDNR	Washougal WA	East, Crossover Alternatives
Lucia Falls/ Moulton Falls Trail	A primitive, shared-use trail that connects Moulton Falls and Lucia Falls parks. Points of interest include three waterfalls, volcanic rock formations from early lava flows, and an arch bridge over 30 feet high.	Non-Motorized Trail	Vancouver-Clark Parks	Yacolt, WA	Central Option 3
40-Mile Loop Trail: Reynolds Trail	A 1.8-mile, paved non-motorized trail section on top of the levee in the Troutdale Reynolds Industrial Park. This trail is part of the 40-Mile Loop Trail system.	Non-Motorized Trail	40-Mile Loop Land Trust	Troutdale, OR	West, Central, East, Crossover Alternatives
40-Mile Loop Trail: Columbia River Trail Extension	A paved, non-motorized trail section connecting the Marine Drive portion of the 40-Mile Loop Trail and the Reynolds Trail. This section of the 40-Mile Loop Trail system is currently under construction.	Non-Motorized Trail	40-Mile Loop Land Trust	Troutdale, OR	West, Central, East, Crossover Alternatives

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Motorized Trails/Hunting					
Western Yacolt Burn State Forest	State forest area open to both motorized and non-motorized trail use, and hunting and fishing. Trails open to motorized use include the Jones Creek Trail and Jones Creek Trail Connector A. WDFW regulates hunting within this recreation area.	Motorized Trails/ Hunting	WDNR	Washougal, WA	Central, East, Crossover Alternatives; East Options 2 and 3
Jones Creek Trail/Jones Creek Trail Connector A	Fourteen miles of double-track motorcycle and all-terrain vehicle motorized trail open seasonally from May 1 to November 30. The trailhead is in the southern portion of the forest, linking to the designated motorized trail system.	Non-Motorized Trails	WDNR	Washougal, WA	East, Crossover Alternatives
Campgrounds/Water-Based Recreation					
Camp Currie	A camping resource for organized youth groups with a rustic lodge, covered outdoor mess hall, three Adirondack camp cabins, and multiple tent camp sites, 3 miles northwest of Camas.	Camping	Private	Camas, WA	West Alternative, West Option 1, Crossover Option 1
Merwin Park: Merwin Ramp, Speelyai Bay Park, and Cresap Bay boat launch	The largest recreation area on the Lewis River. The park is open year round and can accommodate up to 1,500 people. Recreational opportunities at the park include picnic areas, outdoor games, swimming, camping, and bank fishing.	Park/Recreation Facility; Water-Based Recreation	PacifiCorp	Ariel, WA	Central, Crossover Alternatives
Haapa Boat Launch	Boat launch that provides fishing and water access to the North Fork Lewis River about 5 miles east of Woodland. There are picnic areas, parking and restrooms in the vicinity.	Water-Based Recreation	Vancouver-Clark Parks	Woodland, WA	West Alternative
Marina Park	The marina provides moorage slips and docks, and picnic areas, restrooms, a walking path, and events such as concerts and fishing tournaments.	Park/Recreation Facility; Water-Based Recreation	Port of Camas-Washougal	Washougal, WA	West, Central, East, Crossover Alternatives

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Lower Columbia River Water Trail	A 146-mile water trail that provides paddling opportunities, including launching and landing sites, and information about paddling stewardship and safety.	Water-Based Recreation	Lower Columbia River Estuary Partnership	Bonneville Dam to the Pacific Ocean	West, Central, East, Crossover Alternatives
Al Helenburg Memorial Boat Launch	Boat launch that provides fishing and water access to the Cowlitz River just south of Castle Rock High School. There are picnic areas, parking, and restrooms in the vicinity.	Water-Based Recreation	City of Castle Rock	Castle Rock, WA	Central, East Alternatives

Notes:

1. Recreation resources and activities were identified with a "study area"; an area within approximately 1,000 feet of the project that includes the transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way.

Sources: City of Camas 2007, City of Fairview 2004, City of Troutdale 2006, Clark County 2011d, Cowlitz County 2010a, Cowlitz Wahkiakum Council of Governments 2006, EDAW Inc. and PacifiCorp 2008, Metro 2011, USGS 2009, VCPRD 2007, Washington State Tourism 2011, WDNR 2010a

Table 6-2 Planned Recreation Resources and Activities[1]

Location or Name	Description	Activity	Management	Location	Alternative and/or Option
Kelley Meadows Neighborhood Park (formerly East Minnehaha Park)	A 7.5-acre park that features trees, a wetland, and open lawns. Construction to further develop the park area was to begin in 2012 but has been delayed until further funding can be obtained.	Park/Recreation Facility	Vancouver-Clark Parks	Vancouver, WA	West Alternative
Chelatchie Prairie Rail with Trail Project	A multi-use trail paralleling the 33-mile length of the county-owned Chelatchie Prairie Railroad	Non-Motorized Trail	Clark County	Burnt Bridge Creek Trail to Yale Bridge	West, Central, Crossover Alternatives; Central Option 3
40-Mile Loop: Reynolds Gap section	The Reynolds Gap is a planned segment of the 40-Mile Loop Trail in Troutdale, Oregon. The gap segment is about 6 miles long and would run through the Reynolds Industrial Park. The 40-Mile Loop Trail will ultimately connect to make an uninterrupted loop trail. The planned segment of the trail would be north of Sundial Substation.	Non-Motorized Trail	40-Mile Loop Land Trust	Troutdale, OR	West, Central, East, Crossover Alternatives
Canyon Creek Bridge	A 500-acre property at the intersection of Healy and Blevins roads. Development of a zip line tour facility with nine zip lines and three rope-bridge walkways is planned.	Recreation Facility	Private	Amboy, WA	East, Crossover Alternatives
USS Ranger, Chinook Landing Marine Park	A retired U.S. aircraft carrier proposed for development as an aircraft carrier museum, conference center, and event venue at the Chinook Landing Marine Park.	Marine Park/ Recreation Facility	Metro	Fairview, OR	West, Central, East, Crossover Alternatives

Notes:

1. Recreation resources and activities were identified with a "study area"; an area within approximately 1,000 feet of the project that includes the transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way.

Sources: 40-Mile Loop Land Trust 2011, Bungee Masters Inc. 2011, City of Fairview 2004, Vancouver-Clark Parks 2007

6.1.4 Motorized Trails

Motorized trails are trails open for use by four-wheel drive vehicles, ATVs, and motorcycles that can also be used for non-motorized recreation (WDNR 2010a). In the study area, the only trails formally open for motorized recreation are in the Western Yacolt Burn State Forest; these trails include the Jones Creek Trail and Jones Creek Trail Connector A (see Table 6-1; Maps 6-1D, 6-1E). Longview Timberlands LLC, Sierra Pacific Industries, and Weyerhaeuser Company do not allow motorized recreational activities on their lands (WDNR 2010a), although unauthorized motorized uses could occur. WDNR reports that a lack of nearby areas for motorized recreation has driven this use to the Western Yacolt Burn State Forest, which has seen an increase in undesignated (unauthorized) motorized trail use (WDNR 2010a).

6.1.5 Hunting

Washington Department of Fish and Wildlife (WDFW) regulates hunting and issues hunting permits, both on private lands and on lands managed by the WDNR. The following are current hunting seasons in the project area:

- Bear hunting from August to November
- Deer and elk hunting from September to December
- Elk hunting (rifle) season in the first half of November
- Turkey hunting from April to May, September to October, and November to December
- Pheasant hunting from September to October in Western Washington
- Rabbit hunting from September to March
- Grouse hunting from September to December (WDNR 2010a)

The Western Yacolt Burn State Forest is the largest WDNR-managed site in the study area open to hunting (see Table 6-1; Maps 6-1C, 6-1D, 6-1E). There are no other locations in Cowlitz or Clark counties where private landowners have entered into formal "Hunt by Written Permission" or "Feel Free to Hunt" agreements with WDFW to allow public access for hunting (WDFW 2009). Private landowners in the study area may have provided specific written permission to individual hunters, but none are registered with WDNR.

6.1.6 Campgrounds

Within the study area, opportunities for camping are limited. There is camping at Camp Currie (see Table 6-1; Maps 6-1D, 6-1E). Camping occurs in the Lewis River Recreation area (managed by PacifiCorp) at Cresap Bay Campground and in the Western Yacolt Burn Forest on WDNR land but these sites are outside the study area.

6.1.7 Water-Based Recreation

Water-based recreation in the study area includes fishing, boating, swimming, water skiing, jet skiing, kayaking, canoeing, parasailing, tubing, sailing, and rafting on lakes and rivers. There are more than 30 boat launch sites in southwest Washington for anglers, water skiers, jet skiers, and boaters. Public launches are available on the Cowlitz, Kalama, Lewis, and Columbia rivers, and at Yale and Swift reservoirs (Cowlitz County Tourism Bureau 2010). The Columbia, Cowlitz, Kalama, Toutle and Lewis rivers have runs of salmon and steelhead. Yale and Merwin lakes provide opportunities to fish for crappie, bluegill, trout, kokanee, tiger muskies, and bass (Cowlitz County Tourism Bureau 2010). These water resources also provide opportunities for kayaking, canoeing, and boating. Boats can be launched at the Haapa Boat Launch, Washougal River Greenway Park, Merwin Park, the Port of Camas-Washougal Marina and the Chinook Landing Marine Park in the City of Fairview in Oregon (see Table 6-1; Maps 6-1C, 6-1D, 6-1E).

6.1.8 Dispersed Recreation

Dispersed recreation takes place outside of developed recreation facilities, and may include fishing, target shooting, hiking, nature appreciation, and backpacking (WDNR 2010a). Opportunities for authorized dispersed recreational uses exist within the study area on WDNR lands, including the Western Yacolt Burn State Forest area. Unauthorized recreation activities can also occur in these areas. Unauthorized recreational uses known to occur include target shooting, which occurs near the Casey Road substation site, and off-highway vehicle use.

6.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

6.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Obstruct existing or planned dispersed recreational uses after project construction
- Alter or eliminate dedicated recreation opportunities after project construction

Impacts would be **moderate** where project activities would cause the following:

- Temporarily preclude or limit dispersed and dedicated recreational opportunities during peak use periods during project construction
- Permanently impact user experience of a recreation resource
- Create or encourage new unauthorized land uses along the right-of-way for recreational purposes, such as ATV use in unauthorized areas

Impacts would be **low** where project activities would cause the following:

- Temporarily preclude or limit dispersed and dedicated recreational opportunities during off-peak use periods during project construction
- Require relocation of dispersed recreational activities to an equal or better location after project construction
- Temporarily impact user experience of a recreation resource

No impact would occur to recreation areas or activities if there would not be any effect on the location or quality of recreation facilities and uses during and after construction.

6.2.2 Impacts Common to Action Alternatives

6.2.2.1 Construction

Both the Lewis and Clark Trail Scenic Byway and Columbia River Gorge Scenic Byway would be crossed at the same location on SR 14 by the action alternatives. Traffic could be slowed for brief periods during blasting near SR 14 (to protect cars from flying debris), or while the conductor is being strung across SR 14 by helicopter (see Chapter 12, Transportation). Temporary construction activity would create noise and dust, would increase traffic, and could delay access to sites or negatively change user experience at recreation sites. These would be **low** impacts because access to these scenic byways could be delayed but would not be limited or precluded, and because other impacts would be temporary.

The action alternatives would cross Oak Park in Camas, Washington and the Washougal River Greenway east of Camas in Clark County. During construction, access to these resources could be delayed or limited. Goot Park is just east of Segment 52 (common to all action alternatives) in Camas, and visitor experience of Goot Park could be affected by noise, dust, or visual intrusions. These impacts would be **low** if construction occurred during off-peak use periods, and **moderate** if conducted during peak use periods because impacts would be temporary and access would be limited. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

The Columbia River transmission line crossing would include in-water construction activities (see Chapter 3, Project Components). Temporary construction activities would introduce noise, dust, and visual intrusions from helicopters and barges into the scenic character at this crossing location, and could impact motorists' experience along SR-14 scenic drives and the experience of fishermen or boaters along and on the river. Users most likely affected would be those seeking nature appreciation and wildlife viewing experiences; both could be negatively affected by construction noise and visual intrusions. However, impacts from construction would be **low** because construction would be temporary and would not restrict access to scenic drives or in-water areas.

Construction could also have a positive effect on the recreational experience of some users. Construction of a large project such as this one, which includes in-water construction and helicopters, could be a point of interest or even attract additional users to parks or other areas that provide views of construction activities.

6.2.2.2 Operation and Maintenance

The project would create impacts if tower, substation, or road placement changed a recreational function by limiting the use or removing facilities such as picnic areas, boat ramps, trails, or access areas. However, most impacts on recreation would be **experiential** in the form of intrusions to the aesthetic character of the area from helicopter inspections of the line that would occur twice each year. These intrusions would occur at specific recreation sites and at larger, informal recreational areas such as the Lewis and Clark Trail Scenic Byway, Columbia River Gorge Scenic Byway, and the Columbia River. The project would also be visible to users of distant recreation sites outside the study area.

The action alternatives would parallel existing transmission lines in some areas and would cross non-motorized trails a few times within the Washougal River Greenway (see Maps 6-1D and 6-1E). The right-of-way for all action alternatives would bisect one 16-acre parcel of this park that contains the trails. The right-of-way would also run along the western edge of a 3.5-acre parcel of the park, and an improved access road (running east/west near Tower 52/8) would bisect the eastern portion of the parcel. About 0.3 acre of the park would be changed to towers and improved access roads. This would be a **moderate** impact because the project would follow existing transmission lines in some areas, would span the trails within the Washougal River Greenway, and there would be no towers within the 16-acre parcel split by the action alternatives. However, the presence of additional towers and conversion of a small portion of the park to tower footprints could affect the experience of visitors.

The action alternatives would be about 450 feet northwest of the Port of Camas-Washougal Marina (see Maps 6-1D and 6-1E). A new access road, located on the northwest corner of the property, would affect less than 0.1 acre of the marina (see Tables 6-3, 6-4, 6-5, and 6-6). This would be a **low** impact because the project would only convert a small corner of marina property into access roads, which would not affect user experience, and the transmission line would not span the marina or convert any of the Marina property to right-of-way or towers.

The action alternatives would remove and replace the existing two 230-kV transmission lines that cross the southern part of Oak Park with a new double-circuit 230-kV line. The new 500-kV line would parallel the replaced double-circuit line on the vacated right-of-way. Less than 0.1 acre of the park would be converted to new access roads (see Tables 6-3, 6-4, 6-5, and 6-6; Maps 6-1D and 6-1E). This would be a **low** impact because transmission lines already cross the park and the new line would be built within existing right-of-way. The new access road would affect the edge of the park, and this change to the park likely would not affect user experience.

New and improved access roads to and on right-of-way can provide increased access to forested areas of nearby parks and trails along the action alternatives. This could increase access for unauthorized hunting and ATV use on otherwise inaccessible lands causing a **moderate** impact to recreation areas. Signs and fencing may limit some potential impact.

6.2.2.3 Sundial Substation

There are no existing recreation resources within the Sundial site (see Map 6-1D) and **no** impacts on recreation from construction of the substation would occur. Part of the 40-Mile Loop Trail, called the Reynolds Gap, is planned to be constructed north of the site on top of the levee with a full view of the industrial complex. There is no schedule at this time to begin construction. The substation, new roads, and transmission lines would not be out of context with the existing industrial nature of the area. In addition, project components would not interfere with the levee or the future trail.

6.2.3 Castle Rock Substation Sites

There are no existing recreation resources within the Casey Road, Baxter Road, or Monahan Creek sites, so there would be **no** impacts at these sites (see Map 6-1A). There is known unauthorized dispersed recreation in the area of the Casey Road substation site; however, because this use is unauthorized, any changes to the availability of this use from construction of the substation would be a **low** impact.

Impacts common to action alternatives are in Section 6.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

6.2.4 West Alternative

6.2.4.1 Construction

During construction, about 5 acres of recreation facilities and less than 0.1 mile of trails would be temporarily disturbed. The disturbed area would include less than 0.1 acre of the East Fork Lewis River Greenway, almost 2 acres of the Green Meadows Golf Course, almost 3 acres of Camp Currie, and less than 1 acre of the Washougal River Greenway (see Maps 6-1A, 6-1C, 6-1D). Temporarily disturbed trails would include about 50 feet of the Ellen Davis Trail and 200 feet of the Washington State University Vancouver Campus Trail (see Map 6-1D). Temporary disturbance could include noise, dust, restricted access, and visual disturbances.

Construction would occur throughout the year. Summer months are peak use time for general recreation; peak use times for hunting vary by type of hunting (see Section 6.1.5, Hunting). The winter months are non-peak use times for all recreational uses. During peak use times, the West Alternative's temporary impacts on recreation resources would be **moderate**. During non-peak times, temporary impacts on these recreation resources would be **low**. Any temporary impacts on user experience from construction would be **low**. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

The West Alternative route would be near the Haapa Boat Launch; Pleasant Valley, Covington, Sifton, Goot, Tenny Creek, and Walnut Grove parks; Hazel Dell Park and Hazel Dell Park Trail; and Sherwood Ridge and Sherwood Meadows (see Tables 6-1, 6-2; Maps 6-1C, 6-1D, 6-1E). Construction activities could occasionally and temporarily disturb the quiet and scenic landscape at these recreation resources, but these resources would still be accessible. Because no project components would be within these resources and construction activities would be temporary, there would be **no-to-low** impact on these resources.

6.2.4.2 Operation and Maintenance

Required project facilities for the West Alternative would permanently occupy about 8.9 acres of recreation land. Of this total, 0.9 acre would be affected by towers, about 5.5 acres would be affected by new access roads, and about 2.5 acres would be affected by access road improvements (see Table 6-3). In addition, less than 0.3 miles of trails would be permanently crossed by new or improved access roads (see Table 6-3).

The West Alternative would follow existing right-of-way along the eastern edge of the East Fork Lewis River Greenway (see Map 6-1C). New access roads would affect about 3 acres within the greenway (see Table 6-3). No towers or improved access roads would be within the greenway. The new access roads and the transmission line would add an industrial, human-made element to the greenway and would have experiential impacts on recreationists (see Chapter 7, Visual Resources). The new roads would affect areas within the park that are managed for protection and enhancement of the natural environment. This would cause a **high** impact because it would permanently alter a dedicated recreation resource.

Table 6-3 West Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
West Alternative	Parks (acres)	Camp Currie (0.6), Green Meadows Golf Course (0.2), Washougal River Greenway (0.1)	Camp Currie (1.2), East Fork Lewis River Greenway (3.1), Green Meadows Golf Course (0.8), Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Camp Currie (0.3), Green Meadows Golf Course (1.9), Washougal River Greenway (0.2)
	Trails (miles)	--	Ellen Davis Trail (<0.1), Washington State University Vancouver Campus Trail (<0.1)	Washington State University Vancouver Campus Trail (<0.1)
West Option 1	Parks (acres)	Camas Meadows Golf Club (+0.2), Camp Currie (-0.2), Green Meadows Golf Course (-0.2)	Camas Meadows Golf Club (+0.1), Camp Currie (+0.5), Green Meadows Golf Course (-0.8)	Camp Currie (-0.3), Green Meadows Golf Course (-1.9), Camas Meadows Golf Club (+0.2)
	Trails (miles)	Lacamas Heritage Trail (+0.1)	Lacamas Heritage Trail (+0.3)	Lacamas Heritage Trail (+<0.1)
West Option 2	Parks (acres)	Green Mountain (+0.5), Camp Currie (-0.6), Green Meadows Golf Course (-0.2)	Green Mountain (+2.3), Camp Currie (-1.2), Green Meadows Golf Course (-0.8)	Green Mountain (+2.4), Camp Currie (-0.3), Green Meadows Golf Course (-1.9)
	Trails (miles)	N/C	N/C	N/C
West Option 3	Parks (acres)	Green Mountain (+0.5), Camp Currie (-0.6), Green Meadows Golf Course (-0.2)	Green Mountain (+0.9), Camp Currie (-1.2), Green Meadows Golf Course (-0.8)	Green Mountain (+2.4), Camp Currie (-0.3), Green Meadows Golf Course (-1.9)
	Trails (miles)	N/C	N/C	N/C

Notes:
N/C – No net change from the action alternative.
1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.
Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS, 2009

The West Alternative would cross the Northern Clark County Scenic Drive at Northeast Cedar Creek Road and at Northeast 259th Street (see Map 6-1C). The transmission route would be on existing right-of-way and parallel an existing line that already crosses the scenic drive. The additional visual intrusion from the new line would be minor and a motorists view of the crossing would be temporary, a **low** impact.

The existing right-of-way is on the eastern side of the Washington State University Vancouver Campus and crosses the Campus Trail multiple times (see Maps 6-1D and 6-1E). An improved access road would also follow part of the trail for over 300 feet. Less than 0.1 mile of the trail would be changed to new and improved access roads (see Table 6-3). Though the West Alternative would follow existing right-of-way and no towers would be in the trail, this would be a **high** impact because a small area (less than 0.1 mile) of the trail would be changed to new access roads. This would permanently alter this dedicated recreation resource.

A small area of the Ellen Davis Trail would also be affected. The West Alternative would pass near this trail along the trail's north side. Less than 0.1 mile of the trail would be permanently changed to new access road where it would cross the trail near its eastern end. Although this is a small portion of the Ellen Davis Trail, the impact to this area would be **high** because it would permanently alter the recreation resource.

The West Alternative would cross the northern part of Kelley Meadows Neighborhood Park (formerly East Minnehaha Park) (see Maps 6-1D and 6-1E). No new towers, new access roads, or improved access roads would be within the park area. This 7.5-acre park is currently undeveloped and primarily consists of open lawn areas. Construction to develop the park area was scheduled to begin in 2012 but do to the continuing depressed economy construction has been delayed until further funds can be obtained (see Table 6-2). The final layout of the park is being developed, and this project could influence the final park design to avoid placing developed areas of the park within the right-of-way. This would be a **no-to-low** impact because there would be no towers or roads placed in the park area, the park does not currently contain large numbers of trees that would be removed, and the park layout is still being developed and could be coordinated with BPA.

The West Alternative would diagonally bisect the Green Meadows Golf Course, paralleling an existing transmission line through the golf course (see Maps 6-1D and 6-1E). Almost 3 acres of the golf course would be changed to towers, new access roads, and improved access roads (see Table 6-3). This would be a **moderate** impact because an existing transmission line bisects the golf course, and already affects the recreational experience of golfers. The West Alternative would follow the northeast boundary of Camp Currie (a portion of which is in existing right-of-way) (see Maps 6-1D and 6-1E). About 2 acres of the camp would be changed to towers, new access roads, and improved access roads (see Table 6-3). This would cause a **moderate** impact because the existing right-of-way is near the edge of the camp property and only separates about 5 acres of the northeast corner of the property from the rest of the camp.

The West Alternative route would be near the Haapa Boat Launch; Pleasant Valley, Covington, Sifton, Goot, Tenny Creek, and Walnut Grove parks; Hazel Dell Park and Hazel Dell Park Trail; and Sherwood Ridge and Sherwood Meadows (see Tables 6-1, 6-2; Maps 6-1C, 6-1D, 6-1E). The transmission line could visually intrude on the recreational experience of the park and trail users, but there are existing transmission lines that presently pass by these recreation areas and a new line would not be inconsistent with existing views. No towers or right-of-way would be within the parks, so there would be **no-to-low** impact on these resources.

6.2.4.3 West Option 1

West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. Tower construction would temporarily disturb an additional 0.5 acre of parks, about 1.7 acres of the Camas Meadows Golf Club, and 0.8 acre of the Lacamas Heritage Trail. About 0.2 acre of Camp Currie and 1.7 acres of Green Meadows Golf Course would be unaffected (see Table 6-3 and Maps 6-1D and 6-1E). Temporary disturbance could include dust and noise, limited access, visual disturbance, or impacts on user experience. During peak use times (summer months and hunting season), construction of West Option 1 would cause temporary **moderate** impacts on the golf club, Camp Currie, and the Lacamas Heritage Trail, and **low** impacts during non-peak times. Any temporary impacts on user experience at these locations would be **low**.

West Option 1 would reduce the area permanently affected by towers by about 0.2 acre, and reduce the additional area of parks that would be affected by new and improved access roads by almost 2 acres (see Table 6-3). West Option 1's right-of-way would cross the northern part of Camas Meadows Golf Club instead of the Green Meadows Golf Course and follow the existing right-of-way east-west through Camp Currie instead of the eastern border of the camp (see Map 6-1D). West Option 1 would also add the Lacamas Heritage Trail to those crossed by improved access roads (see Table 6-3). No towers would be constructed within the trail, and the portion of the line crossing the trail would follow existing right-of-way. West Option 1 would reduce the total area of parks and increase the amount of trails that would be changed to towers and access roads. This option could create **moderate** permanent impacts on user experiences at the golf club, and Camp Currie.

6.2.4.4 West Option 2

West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. West Option 2 would reduce the temporary disturbance from tower construction by almost 2 acres. West Option 2 would increase the amount of land permanently converted to towers and access roads by about 5 acres within Green Mountain Park, but would eliminate permanent impacts within Camp Currie and Green Meadows Golf Course (see Table 6-3 and Map 6-1D). Impacts on Green Mountain Park would be **low** because the park is not heavily used and the option would follow existing right-of-way for most of its length.

6.2.4.5 West Option 3

West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing rural residential and rural areas farther east. West Option 3 would reduce the temporary disturbance to parks from tower construction by almost 2 acres. This option would permanently impact about 4 acres of land within Green Mountain Park, but would not impact Camp Currie or

Green Meadows Golf Course. Impacts on Green Mountain Park would remain **low** because the park is not heavily used and the option would follow existing right-of-way for most of its length.

6.2.5 Central Alternative

6.2.5.1 Construction

During construction, temporary impacts to recreation would occur on about 1 acre of the Washougal River Greenway; no temporary impacts would occur on the trails. Temporary disturbance could include noise, dust, restricted access, and visual disturbances.

Proposed new right-of-way would be near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), Goot Park, and the Western Yacolt Burn Forest (see Table 6-1; Maps 6-1C, 6-1D, 6-1E). Construction activities could disturb the quiet and scenic landscape of the recreation areas, but the facilities would still be accessible, and no towers or right-of-way would be within the park. There would be **no-to-low** impact on these resources.

Construction would occur throughout the year. During peak use times (such as summer for general recreation, and hunting season for hunting uses), temporary impacts on recreation resources from construction of the Central Alternative would be **moderate**. During non-peak times (winter), temporary impacts on these recreation resources would be **low**. Any temporary impacts on user experience from construction would be **low**. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

6.2.5.2 Operation and Maintenance

Required project facilities for the Central Alternative would permanently occupy about 0.5 acre of recreation land. Of this total, 0.1 acre would be affected by towers, about 0.2 acre would be affected by new access roads, and about 0.2 acre would be affected by existing access road improvement (see Table 6-4; impacts to the Washougal River Greenway, Port of Camas-Washougal Marina and Oak Park are discussed under 6.2.2, Impacts Common to Action Alternatives).

In addition, less than 0.2 mile of trails would be permanently crossed by improved access road. These would be the Riverfront Trail (East) and Bells Mountain Trail (see Table 6-4 and Map 6-1A). The roads would have a **low** impact on these trails because maintenance activities are infrequent and the chance of maintenance activities occurring during trail use is likely low. Where new right-of-way would also cross Bells Mountain Trail, it would add an industrial, human-made element to the trail that could negatively affect the experience of recreationists. This impact on user experience would be **moderate**.

Proposed right-of-way would cross the Spirit Lake Memorial Highway (SR 504). The project would be a visual intrusion into this drive's scenic views. This would be a **low** impact because the crossing is less than a mile from the SR 504 interchange with I-5 and is in more developed areas of the scenic drive. The transmission line could also visually intrude on the recreation experience of park and trail users where it is visible from Merwin Park, Goot Park, and the Western Yacolt Burn Forest. However, no towers or right-of-way would be within these parks, so **no-to-low** impacts on these resources would occur.

6.2.5.3 Central Options 1 and 2

Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated forest production and open space land. Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. This option would add a new route running southeast from the Monahan Creek substation site through sparsely populated land, crossing the unincorporated community of West Side Highway next to SR 411, the Cowlitz River and I-5, and running through largely unpopulated land toward the east.

Central Options 1 and 2 would have no additional impacts since there are no parks or trails along these options. In addition, there would be **no** impact on the Riverfront Trail (East) from access road improvements under Central Option 2 because it would not cross the trail. There would be **no** impact on the Spirit Lake Memorial Highway at SR 504 from visual intrusions by either option (see Table 6-4 and Map 6-1A) because they do not cross the highway. Unauthorized target shooting at the Casey Road substation site is discussed in Section 6.2.3, Castle Rock Substation Sites.

6.2.5.4 Central Option 3

Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. Central Option 3 would have **no** impact on Bells Mountain Trail or the recreation resources within the Western Yacolt Burn Forest because this option does not cross these resources. This option does not directly cross the recreation resources near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), but construction activities could disturb the quiet and scenic landscape of the recreation area. Because facilities would still be accessible, and no towers or right-of-way would be within the park, there would be **no-to-low** impact on these resources.

Tower construction for Central Option 3 would temporarily disturb about 0.2 acre of Moulton Falls Park. Less than 0.1 acre of the park would be permanently changed by towers, and an additional 0.7 acre would be changed by new and improved access roads. Tower construction would temporarily disturb less than 0.1 mile of the Lucia Falls/Moulton Falls Trail (a wide paved trail); towers would permanently alter less than 0.1 mile of trail, and less than 0.1 mile of the trail would be converted to a new access road.

Table 6-4 Central Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
Central Alternative	Parks (acres)	Washougal River Greenway (0.1)	Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Washougal River Greenway (0.2)
	Trails (miles)	--	--	Bells Mountain Trail (<0.1), Riverfront Trail (East) (<0.1)
Central Option 1	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	N/C
Central Option 2	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	Riverfront Trail (East) (-<0.1)
Central Option 3	Parks (acres)	Moulton Falls (+<0.1)	Moulton Falls (+0.1)	Moulton Falls (+0.6)
	Trails (miles)	Lucia Falls / Moulton Falls Trail (+<0.1)	Lucia Falls / Moulton Falls Trail (+<0.1)	Bells Mountain Trail (-<0.1)

Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.

Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS 2009

The route and access roads would require vegetation clearing for new right-of-way through the park. The project would visually intrude on the recreational experience of visitors to the park and trail. Impacts could be mitigated by repositioning the access road and tower away from the trail and minimizing vegetation removal near the trail as much as possible. A **high** impact would occur at Lucia Falls/Moulton Falls Trail because this recreation resource would be permanently altered.

Central Option 3 would also cross the Northern Clark County Scenic Drive at Northeast Cedar Creek Road and at Lucia Falls Road (see Table 6-4 and Map 6-1C). The project would be a visual intrusion into the drive's scenic views because, unlike the West Alternative, there is no existing right-of-way at these crossings. While motorist's views of cleared vegetation would be temporary and the transmission line would be high above the windshield view, the character of the drive at these locations would be different and permanent, a **moderate** impact.

6.2.6 East Alternative

6.2.6.1 Construction

Tower construction would temporarily disturb about 0.7 acre of the Washougal River Greenway and about 0.1 mile of the Tarbell Trail. Access to the Riverfront Trail (East) and the Jones Creek Trail might also be limited during construction where roads crossing the trails would be improved.

Construction would occur throughout the year, weather permitting. During peak use times (such as summer for general recreation, hunting season for hunting uses), temporary impacts on recreation resources would be **moderate**. During non-peak times (such as winter), temporary impacts on these resources would be **low**. Any temporary impacts on user experience from construction would be **low**. In addition, many parks in the surrounding area would be unaffected by the project and could provide additional recreation opportunities.

Similar to the Central Alternative, the East Alternative right-of-way would be near PacifiCorp's public recreation areas between Lake Merwin and Yale Lake, Goot Park, Larch Mountain Trail, and within the Western Yacolt Burn Forest (see Table 6-1; Maps 6-1C and 6-1D). Construction activities could disturb the quiet and scenic landscape of these recreation areas, but the facilities would still be accessible. No towers or right-of-way would be within these recreation areas, so **no-to-low** impacts on these resources would occur.

6.2.6.2 Operation and Maintenance

Required project facilities for the East Alternative would permanently occupy about 0.5 acre of recreation land. Of this total, 0.1 acre would be affected by towers, about 0.2 acre would be affected by new access roads, and 0.2 acre would be affected by improvement of existing access roads (see Table 6-5; impacts on the Washougal River Greenway, Port of Camas-Washougal Marina and Oak Park are discussed under 6.2.2, Impacts Common to Action Alternatives).

In addition, less than 0.6 mile of trails would be permanently crossed by towers, and new and improved access roads. Less than 0.1 mile of the Riverfront Trail would be converted to improved access road. Less than 0.1 mile of the Tarbell Trail would be converted to towers, and less than 0.5 mile of additional trail would be converted to new and improved access roads (see Table 6-5 and Maps 6-1C, 6-1D, 6-1E), a **high** impact since the trail would be permanently altered by the project. Impacts to the trail might be mitigated by adjusting locations of towers and roads or by moving portions of the trail. The impact on user experience would be **moderate** since the project would add an industrial, human-made element to views from the trail that could negatively affect the experience of recreationists.

Improved access roads would upgrade about 0.2 mile of the Jones Creek Trail (see Table 6-5; Maps 6-1D and 6-1E). This is a motorized trail, so the upgrades would add traffic to the trail and potentially improve the trail experience for ATV users by changing the road conditions (e.g., surface, width). The right-of-way would be west of the trail and could add an industrial, human-made element to the views from the trail that could negatively affect the experience of recreationists. The impact on user experience would be **moderate**.

The right-of-way for the East Alternative would cross the Tarbell Trail eight times, going through the middle of the trail's loop (see Map 6-1C). At the northern portion of the trail, five crossings would occur and the right-of-way would closely parallel the trail for about 1 mile. At the southern portion of the trail, three crossings would occur and the right-of-way would closely parallel the trail for about 1,500 feet. Less than 0.1 mile of the trail would be changed to towers and an additional 0.1 mile of the trail would be converted to new and improved access roads. The right-of-way, towers, and access roads would add an industrial, human-made element to the trail's views that could negatively impact the experience of recreationists. The access roads would also convert portions of a non-motorized trail to motorized uses, which may require moving parts of the trail. Because permanent alterations to the trail would be necessary, this would be a **moderate-to-high** impact. Visual and experiential impacts to the recreational user could be eliminated by relocating nearby sections of the trail away from the right-of-way.

Like the Central Alternative, the right-of-way would cross the Spirit Lake Memorial Highway (SR 504) and be a visual intrusion into the drives scenic views (see Section 6.2.5.2, Operation and Maintenance). This would be a **low** impact because the crossing is less than 1 mile from the SR 504 interchange with I-5 and is in more developed areas of the scenic drive. The transmission line could also visually intrude on the recreation experience at PacifiCorp's public recreation areas between Lake Merwin and Yale Lake, Goot Park, Larch Mountain Trail, and the Western Yacolt Burn Forest. However, no towers or right-of-way would be in these areas, so **no-to-low** impacts on these resources would occur. The Silver Star trailhead and trail system are inside the Silver Star Scenic Area of the Gifford Pinchot National Forest but outside the study area. The Silver Star trail climbs to the peak of Silver Star Mountain, about 2 miles east of the East Alternative. From the peak, the East Alternative would be visible to hikers and would visually intrude on scenic views of the area west of the peak. Because this could negatively impact user experiences, it would be a **moderate** impact.

Table 6-5 East Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
East Alternative	Parks (acres)	Washougal River Greenway (0.1)	Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Washougal River Greenway (0.2)
	Trails (miles)	Tarbell Trail (<0.1)	Tarbell Trail (0.1)	Jones Creek Trail (0.2), Riverfront Trail (East) (<0.1), Tarbell Trail (<0.1)
East Option 1	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	Riverfront Trail (East) (-<0.1)
East Option 2	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	Tarbell Trail (-<0.1)	Tarbell Trail (-0.1)	Bells Mountain Trail (+<0.1), Jones Creek Trail (-0.2), Tarbell Trail (-<0.1)
East Option 3	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	Jones Creek Trail (+<0.1)	Jones Creek Trail Connector A (+<0.1)	Jones Creek Trail Connector A (+0.3), Jones Creek Trail (-0.2)

Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.

Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS 2009

6.2.6.3 East Option 1

East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. East Option 1 would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. East Option 1 would cause **no** impacts on the Riverfront Trail (East) or to the visual quality of the Spirit Lake Memorial Highway at SR 504 (see Table 6-5, Map 6-1A) because this option does not cross these resources. The East Option 1 route would be near Riverside Park (see Table 6-1, Map 6-1A), where the transmission line could visually intrude on the recreational experience of the park users, but there would be no change to access or to the park facility. This visual intrusion would be a **moderate** impact. Temporary impacts on user experience from construction dust and noise would be **low** at Riverside Park.

6.2.6.4 East Option 2

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. East Option 2 would cross the Bells Mountain Trail, and part of the trail would also be changed to an improved access road (see Table 6-5, Map 6-1C). Construction and upgrades to the access road could cause noise, dust, and temporary limited access and use of the trail, which would be a **low** impact on Bells Mountain Trail user experience. Maintenance activities would have a **low** impact on the trail because these activities are infrequent. New right-of-way crossing Bells Mountain Trail would add an industrial, human-made element to the trail that could negatively affect the experience of recreationists. The impact on user experience would be **moderate**. East Option 2 would modify the route south of Yale Dam to go farther west and closer to the western edge of the Western Yacolt Burn State Forest. East Option 2 would not change impacts on the parks, but would eliminate direct or indirect impacts on Jones Creek Trail, Tarbell Trail, and Larch Mountain Trail (see Table 6-5, and Maps 6-1D and 6-1E) because this option does not cross these resources.

6.2.6.5 East Option 3

East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. East Option 3 would modify part of the route in the southern part of the Western Yacolt Burn State Forest. The right-of-way would cross the Jones Creek Trail and the Jones Creek Trail Connector A twice (see Maps 6-1D and 6-1E). Tower construction would temporarily disturb less than 0.1 mile of the Jones Creek Trail, with less than an additional 0.1 mile of the Jones Creek Trail converted to towers, a **low** impact (see Table 6-5). About 0.4 mile of Jones Creek Trail Connector A would be converted to new and improved access road (see Table 6-5). This option would eliminate impacts to a portion of Jones Creek Trail proposed to be used for an access road for the East Alternative (see Section 6.2.6.2, Operation and Maintenance) because it would not use that road and does not cross it. The

Jones Creek Trail and Jones Creek Trail Connector A are motorized trails; the upgrade to both trails would likely add traffic to the trails and potentially improve the trail experience for ATV users by changing the road conditions (e.g., surface, width). The right-of-way would cross the trails multiple times and would add an industrial, human-made element to the views from the trails that could negatively impact the experience of recreationists. This would be a **moderate** impact to these trails.

6.2.7 Crossover Alternative

6.2.7.1 Construction

There are no recreation resources along the northern portion of the Crossover Alternative.

Temporary impacts that would occur near PacifiCorp's public recreation areas along the Lewis River (Merwin Park) and Goot Park would be the same as those discussed for the Central Alternative because the portion of the Crossover Alternative where these resources are located is the same as the central portion of the Central Alternative.

Temporary impacts on the Washougal River Greenway, Tarbell Trail, and other parks and trails would be the same as those discussed for the East Alternative, because the portion of the Crossover Alternative where these resources are located is the same as the southern portion of the East Alternative.

6.2.7.2 Operation and Maintenance

Required project facilities for the Crossover Alternative would permanently occupy about 0.5 acre of recreation land. Of this total, about 0.1 acre would be affected by towers, less than 0.2 acre would be affected by new access roads, and about 0.2 acre would be affected by improvement of existing access roads (see Table 6-6). In addition, less that 0.1 miles of trail would be affected by towers, and less than 0.4 miles would be affected by new and improved access roads.

Permanent impacts on the Washougal River Greenway, Tarbell Trail, and Jones Creek Trail would be the same as those discussed for the East Alternative (see Table 6-6). The Crossover Alternative would not impact the Riverfront Trail (East). The proposed right-of-way would be near PacifiCorp's public recreation areas along the Lewis River (Merwin Park), Goot Park, Larch Mountain Trail, and the Western Yacolt Burn Forest (see Table 6-1; Maps 6-1C, 6-1D, 6-1E). The transmission line could visually intrude on the recreational experience of the park and trail users and construction activities could disturb the quiet and scenic landscape of the recreation areas, but the facilities would still be accessible. No towers or right-of-way would be within these parks and this trail, so **no-to-low** impacts on these resources would occur. The Silver Star trailhead and trail system are inside the Silver Star Scenic Area of the Gifford Pinchot National Forest but outside the study area. The Silver Star trail climbs to the peak of Silver Star Mountain, about 2 miles east of the Crossover Alternative. From the peak, the Crossover Alternative would be visible to hikers and would visually intrude on scenic views of the area west of the peak. Because this could negatively impact user experiences, it would be a **moderate** impact.

Because the Crossover Alternative is close to trails and parks, the right-of-way would provide increased access to the forested areas of the parks and trails, primarily the western portion of the Yacolt Burn State Forest. This would cause increased access for hunting and ATV use on these otherwise inaccessible lands. The Yacolt Burn State Forest is open to motorized users during the summer, beginning on May 1 of each year, and closes in the fall when conditions become wet. Increased access to these areas by motorized users would be a positive impact during the summer months when motorized access is permitted. However, during the seasons when this area is closed to motorized users, improved access could allow unauthorized use, which would be a **moderate** impact. Signs, gates, and fencing may limit some potential impact.

6.2.7.3 Crossover Option 1

Crossover Option 1 would remove a portion of the alternative crossing north–south through rural residential areas north of Camas between NE Zeek Road and SE 23rd Street, and replace it with a route running west along an existing right-of-way until about NE 232nd Avenue, then southeast through open fields and more rural residential areas. Crossover Option 1 would modify part of the route north of Camas and Washougal. The right-of-way would follow part of the east boundary of Camp Currie (see Maps 6-1D and 6-1E). Tower construction would temporarily disturb about 1.5 acres of the camp. About 1.2 acres of the camp would be permanently converted to towers and new access roads (see Table 6-6). This would be a **moderate** impact on the camp because the right-of-way would follow existing right-of-way along the edge of the camp property.

6.2.7.4 Crossover Options 2 and 3

Crossover Options 2 and 3 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land. Crossover Option 3 would require some additional new right-of-way. Crossover Options 2 and 3 would have no additional impacts since there are no parks or trails along either option.

Table 6-6 Crossover Alternative and Options—Permanent Impacts on Parks and Trails

Alternative and Options[1,2]	Recreation Resource	Towers[3]	New Access Roads[4]	Improved Access Roads[4]
Crossover Alternative	Parks (acres)	Washougal River Greenway (0.1)	Port of Camas-Washougal Marina (<0.1), Oak Park (<0.1)	Washougal River Greenway (0.2)
	Trails (miles)	Tarbell Trail (<0.1)	Tarbell Trail (0.1)	Jones Creek Trail (0.2), Tarbell Trail (<0.1)
Crossover Option 1	Parks (acres)	Camp Currie (+0.3)	Camp Currie (+0.9)	N/C
	Trails (miles)	N/C	N/C	N/C
Crossover Option 2	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	N/C
Crossover Option 3	Parks (acres)	N/C	N/C	N/C
	Trails (miles)	N/C	N/C	N/C

Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the total impacted acres or miles added by the option minus the total impacted acres or miles in the segments the option replaces.
2. No permanent impacts would occur in substation areas.
3. Includes rebuilt and new towers.
4. Includes access roads within and outside of the 150-foot right-of-way.

Sources: Clark County 2011d, Cowlitz Wahkiakum Council of Governments 2006, Metro 2011, USGS, 2009

6.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional mitigation measures have been identified to further reduce or eliminate adverse impacts on recreation by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- If desired by local governments or property owners, make sections of the right-of-way available for hiking and biking activities in selected areas.
- Coordinate with agencies managing recreation resources to inform the public about construction closures.
- Discuss locations of new towers, substations, and access roads with land managers and owners to avoid sensitive recreation areas.
- Place towers so that they would not be visible from nearby recreation areas where possible.
- Preserve existing vegetation (except weeds) along the roadway if possible to screen the transmission lines and towers. Allow the growth of dense masses of medium shrubs parallel to the roadway where the transmission line right-of-way crosses.
- Use techniques to re-vegetate cut and fill slopes on access roads and near tower locations.
- Minimize access road placement in highly sensitive recreation areas.
- Implement signage, gates, and fencing where necessary to prevent unauthorized access to previously inaccessible areas via the new right-of-way.

6.2.9 Unavoidable Impacts

Temporary construction activity (noise, dust, visual intrusions, traffic) would impact users' experiences at recreation sites and along the Columbia River and scenic drives. For all action alternatives, portions of a new transmission line would be introduced to areas where such infrastructure does not currently exist. Existing recreation areas at these locations would be altered by the placement of transmission towers, access roads, and right-of-way restrictions. Most permanent impacts on recreation would be experiential intrusions to the scenic character of the area from the transmission towers and lines (see Chapter 7, Visual Resources). These intrusions would occur at specific recreation sites and for general dispersed or informal recreational uses, such as the Lewis and Clark Trail Scenic Byway, Columbia River Gorge Scenic Byway, and the Columbia River.

6.2.10 No Action Alternative

Under the No Action Alternative, the project would not be constructed and there would be **no** impact on recreation. Authorized and unauthorized recreational activities would continue to occur in the project area. As the area continues to grow, more recreation resources may be developed. Dispersed recreation would likely continue to grow.

Chapter 7 Visual Resources

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

This chapter describes the existing visual resources in the project area, and how the project alternatives could affect these resources. Related information can be found in Chapter 5, Land and Chapter 6, Recreation, and Appendix E, Visual Assessment.

7.1 Methodology

The methodology used for this visual resources assessment is based on the BLM's Visual Resource Management (VRM) system. This methodology is effective for evaluating many different types of development, including transmission line projects within rural and urban settings, and is regularly used for visual resource assessments by federal agencies. Visual resources within 5 miles of the action alternatives were inventoried using BLM Visual Resource Inventory methods (BLM 1986a). This distance was used because it represents locations with a potential **foreground** or **middle-ground view**, and the assumed maximum distance at which a transmission line would present a dominant or intrusive presence to the viewer (BLM 1986a). This methodology assesses landscapes according to the attributes described below. Impact levels incorporating these attributes are defined in Section 7.3.1, Impact Levels.

7.1.1 Landscape Rating Determination

The BLM VRM rates an area by combining the scenic quality of the land with the sensitivity of the viewers to give an overall rating to the landscape. This landscape rating is then contrasted with project components to evaluate visual impacts.

7.1.1.1 Scenic quality

This is a measure of the overall appeal of a view. Under BLM's VRM system, the scenic quality of an area is categorized as "high," "medium," or "low," based on several key factors, including landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modifications (i.e., manmade additions to the landscape) (BLM 1986a).

- Landform
    - high vertical relief in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or dominant and exceptionally striking and intriguing features such as glaciers (high scenic quality);
    - steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosional patterns or variety in size and shape of landforms; or features that are interesting though not dominant or exceptional (medium scenic quality);
    - low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features (low scenic quality).

- Vegetation
    - a variety of vegetation types in interesting forms, textures, and patterns (high scenic quality);

- some variety of vegetation, but only one or two major types (medium scenic quality);
- little or no variety or contrast in vegetation (low scenic quality).

- Water
  - clear and clean appearing, still, or cascading white water that is dominant in the landscape (high scenic quality);
  - flowing, or still, but not dominant in the landscape (medium scenic quality);
  - absent, or present, but not noticeable (low scenic quality).
- Color
  - rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields (high scenic quality);
  - some intensity or variety in colors and contrast of the soil, rock and vegetation, but not a dominant scenic element (medium scenic quality);
  - subtle color variations, contrast, or interest; generally mute tones (low scenic quality).
- Influence of Adjacent Scenery (beyond the landform being evaluated)
  - adjacent scenery greatly enhances visual quality (high scenic quality);
  - adjacent scenery moderately enhances overall visual quality (medium scenic quality);
  - adjacent scenery has little or no influence on overall visual quality (low scenic quality).
- Scarcity
  - one of a kind; or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. (high scenic quality);
  - distinctive, though somewhat similar to others within the region (medium scenic quality);
  - interesting within its setting, but fairly common within the region (low scenic quality).
- Cultural Modifications (changes to the visual landscape discernable as artificial, such as buildings or roads)
  - modifications add favorably to visual variety while promoting visual harmony (high scenic quality);
  - modifications add little or no visual variety to the area, and introduce no discordant elements (medium scenic quality);
  - modifications add variety but are very discordant and promote strong disharmony (low scenic quality).

7.1.1.2 Viewer Sensitivity levels

Sensitivity is an evaluation of the viewer and not the landscape, and is a way of ranking public concern for visual resources, based on the viewer. The type of user has an influence on visual sensitivity, as perceptions of the landscape tend to vary based on the intended use of the land and related expectations of the user. For example, hikers on a scenic trail may have a higher visual sensitivity than loggers or farm workers who are there as part of their job. Adjacent land use can also influence viewer sensitivity, based on the land use type and viewer expectations. Special places such as parks, natural areas, and designated scenic areas generally have a high level of viewer sensitivity, but sensitivity may depend on the management objectives for the area. Viewer sensitivity can also depend on distance.

The BLM VRM system categorizes sensitivity levels as “high,” “medium,” or “low.” Factors considered include the type of users, amount of use, public interest, adjacent land uses, and special areas. These measures of public concern are intended to be subjective, and have no standard definitions—the definitions are determined by what factors affect sensitivity on specific projects. Viewer sensitivities on this project were determined as follows:

- High viewer sensitivity—a large number of viewers, public use and exposure to the site or area; high public interest; typical viewers are nearby residents with an attachment to the landscape and long duration of their views, and recreational sightseers highly sensitive to changes in scenic quality and **viewsheds** (the visible landscape).
- Medium viewer sensitivity—intermediate viewer numbers, public uses, overall public interest, or adjacent land uses.
- Low viewer sensitivity—sparsely populated areas; few recreational or other public uses; most viewers are non-residents or workers traveling through or working in an area, or viewers from nearby commercial or industrial land uses.

The overall ranking does not necessarily represent an average of all individual factors, since it is possible for certain factors to outweigh others. For example, sensitivity can be affected by the amount of public use and exposure to the public, where a large number of viewers translates to high sensitivity. Sensitivity may also be high if public interest is very high. In such cases, the sensitivity rating may be high, despite other factors being low, indicating a generally high level of concern.

Because the project covers a large geographic area within both densely and sparsely populated areas, sparsely populated locations are generally given a low sensitivity level compared to densely populated areas, if other factors are equal, because of a low number of viewers. The combination of an area’s scenic quality and the sensitivity level of viewers in that area result in the visual resource landscape rating (see Table 7-1), and provide the baseline to determine the visual effects of the alternatives.

Table 7-1 Landscape Rating

Scenic Quality	Viewer Sensitivity		
	High	Medium	Low
High	High	High	High
Medium	High	Medium	Low
Low	Medium	Low	Low

Source: BLM 1986a (Illustration 11 – Determining Visual Resource Inventory Classes, Manual 8410a)

7.1.2 Visual Resource Impact Determination

To evaluate the visual impacts from a project, the BLM VRM evaluates the visual attributes of a project compared against the visual resource landscape rating at the locations being described. The comparison is based on the contrast elements described below.

Visual Contrast Elements

- Form—includes structures and movement, relates to the shape of disturbances in contrast to existing landscape shapes.
- Line—relates to the path the eye naturally follows when perceiving differences in landscape shape, color or texture.
- Color—relates to the degree that hue (e.g., red, blue, green), value (e.g., brightness), and chroma (e.g., saturation) contrast with existing landscape colors.
- Texture—relates to the patterns that exist within the larger landscape elements.
- Scale—relates to the proportional size of the object in relation to the field of view.

These elements are then combined into an overall contrast rating as follows: “none” where the element is not visible or perceived; “weak” where the element contrast can be seen but does not attract attention; “moderate” where the element contrast begins to attract attention and begins to dominate the characteristic landscape; or “strong” where the element contrast demands attention, will not be overlooked, and is dominant in the landscape (BLM 1986b).

The overall visual contrast is then combined with the landscape rating (see Table 7-1) to determine a visual impact rating for the area (see Table 7-2).

Table 7-2 Visual Impact Rating

Contrast	Landscape Rating		
	Low	Medium	High
None	Negligible	Negligible	Negligible
Weak	Low	Low	Moderate
Moderate	Low	Moderate	High
Strong	Moderate	High	High
Source: BLM 1986b			

More information about assessment and impact methodology, and a discussion of the landscape ratings assigned to the action alternatives by segment is in Appendix E.

7.2 Affected Environment

The action alternatives cross five regions with similar types, quality, and quantity of environmental resources: Willapa Hills, Cowlitz/Chehalis Foothills, Western Cascades Lowlands and Valleys, Valley Foothills, and Portland/Vancouver Basin (EPA 2007).

- Willapa Hills: The north end of the project is in the Willapa Hills. The action alternatives cross this region northwest of Castle Rock and parallel to the Cowlitz River, between the Monahan Creek and Baxter Road substation sites. Portions of the alternatives also cross this region between the Monahan Creek site and the Lexington area, and between Castle Rock and Silver Lake, north of Ostrander, Washington. The Willapa Hills are characterized by low, rolling hills and gently sloping mountains with fewer drainages than surrounding areas (EPA 2007). Water features are not prominent in the area. Given the fairly uniform textures and patterns of vegetation, color is also relatively uniform. The consistent vegetation and low rolling hills allow few **long-range views** and do not contribute greatly to scenic quality under BLM's VRM system. The region is relatively sparsely populated, with the neighborhood of Longview Heights to the south and scattered residential residences throughout other areas.
- Cowlitz/Chehalis Foothills: The project crosses the rolling to steeply sloping hills near Chehalis and the relatively flat Cowlitz River Valley. The action alternatives cross this region just east of Lexington, Washington, east of Longview, and north of the Lewis River. The urban areas of Longview/Kelso, Castle Rock and I-5 are in this region. The vegetation textures and patterns are fairly uniform, and visually limit views so that long-range viewing opportunities are rare. There are some color variations in the vegetation, although they do not dominate or create a strong scenic element. Water flows through this area, predominantly along the Cowlitz River, and contributes to scenic quality. The influence of scenery next to the Cowlitz/Chehalis Foothills region is limited due to the few long-range viewing opportunities. The visual characteristics of the Cowlitz/Chehalis Foothills are common in much of southwestern Washington and northwestern Oregon.
- Western Cascades Lowlands and Valleys: This region is characterized by large areas of lowlands and valleys that extend west from the Cascade Range. The action alternatives south of the Kalama River and north of the Washougal River, including most of the Central and East alternatives, West Option 3, Central Options 2 and 3, and East Options 1, 2, and 3, cross this region. The moderate to steeply sloping hills are predominantly covered by western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*) forests, and many areas have been, or will be, harvested for timber. The area is sparsely populated, but includes the communities of Ariel, Amboy, and Yacolt in the north; Venersborg and Hockinson in the southwest; and Camas and Washougal in the south.

  The Western Cascades Lowlands and Valleys have more geographic relief than other regions. The vegetation is fairly consistent and tends to be most varied around rivers and lakes. Although not dominant through most of the area, water contributes to scenic quality around Merwin and Yale lakes and along the banks of rivers and creeks. Color contributes to scenic quality, primarily in autumn. Otherwise, the landscape is dominated by similar shades of green during most of the year.
- Valley Foothills: The action alternatives cross foothills in the Camas area, a transition zone between the Portland/Vancouver Basin to the west and the Western Cascades Lowlands and Valleys to the east. Portions of the action alternatives and options including West Options 1, 2 and 3, and Crossover Option 1 cross this region between Camas, Washington and the Sifton area. The Valley Foothills are drier than the neighboring mountains and have vegetation reflective of this, with Oregon oak (*Quercus garryana*) and Douglas-fir as the native vegetation. Non-native vegetation is more

common than native vegetation in the Valley Foothills, as predominant land use is rural residential developments, woodlands, pastures, tree farms, vineyards, and orchards.

The Valley Foothills region contains low rolling foothills with few dramatic features. There is some variety in the vegetation; however, it is rarely expressed in distinctive forms, textures or patterns. Visible water is rare throughout these foothills and, for the most part, does not contribute to scenic quality in the BLM's VRM system. There are some variations in color that contribute slightly to scenic quality; they are mostly shades of green and are not a dominant scenic element. Adjacent scenery to the Valley Foothills region has little effect on scenic quality, as most is blocked by the topography and vegetation. The scenery found in the Valley Foothills is similar to that found throughout much of southwestern Washington and northwestern Oregon.

- Portland/Vancouver Basin: The Portland/Vancouver Basin contains floodplains and undulating terraces. Portions of the action alternatives and options in Vancouver, Minnehaha, Camas, Washougal, and the Sifton area east of Minnehaha, Washington cross this region. All action alternatives cross this basin before ending at the Sundial substation site. The landforms of the region are dominated by low-relief floodplains with small rolling hills on the eastern edge that do not greatly contribute to scenic quality in the BLM's VRM system. Vegetation is moderately varied in the basin, as the change from rolling hills to floodplains creates more distinctive forms, patterns and textures. The vegetation patterns in the area moderately enhance scenic quality.

  Water in the Portland/Vancouver Basin also moderately enhances scenic quality at select locations surrounding the Columbia and Lewis rivers, and other small creeks. As a scenic element, although it is only visible in select locations, water is a distinctive feature to the viewers of this area. Color variations in the diverse vegetation moderately enhance scenic quality, but do not tend to be a dominant landscape element. Adjacent scenery to the Portland/Vancouver Basin region is generally not highly visible or has little influence on scenic quality. This type of landscape is similar to other valley and basin areas in southwestern Washington and northwestern Oregon.

7.2.1 West Alternative and Options

The West Alternative originates in the Willapa Hills where the scenic quality is low because of the low topography of shallow, rolling hills with few prominent landscape features; little variation or contrast of vegetation types; color variations of vegetation that are present but not dominant; and limited visibility in most areas such that adjacent scenery does not influence or enhance the viewshed. Water is present, but in general is not cascading or entirely undisturbed by land development, and is not visible from most locations. The alternative continues south through the Cowlitz/Chehalis Foothills where the vegetation has some variety but does not form conspicuous textures or patterns over the rolling hills and meadows; these views of hills and vegetation are relatively uniform across the landscape. Rivers and riparian areas are present and contribute to scenic value, but they are generally obscured from most viewers due to forests and the low topography of the area. Views within the area are common to much of southwest Washington. The alternative passes through rural areas, and both rural and residential areas in the communities of West Side Highway and Kelso.

The hills become larger and the population less dense as the route passes into the Western Cascades Lowlands and Valleys. Scenic quality is rated low in this portion of the alternative due to the relatively low and uniform foothills, uniform textures, patterns of color and vegetation that are common to much of southwest Washington, water that is present but not dominant, and the lack of dominant features in the landscape. In most portions of this region, adjacent scenery is not visible or does not enhance the scenic quality due to limited long-range viewing or due to the numerous areas of timber harvest that contribute to disharmony in the landscape. Roads and transmission lines that exist along much of the West Alternative modify the view and can be dominant in areas where forest has been removed.

The alternative crosses the East Fork Lewis River and enters the Portland/Vancouver Basin ecoregion. This portion of the alternative is rated low due to flat terrain and relatively low rolling hills with few or no prominent features. Agricultural fields and rural development are common and modify the scenic quality. Water is present in some locations but is either not visible or not a dominant scenic element. An exception is the East Fork Lewis River system that does contribute to the scenic quality of that area. The river's riparian habitat offers some scenic contributions to the floodplain, meadows and open fields found in the basin. A limited number of parks such as the East Fork Lewis River Greenway also offer local natural landscapes of scenic value.

Dense population and commercial and industrial structures are prominent in the southern portion of the alternative. Scenic quality is generally low in the urban environment due to common views of buildings, bridges, and transportation corridors that are not harmonious with the natural landscape. Larger parks and greenways within the urban environment provide open space and contribute locally to scenic value. Undisturbed open space with native vegetation, such as the Lacamas Prairie Natural Area, add higher scenic value locally. As a major water course, the Columbia River offers scenic quality with islands formed by braided channels and riparian forests adding to the visual character of the metropolitan developed areas.

Local sites of higher scenic value are present along the route, but these are often small or have limited viewing opportunity due to surrounding low topography or tall vegetation. Scenic areas near larger river systems, such as the complex of green space just north of the Columbia River crossing, including Lacamas Lake Park, the Washougal River Greenway, Lacamas Park Trail, and Goot and Oak parks contribute locally to scenic quality. Because of the limited number of these local sites of higher scenic quality, the overall scenic quality along the West Alternative is rated low.

West Options 1, 2, and 3 all pass through developed areas of Vancouver and Camas and each have a rating of low scenic quality as discussed above for this area. Although there are local sites with natural scenic value and some riparian systems with higher scenic quality, these sites are limited.

Viewer sensitivity along the West Alternative varies locally with land use, but viewer sensitivity is rated high along most of this route. The primary factor affecting viewer sensitivity is the viewer's proximity to the alternative. The West Alternative is relatively close to residential areas for most of its length, although population density varies. At the north end, it passes through rural residential areas northwest of the West Side Highway community where viewer sensitivity is rated medium. Rural residential areas have fewer users of the land, so the amount of use is lower than in more densely populated residential areas. However, public concern for the visual landscape in these areas may be higher because of rural residents' expectation of a more natural or open-appearing landscape. Public comments received during the scoping process for this EIS have indicated that residents along the West Alternative are highly sensitive to changes in scenic quality.

As the alternative crosses through the communities of West Side Highway and Kelso, it runs through or close to residential areas where viewer sensitivity is rated high. The alternative then crosses the Coweeman River and again through rural residential areas, with increased viewer sensitivity. As the alternative continues south across the Lewis River, it passes through agricultural land, which tends to have less-sensitive viewers than rural residential land. The density of residences increases south toward Hazel Dell. As the alternative crosses BPA's Ross Complex and shifts to a predominantly east–west direction, it passes through urban residential, commercial, and industrial land already affected by development, including transmission lines. Here, viewer sensitivity is lower because of existing similar development. Crossing Northeast 4th Plain Road and heading southeast toward Mill Plain and Camas, the alternative passes through open space and rural residential areas. Overall, the West Alternative and its options have viewers with a high sensitivity level for two reasons: a large amount of new right-of-way is in undeveloped areas to the north where citizens are less used to power lines; and there are high populations of concerned citizens to the south, though other lines exist. The West Alternative and its options have a medium overall landscape rating based on having a low level of scenic quality and an average high viewer sensitivity level.

7.2.2 Central Alternative and Options

The area crossed in the north by the Central Alternative shares many visual characteristics with the West Alternative that result in a low scenic quality rating. Northwest of the Cowlitz River the alternatives are similar with only slight, localized differences. In general, the area has low rolling hills, and some variation in patterns, textures, and colors of vegetation between forested areas and rural residential development and agricultural pastures and cropland; these land uses modify the scenic quality of the area. Water is present but not always visible, except at Castle Rock and along trails on the Cowlitz River floodplain. East of the Cowlitz River, the Central Alternative crosses the Cowlitz/Chehalis Foothills area where numerous timber cuts and logging roads along the route modify the landscape and contribute to the low scenic quality, except where the alternative crosses Spirit Lake Memorial Highway which adds some local scenic value for motorists. Riparian areas, also, are primary sites of local scenic value, such as at the Coweeman and Kalama river crossings.

The alternative crosses the Western Cascades Lowlands and Valleys where scenic quality is rated medium due to the distinctive nature of Merwin Dam and Lake Merwin, although such dams and reservoirs are not uncommon in the foothills of the Cascades. Texture and color of vegetation has some variety but is generally uniform across the landscape. Vegetation and topography limit views of adjacent scenery in this area. Rural residential and agricultural fields occur south of the lake and are scattered across the general landscape, and become more common farther south. The rolling hills often block adjacent scenery, but when visible these adjacent sites only contribute to a scenic quality rating of low because they are highly modified by timber harvest and logging roads.

Within the Portland/Vancouver Basin scenic quality is generally rated low due to the visual characteristics of the urban environment as described for the West Alternative. Local sites such as the Washougal River crossings do have higher scenic value.

Central Option 1 is in an area of low scenic quality on timber harvest land that has low rolling hills with little variation in texture, color, or pattern of vegetation. Central Option 2 is near Longview and Ostrander where scenic quality is low due to the commercial and industrial nature of the urban environment and development along the I-5 corridor. Most of the scenic quality along Central Option 3 is rated medium because of Merwin Dam and its reservoir and also the East Fork Lewis River at Lucia Falls and Moulton Falls Park; although these types of features are not uncommon in Washington foothills, and they do contribute to the scenery at local sites. The Central Alternative and its options have an overall low scenic quality.

The Central Alternative has generally low viewer sensitivity through the portion southeast of the Cowlitz River and north of the Lewis River. This area is sparsely populated and has limited use. Sensitivity and scenic quality are higher near the Lewis River just west of Lake Merwin through Ariel. West of Amboy and Yacolt, and east of Lewisville and Battle Ground, the alternative is located among rural residential homes and has medium *s*ensitivity. East of Vancouver, the alternative turns east and away from rural residential areas until the alternative passes near the rural residential areas of Camas. The Central Alternative and its options have a low overall landscape rating based on having a low level of scenic quality and an average medium viewer sensitivity level.

7.2.3 East Alternative and Options

The area crossed by the East Alternative originates west of Castle Rock in the Willapa Hills and has visual characteristics similar to the Central Alternative. Scenic quality in this area is low because of the low topography of the shallow, rolling hills with few prominent landscape features; little variation in vegetation type, color, and patterns across the landscape; and in most areas adjacent scenery does not influence the view due to limited visibility except along the Spirit Lake Memorial Highway. The alternative crosses the Cowlitz and Coweeman rivers; at these locales which can be accessed by trails, these rivers contribute to the natural scenic quality. Where the alternative extends across the Cowlitz/Chehalis Foothills, the scenic quality remains low due to low topography with few prominent landscape features, and forest cover that is modified by timber harvest.

In the Western Cascades Lowlands and Valleys ecoregion, scenic quality for the alternative is rated medium. This is due to large areas of undisturbed landscape, especially in the vicinity of the upper Kalama River basin, and more topographic variation and steeper slopes where the alternative crosses between Lake Merwin and Yale Lake, near Canyon Creek, and where it crosses the Tarbell Trail. Adjacent scenery is visible in many areas, moderately enhancing the views.

In the Portland/Vancouver Basin ecoregion just east of Camas, the scenic quality is generally low due to flatter and less varied topography and uniform vegetation patterns. Although water is present, there are only limited and local views of Jones Creek and the Little Washougal River. Closer to Camas and the Columbia River, the scenic quality is the same as discussed for the West and Central alternatives. There are local sites of higher scenic value, but these are often limited and small in size or have limited viewing opportunity due to surrounding topography or vegetation.

East Option 1 is located in the Willapa Hills and Cowlitz/Chehalis Foothills ecoregions and has a low scenic quality rating as described for this area previously. The Cowlitz and Coweeman rivers and their tributaries offer higher scenic quality at local sites. East Option 2 is located in the Western Cascades Lowlands and Valleys ecoregion where scenic quality is rated low due to lower foothills and a landscape modified by timber harvest. East Option 3 crosses the Jones Creek Trail where scenic quality is enhanced locally where water is visible; overall, the scenic quality of this option is low due to the low topography of shallow hills, and vegetation that limits viewing opportunities. The East Alternative and its options have an overall low scenic quality.

At the north end of the East Alternative, viewer sensitivity is low because there are no homes, roads, or recreation areas. Near the north end of Castle Rock, sensitivity increases to medium because the amounts of use and types of users increase. The number of potential viewers increases near SR 504 and I-5. State Route 504 is a designated state scenic drive, and viewer sensitivity is high. East of Castle Rock, viewer sensitivity is low, because there are few residences, roads, or recreation areas. The northern portion of the alternative has low sensitivity for most of its length because there are few homes, few roads, and low levels of use, resulting in an overall viewer sensitivity of medium.

Sensitivity is greater where the alternative crosses Lewis River Road, and extends across the rural residential areas northeast of Ariel, and past the east end of Lake Merwin. South of Lake Merwin, sensitivity is lower, because there are fewer residences close to the alternative. Recreational land use becomes more influential on sensitivity; however, there is not a high amount of use, so sensitivity is low-to-medium. In the rural residential areas of Camas, sensitivity is medium-to-high, depending on the number of residences and their proximity to the East Alternative. The East Alternative and its options have a low overall landscape rating based on having a low level of scenic quality and an average medium viewer sensitivity level.

7.2.4 Crossover Alternative and Options

The area crossed by the Crossover Alternative shares its northern portion with the West Alternative where the overall scenic quality is rated low for the Longview area and along low rolling hills. The middle portion of the alternative is the same as the Central Alternative where scenic quality is rated medium because of the enhanced views in the Merwin Dam, Lake Merwin, Yale Dam, Yale Lake, and Canyon Creek areas. The Crossover Alternative also shares the portion of its route south of Lake Merwin and Yale Lake with the East Alternative through low rolling foothills where timber harvest and logging roads are noticeable modifications to the landscape that contribute to the overall rating of low scenic quality, although the Tarbell and Jones Creek trails wind through unharvested areas that contribute some local scenic value. The physiographic characteristics and scenic quality of the areas for the overlapping portions of the West, Central and East alternatives are the same for the Crossover Alternative as more fully described for the other alternatives in Sections 7.2.1 through 7.2.3.

Crossover Option 1 is located in Camas where the scenic quality is rated low. Crossover Options 2 and 3 are located in the north near Castle Rock in areas rated as having low scenic value due to the low topography with few interesting landscape features; mostly uniform patterns and colors of vegetation; localized views of water; and development or land uses that modify the landscape. Based on the assessment of the landscape features, the Crossover Alternative and its options have an overall low scenic quality.

Sensitivity varies along the alternative, with land use influencing the level. Near Amboy and Ariel, there are residential users, motorists, and recreational users of the landscape. South of Lake Merwin, viewer sensitivity is lower, as there are fewer residences close to the alternative. Recreational land use becomes more influential on sensitivity; however, there is not a high amount of use, so sensitivity is low-to-medium. Entering the rural residential areas of Camas, sensitivity becomes medium-to-high, depending on the number and proximity of residences.

The Crossover Alternative and its options have a low overall landscape rating based on a low level of scenic quality and an average medium viewer sensitivity level.

7.2.5 Substation Sites

The Sundial substation site is in an area of low scenic quality, because of the flat relief floodplains; only somewhat varied vegetation (small patches of forest, shrubs, altered wetlands, and open pastures); some water influence; some color variations that are not a dominant scenic feature; no influence from adjacent scenery (due to limited visibility); somewhat distinctive scenery, but still common to floodplain landscape; and negative **cultural modifications** because of its location in an industrial park. The area has medium sensitivity because it is next to the Columbia River, has a high amount of use, there is low public interest in the site, adjacent land use does not greatly influence the sensitivity, and it lacks any special areas or other considerations. The combined low scenic quality and medium sensitivity result in an overall low landscape rating.

The Casey Road substation site is in an area of low scenic quality, based on the low rolling foothills lacking dominant vertical relief or specific interesting landforms; a dense, uniform mixed wood vegetation that is currently partly logged; very little visible water; few color variations; and no influence of adjacent scenery (due to limited visibility). The site is a visual landscape common to the region, and includes negative cultural modifications such as logging activity and the existing transmission corridor. The area has low sensitivity, given the following factors: the type of use does not include residential use, parks, or other sensitive recreational uses; the amount of use is low; there is low public interest; the adjacent land uses do not increase the sensitivity; and there are no special areas. The low scenic quality and medium sensitivity result in an overall low landscape rating.

The Baxter Road substation site sits in a small topographical depression surrounded by vegetation. The site is not visible from sensitive viewpoints. The site is in the same remote area as the Casey Road substation site (about 2.5 miles away), and has the same negative cultural modifications. The scenic quality and sensitivity ratings for both sites are similar, with the same overall low landscape rating.

The Monahan Creek substation site is in an area of low scenic quality, based on the low foothills lacking dominant vertical relief or specific distinct landforms; largely uniform vegetation of mixed wood forest and small open pastures; very little visible influence of water on the landscape; few color variations in the vegetation; and no influence of adjacent scenery (due to limited visibility). The site is a commonly occurring landscape throughout the region, with cultural modifications (buildings and other structures) that have a negative effect on scenic quality. The area has medium sensitivity, given the rural residential usage (near existing residences and along a rural commuter road), amount of use, and public interest. The combined low scenic quality and medium sensitivity result in an overall low landscape rating.

7.3 Environmental Consequences

The evaluation of visual resource impacts is generally based on the BLM VRM system, which evaluates the existing visual landscape in the context of the project features, and how changes are likely to be perceived by viewers. The effect of a new feature on visual quality can be different when placed in remote locations as compared to being placed next to existing disturbances. Remote locations tend to have fewer potential viewers, but are often less disturbed and more natural in appearance, and viewers in remote locations may be more sensitive to potential changes. Sites close or next to existing disturbances tend to be of a lower scenic quality, but often have higher populations with more potential viewers.

To assist with the evaluation of potential visual resource impacts, a series of photographs were taken from viewpoints in the project area (see Map 7-1). Using visual simulations prepared from the photographs presented in this chapter, visual impact was then determined as a function of the landscape classification (based on scenic quality and viewer sensitivity) and the contrast rating, which evaluates how the project features would fit into the existing landscape (i.e., dominate it, attract attention, or would not attract attention).

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

7.3.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Landscape rating is high or medium, and project features dominate the landscape.
- Landscape rating is high, and project features attract attention to the landscape.

Impacts would be **moderate** where project activities would cause the following:

- Landscape rating is high, and project features do not attract attention to the landscape.
- Landscape rating is medium, and project features attract attention to the landscape.
- Landscape rating is low, and project features dominate the landscape.

Impacts would be **low** where project activities would cause the following:

- Landscape rating is medium or low, and project features do not attract attention to the landscape.
- Landscape rating is low, and project features attract attention to the landscape.
- Temporary visual changes from project construction.

No impact would occur where project features are visually negligible or not visible.

7.3.2 Impacts Common to Action Alternatives

7.3.2.1 Construction

Potential visual impacts include temporary visual changes during construction of the towers, conductors, access roads, and substations. Construction activities would create temporary changes in scenery by introducing helicopters, trucks, and heavy equipment such as cranes and bulldozers to the area. Construction activity in any one area would be brief (a few weeks), except at substation sites where construction would occur over many months. Construction crews would be working in localized areas of the transmission line right-of-way and at the substation sites, and would be visible primarily to nearby viewers or those with a direct line of sight to the activity. Installation of towers and stringing of the conductor by helicopter would be visible from a greater distance. The temporary staging areas that would be needed along or near the right-of-way to store materials, equipment, and vehicles would be visible to those in the immediate vicinity. The staging areas, ranging from 5 to 15 acres, would be located within existing developed sites or parking lots, where possible.

Construction activities would create a **low**, temporary visual impact because impacts would be short-term and temporary; right-of-way clearing, and towers and access road construction (a few weeks at a time for any one activity). At substation sites, construction activities would occur over a longer period but impacts would still be **low** since the Baxter and Casey sites are remote and the Sundial site is in an industrial complex. Impacts at the Monahan site may be higher for residents living adjacent or close to the site, or for motorists who use Delameter Road.

7.3.2.2 Operation and Maintenance

Permanent visual changes would be caused by the presence of the towers, conductors, access roads, cleared rights-of-way through forested areas, and from building substations on the landscape. Towers would create an obvious human made or industrial element to the **viewscape**. Where the new line would parallel other transmission lines, the line would not be out of context. In contrast, a new line within new right-of-way would degrade the natural visual quality of the area. While smaller transmission lines can be found in rural landscapes, the size of the towers required to support 500-kV lines are not typical in the project area. Most existing lines are 230-kV or below. Where there are fewer trees (primarily in the western segments), foreground views of the towers would be apparent because they could not be screened by vegetation (for example, in areas where there are no trees along roadsides to block views of towers). In distant views, towers would more readily blend into developed areas with existing rights-of-way.

> Because of the variations in project features among the action alternatives and across the landscape, and because of the variation in viewer sensitivity at any particular location close to or farther away from the alternatives and options, permanent placement and operation of project components on the landscape would cause **low-to-high** impacts. These impacts are discussed in Sections 7.3.2.3 to 7.3.7.

Because lattice steel towers have spaces between their structural members through which the background can be seen (see Figure 3-1), the towers would blend in with the landscape from a distance where they have a backdrop of hills or vegetation. Weather conditions such as fog and rain further obscure visibility of the towers from a distance. Towers would be more obvious on top of hills or ridges where they would break the skyline. The galvanized steel towers would appear shiny for 2 to 4 years before they dull from weathering. Conductors would be treated to reduce the shininess of the metal. The proposed single-, double-, and triple-circuit 500-kV towers would be larger than the towers on existing rights-of-way. In general, new towers would range from 50 to 140 feet taller than existing BPA wood pole structures or lattice steel towers in the area. In some cases, the new towers would replace existing structures and towers, reducing the number of towers and sense of clutter in the landscape, though the new towers would be larger and more obvious. In forested areas, the right-of-way clearing would create additional visual impacts and would make the transmission lines more noticeable from a distance, especially where towers are higher than trees or where the cleared right-of-way can be seen. Where viewpoints allow viewers to see down a cleared right-of-way, the linear nature of the transmission line would be more noticeable than at other viewpoints.

Access roads would also create visual impacts both in the foreground and in the distance, with new roads producing a more evident visual change than the upgrade of existing roads, especially where new roads cut through forested areas or are cut into hillsides. Improving existing roads (widening, blading, or adding gravel) would brighten the roads, and would make them more visible from a distance than they may be currently. Unlike transmission lines, which form straight lines and angles, access roads can curve and follow terrain. In flat areas, roads are not easily seen from a distance, but on steep slopes, especially where cut and fill is needed, roads would likely appear more obvious, unless uneven terrain allows them to be hidden on the hillside.

Maintenance activities would occur on a regular or as needed basis and would be limited to viewers intermittently seeing helicopters, trucks, equipment, and maintenance workers along rights-of-way and access roads. Similar to construction, these activities would be temporary, and would have **no-to-low** temporary impacts on visual resources.

7.3.2.3 Sundial Substation

There are no sensitive viewpoints identified with views of the Sundial substation site. There are many existing transmission lines and two existing substations in the area. The existing industrial land use, with its many industrial operations surrounding the substation site, would provide a consistent visual landscape, and it would be unlikely that a new substation would draw viewer attention. Given the similar existing visual environment and a landscape rating of low, the overall visual impact would be **low**.

7.3.3 Castle Rock Substation Sites

7.3.3.1 Casey Road

The Casey Road substation site is in a remote area of low scenic quality. The site has limited visibility and includes an existing transmission corridor with four large transmission lines. The site has low viewer sensitivity, and is not visible from any sensitive viewpoints. The visual impact of Casey Road Substation would be **low**.

> Impacts common to action alternatives are in Section 7.3.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

7.3.3.2 Baxter Road

The Baxter Road substation site sits in a small topographical depression in a remote area of low scenic quality. It is surrounded by vegetation, but also includes an existing transmission line corridor through the site. This contributes to low viewer sensitivity and no visibility from any sensitive viewpoints. The visual impact of Baxter Substation would be **low**.

7.3.3.3 Monahan Creek

The Monahan Creek substation would be visible to surrounding residents and to motorists and commuters along Delameter and Monahan roads. The substation would be within some long-range views; however, the substation would likely dominate the attention of viewers that have a foreground view, including users of Delameter Road. From beyond the immediately adjacent area, foreground vegetation would likely block views of most of the substation depending on the location of the viewer. This site also includes an existing transmission line corridor on several sides. No scenic viewpoints or designated areas would be affected. The substation would likely be visible and attract viewer attention, but not completely dominate the visual character of the landscape. Given the limited visibility of the substation and a landscape rating of low, the visual impact of Monahan Creek Substation would be **low**.

7.3.4 West Alternative

The West Alternative begins at the Monahan Creek substation site (see Section 7.2.1, West Alternative and Options). The views of the West Alternative between the Monahan Creek site and Longview would be partially or fully obstructed by vegetation and some residences. Towers would blend more readily into background views and provide less contrast and a **low** impact, except where residences are close to the transmission line. The alternative would be visible near Delameter Road and from rural residences at several locations along Hazel Dell Road and in the area of Trout Lake Road. The alternative would also be highly visible near Longview, and residents within the residential area at the south end of the West Side Highway neighborhood and across I-5 would also be able to see towers. From residences along the right-of-way, the contrast would be **high** due to the large scale of the nearby towers.

A portion of the alternative between Longview/Kelso and just north of the Lewis River runs next to existing transmission lines, which reduces scenic quality. The alternative crosses I-5 and runs through rural residential areas that decrease in density farther south along the alternative. Some residents would have a view dominated by the project, but most viewers in this area would experience a more distant view with many vegetative visual obstructions; the line would be visible, but would not completely dominate the view. Impacts to visual resources would be **moderate** because of the reduced scenic quality and the contrast of the line being visible but not totally dominant to most viewers. At local sites of higher scenic quality and viewer sensitivity such as at the Kalama, Lewis, and East Fork Lewis river crossings visual impacts would be **moderate-to-high**, especially where the removal of trees within riparian areas make towers more visible. Visual impacts would also be **high** at some local parks such as the East Fork Lewis River Greenway and Pleasant Valley Park where the alternative would have more contrast in a natural area.

Because the alternative follows an existing right-of-way, the effect of vegetation clearing, where required, would be less than where a new right-of-way is necessary. However, in many cases where homes are near the existing right-of-way, trees within and just outside the right-of-way block any views of the existing towers. Once the right-of-way is cleared and danger trees are removed, there would be no vegetative buffer between those homes and the existing and new lines; because of their large scale and proximity to viewers, the towers would dominate the view of anyone next to the right-of-way. From slightly farther away, the view would be partially obscured by trees and other houses, which would reduce the visual impact of the project on viewers. Visual impacts would be **moderate** because most views would have many other existing visual alterations in the view, which would dilute viewer sensitivity.

Residents next to the right-of-way would typically see an expanded, cleared right-of-way and taller towers, which would draw the attention of the viewer (see Figure 7-1). The typical view from neighborhoods surrounding the right-of-way would include taller, more visible towers above the houses and trees (see Figure 7-2). The typical view from Washington State University's Vancouver campus in Mt. Vista and some areas of Mt. Vista would also include new, taller towers (see Figure 7-3). Visual impacts would be **moderate** because the alternative follows an existing right-of-way that moderates the effect of vegetation clearing and the larger towers would not greatly change the character of the existing view.

The West Alternative continues to follow the existing right-of-way northeast of Vancouver. Viewers in this area would have an unobstructed view of the project. The project would be visible from the residences along NE Stoney Meadows Drive that back onto the open space and from NE 199th Avenue where some clearing of vegetation would be required and where the alternative crosses the road. Visual impacts would be **moderate** at these sites because of the existing right-of-way. The alternative would be on the south side of the existing right-of-way. The current vegetation buffer between the towers and the residential area around NE 48th Circle would be maintained and visibility from NE 48th Circle would likely be limited.

The project would be visible from the Green Meadows Golf Course, Camp Currie, and by a few residences and motorists along NE 28th Street (see Figure 7-4). The typical view from the golf course would be unobstructed; most residents in the area would have a partially obstructed view. The towers in this area would be about twice as tall as the existing towers, and would draw more attention from nearby viewers. The alternative passes through agricultural fields with open views but few viewers, and rural residential neighborhoods north of Camas. The project would be highly visible to homes next to the right-of-way and would also be visible to more distant residences. The new, larger towers would begin to dominate the surroundings (see Figure 7-5). There would be little change to vegetation in this area because little clearing would be required and the project would be near an existing transmission line. Although the towers would be larger in scale and prominent in some views, overall visual impacts in this area would be **moderate** due to an existing transmission line, little required clearing, and weak contrast in texture. At certain local sites, such as the Lacamas Prairie Natural Area, visual impacts could be **high** due to the scale of larger towers in a natural area.

The views of the alternative in the Camas and Washougal areas include unobstructed and distant views across the open, rural landscape; close-up views from roads and residences along the right-of-way in Camas; and views from SR 14. The rebuilt 230-kV lines and new 500-kV towers would be of a different shape and larger than existing towers. From the Lewis and Clark Camp National Historic Site along SR 14 the greater size and shape of the towers would not dominate the view (see Figure 7-6). Although there would be noticeable changes, they would not become dominant when compared to existing conditions. Visual impacts would be **low** because much of this area is rural and agricultural with fewer viewers. Impacts would be **moderate** at local parks and recreational areas where the contrast of larger, different shaped towers in a natural setting would be more noticeable. The West Alternative ends at the Sundial substation site.

Figure 7-1 Viewpoint 25-1: Looking North from NE Salmon Creek Avenue, Salmon Creek (West Alternative)

Existing Conditions

Simulation

Figure 7-2 Viewpoint 25-2: Looking North-Northeast from NE 76th Avenue, Walnut Grove (West Alternative)

Existing Conditions

Simulation

Figure 7-3 Viewpoint 25-3: Looking East from WSU Campus, Vancouver (West Alternative)

Existing Conditions

Simulation

The West Alternative has a uniform low scenic quality rating and high viewer sensitivity. The West Alternative would have a **moderate** impact on visual resources for most of its length, with areas of **high** impact localized to a fairly limited number of residences near the Longview/Kelso area and higher number of residents east of Vancouver. This alternative does not affect any recognized scenic areas or viewpoints, but has localized impacts on parks, areas of community greenspace, natural areas such as the Lacamas Prairie, and on a large number of residents. The overall impact of the West Alternative would be **moderate-to-high (**see Table 7-3).

Table 7-3 Visual Impact

Alternatives and Options	Visual Impact
West Alternative	**moderate-to-high**
West Option 1	N/C
West Option 2	+
West Option 3	+
Central Alternative	**low-to-moderate**
Central Option 1	N/C
Central Option 2	+
Central Option 3	+
East Alternative	**low-to-moderate**
East Option 1	+
East Option 2	N/C
East Option 3	N/C
Crossover Alternative	**low-to-moderate**
Crossover Option 1	+
Crossover Option 2	-
Crossover Option 3	-

Notes:
N/C – No net change from the action alternative.
+ Overall impact of option is higher than the impact of segments the option replaces.
- Overall impact of option is lower than the impact of segments the option replaces.

Figure 7-4 Viewpoint 41-1: Looking Northwest from NE 28th Street (West Alternative)

Existing Conditions

Simulation

Figure 7-5 Viewpoint 50-1: Looking Northwest from NE 3rd Street, North of Camas (West Alternative and Crossover Option 1)

Existing Conditions

Simulation

Figure 7-6 Viewpoint 52-1: Looking North-Northeast from Lewis and Clark Highway, Camas (All Action Alternatives)

Existing Conditions

Simulation

Figure 7-7 Viewpoint 40-1: Looking East-Southeast from Lacamas Heritage Trail Parking Area (West Option 1)

Existing Conditions

Simulation

7.3.4.1 West Option 1

West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. This portion of the alternative includes replacing one of the existing 230-kV lines with a new double-circuit 500-kV line. The existing 230-kV line and the new line would be placed on new 500-kV towers (see Figure 7-7). The new towers would be taller than the existing towers, but the need for additional right-of-way or clearing would be minimized. West Option 1 would reduce impacts on residents along NE 48th Circle and mitigate the impact on the Green Meadows Golf Course.

This option would also pass through rural fields where homes that back onto the open space along NE Stoney Meadows Drive would have a clear view of the project, since it passes over flat ground with little vegetation. West Option 1 would cross NE Goodwin Road, Camp Currie, and Camas Meadows Golf Course. The view of the project from several residential roads and homes southwest of this option would likely be unobstructed or only partially obstructed.

Impact levels on visual resources would be the same as the West Alternative (see Table 7-3).

7.3.4.2 West Option 2

West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. With no change in the right-of-way width, the visible changes would come from the larger double-circuit towers (see Figure 7-8). Near NE Zeek Road, larger towers and an increased right-of-way width is needed (see Figure 7-9). Visual impacts for West Option 2 range from low to high along its length depending on the segment. This option would increase the impact on residents along NE 48th Circle from a moderate level to high, avoid the impact on the Green Meadows Golf Course, and transfer the impact on residents along NE 28th Street farther east to Green Mountain Park and a new right-of-way.

This option would increase visual impacts, since the option would increase the amount of high impacts on several residents, would require new right-of-way, and would add line length (see Table 7-3).

7.3.4.3 West Option 3

West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing the rural residential and rural areas farther east. Visual impacts range from low to high along its length depending on the segment. West Option 3 would increase the impact on residents along NE 48th Circle from moderate to high, but avoid the impact on the Green Meadows Golf Course and to residents along NE 28th Street.

This option would increase visual impacts because it would create additional high impacts on several residents and users of Green Mountain Park, would require some new right-of-way, and would add a longer route (see Table 7-3).

7.3.5 Central Alternative

The Central Alternative begins at the Baxter Road substation site (see Section 7.2.2, Central Alternative and Options). The alternative extends southeast and crosses the Cowlitz River Valley north of Castle Rock. It would be visible to residences east of the Cowlitz River, I-5, and SR 504, and roads and residences surrounding Bond Road on the east side of I-5 as it crosses the river and extends south along the slopes on the east side of the valley.

The alternative continues southeast through sparsely populated land with few potential viewers where visual impacts are **low** until it crosses the Lewis River near Ariel. The alternative would likely be visible from some residences in Ariel and along the Lewis River with few unobstructed and more distant views. The alternative runs east from Ariel, where potential views exist from some parts of Lake Merwin, which is popular for boating, swimming, and other types of water-based recreation. There are also a few rural residences south of the lake. The combination of sensitive viewers, higher scenic resources, and sparse population causes a **moderate** impact in this area. At this point, the alternative turns south through sparsely populated land with few rural residences; visual impacts in this area would be **low**. In the vicinity of NE Zeek Road, the alternative would enter the rural residential areas north of Camas, would typically be viewed from residences or roads, and would require larger towers and additional right-of-way (see Figure 7-9). Some **moderate** impacts to a limited number of viewers would occur at local sites of higher scenic quality such as at the Washougal River crossings. The alternative crosses the town of Camas and the Columbia River to its southern end at the Sundial substation site. Because of its sparse population and rural land use, and existing lines entering Camas and crossing the Columbia River, this portion of the line is rated a **low** visual impact.

Because most of the Central Alternative runs through sparsely populated land with few sensitive viewers and low scenic quality, most impacts are **low**, with a few **moderate** impacts around Ariel, Lake Merwin, Camas (where there are parks and community greenspace), and where residents are close to the right-of-way. The overall impact of the Central Alternative would be **low-to-moderate (**see Table 7-3).

Figure 7-8 Viewpoint 48-1: Looking West-Southwest from NE 267th Avenue (West Option 2, Crossover Option 2)

Existing Conditions

Simulation

Figure 7-9 Viewpoint 51-1: Looking South from NE Zeek Road, Washougal (Central, East, and Crossover Alternatives, and West Options 2 and 3)

Existing Conditions

Simulation

7.3.5.1 Central Option 1

Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated land with few distinctive viewpoints. Impact levels on visual resources would be the same as the Central Alternative (see Table 7-3).

7.3.5.2 Central Option 2

Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. This option would add a new route running southeast from the Monahan Creek site through sparsely populated land, crossing the unincorporated community of West Side Highway next to SR 411, the Cowlitz River and I-5, and running through largely unpopulated land toward the east. The option would remove visual impacts to the area north of Castle Rock, but would introduce **high** impacts in the West Side Highway area. Central Option 2 also replaces the Baxter Road substation site, which would create low impacts, with the Monahan Creek substation site, which would create **moderate** impacts.

Impact levels on visual resources would increase from levels for the Central Alternative (see Table 7-3).

7.3.5.3 Central Option 3

Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. The crossing of the Lewis River near Ariel is in a visually sensitive area. Both the river and nearby Lake Merwin attract recreational users who are likely more sensitive to potential changes to the visual landscape. From Ariel, the view across the river to the south side of the valley would likely be partially obstructed by foreground vegetation. Where views are possible, the towers and right-of-way clearing would be noticeable, but not dominant, as the option climbs the hill on the south side of the Lewis River.

Towers would be visible near a swimming beach within the recreational area at Lake Merwin (see Figure 7-10, which shows potentially greater contrast of the line and tower during inclement weather). The new Lewis River crossing and the crossing more to the east that it replaces have similar visual impacts. This option does introduce a new right-of-way through rural residential areas southeast of Ariel, which has a higher visual impact than the segments it replaces. Visual impact at local sites, such as Lucia Falls and Moulton Falls Park at the East Fork Lewis River, would be **moderate** due to higher scenic quality and viewer sensitivity because the alternative would have greater contrast against the existing view. Potential viewing locations in this area would include rural residential homes and SR 503.

Impact levels on visual resources would increase from the Central Alternative (see Table 7-3).

Figure 7-10 Viewpoint M-1: Looking South near Swimming Beach on Lake Merwin, Ariel (Central and Crossover Alternatives)

Existing Conditions

Simulation

7.3.6 East Alternative

The East Alternative begins at the Baxter Road substation site. The alternative runs southeast and crosses the Cowlitz River valley north of Castle Rock. Where it crosses the river and travels south along the slopes on the east side of the valley, locations with potential views of the alternative include residences east of the Cowlitz River, I-5 and SR 504, and roads and residences surrounding Bond Road on the east side of I-5. Although sparsely populated, the alternative would cause **moderate** impacts at local sites due to the scenic quality of the river crossing and views from SR 504, and the sensitivity of nearby residences.

The alternative then runs farther southeast through unpopulated land toward Yale where it crosses SR 503. In this area, the alternative would likely be visible from some rural residences along the highway (see Figure 7-11). The alternative then runs south through unpopulated land and the Western Yacolt Burn State Forest until it enters rural residential areas north of Camas in the vicinity of NE Zeek Road. Typical views in this area would be from residences or roads (see Figure 7-9) with **low** impacts due to the lower scenic value, unpopulated areas, and existing transmission lines near Camas.

Within the Western Yacolt Burn State Forest, the East Alternative would pass near or over several trails popular with motorized trail users and hikers, bikers, and equestrians. These trails include the Jones Creek Trail, Jones Creek Connector A, Jones Creek Connector B, and Tarbell Trail. Impacts here are **moderate** overall, and range locally from **high** where cleared right-of-way crosses the trail (which is a location of high viewer sensitivity), to **moderate** where the line can be seen from some trail viewpoints, to **low** where trees along the trails obscure views of the line.

The alternative crosses the town of Camas and the Columbia River and ends at the Sundial substation site. Because most of the East Alternative runs through sparsely populated or unpopulated land, most impacts are **low** (although residents in the area would be sensitive to the changes), with a few **moderate** impacts to the north, in and around Camas (where there are parks and community greenspace) and through the Yacolt Burn area. The overall impact of the East Alternative would be **low-to-moderate** (see Table 7-3).

Figure 7-11 Viewpoint K-1: Looking East-Southeast from Yale Bridge Road, Ariel (East Alternative)

Existing Conditions

Simulation

7.3.6.1 East Option 1

East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. East Option 1 would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. The option would remove visual impacts in the area north of Castle Rock, but would introduce impacts where it crosses the Cowlitz River farther south, and would be visible from several residences. East Option 1 also replaces the Baxter Road substation site, which would create **low** impacts, with the Monahan Creek substation site, which would create **moderate** impacts.

East Option 1 would have a slightly higher impact on visual resources because of the substation site used (see Table 7-3).

7.3.6.2 East Option 2

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a similarly rated route farther to the west. This option could remove some visual impacts on outdoor and recreational users east of the East Alternative, but would also introduce additional impacts on rural residences along the option's route.

Impact levels on visual resources would be the same as the East Alternative (see Table 7-3).

7.3.6.3 East Option 3

East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. Impact levels on visual resources would be the same as the East Alternative (see Table 7-3).

7.3.7 Crossover Alternative

The Crossover Alternative begins at the Monahan Creek substation site, and follows the same path as the West Alternative to a point north of the Lewis River. Similar to the West Alternative (see Section 7.2.1, West Alternative and Options), most views between the Monahan Creek site and the Longview area would be partially or fully obstructed by vegetation and, in some cases, residences. The new transmission line would be visible near Delameter Road and from some rural residences in a few locations along Hazel Dell Road and rural residences near Trout Lake Road. The transmission line would run next to existing lines between Longview/Kelso and just north of the Lewis River. East of I-5, the Crossover Alternative runs through rural residential areas decreasing in density farther south. Some residents would have a view dominated by the project, but the experience of most viewers in this area would be slightly more distant; the line would be visible, but would not completely dominate the view. In general, visual impacts would be **low** for this alternative due to the relatively limited number of viewers and, near Kelso, the presence of existing lines.

The Crossover Alternative crosses the Lewis River near Ariel, farther east than the West Alternative's crossing. The alternative would likely be visible from some residences in Ariel and along the Lewis River. However, there would be few unobstructed and more distant views. As the alternative runs east from Ariel, potential views exist from some parts of Lake Merwin and some rural residences south of the lake. The alternative crosses SR 503 just south of the Lewis River and then turns south, crossing unpopulated land with few potential viewers. In the vicinity of NE Zeek Road, the alternative enters the rural residential areas north of Camas where typical views would be from residences or roads, and larger towers and increased right-of-way width is needed (see Figure 7-9). The alternative crosses Camas and the Columbia River and ends at the Sundial substation site. This portion of the alternative south of the Lewis River has somewhat greater (**moderate**) effects because of the sensitive viewers from the Lewis River area and Lake Merwin, although the final portion through Camas and the Columbia River crossing follow existing lines.

The Crossover Alternative would have a **low-to-moderate** visual impact for most of its length. Localized visual impacts to a limited number of residences would likely be found in the community of West Side Highway. This alternative does not impact any recognized scenic areas or viewpoints, but has localized impacts on parks and areas of community greenspace. The overall impact of the Crossover Alternative would be **low-to-moderate** (see Table 7-3).

7.3.7.1 Crossover Option 1

Crossover Option 1 would remove a portion of the alternative crossing north–south through rural residential areas north of Camas between NE Zeek Road and SE 23rd Street, and replace it with a route running west along an existing right-of-way until about NE 232nd Avenue, then southeast through more natural areas of the Lacamas area, open fields and more rural residential areas. The option would remove visual impacts in the areas around NE Zeek Road and NE Blair Road; however, it would introduce additional impacts on the residences in the area around NE 267th Avenue (see Figure 7-8). With no change in the right-of-way width, visible changes would result from the larger double-circuit towers. The new, larger towers would dominate the surroundings (see Figure 7-5). There would be little change to vegetation in this area because little clearing would be required and the project would be near an existing transmission line.

Crossover Option 1 would have a higher impact on visual resources because it adds a new route that, while rated the same as the route it replaces, is longer (see Table 7-3).

7.3.7.2 Crossover Options 2 and 3

Crossover Option 2 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land. The option does add additional segments, but would use a substation site with potentially lower visual impacts than the Monahan Creek substation site. Crossover Option 3 is similar, except that parts of the route would require additional right-of-way parallel to the existing line instead of within the right-of-way.

Crossover Options 2 and 3 would have lower impacts on visual resources than the alternative because of the different substation location (see Table 7-3).

7.3.8 Recommended Mitigation Measures

Mitigation measures are included as part of the project (see Table 3-2). The following additional mitigation measures have been identified to further reduce or eliminate adverse impacts on visual resources by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Site new towers next to or near existing towers and use a similar tower type. This would lessen visual clutter that can occur when different types of towers are visible in a vast open landscape.
- Site new towers to take advantage of existing screening offered by topography or vegetation, e.g., avoid ridgetops where practicable.
- Set towers back from road crossings, to minimize intrusion on views along road corridors.
- Preserve existing vegetation along the roadway to screen transmission lines and towers. Allow dense masses of shrubs to grow parallel to the roadway where the transmission line right-of-way crosses.
- Integrate revegetation activities with the construction schedule to ensure the quickest site rehabilitation.
- Minimize access road placement in highly sensitive areas.

7.3.9 Unavoidable Impacts

After mitigation, vegetation clearing, transmission towers, access roads and substations would still be visible to residents, motorists, and recreationists from many locations.

7.3.10 No Action Alternative

Under the No Action Alternative, existing visual resource conditions would continue (see Section 7.2, Affected Environment). Transmission lines in existing rights-of-way, substations, and access roads would continue to be visible to surrounding viewers. In areas without existing transmission lines, other existing and future alterations would continue to occur, such as commercial forest harvest, urban development, and road and rail operation and expansion.

Chapter 8 Electric and Magnetic Fields

This chapter defines **electric and magnetic fields** and discusses typical field levels, what factors affect field strength, safety standards (if any), and expected average and maximum fields along the action alternatives. It also discusses potential corona-caused interference with broadcast radio or television (TV) signals and implanted medical devices.

Words in bold and acronyms are defined in Chapter 32, Glossary and Acronyms.

8.1 Affected Environment

Electric and magnetic fields (EMF) exist everywhere electricity is used. Fields vary widely throughout the project area, depending on proximity to electronic devices or electrical lines and intervening landscape or walls. In general, existing EMF levels are higher in developed areas with electrical lines and buildings with electrical wiring, electrical equipment, and appliances.

Transmission lines, like all electric devices, produce EMF. **Current**, the flow of electric charge in a wire, produces the magnetic field. Voltage, the force that drives the current, is the source of the electric field. The strength of EMF around existing lines throughout the project area depends on the design of the electrical line and distance from it.

Corona is caused by strong electric fields at the surface of conductors. Throughout the project area, corona can occur on existing transmission lines during foul weather when the conductors are wet. Corona produces audible noise (see Chapter 9, Noise) and electromagnetic interference (static) that can affect AM radio or broadcast TV signals. The level of interference depends on the distance that the radio or TV is from the transmission line and the strength of the radio or TV signal being received. Signal reception is dependent on the strength of the signal generated from the radio or TV tower, and the distance from that tower to the receiver. In general, remote rural areas are farther from tower transmitters and more likely to receive a weak signal. This does not apply to reception via cable or satellite TV or radio, or FM radio frequencies. Generally, interference from corona would be higher if the radio or TV is closer to the transmission line but less if the signal is weaker.

8.1.1 Electric Fields

Electric fields are measured in **volts** per meter (V/m) or **kilovolts** per meter (kV/m). Throughout a home, the average electric field strength from wiring and appliances can range from 5 to 20 V/m, but is often less than 10 V/m (Bracken 1990). Localized fields near a small household appliance can range from 30 to 60 V/m, but field strengths drop off sharply with distance from the source. Electric-field levels in public buildings such as shops, offices, and malls are comparable with residential levels. Outdoor electric fields in publicly accessible places can range from 1 V/m to 12 kV/m, with the higher fields present near high-voltage transmission lines of 500 kV or greater. Electric field strength is reduced by objects such as walls and vegetation.

General guidelines for both electric and magnetic exposure have been established by several national and international organizations (see Appendices F and G). Electric field guidelines for public exposure range from 4.2 to 5 kV/m. In one guideline, the limit on transmission line rights-of-way is 10 kV/m. Occupational exposure guidelines (i.e., for employees in the workplace) range from 8.3 to 25 kV/m. There are no national standards for electric fields from transmission lines, and the state of Washington has no electric field limit. Oregon's Energy Facility Siting Council (EFSC) has established a limit of 9 kV/m within the right-of-way (there is no edge of right-of-way limit). BPA requires new transmission lines to meet its electric field guideline of 9 kV/m maximum on the right-of-way and 2.5 kV/m maximum at the edge of the right-of-way. BPA also specifies maximum-allowable electric field strengths of 5 kV/m for road crossings, 3.5 kV/m for shopping center parking lots, and 2.5 kV/m for commercial and industrial parking lots.

8.1.2 Magnetic Fields

Magnetic fields are measured in units of **gauss** (G) or **milligauss** (mG), with 1 G being equal to 1,000 mG. Average magnetic field strength in most homes (away from electrical appliances and wiring) is typically less than 2 mG. However, appliances carrying high current or those with high-torque motors, such as microwave ovens, vacuum cleaners or hair dryers, may generate fields of tens or hundreds of milligauss directly around them (see Table 8-1). Office workers operating electric equipment and industrial workers can be exposed to similar or higher magnetic fields. Outdoor magnetic fields in publicly accessible places can range from less than 1 mG to about 1,000 mG (i.e., about 1 G), with the highest levels localized near devices powered by large electric motors.

Table 8-1 Typical Magnetic Field Levels

Appliance[1]	Magnetic Field Range (mG)[2]
Can Opener	40–300
Vacuum Cleaner	20–200
Microwave Oven	1–200
Hairdryer	0.1–70
Power Drill	20–40
Television	0–20
Computer Monitor	2–6

Notes:
1. Applies to plug-in devices.
2. At a distance of 1 foot.
Source: NIEHS 2002

Like electric fields, magnetic fields fall off with distance from the source. Unlike electric fields, however, magnetic field strength is not reduced by intervening common objects such as walls and vegetation. Consequently, though appliances can produce high localized magnetic fields, transmission lines serving neighborhoods and distribution lines serving individual homes or businesses can contribute to longer-term magnetic field exposure at much lower levels.

There are no national standards for magnetic fields, and Oregon, Washington and BPA do not have magnetic field limits for transmission lines. Guidelines created by national and international organizations range from 833 to 9,040 mG for public magnetic-field exposure and from 4,200 to 27,100 mG for occupational magnetic-field exposure (see Appendices F and G).

8.1.3 Electromagnetic Interference

If corona is present at the surface of transmission line conductors, it generates electromagnetic interference that can affect reception of broadcast radio and TV signals close to the right-of-way. This affects only conventional broadcast radio and TV receivers operating at lower frequencies (AM radio and TV channels 2 to 6). With the introduction of digital television technology, the broadcast frequencies for affected channels have been raised and corona interference with these television signals is no longer a potential problem. Satellite and cable TV systems are not affected, nor are FM radio signals.

Electromagnetic interference is generally from transmission lines operating at voltages of 345 kV or higher. However, sparks occurring in gaps between loose hardware and loose wires on distribution lines and low-voltage wood-pole transmission lines are a more common (95 percent) source of interference than corona from high-voltage electrical systems (USDOE 1980). This gap-type interference is primarily a fair-weather phenomenon and is easily remedied by line maintenance, relocation of a radio or TV antenna, or use of a directional antenna.

In the U.S., electromagnetic interference from transmission systems is governed by the Federal Communications Commission (FCC), which requires the operator of any device that causes "harmful interference" to take prompt steps to eliminate it (FCC 1988; see also Appendix F). There are no state limits for electromagnetic interference.

8.2 Environmental Consequences

General electric and magnetic field effects are discussed below, followed by specific electric and magnetic field calculations and discussion for each action alternative.

8.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- The electric field levels would induce a large enough current on objects on the right-of-way to exceed limits set by the National Electric Safety Code (NESC)
- Shocks would approach dangerous levels

Impacts would be **moderate** where project activities would cause the following:

- The electric field levels would violate BPA policies, but meet the NESC
- Shocks would be unpleasant, but would not be dangerous

- Impacts would be **low** where project activities would cause the following:
  - The electric field levels would meet BPA policies and the NESC
  - Perceptible nuisance shocks may occur when touching metallic objects on the right-of-way; these shocks would not be hazardous, but may still cause discomfort

No impact would occur if shocks were not perceptible or electric field levels would not increase over existing levels.

Because studies have provided insufficient or inconclusive evidence about the potential health impacts of magnetic fields (see Section 8.2.2.2, Magnetic Fields), and because there are no national or regional standards for magnetic fields, BPA has not defined impact levels for magnetic fields.

8.2.2 Impacts Common to Action Alternatives

8.2.2.1 Electric Fields

Transmission lines, like all electrical wiring, can cause serious electric shocks if certain precautions are not taken. All BPA lines are designed and built to meet or exceed the NESC, which specifies the minimum allowable distance between conductors and the ground or other objects. These requirements determine the minimum distance to the edge of the right-of-way and the minimum height of the line, that is, the closest point that houses, other buildings, and vehicles are allowed to the line. These clearances are specified to prevent harmful shocks to workers and the public.

BPA also does not permit any uses within rights-of-way that are unsafe or might interfere with safely constructing, operating, or maintaining the transmission facilities. These restrictions are part of the legal rights BPA acquires for its transmission line easements.

However, people working or living near transmission lines must also take certain precautions. In general, when under a transmission line, a person should never put themselves or any object higher than 14 feet above ground. For example, it is important never to bring conductive materials—including TV antennas, irrigation pipes or water streams from an irrigation sprinkler—too close to the conductors as serious shocks or electrocution can occur. Also, vehicles should not be refueled under or near conductors. A free BPA booklet describes safety precautions for people who live or work near transmission lines (see *Living and Working Safely around High-Voltage Transmission Lines* available at http://www.bpa.gov/corporate/pubs/Public_Service/LivingAndWorking.pdf.

Besides serious shocks, transmission lines can also cause nuisance shocks when a grounded person touches an ungrounded object under or near a line, or when an ungrounded person touches a grounded object. BPA takes additional precautions to minimize nuisance shocks. Fences and other metal structures on and near the right-of-way would be grounded during construction. After construction, BPA would respond to any complaints and install or repair grounding as needed. Nuisance shocks from mobile objects that cannot be grounded permanently are minimized by conductor clearance codes and design practices, such as BPA's 5 kV/m electric field requirement for road crossings and 2.5 to 3.5 kV/m limit for parking lots.

For the action alternatives, standard minimum clearance of the conductors above ground would be 35 feet at a conductor temperature of 122°F (50°C). This standard minimum clearance would also ensure that the BPA criterion for maximum electric fields of 9 kV/m at 50°C is met.

Because of the many precautions BPA would take to minimize the risk of serious or nuisance shocks to nearby residents and passers-by, the project would create **no-to-low** impacts.

8.2.2.2 Magnetic Fields

Decades of scientific studies are inconclusive as to whether magnetic fields can potentially cause health effects. A review of these studies and their implications for health-related effects is provided in Appendix G. In summary, the scientific studies and reviews of research on the potential health effects of power line electric and magnetic fields have found there is insufficient evidence to conclude exposure to either field leads to long-term health effects, such as adult cancer, neurodegenerative diseases (such as Alzheimer's or Lou Gehrig's disease), or adverse effects on reproduction, pregnancy, or growth and development of an embryo. Uncertainties do remain about possible links between childhood leukemia and childhood magnetic field exposures at levels greater than 3-4 mG. There are also suggestions that short-term exposures to magnetic fields greater than 16 mG may be related to an increased risk of miscarriage. However, animal and cellular studies provide limited support for the idea that statistical associations observed in epidemiology studies reflect a causal relationship between magnetic field exposure and an increased risk of childhood cancer or miscarriage.

An increase in public exposure to magnetic fields could occur if the project causes field level increases and if residences or other structures draw people to these areas. The predicted field levels discussed under each action alternative are only indicators of how the project would affect the overall magnetic field environment. They are not measures of risk or impacts on health. No impact levels are stated because, unlike in other resource chapters in this EIS, no basis exists for determining them (see Section 8.2.1, Impact Levels).

8.2.2.3 Implanted Medical Devices

Because EMF from various sources (including automobile ignitions, appliances and possibly transmission lines) can interfere with implanted cardiac pacemakers, manufacturers are now designing devices to be immune from such interference. However, a few models of older pacemakers still in use could be affected by EMF from transmission lines. Many pacemaker models are unaffected by fields larger than those found under transmission lines.

No government EMF limits exist to guide pacemaker wearers. However, because of the known potential for interference with some older pacemakers, EMF field limits for pacemaker wearers in occupational areas have been established by the American Conference of Governmental Industrial Hygienists (ACGIH). The ACGIH recommends that, if unsure about their pacemakers, wearers of these and similar medical-assist devices should limit their exposure to electric fields of 1 kV/m or less and to magnetic fields of 1,000 mG or less (ACGIH 2008).

Electric fields from the proposed 500-kV line would generally meet ACGIH limits beyond about 30 feet from the edge of the rights-of-way. Wearers of pacemakers and similar medical-assist devices are discouraged from unshielded right-of-way use. A driver or passenger in an automobile under the line would be shielded from the electric field. Magnetic fields would be well below ACGIH limits. For additional discussion about potential interference with implanted devices, see Appendix G.

8.2.2.4 Electromagnetic Interference

For each action alternative, potential corona-caused electromagnetic interference levels that could affect radio or TV reception were calculated for fair and foul weather conditions (see Appendix F). Radio interference calculations show that levels would be at or below acceptable limits for avoiding interference. TV interference levels would be comparable to, or less than, interference levels from other BPA 500-kV lines.

Recent conversion to digital television technology has made TV reception much less susceptible to corona-generated interference. Because of this conversion, the lower-channel stations (Channels 2 to 6), where interference could occur, now transmit at higher frequencies where corona-generated interference has not been a problem. The likelihood of TV interference due to corona is greatly reduced from just a few years ago and is anticipated to occur very rarely, if at all, along the right-of-way. The bundle of three conductors used for each phase of the proposed 500-kV transmission line would also minimize corona generation and further prevent radio and TV interference. In the event interference does occur, BPA has a mitigation program to correct it and would restore reception to the same or better quality.

Corona-generated interference can conceivably cause disruption on other communications bands. However, interference is unlikely with newer devices (cell phones and GPS units) that operate with digital signals and at frequencies well above those where corona-generated interference is prevalent. Mobile-radio communications are not susceptible to transmission-line interference because they are generally frequency modulated (FM). In the unlikely event that interference occurs with these or other communications, mitigation can be achieved with the same techniques used for TV and AM radio interference. To comply with FCC regulations, BPA would work with owners and operators of communications facilities along the action alternatives to identify and implement mitigation measures in the event of interference from the new line.

Magnetic fields can also distort images on older video display monitors with cathode ray tubes. This is unlikely to occur at magnetic field levels found very close to (within about 100 feet of) the transmission line right-of-way. If these effects occur, such interference can be remedied by moving the monitor to another location or replacing it with a contemporary flat-panel device such as a liquid-crystal or plasma display. The latter are not affected by magnetic fields.

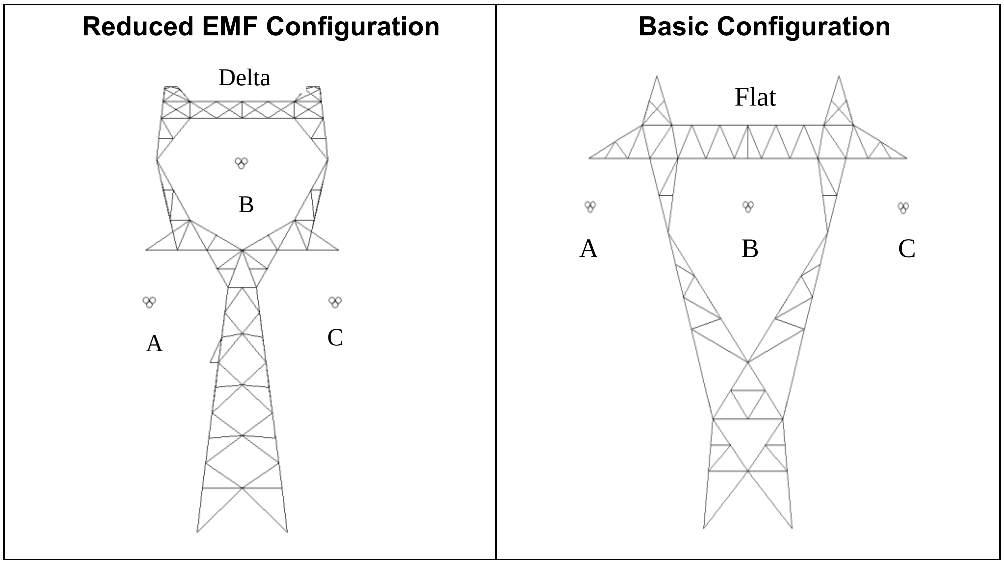
8.2.2.5 Designing Lines to Reduce EMF

When BPA builds new high-voltage 500-kV transmission lines, the agency designs them using “EMF mitigation” techniques to keep EMF exposure as low as reasonably achievable, while maintaining system reliability.

For example, BPA uses “delta configuration” tower designs for single-circuit lines, where the three phase conductor bundles (called A, B, and C) are positioned in a triangular shape (two on the bottom, one on top) (see Figure 8-1). This configuration provides for more EMF cancellation effects than the more traditional “flat configuration,” where the three phase conductor bundles are arranged horizontally and all are at the same height above ground.

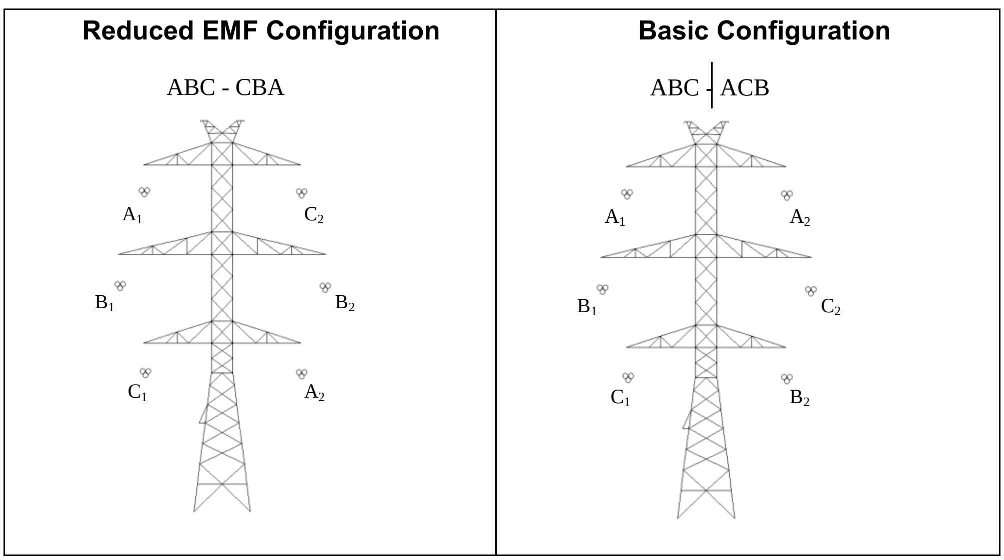
For double-circuit lines (two transmission line circuits on the same tower; six phase conductor bundles instead of three), BPA uses a “phase-optimization” approach to minimize EMF levels, when feasible. Generally, three phase conductor bundles of one line circuit are placed vertically on the left side of the tower and the three phase conductor bundles of the other circuit are placed vertically on the right side (see Figure 8-2). Such phasing arrangements for the two circuits can result in some EMF cancellation. The actual reduction of electric fields depends on the circuit voltages; the reduction of magnetic fields depends on the direction of the power flow and magnitude of the current.

Figure 8-1 Single-Circuit Tower Design to Reduce EMF



For the few short segments where triple-circuit towers would be required, each segment would be individually considered to minimize EMF.

Figure 8-2 Double-Circuit Tower Design to Reduce EMF



8.2.2.6 Substation Sites

Both electric and magnetic fields at the perimeter of the Sundial substation site and any Castle Rock substation site would reflect fields generated by the new 500-kV line, with the same magnitudes and impacts (see Section 8.2.2, Impacts Common to Action Alternatives). Within several hundred feet of the transmission line or substation fence, these fields would dissipate to ambient levels.

8.2.3 EMF Calculations

Impacts common to action alternatives are in Section 8.2.2. The remaining sections discuss methods used to calculate electric and magnetic fields, impacts unique to each alternative, and recommended mitigation measures.

EMF levels were calculated for every line section within route segments for each alternative and option (see Appendix F). The information in Appendix F can be used to pinpoint predicted EMF levels at properties along any of the action alternatives. The average of these field levels was computed across the length of the action alternatives to provide an overall measure of EMF for each alternative and option.

8.2.3.1 Electric Fields

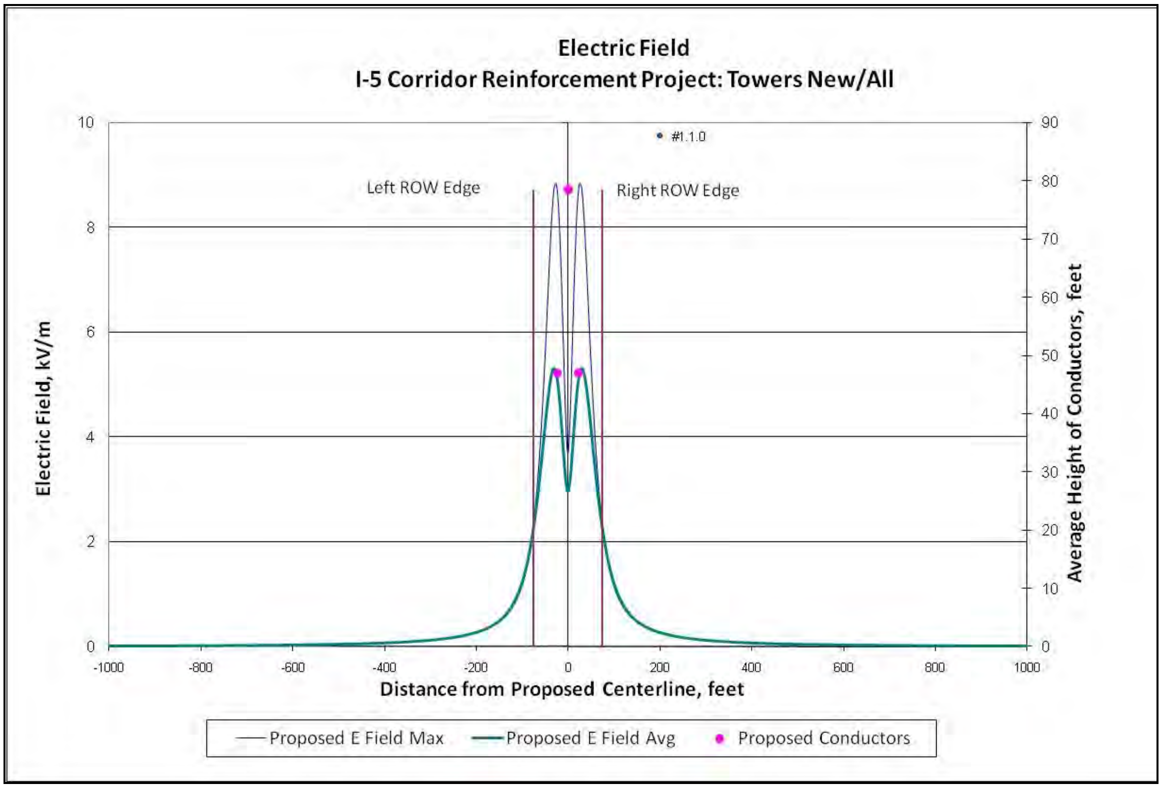
Electric fields for each route segment, and for each line section within a segment, were calculated for their value on the right-of-way and their value at the edge of the right-of-way. Fields at these two locations were calculated under two operating scenarios that result in different conductor heights (and therefore different potential field strengths) above ground.

The first scenario produces the lowest allowed conductor height of 35 feet. It assumes a conductor temperature of 122°F (50°C) and that the line is operating at maximum voltage (550 kV) and carrying maximum current (1,080 Amperes [A]). Though this allows maximum electric fields to be calculated directly under the line and at the edge of right-of-way, it represents a situation that would rarely occur. Actual line height is generally above minimum clearance levels, actual voltage is generally lower than maximum, and vegetation within and near the edge of the right-of-way tends to shield electric fields at ground level. Electric fields calculated under this scenario are considered maximum levels.

The second scenario assumes an average conductor height of 47 feet (averaged along an entire span) and average current (324 A), but still assumes a maximum voltage (550 kV) to ensure conservative calculations (highest possible electric field levels under average conditions). These conditions more closely correspond to normal operating conditions with lower temperatures and average currents. Electric fields calculated under this scenario are considered average levels.

To provide summary measures of the fields for each alternative and option, the edge of right-of-way fields from all segments in alternatives and options were combined in a length-weighted average. (In the length-weighted average, the fields for the longest/shortest segments are given the most/least weight, respectively, in computing average values.) The results summarize the field levels on and at the edge of the right-of-way under extreme (maximum) and normal (average) conditions by alternative and option. (See Figure 8-3 for a visual example of maximum and average [normal] electric fields along all portions of action alternatives on new right-of-way. See figures in Appendix F for fields created in route segments on existing right-of-way.)

Figure 8-3 Electric Fields Surrounding the Transmission Line on New Right-of-Way[1]

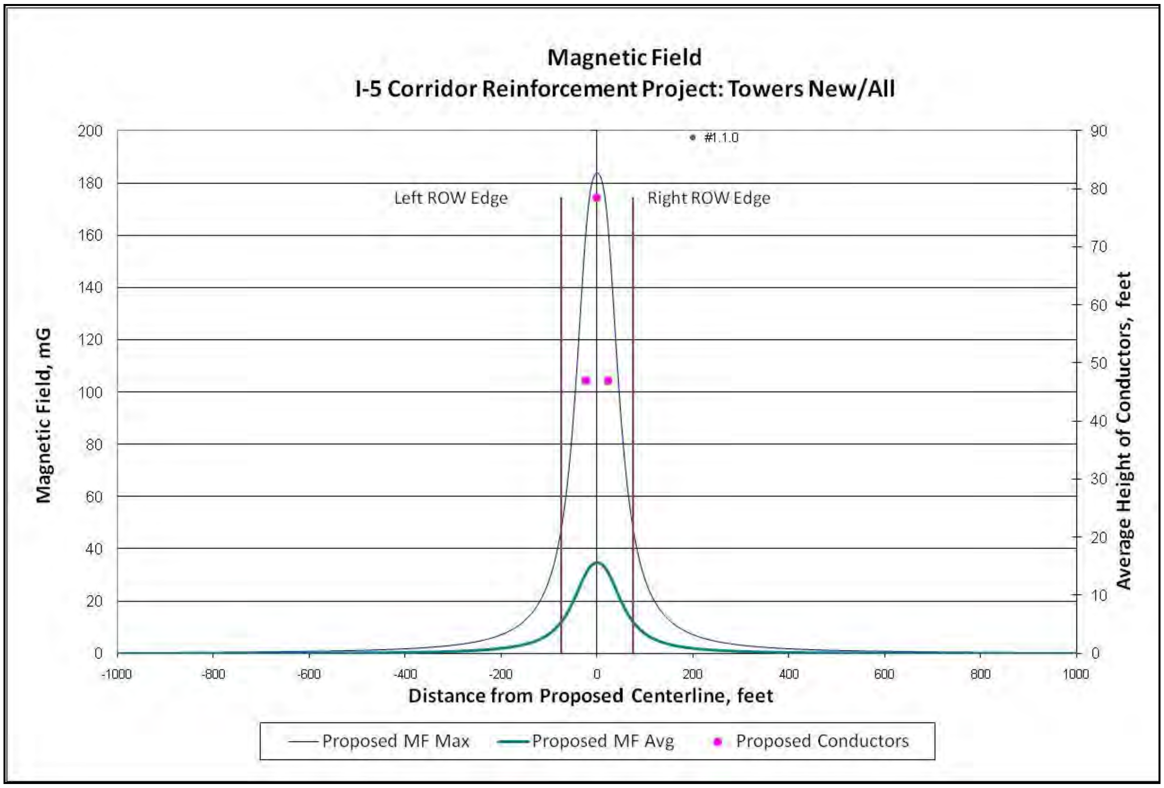


[1] This is identified as field calculation 1.1.0 in the tables in Appendix F, where the numeric values can be found.
Source: Bracken 2011 (see Appendix F)

8.2.3.2 Magnetic Fields

Maximum and average magnetic fields were calculated using the same two operating scenarios as for electric fields. As with electric fields, the summary measures for alternatives and options represent length-weighted averages over all segments in the alternative or option. (See Figure 8-4 for a visual example of maximum and average [normal] magnetic fields along all route segments in new right-of-way. See figures in Appendix F for fields created along route segments in existing right-of-way.) These calculations take into consideration that portions of the action alternatives would share rights-of-way with existing lines, or in some cases could replace those lines. In other words, they represent the total projected magnetic fields along the rights-of-way, not net gains or losses in fields.

Figure 8-4 Magnetic Fields Surrounding the Transmission Line on New Right-of-Way[1]



[1] This is identified as field calculation 1.1.0 in the tables in Appendix F, where the numeric values can be found.
Source: Bracken 2011 (see Appendix F)

8.2.4 West Alternative and Options

The West Alternative and options would be mostly in (98 percent) existing right-of-way, which crosses the highest proportion (17 percent) of populated area compared to the other action alternatives—about 7 percent urban/suburban and 10 percent rural areas. Most of the rural area is undeveloped. Beyond the right-of-way, from the right-of-way edge out to 1,000 feet on either side of the line, the West Alternative and options would be located near a greater percentage of property zoned for residential use than the other action alternatives: about 46 percent. As a result, a greater number of people would live near or pass by the West Alternative and options than the other action alternatives. (This is also substantiated by housing counts—see Table 5-1.)

Distance-weighted maximum electric fields on the rights-of-way for the West Alternative and options would range from 8.8 to 8.9 kV/m (see Table 8-2). These values,

Table 8-2 West Alternative and Options—Length-Weighted Average Electric and Magnetic Field Levels

West Alternative				Electric Field (kV/m)		Magnetic Field (mG)	
Right-of-Way	Length (miles)[1]	Field Location	Field Descriptor[2]	Proposed Action	No Action	Proposed Action	No Action
New	1.4	On right-of-way	Average	5.3	—	35	—
			Maximum	8.8		184	
		Edge of right-of-way	Average	2.3		12	
			Maximum	2.3		48	
Existing	64.2	On right-of-way	Average	5.4	2.0	36	24
			Maximum	8.8	3.8	182	134
		Edge of right-of-way	Average	1.4	0.5	10	5
			Maximum	1.4	0.5	36	21
West Option 1[3]				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	2.0 (0.3)	Same as new right-of-way values shown above for West Alternative					
Existing	1.1 (2.7)	On right-of-way	Average	5.6	2.3	28	19
			Maximum	8.9	4.6	139	94
		Edge of right-of-way	Average	0.6	0.6	10	4
			Maximum	0.6	0.5	35	13
West Option 2				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	1.7 (1.0)	Same as new right-of-way values shown above for West Alternative					
Existing	7.3 (6.1)	On right-of-way	Average	5.6	2.4	35	32
			Maximum	8.8	4.4	158	119
		Edge of right-of-way	Average	1.0	0.8	10	8
			Maximum	1.1	0.8	34	23
West Option 3				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	1.5 (1.0)	Same as new right-of-way values shown above for West Alternative					
Existing	11.5 (6.1)	On right-of-way	Average	5.6	2.8	41	43
			Maximum	8.8	5.2	163	136
		Edge of right-of-way	Average	1.3	0.6	12	9
			Maximum	1.3	0.5	35	21

Notes:
1. Lengths in parentheses are for the original segments in the West Alternative that would be replaced by the option. The total lengths include only those segments used in the calculation of averages and, in some cases, are slightly less than the lengths in Table 4-1.
2. All field descriptors are segment-length-weighted means of the fields on or at the edge of the right-of-way. The values for the edge of right-of-way are computed from fields on both sides of the route. Average electric fields are computed for maximum voltages and average clearances along the route; likewise, average magnetic fields are computed for average currents and average clearances. Maximum electric fields are computed for maximum voltages and minimum clearances; maximum magnetic fields are computed for maximum currents and minimum clearances.
3. The field levels for all West options are very similar to those in the segments they would replace. The inclusion of one of these options would not significantly affect the overall mean field levels for the alternative.

Source: Bracken 2011 (see Appendix F)

which occur only in small areas directly beneath conductors at the lowest clearance, meet BPA's criterion for maximum electric fields of 9 kV/m. The maximum fields for all route segments and line sections within segments would also meet the BPA criterion. Under normal (average) conditions, the highest fields would range from 5.3 to 5.6 kV/m.

At the edge of the right-of-way, under both extreme (maximum) and normal (average) conditions, electric fields for the West Alternative and options would range from 0.6 to 1.4 kV/m on existing right-of-way and 2.3 kV/m on new right-of-way, meeting BPA's guidelines of 2.5 kV/m. (Maximum and average electric field calculations for individual route segments and line sections within segments can be found in Appendix F.) These electric field levels would be comparable to or less than those from existing 500-kV lines in the area and elsewhere, and would cause **no-to-low** impacts (see Section 8.2.2.1, Electric Fields).

Maximum magnetic fields on the rights-of-way for the West Alternative and options would range from 139 to 182 mG on existing right-of-way (184 mG on new right-of-way). Under normal (average) conditions, the highest magnetic fields would range from 28 to 41 mG (35 mG on new right-of-way).

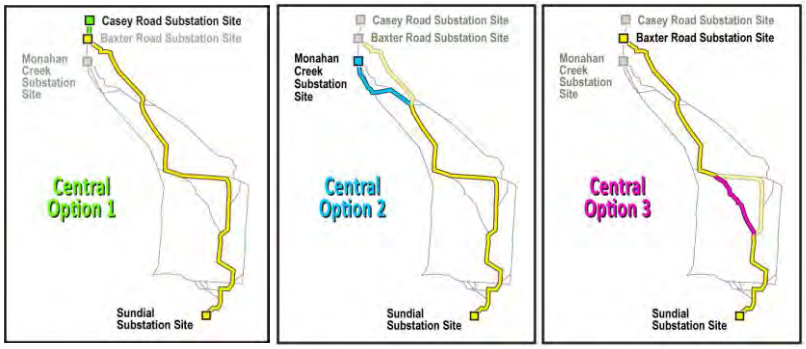
At the edge of rights-of-way, the maximum magnetic fields for the West Alternative and options would range from 34 to 36 mG; under normal conditions, the highest fields would range from 10 to 12 mG (see Table 8-2). (Magnetic field calculations under maximum and normal conditions, for individual route segments and line sections within segments, can be found in Appendix F.) If more than one line is present in a segment, the maximum and normal fields would depend on the relative electrical phasing of the conductors and the relative direction of power flow in the lines.

Beyond the edge of rights-of-way, magnetic fields decrease quickly with distance. For example, a maximum magnetic field of 48 mG at the edge of right-of-way (75 feet from centerline) would drop to 13 mG at a distance of 150 feet from centerline, and to 3 mG at 300 feet. For the same example, the average field would drop from 12 mG at the edge of the right-of-way to 4 mG at 150 feet, and to 1 mG at 300 feet. This means that beyond a few hundred feet, transmission line magnetic fields approach common ambient levels and would be far less than those encountered near common household appliances or directly under the line.

8.2.5 Central Alternative and Options

The Central Alternative and options would mostly use new right-of-way (about 90 percent) that would cross predominantly forest land (around 90 percent of land use crossed). Only 3 percent of the land crossed by the right-of-way would be populated—1 percent urban/suburban and 2 percent rural areas (4 percent for Central Option 2). About 14 percent of the land beyond the right-of-way (out to 1,000 feet) is zoned for residential use. Fewer people would live near or pass by this action alternative than the West Alternative.

Maximum electric fields on the rights-of-way for the Central Alternative and options would range from 8.8 to 9.0 kV/m (see Table 8-3), meeting BPA's criterion for maximum electric fields of 9 kV/m. The maximum fields for all route segments and line sections within segments would also meet the BPA criterion. Under normal (average) conditions, the highest fields would range from 5.3 to 5.5 kV/m.



At the edge of the right-of-way, electric fields for the Central Alternative and options would range from 1.1 to 2.4 kV/m (2.3 kV/m on new right-of-way) under both extreme (maximum) and normal (average) conditions, meeting BPA's guidelines of 2.5 kV/m. (Maximum and average electric field calculations for individual route segments and line sections within segments can be found in Appendix F.) Like the West Alternative, these electric field levels would be comparable to or less than those from existing 500-kV lines in the area and elsewhere, with a similar **no-to-low** impact.

Maximum magnetic fields on the rights-of-way for the Central Alternative and options would range from 175 to 257 mG (184 mG on new right-of-way). Under normal (average) conditions, the highest magnetic fields would range from 33 to 62 mG (35 mG on new right-of-way).

At the edge of rights-of-way, the maximum magnetic fields for the Central Alternative and options would range from 27 to 59 mG; under normal conditions, the highest fields would range from 7 to 15 mG (see Table 8-3). (Magnetic field calculations under maximum and normal conditions, for individual route segments and line sections within segments, can be found in Appendix F.) Maximum and normal fields would depend on the number of transmission lines present, the relative electrical phasing of the conductors and the relative direction of power flow in the lines. Beyond the edge of rights-of-way, magnetic fields would decrease quickly with distance, approaching common ambient levels within a few hundred feet. This means that beyond a few hundred feet, transmission line magnetic fields approach common ambient levels and would be far less than those encountered near common household appliances or directly under the line.

Table 8-3 Central Alternative and Options—Length-Weighted Average Electric and Magnetic Field Levels

Central Alternative				Electric Field, kV/m		Magnetic Field, mG	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	69.5	On right-of-way	Average	5.3	—	35	—
			Maximum	8.8		184	
		Edge of right-of-way	Average	2.3		12	
			Maximum	2.3		48	
Existing	6.8	On right-of-way	Average	5.4	2.1	33	31
			Maximum	8.9	3.8	175	135
		Edge of right-of-way	Average	1.1	1.0	9	11
			Maximum	1.1	1.0	32	36

Central Option 1[3]				Electric Field, kV/m		Magnetic Field, mG	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	0	Same as edge of right-of-way values shown above for Central Alternative					
Existing	2.5 (0.0)	On right-of-way	Average	5.5	5.5	62	49
			Maximum	9.0	9.0	257	235
		Edge of right-of-way	Average	2.3	1.4	15	10
			Maximum	2.4	1.5	59	40
Central Option 2				**Electric Field, kV/m**		**Magnetic Field, mG**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	15.0 (18.0)	Same as edge of right-of-way values shown above for Central Alternative					
Existing	0.4 (0.0)	On right-of-way	Average	5.5	2.0	34	11
			Maximum	8.8	3.7	180	78
		Edge of right-of-way	Average	1.6	0.7	7	3
			Maximum	1.7	0.8	27	15
Central Option 3				**Electric Field, kV/m**		**Magnetic Field, mG**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	14.9 (20.8)	Same as edge of right-of-way values shown above for Central Alternative					
Existing	0	On right-of-way	Average	—	—	—	—
			Maximum				
		Edge of right-of-way	Average				
			Maximum				

Notes:

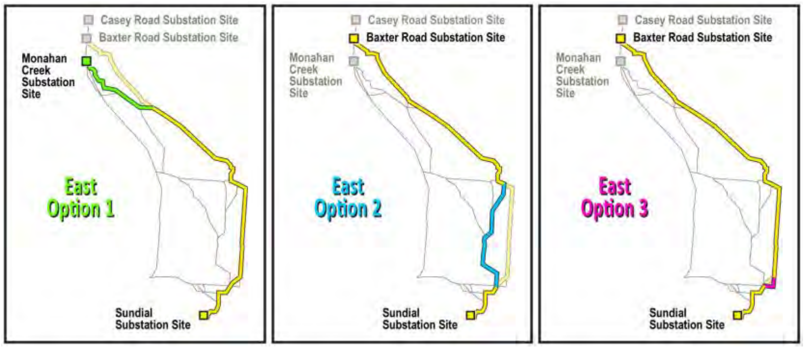
1. Lengths in parentheses are for the original segments in the West Alternative that would be replaced by the option. The total lengths include only those segments used in the calculation of averages and, in some cases, are slightly less than the lengths in Table 4-1.
2. All field descriptors are segment-length-weighted means of the fields on or at the edge of the right-of-way. The values for the edge of right-of-way are computed from fields on both sides of the route. Average electric fields are computed for maximum voltages and average clearances along the route; likewise, average magnetic fields are computed for average currents and average clearances. Maximum electric fields are computed for maximum voltages and minimum clearances; maximum magnetic fields are computed for maximum currents and minimum clearances.
3. The segments in the Central options do not replace any existing segments. Using one of these options would not significantly affect average field levels for the alternative. However, there would be localized increases in magnetic fields for Central Option 1.

Source: Bracken 2011 (see Appendix F)

8.2.6 East Alternative and Options

Similar to the Central Alternative, the East Alternative and options would primarily use new right-of-way (about 90 percent) that would mostly cross forest land (around 90 percent of land use crossed). Only 3 percent of the land crossed by the right-of-way would be populated—about 1 percent urban/suburban and 2 percent rural areas (4 percent for East Option 1). About 7 percent of the land beyond the right-of-way (out to 1,000 feet) is zoned for residential use, the lowest of all action alternatives. Fewer people would live near or pass by this action alternative than the West Alternative.

Maximum electric fields on the rights-of-way for the East Alternative and options would range from 8.8 to 8.9 kV/m (see Tables 8-4), meeting BPA's criterion of 9 kV/m. The maximum fields for all route segments and line sections within segments would also meet the BPA criterion. Under normal (average) conditions, the highest fields would range from 5.3 to 5.7 kV/m.



At the edge of the right-of-way, electric fields for the East Alternative and options would range from 1.1 to 1.4 kV/m on existing right-of-way (2.3 kV/m on new right-of-way) under both extreme (maximum) and normal (average) conditions, meeting BPA's guidelines of 2.5 kV/m. (Maximum and average electric field calculations for individual route segments and line sections within segments can be found in Appendix F.) Similar to the other action alternatives, these electric field levels would be comparable to or less than those from existing 500 kV lines in the area and elsewhere, with a similar **no-to-low** impact.

Maximum magnetic fields on the rights-of-way for the East Alternative and options would range from 174 to 186 mG (184 mG on new right-of-way). Under normal (average) conditions, the highest magnetic fields would range from 32 to 53 mG (35 mG on new right-of-way).

At the edge of rights-of-way, the maximum magnetic fields for alternatives and options would range from 27 to 48 mG; under normal conditions, the highest fields would range from 6 to 12 mG (see Table 8-4). (Magnetic field calculations under maximum and normal conditions, for individual route segments and line sections within segments, can be found in Appendix F.) Maximum and normal fields would depend on the number of transmission lines present, their relative phasing and direction of power flow. Beyond the edge of rights-of-way, magnetic fields decrease quickly with distance, approaching common ambient levels within a few hundred feet.

This means that beyond a few hundred feet, transmission line magnetic fields approach common ambient levels and would be far less than those encountered near common household appliances or directly under the line.

Table 8-4 East Alternative and Options—Length-Weighted Average Electric and Magnetic Field Levels

East Alternative				Electric Field (kV/m)		Magnetic Field (mG)	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	67.7	On right-of-way	Average	5.3	—	35	—
			Maximum	8.8		184	
		Edge of right-of-way	Average	2.3		12	
			Maximum	2.3		48	
Existing	6.8	On right-of-way	Average	5.4	2.1	32	31
			Maximum	8.9	3.8	174	135
		Edge of right-of-way	Average	1.1	1.0	9	11
			Maximum	1.1	1.0	32	36
East Option 1[3]				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	17.6 (19.4)	Same as edge of right-of-way values shown above for East Alternative					
Existing	0	On right-of-way	Average	—	—	—	—
			Maximum				
		Edge of right-of-way	Average				
			Maximum				
East Option 2				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	23.5 (22.5)	Same as edge of right-of-way values shown above for East Alternative					
Existing	0	On right-of-way	Average	—	—	—	—
			Maximum				
		Edge of right-of-way	Average				
			Maximum				
East Option 3				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	1.9 (2.6)	Same as edge of right-of-way values shown above for East Alternative					
Existing	1.8	On right-of-way	Average	5.7	2.9	53	48
			Maximum	8.8	5.3	186	133
		Edge of right-of-way	Average	1.2	0.2	6	4
			Maximum	1.4	0.2	27	8

Notes:
1. Lengths in parentheses are for the original segments in the West Alternative that would be replaced by the option. The total lengths include only those segments used in the calculation of averages and, in some cases, are slightly less than the lengths in Table 4-1.
2. All field descriptors are segment- length-weighted means of the fields on or at the edge of the right-of-way. The values for the edge of right-of-way are computed from fields on both sides of the route. Average electric fields are computed for maximum voltages and average clearances along the route; likewise, average magnetic fields are computed for average currents and average clearances. Maximum electric fields are computed for maximum voltages and minimum clearances; maximum magnetic fields are computed for maximum currents and minimum clearances.
3. The segments in the East options do not replace any existing segments. Using one of these options would not significantly affect average field levels for the alternative.
Source: Bracken 2011 (see Appendix F)

8.2.7 Crossover Alternative and Options

The Crossover Alternative and options would require about 55 percent new right-of-way that would mostly cross forest land (about 76 percent). About 8 percent of the land crossed by right-of-way would be populated—1 percent urban/suburban and 7 percent rural areas. About 14 percent of the land beyond the right-of-way (out to 1,000 feet) is zoned for residential use, similar to the Central Alternative. Fewer people would live near or pass by this action alternative than the West Alternative.

Maximum electric fields on the rights-of-way for the Crossover Alternative and options would range from 8.8 to 8.9 kV/m (see Table 8-5), meeting BPA's criterion of 9 kV/m. The maximum fields for all route segments and line sections within segments would also meet the BPA criterion. Under normal (average) conditions, the highest fields would range from 5.3 to 5.8 kV/m.

At the edge of the right-of-way, electric fields for the Crossover Alternative and options would range from 0.9 to 2.3 kV/m (2.3 kV/m on new right of way) under both extreme (maximum) and normal (average) conditions, meeting BPA's guidelines of 2.5 kV/m. (Maximum and average electric field calculations for individual route segments and line sections within segments can be found in Appendix F.) Like the other action alternatives, these electric field levels would be comparable to or less than those from existing 500-kV lines in the area and elsewhere, with a similar **no-to-low** impact.

Maximum magnetic fields on the rights-of-way for the Crossover Alternative and options would range from 150 to 276 mG (184 mG on new right-of-way). Under normal (average) conditions, the highest magnetic fields would range from 29 to 68 mG (35 mG on new right-of-way).

At the edge of rights-of-way, the maximum magnetic fields for alternatives and options would range from 26 to 52 mG; under normal conditions, the highest fields would range from 7 to 14 mG (see Table 8-5). (Magnetic field calculations under maximum and normal conditions, for individual route segments and line sections within segments, can be found in Appendix F.) Maximum and normal fields would depend on the number of transmission lines present, their relative phasing and direction of power flow. Beyond the edge of rights-of-way, magnetic fields decrease quickly with distance, approaching common ambient levels within a few hundred feet. This means that beyond a few hundred feet, transmission line magnetic fields approach common ambient levels and would be far less than those encountered near common household appliances or directly under the line.

Table 8-5 Crossover Alternative and Options—Length-Weighted Average Electric and Magnetic Field Levels

Crossover Alternative				Electric Field (kV/m)		Magnetic Field (mG)	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	42.7	On right-of-way	Average	5.3	—	35	—
			Maximum	8.8		184	
		Edge of right-of-way	Average	2.3		12	
			Maximum	2.3		48	
Existing	29.7	On right-of-way	Average	5.4	2.0	34	17
			Maximum	8.9	3.7	182	96
		Edge of right-of-way	Average	1.3	0.5	7	3
			Maximum	1.25	0.5	26	12
Crossover Option 1[3]				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	0.7 (2.1)	Same as edge of right-of-way values shown above for Crossover Alternative					
Existing	6.6	On right-of-way	Average	5.5	1.5	29	11
			Maximum	8.8	2.8	150	63
		Edge of right-of-way	Average	0.9	0.3	9	2
			Maximum	0.9	0.3	34	24
Crossover Option 2				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	0	Same as edge of right-of-way values shown above for Crossover Alternative					
Existing	4.1 (0.0)	On right-of-way	Average	5.8	5.5	68	49
			Maximum	8.8	9	270	235
		Edge of right-of-way	Average	1.9	2.1	14	16
			Maximum	2.1	2.1	51	57
Crossover Option 3				**Electric Field (kV/m)**		**Magnetic Field (mG)**	
Right-of-Way	**Length (miles)[1]**	**Field Location**	**Field Descriptor[2]**	**Proposed Action**	**No Action**	**Proposed Action**	**No Action**
New	0	Same as edge of right-of-way values shown above for Crossover Alternative					
Existing	4.2 (0.0)	On right-of-way	Average	5.8	5.5	68	49
			Maximum	8.9	9	276	235
		Edge of right-of-way	Average	2.2	1.6	13	12
			Maximum	2.3	1.7	52	45

Notes:
1. Lengths in parentheses are for the original segments in the West Alternative that would be replaced by the option. The total lengths include only those segments used in the calculation of averages and, in some cases, are slightly less than the lengths in Table 4-1.
2. All field descriptors are segment-length-weighted means of the fields on or at the edge of the right-of-way. The values for the edge of right-of-way are computed from fields on both sides of the route. Average electric fields are computed for maximum voltages and average clearances along the route; likewise, average magnetic fields are computed for average currents and average clearances. Maximum electric fields are computed for maximum voltages and minimum clearances; maximum magnetic fields are computed for maximum currents and minimum clearances.
3. The segments in the Crossover options do not replace any existing segments. Using one of these options would not significantly affect average field levels for the alternative. However, there would be localized increases in the magnetic fields for Crossover Options 2 and 3.
Source: Bracken 2011 (see Appendix F)

8.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. More information on how BPA minimizes EMF levels through project design is provided in Section 8.2.2.5, Designing Lines to Reduce EMF. No additional mitigation measures have been identified at this time.

8.2.9 Unavoidable Impacts

Once built, the proposed line could cause accidental injury from electric shock if someone were to bring conductive material too close to the lines within the right-of-way. Electric fields on the right-of-way also have the potential to create nuisance shocks on the right-of-way and to interfere with older model implanted cardiac pacemakers worn by persons walking (or otherwise not shielded) under the line or within 30 feet from the edge of the right-of-way.

EMF levels directly under the lines and in the rights-of-way could be higher than ambient levels, but would meet all applicable regulations and standards and would dissipate quickly with increasing distance beyond the transmission line right-of-way.

8.2.10 No Action Alternative

Under the No Action Alternative, no new transmission lines or substations would be constructed and the voltage on existing lines would not change. There would be no change in electric fields, shock potential, or radio and TV interference throughout the project area. However, magnetic fields near existing lines would increase as loads on these lines increase. Impacts from maintenance of existing lines and substations would continue unchanged.

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Chapter 9 Noise

This chapter describes current noise sources and levels in the project area, and noise levels that may be created by the construction, operation and maintenance of the action alternatives.

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

9.1 Affected Environment

9.1.1 Noise Definitions and Limits

Noise is commonly defined as unwanted sound that disrupts normal human activities or diminishes the quality of the human environment. Transient noise sources, such as passing aircraft or motor vehicles, produce noise usually of short duration. Stationary sources such as urban freeways, commercial and industrial facilities, and transmission lines, substations and transformers can emit noise over a longer period. Ambient noise at any one location is all noise generated by typical sources such as traffic, neighboring businesses or industries, and weather (wind or rain). The ambient noise level is typically a mix of noise from natural and manmade sources that may be near or distant.

Noise is usually expressed in **decibels** on the A-weighted scale (dBA), which corresponds to how humans hear sound (see Table 9-1 for typical noise levels for common sources, expressed in dBA). Noise exposure depends on the amount of time an individual spends near the source and distance from the source.

Table 9-1 Common Noise Levels

Noise Source or Effect	Sound Level (dBA[1])
Rock-and-roll band	110
Truck at 50 feet	80
Gas lawnmower at 100 feet	70
Normal conversation indoors	60
Moderate rainfall on foliage	50
BPA 500-kV transmission line	49[2]
Refrigerator	40
Bedroom at night	25

Notes:
1. Decibels (A-weighted)
2. Reflects typical noise levels at the edge of right-of-way during foul weather, when **corona** is most likely to be present.

Sources: USDOE 1986, 1996

The federal government and some states have established noise limits. At the federal level, the EPA has established a guideline of 55 dBA for an average day–night noise level (L_{dn}) in outdoor areas (EPA 1978). Washington has similar limits of maximum permissible noise levels of 60 dBA (L_{dn}) and 50 dBA (night-time) to intrude into residential property (WAC 173-60). These levels apply to new transmission lines that operate continuously. Oregon allows an L_{50} noise level of ambient +10 dBA (not to exceed 55 dBA) in daytime and ambient +10 dBA (not to exceed 50 dBA) at night, assuming a new noise source on a previously unused site (OAR 340-035). The cities and counties crossed by the action alternatives either do not have established noise limits or defer to the states or the federal government for noise limits.

BPA has established a transmission line design criterion for corona-generated noise (L_{50}, foul weather; refers to a sound level exceeded 50 percent of the time) of 50 dBA at the edge of the right-of-way for new transmission lines (USDOE 2010). An exception to the 50 dBA criterion is allowed when there is an existing line (or lines) on the right-of-way with noise levels above 50 dBA. In such cases, a new line may not cause the L_{50} noise level to increase by more than 3 dBA over current levels. Likewise, BPA's design criterion for substation noise is 50 dBA at a substation property line. Besides meeting Washington's code limits, these design criteria are considered to be consistent with Oregon's regulatory limits.

9.1.2 Existing Noise

Throughout the project area, noise levels can vary widely. Ambient noise levels may be intermittently high in urban areas such as Longview and Vancouver, Washington, particularly near industrial and commercial uses and highways, but consistently low or moderate elsewhere, depending on suburban and rural population, wind levels, aircraft traffic, and recreation (authorized or unauthorized), forest, or agricultural activities.

In some areas, existing transmission lines may contribute to this noise. This is particularly true of higher voltage (345-kV or higher) lines built before 1978, when noise limits were being established by Washington and Oregon. During foul weather, these older transmission lines can generate noise, which is created by corona. Corona is the partial electrical breakdown of the insulating properties of air around the conductors of a transmission line. Corona-generated noise is usually heard as a hissing or crackling sound accompanied by a hum under certain conditions. Based on several years' meteorological records (2005-2009) from the Portland International Airport, foul weather conditions occur about 20 percent of the time in the general project area (NOAA 2010a). (Continuous hourly meteorological records were not found for other locations in the project area.)

Currently, high-voltage transmission line conductors are designed to be corona free under ideal conditions. Nonetheless, noise from transmission lines still can occur when conductors are wet during foul weather (periods of rain, fog, snow, or icing). On rare occasions, insects and dust on conductors also can cause occasional corona during fair weather.

Some existing substations in the project area may contribute noise as well, mainly caused by transformer equipment that creates a 120-Hz (less than 50 dBA) hum or the infrequent sound of opening and closing circuit breakers.

9.2 Environmental Consequences

General impacts that would occur for all action alternatives, and impacts by specific action alternatives, are defined and discussed below.

9.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Construction activities would be temporary and infrequent, but increase ambient noise levels in a localized area over a longer period of time or a larger geographical area over a shorter period of time.
- Corona noise would consistently exceed allowed L_{50} levels (per noise criteria and limits).

Impacts would be **moderate** where project activities would cause the following:

- Construction activities would be temporary and infrequent, but increase ambient noise levels in a localized area over a shorter period of time.
- Corona noise is expected to increase existing noise levels and would occasionally exceed allowed L_{50} levels (per noise criteria and limits).
- Maintenance activities would be temporary and infrequent and include the use of loud equipment or power equipment, causing ambient noise levels to increase in a localized area over a short period of time.

Impacts would be **low** where project activities would cause the following:

- Construction activities would be temporary and infrequent, but increase ambient noise levels immediately adjacent to the construction site.
- Corona noise is expected to increase existing noise levels slightly, but that increase would barely be discernible (within 3 dBA of existing levels) and would meet allowed L_{50} levels (per noise criteria and limits).
- Maintenance activities would be temporary and infrequent, but increase ambient noise levels in a localized area over a short period of time.

No impact would occur if corona noise or noise from construction and maintenance activities is expected to cause no increase in existing noise levels.

9.2.2 Impacts Common to Action Alternatives

9.2.2.1 Construction

Construction of the transmission line, substations, and access roads would generate temporary noise that could affect nearby residences, business owners, employees and customers, visitors and recreationists. Though project construction would occur over 30 months, most transmission line construction activities would last only days or a few weeks at any one location, a **low-to-moderate** impact. Noise impacts from construction of the 500-kV substations, which would take about 13 months, and would occur at the substation locations the entire time, would cause **moderate-to-high** impacts. Potentially loud equipment would not be used during all construction phases.

Although daytime construction activities are excluded from noise limits and line construction activities would be temporary, BPA did evaluate these noise impacts. The project would be built primarily using conventional construction equipment (see Table 9-2). Construction activities that would create noise include right-of-way clearing, access road construction and improvement, substation pad grading, excavation for tower footings, assembling and lifting towers into place, helicopter assistance during tower installation and stringing of conductors, and blasting in bedrock (if needed).

Table 9-2 Construction Equipment Noise Levels

Type of Equipment	Maximum dBA[1] at 50 Feet
Road Grader	85
Bulldozers	85
Heavy Trucks	88
Backhoe	80
Pneumatic Tools	85
Crane	85
Combined Equipment	89

Notes:
1. Decibels (A-weighted)
Source: Thalheimer 1996

When determining noise levels, an equivalent sound level (L_{eq}) is generally accepted as the average sound level perceived by the human ear from any noise source. The overall noise caused by conventional construction equipment is estimated to be 89 dBA L_{eq} at 50 feet, dissipating with distance (see Table 9-3).

Table 9-3 Construction Equipment Noise Levels by Distance from Construction Site

Distance from Construction Site (feet)	Hourly L_{eq} (dBA[1])
50	89
100	83 (similar to truck at 50 feet)
200	77
400	71 (similar to gas lawnmower at 100 feet)
800	65
1,600	59 (similar to indoor conversation)

Notes:
1. Decibels (A-weighted)
Assumptions: Equipment used was one each—grader, bulldozer, heavy truck, backhoe, pneumatic tools, concrete pump, crane. Reference noise level of 89 dBA (L_{eq}). Distance for the reference noise level: 50 feet. Noise **attenuation** rate: 6 dBA/doubling of distance. This calculation does not include the effects, if any, of local shielding or atmospheric attenuation.

A helicopter may be used to assist with tower installation. A loaded cargo helicopter flying 250 feet away produces about 95 dBA, which is the same amount of noise produced by a diesel locomotive 100 feet away (Helicopter Association International 1993). If a helicopter is used, towers would be preassembled at one or more central staging areas and then transferred by helicopter to tower sites. The helicopter would hover at central staging areas for 2 to 5 minutes per tower as it picked up each tower section, and would then hover at each tower site for 2 to 10 minutes during a 1-hour period while the tower is placed on the foundation.

Noise generated during construction would depend on the equipment being used, tasks being performed, and nearby topography. In general, construction of the transmission line would produce temporary elevated noise levels that would be heard by people living or working throughout the project area. People living in more rural areas (the predominant land use crossed by the action alternatives) may hear the noise from greater distances while those in more urban areas may not hear the noise over other urban sounds. The short duration of noise from construction activities, the limited number of days or weeks it may occur in any one location, and its presence only during daytime hours would mean overall **low-to-moderate** impacts. Residents, recreationists, and workers near substation sites, particularly residents near the Monahan Creek substation site, may experience **moderate-to-high** noise impacts because construction activities would occur over a longer period.

Blasting could be required in rocky areas where conventional excavation for tower footings or substation facilities would be impractical. Where blasting might occur, the explosion would produce a short noise like a thunderclap that could be audible for a mile or more. These disturbances would be **high** impacts, but temporary and infrequent.

9.2.2.2 Transmission Line Operation and Maintenance

Once operating, the impact of corona-generated audible noise by the project depends on the level of corona noise, the level of ambient noise, and proximity to the new transmission line. Corona noise itself depends on voltage, line configuration, the number of transmission lines sharing the right-of-way, and weather. Also, for a few months after construction, residual grease or oil can cause water to bead up on the surface of conductors, producing temporarily higher levels of audible noise. Though foul weather may induce corona, it can also mask it by increasing ambient noise (due to wind or heavy rain hitting foliage). Also during such conditions, people are more likely to be indoors where sound from nearby transmission lines would be reduced. Both these factors reduce corona-generated noise even in populated areas, where ambient noise levels tend to be higher.

> Potential corona noise levels for the project at the edges of transmission line rights-of-way were calculated and then compared with BPA's design criteria, state noise limits, and federal noise guidelines. (Methodology used for calculations, and detailed calculations within each action alternative can be found in Appendix F.)

Corona activity also increases with altitude. For every 1,000-foot gain in elevation, noise generally increases by 1 dBA. For the action alternatives, 62 percent of transmission line conductors would be at elevations below 1,000 feet; 94 percent would be below 2,000 feet (see Figure 20-1). Most of the population along the alternatives is at lower elevations.

Since all design criteria and noise limits would be met, there would be **no-to-low** impacts from transmission line operation.

Each tower and line would be inspected by field crews at least once annually. Twice a year a helicopter would patrol the transmission line corridor to look for problems. If repairs are needed, field vehicles would be dispatched to access trouble spots.

BPA would also need to maintain vegetation along the line for safe operation and to allow access to the line. This can require using chainsaws, roller choppers, and brush hogs. Before conducting vegetation maintenance, BPA would typically send notices to landowners.

Occasional maintenance activities along the line would generate infrequent and temporary higher noise levels that would generally be a **low** impact. The exception would be when loud equipment such as chainsaws may be required, causing a temporary **moderate** impact.

9.2.2.3 Substation Operation and Maintenance

Audible noise levels at the proposed substations would predominantly reflect foul weather corona noise from incoming and outgoing transmission lines (see Section 9.2.2.2, Transmission Line Operation and Maintenance). Though transformers can hum, no transformers would be installed at the substations for this project. The operation of circuit breakers can generate a loud but short, temporary, burst of noise, a **low** impact. **No** noise impacts would occur from most maintenance activities inside the substation.

Like transmission lines, substations are continually inspected. Helicopters doing routine aerial inspections as described above would also fly over substations. Maintenance crews on the ground would inspect and fix any problems identified and conduct routine maintenance. Vegetation inside and outside the substations is strictly controlled similar to transmission line rights-of-way. Any noise generated by these actions would be a temporary, **low** impact.

9.2.2.4 Sundial Substation

Although the substation, access roads, and line changes would occur in mostly non-forested open space, the area is within an industrial complex and close to two airports. Sundial Substation would meet BPA's 50 dBA design criteria at the substation perimeter and all state noise limits and federal guidelines. As described above, there would be **no-to-moderate** impacts during construction and operation and maintenance of the substation.

9.2.3 Castle Rock Substation Sites

The proposed substation sites, which would be on forest land (Casey Road and Baxter Road), and open space and rural land (Monahan Creek) would meet BPA's 50 dBA design criteria at the substation perimeters and all state noise limits and federal guidelines. There would be **no to-moderate** impacts during construction and operation and maintenance of these substations. Noise impacts could be considered higher at the Monahan Creek site since it is surrounded by residential land uses.

Impacts common to action alternatives are in Section 9.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

9.2.4 West Alternative and Options

The West Alternative and its options would meet all design criteria and noise limits, and would have **no-to-low** impacts from transmission line noise. The West Alternative and options would use predominantly (98 percent) existing right-of-way with the remaining using new right-of-way (i.e., areas with no existing transmission lines), crossing predominantly forest land and rivers, lakes and wetlands (51 percent) and agricultural land (33 percent). The West Alternative would cross slightly more urban, suburban, and rural development areas (17 percent) than the other action alternatives. Beyond the right-of-way—from the right-of-way edge out to 1,000 feet on either side of the line—the West Alternative and options would also cross near a greater percentage of property zoned for residential use: about 46 percent.

Land uses crossed by the action alternatives, and zoning within 1,000 feet of the transmission line provide information about the relative differences (or similarities) among alternatives (Golder 2011). However, noise impacts from the alternatives were not weighted by land use or zoning crossed because there is not an established relationship between the two. People living in populated areas may be more adapted to higher ambient noise levels and so may be less sensitive to additional audible noise.

In new right-of-way, L_{50} audible noise levels at the edge would be 47 dBA (see Table 9-4). This level would drop about 3 dBA for every doubling of distance away from the line; e.g., a 47 dBA level at the edge of right-of-way would drop to 44 dBA at 150 feet and to 40 dBA by 330 feet from the centerline. This latter level is 15 dBA below the EPA outdoor noise limit. Consequently most, if any, noise impacts occur within about 300 feet of the edge of the right-of-way.

Based on the summaries of foul weather audible noise levels on existing right-of-way, the West Alternative and options would create increases in potential corona noise up to 7 dBA (West Alternative would be 5 dBA). Even with these increases, the alternative and options would still meet BPA's 50 dBA design criteria and the statutory limits established in Oregon and Washington.

Some individual route segments within the West Alternative would exceed 50 dBA, but are not seen in the averages in Table 9-4. These segments are identified in tables in Appendix F. In all cases where the 50 dBA criterion could be exceeded, the change from existing noise levels would differ by at most 3 dBA.

During foul weather, the West Alternative and options would meet the EPA's 55 dBA guideline for L_{dn} at the edge of the right-of-way. During fair weather, which occurs about 80 percent of the time, audible noise levels at the edge of the right-of-way would be about 20 dBA lower if corona were present at all. In quieter, open space areas, hikers on trails that cross the West Alternative's and options' right-of-way would experience temporarily higher noise levels (see Appendix F). Off the right-of-way, potential L_{50} foul weather corona noise created by the West Alternative would generally be well below the 55 dBA level that can interfere with speech outdoors. In a few segments where existing noise levels are already above 50 dBA, the West Alternative could create L_{50} levels near or slightly above 55 dBA.

Table 9-4 Summary of L_{50} Foul Weather Audible Noise Levels

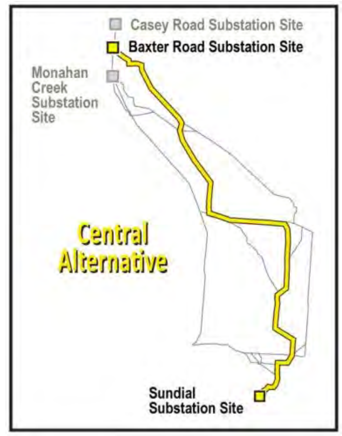
		Audible Noise (dBA) at Edge of Right-of-Way[1]				Audible Noise (dBA) at Edge of Right-of-Way[1]	
Right-of-Way	Length (miles)[2]	Proposed Action	No Action	Right-of-Way	Length (miles)[2]	Proposed Action	No Action
West Alternative				**Central Alternative**			
New	1.4	47	—	New	69.5	47	—
Existing	64.2	48	42	Existing	6.8	47	42
West Option 1				**Central Option 1**			
New	2.0	47	—	New	0	—	—
Existing	1.1	47	40	Existing	2.5	53	52
West Option 2				**Central Option 2**			
New	1.7	47	—	New	15	47	—
Existing	7.3	49	47	Existing	0.4	47	41
West Option 3				**Central Option 3**			
New	1.5	47	—	New	14.9	47	—
Existing	11.5	50	49	Existing	0	—	—
East Alternative				**Crossover Alternative**			
New	67.7	47	—	New	42.7	47	—
Existing	6.8	47	41	Existing	29.7	48	40
East Option 1				**Crossover Option 1**			
New	17.6	47	—	New	0.7	47	—
Existing	0	—	—	Existing	6.6	47	37
East Option 2				**Crossover Option 2**			
New	23.5	47	—	New	0	—	—
Existing	0	—	—	Existing	4.1	56	57
East Option 3				**Crossover Option 3**			
New	1.9	47	—	New	0	—	—
Existing	1.8	50	48	Existing	4.2	54	54

Notes:

1. Audible noise levels are the distance-weighted means of the L_{50} foul weather levels at the edge of the right-of-way. The highest average value from the two edges is shown. Audible noise levels are computed for average voltages and average conductor heights.
2. The total lengths include only those segments used in the calculation of averages and, in some cases, are slightly less than the lengths in Table 4-1.

Source: Bracken 2011 (see Appendix F)

9.2.5 Central Alternative and Options



The Central Alternative and its options would meet all design criteria and noise limits, and would have **no-to-low** impacts from transmission line noise. The Central Alternative and options would primarily use new right-of-way (about 90 percent), which would cross predominantly forest land and rivers, lakes and wetlands (about 90 percent of land use crossed). Only 3 percent of the land crossed by the Central Alternative's and options' right-of-way would be in urban, suburban, or rural development areas. Beyond the right-of-way (out to 1,000 feet on both sides), the percentage of nearby residential property is also small: about 14 percent is zoned residential.

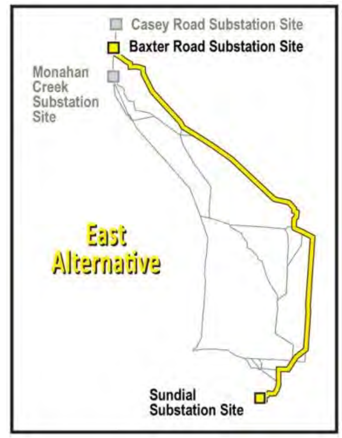
Where the Central Alternative and options would occupy new right-of-way, L_{50} audible noise levels at the edge would be 47 dBA. This level would drop about 3 dBA for every doubling of distance away from the line; e.g., a 47 dBA level at the edge of right-of-way would drop to 44 dBA at 150 feet and to 40 dBA by 330 feet from the centerline. This latter level is 15 dBA below the EPA outdoor noise limit. Consequently most, if any, noise impacts occur within about 300 feet of the edge of the right-of-way.

Based on the summaries of foul weather audible noise levels (see Table 9-4), when on existing right-of-way, the Central Alternative and options would create increases in potential corona noise up to 7 dBA (Central Alternative would be 5 dBA). Even with the increases, the Central Alternative and Central Option 2 and 3 would still meet BPA's 50 dBA design criteria and the statutory limits established in Oregon and Washington.

Central Option 1, where older lines would remain on the right-of-way, would exceed the 50 dBA criterion for L_{50} levels, but would meet the second criterion—falling within the maximum 3 dBA increase allowed.

During foul weather, the Central Alternative and options would meet the EPA's 55 dBA guideline for L_{dn} at the edge of the right-of-way. During fair weather, which occurs about 80 percent of the time, audible noise levels at the edge of the right-of-way would be about 20 dBA lower if corona were present at all. For example, in quieter open space areas, hikers on trails that cross the Central Alternative's and options' right-of-way would experience temporarily higher noise levels (see Appendix F). Off the right-of-way, potential L_{50} foul weather corona noise created by the Central Alternative would generally be well below the 55 dBA level that can interfere with speech outdoors. In a few segments where existing noise levels are already above 50 dBA, the Central Alternative could create L_{50} levels near or slightly above 55 dBA.

9.2.6 East Alternative and Options



The East Alternative and its options would meet all design criteria and noise limits, and would have **no-to-low** impacts from transmission line noise. The East Alternative and options would primarily use new right-of-way (about 90 percent), which would cross predominantly forest land and rivers, lakes, and wetlands (about 90 percent of land use crossed). Only 4 percent of the land crossed by the East Alternative's and options' right-of-way would be in urban, suburban, or rural development areas. Beyond the right-of-way (out to 1,000 feet), the percentage of nearby residential property is the lowest of all action alternatives: about 7 percent is zoned residential.

Where the East Alternative and options would occupy new right-of-way, L_{50} audible noise levels at the edge would be 47 dBA. This level would drop about 3 dBA for every doubling of distance away from the line; e.g., a 47 dBA level at the edge of right-of-way would drop to 44 dBA at 150 feet and to 40 dBA by 330 feet from the centerline. This latter level is 15 dBA below the EPA outdoor noise limit. Consequently most, if any, noise impacts occur within about 300 feet of the edge of the right-of-way.

Based on the summaries of foul weather audible noise levels (see Table 9-4), when on existing right-of-way, the East Alternative and options would create increases in potential corona noise up to 6 dBA (East Alternative would create the highest increase at 6 dBA). Even with the increases, the alternative and options would still meet BPA's 50 dBA design criteria and the statutory limits established in Oregon and Washington.

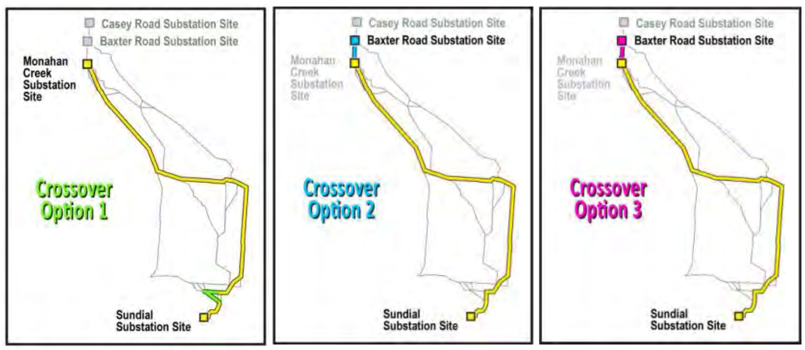
During foul weather, the East Alternative and options would meet the EPA's 55 dBA guideline for L_{dn} at the edge of the right-of-way. During fair weather, which occurs about 80 percent of the time, audible noise levels at the edge of the right-of-way would be about 20 dBA lower if corona were present at all. For example, in quieter open space areas, hikers on trails that cross the East Alternative's and options' right-of-way would experience temporarily higher noise levels (see Appendix F). Off the right-of-way, potential L_{50} foul weather corona noise created by the Central Alternative would generally be well below the 55 dBA level that can interfere with speech outdoors. In a few segments where existing noise levels are already above 50 dBA, the East Alternative could create L_{50} levels near or slightly above 55 dBA.

9.2.7 Crossover Alternative and Options

The Crossover Alternative, Crossover Option 1, and Crossover Option 3 would meet all design criteria, and would have **no-to-low** impacts from transmission line noise. Crossover Option 2 exceeds EPA noise guidelines by 1 dBA, but does so on Segment C which crosses through forest;

no change in noise level from the existing situation would be discernible. The Crossover Alternative and options would require about 58 percent new right-of-way, which would cross predominantly forest land and rivers, lakes, and wetlands (about 76 percent). About 8 percent of the land crossed by the Crossover Alternative's and options' right-of-way would be urban, suburban, and rural development areas. Beyond the right-of-way (out to 1,000 feet), the Crossover Alternative and options would cross near about 14 percent residential-zoned land.

Where the Crossover Alternative and options would occupy new right-of-way, L_{50} audible noise levels at the edge would be 47 dBA. This level would drop about 3 dBA for every doubling of distance away from the line; e.g., a 47 dBA level at the edge of right-of-way would drop to 44 dBA at 150 feet and to 40 dBA by 330 feet from the centerline. This latter level is 15 dBA below the EPA outdoor noise limit. Consequently most, if any, noise impacts occur within about 300 feet of the edge of the right-of-way.



Based on the summaries of foul weather audible noise levels (see Table 9-4), when on existing right-of-way, the Crossover Alternative and options would create increases in potential corona noise up to 10 dBA (Crossover Alternative would be 7 dBA). Even with the increases, the Crossover Alternative and Crossover Option 1 would still meet BPA's 50 dBA design criteria and the statutory limits established in Oregon and Washington.

Crossover Option 2 and 3, where older lines would remain on the right-of-way, would exceed the 50 dBA criterion for L_{50} levels, but would meet the second criterion—falling within the maximum 3 dBA increase allowed.

During foul weather, the Crossover Alternative and options would meet the EPA's 55 dBA guideline for L_{dn} at the edge of the right-of-way. During fair weather, which occurs about 80 percent of the time, audible noise levels at the edge of the right-of-way would be about 20 dBA lower if corona were present at all. For example, in quieter open space areas, hikers on trails that cross the Crossover Alternative's and options' right-of-way would experience temporarily higher noise levels (see Appendix F). Off the right-of-way, potential L_{50} foul weather corona noise created by the Crossover Alternative would generally be well below the 55 dBA level that can interfere with speech outdoors. In a few segments where existing noise levels are already above 50 dBA, the Crossover Alternative could create L_{50} levels near or slightly above 55 dBA.

9.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project have been identified (see Table 3-2). The following additional mitigation measures have been identified to further reduce or eliminate adverse noise impacts by the action alternatives:

- Limit construction activities to daytime hours
- Incorporate conductor and line designs that result in acceptable corona performance

9.2.9 Unavoidable Impacts

After appropriate mitigation actions have been taken, the project would still produce temporary noise impacts during construction and maintenance. Corona noise would also periodically be heard along the right-of-way during foul weather. If an alternative is chosen that occupies new right-of-way, an unavoidable new source of noise from operation of the line would occur. New sources of noise may also occur on new rights-of-way from unauthorized uses such as ATVs, snowmobiles, and target practice.

9.2.10 No Action Alternative

Under the No Action Alternative, current transmission line noise levels at the edges of existing rights-of-way would continue to range from ambient to 57 dBA throughout the project area (see Table 9-4). There are 20 existing BPA, utility and privately owned transmission lines in the area. The highest corona noise levels occur on older 500-kV lines.

Noise impacts from maintenance of existing lines, substations, and access roads would continue unchanged. Also, noise impacts that may be occurring from unauthorized access and use of existing BPA rights-of-way in the project area would likely continue to occur unless actions were developed and implemented to prevent the unauthorized access and use.

Chapter 10 Health and Safety

This chapter describes existing health and safety conditions in the project area, and how the project alternatives could affect public health and safety.

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

10.1 Affected Environment

Transmission facilities provide electricity for heating, lighting, and other services essential for public health and safety. If not constructed, operated, and maintained properly, however, these same facilities could pose risks to humans—including electrocution, fire, collision with aircraft and watercraft, and exposure to **toxic and hazardous substances.** Transmission facilities can also become a target for vandalism, sabotage, and terrorism. BPA designs its facilities to meet safety requirements to prevent or reduce these risks. These measures include maintaining proper clearances between transmission lines and the ground, roadways and vegetation, and preventing inappropriate use of rights-of-way.

10.1.1 Public Health and Safety

Many people live, recreate, and work in the project area along existing transmission lines, access roads, and substations (see Map 1-2 and Section 2.2, Developing Route Segments and Substation Sites). These existing facilities are in rural and heavily populated residential areas, in parks and other recreation areas, in commercial and industrial areas, and in areas used for agriculture and timber harvest. BPA maintains its existing facilities to ensure maximum safety. This includes twice annual inspections by helicopter, and annual inspections by ground crews.

10.1.2 Toxic and Hazardous Substances

Portions of the action alternatives are in rural, undeveloped areas where the risk of encountering unreported **hazardous waste** sites or unreported contamination is possible, but highly unlikely. These sites may include illegal dump sites, illicit drug labs, buried drum sites, unreported chemical spills, abandoned industrial properties, or old landfills. In more developed areas, including urban areas, contaminated sites are generally identified and listed with regulatory agencies.

Three hazardous waste and contaminated sites reported to environmental regulatory agencies (U.S. Environmental Protection Agency [EPA], Washington State Department of Ecology [Ecology], Oregon Department of Environmental Quality [ODEQ], and local health departments) are crossed by one or more of the action alternatives:

- BPA's Ross Complex: West Alternative
- International Paper Company Mill and Solid Waste Site: Central Alternative
- Reynolds Metals Site: all action alternatives

10.1.2.1 BPA Ross Complex

BPA's Ross Complex was established on a 200-acre site north of Vancouver, Washington in 1939 and houses one of the control centers for BPA's transmission system. The West Alternative route enters BPA's Ross Complex from the north on existing right-of-way, turns east, and follows the existing right-of-way as it leaves the Ross Complex (see Figure 10-1).

The BPA Ross Complex was listed on the National Priorities List (NPL) in 1989 for contamination present in soil and groundwater that included **polychlorinated biphenyls** (**PCB**s), **polycyclic aromatic hydrocarbons** (**PAH**s) and **pentachlorophenol** (**PCP**). After completing cleanup actions and implementing institutional controls, the BPA Ross Complex was delisted from the NPL in 1996. Contaminants remain in selected areas, but institutional and engineering controls including clean fill soil caps, and land use restrictions, continue to protect human health and the environment (EPA 2010a).

The BPA Ross Complex has five designated institutional control areas numbered 1 through 5 (see Figure 10-1). Institutional controls are defined as administrative actions taken to reduce the potential for exposure to hazardous substances and may include use restrictions, environmental monitoring requirements, and site access and security measures. Institutional Control Area No. 5 is within existing right-of-way and under an existing access road proposed to be improved.

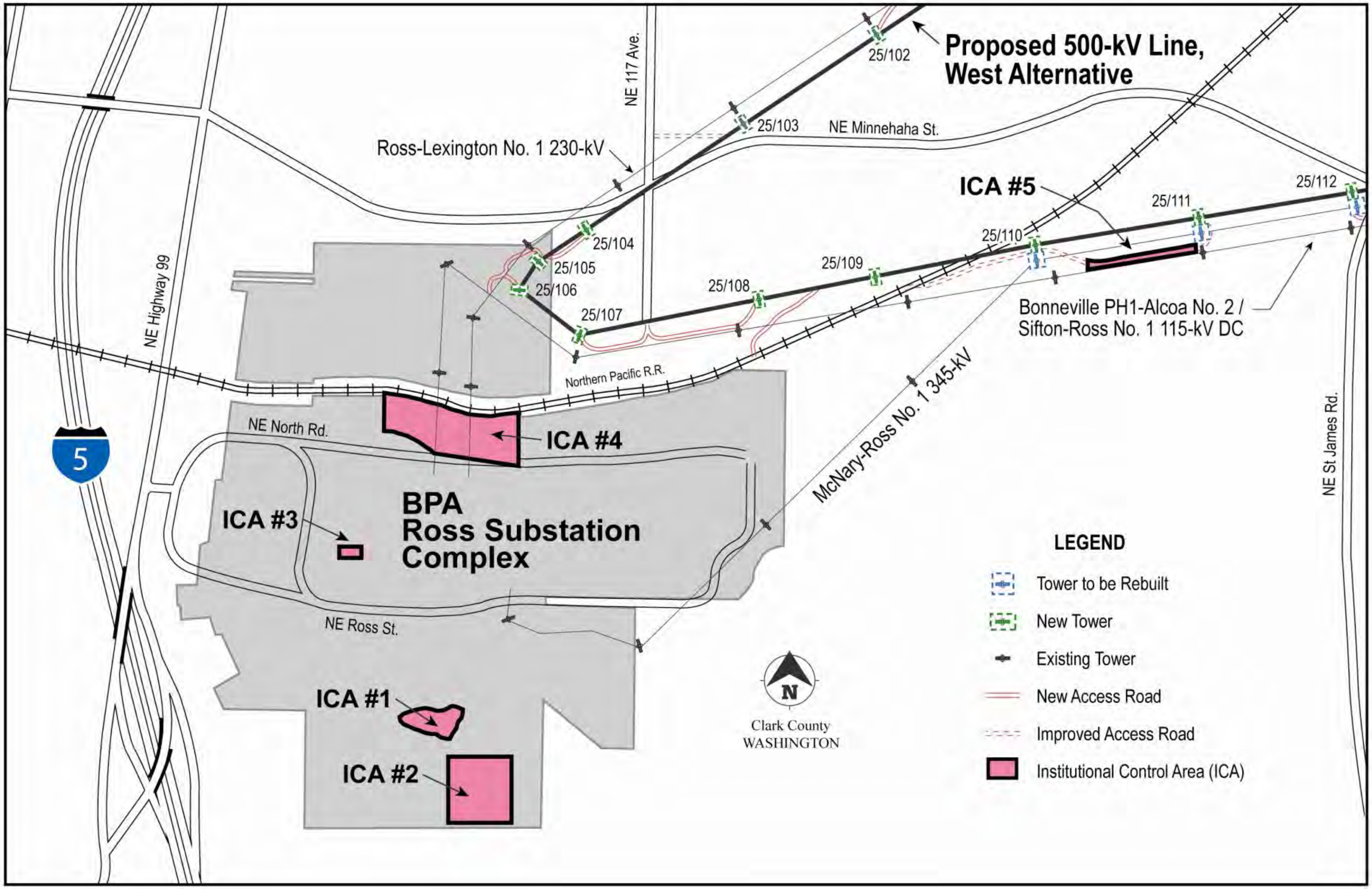
10.1.2.2 International Paper Company Mill and Solid Waste Site

The former International Paper Company site is a state-listed hazardous waste site near Chelatchie, Washington about 23 miles northeast of Vancouver, Washington. It includes the mill site and adjacent (solid waste site) landfill. A small section of the Central Alternative route and a proposed new access road cross the western portion of the former mill site.

International Paper Company operated a plywood mill and sawmill at this site from 1960 until the mill was closed in 1979 (The Columbian 2011). Ecology performed a Site Hazard Assessment (SHA) of the adjacent landfill and placed it on the Hazardous Sites List in 1996. Ecology placed the mill site on the list in 1997.

Ecology uses the Washington Ranking Method (WARM) to estimate the potential threat a site poses to human health and the environment if not cleaned up. Sites are ranked relative to each other on a scale of 1 to 5, with 1 representing the highest level of concern and 5 the lowest. The mill site was ranked 5. The landfill was ranked 2. At the mill site, suspected contaminants in soil are PCBs, petroleum products, and PAHs. At the landfill, confirmed contaminants in soil are PCBs, and suspected contaminants in soil are petroleum products and PAHs. At both sites, suspected contaminants in sediment and surface water are PAHs.

Figure 10-1 BPA Ross Complex



10.1.2.3 Reynolds Metals Company Site

The Reynolds Metals Company (RMC) site is an active NPL or "Superfund" site about 20 miles east of Portland and about 1 mile north of Troutdale on Port of Portland property. The proposed Sundial substation site is on part of this Superfund site, requiring the transmission line route for all action alternatives to cross a portion of it.

Reynolds Metals Company operated as a primary aluminum reduction plant where aluminum was produced from the raw material alumina. The aluminum plant occupied about 108 acres of the 800-acre RMC site. The plant operated from 1941 until fall 2000 when it was closed by its owner Alcoa. The plant buildings were demolished from 2003 through January 2006. The Port of Portland acquired the site from Alcoa in 2008.

The RMC site was placed on the NPL in December 1994. Cleanup of several waste areas began in 2003. Cleanup of fluoride-contaminated groundwater began in 2005. Plant demolition and additional soil cleanup was done between 2003 and 2006.

In 2006 the RMC site was divided into four areas for post-demolition investigation and evaluation of site soil conditions (see Figure 10-2). Three of these areas could be affected by the project:

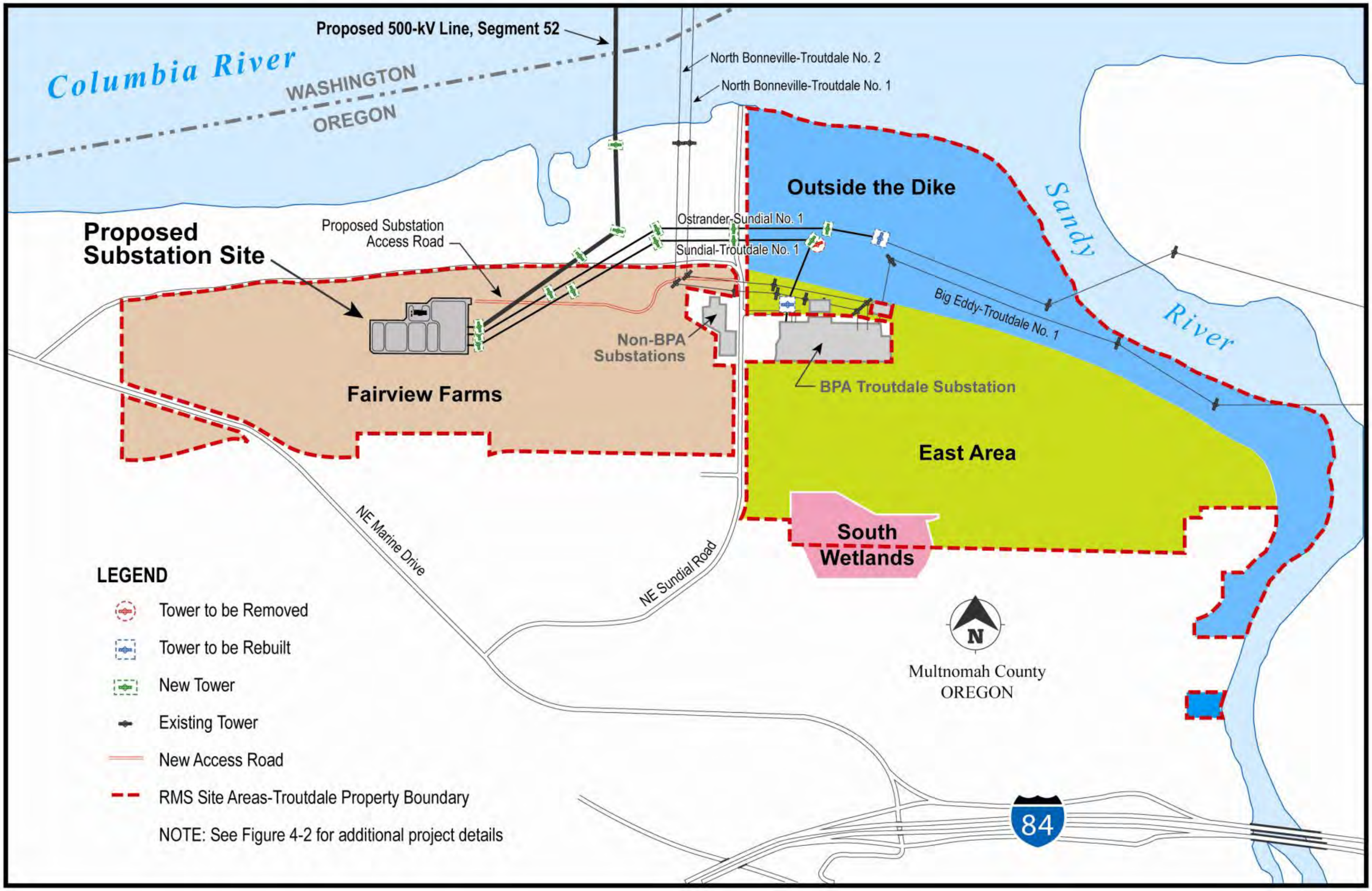
- Fairview Farms (location of Sundial Substation, new line, connector lines, access roads, and non-BPA lines to be re-routed [see Figure 4-2 for most project detail])
- Outside the Dike (location of connector lines and access roads)
- East Area (former plant, location of connector lines)

Early cleanup actions at Fairview Farms between 1995 and 2002 included excavating and disposing of 150 tons of debris from four piles to a permitted off-site disposal facility. Cleanup actions within the Outside the Dike area between 1993 and 2001 included the excavation and removal of 93,854 tons of process residue and sediment from the Company Lake portion of this area. Extensive removal actions within the East Area included the main RMC plant. Remedial actions within the northwestern portion of the East Area included the removal of a wooden wastewater pipeline and 28 tons of material.

Groundwater contamination at the RMC site was caused by fluoride leaching from former waste areas at the East Area (former plant) and the Outside the Dike area. Source areas of groundwater contamination were removed during remedial actions between 2002 and 2005. A fluoride-contaminated groundwater plume (northern plume) remained at depths from 30 to 100 feet below ground surface. An extraction/production well system was installed in 2005. Since that time the concentration levels in some monitoring wells near the source areas have begun to show a downward trend.

The post-demolition risk assessment (RA) done in 2006 addressed possible future land use of the area as a mixed-use general industrial complex consistent with existing industrial zoning. The RA considered the potential for soil exposure to future site users: site trespassers, recreational users, construction workers, excavation/trench workers, and standard occupational workers. The RA's human health risk assessment concluded that soils within all three areas were within the EPA's and ODEQ's acceptable risk range for all contaminants.

Figure 10-2 Reynolds Metal Company Site



10.1.3 Fire

Potential fire hazards in the project area are both natural and human-caused. Fire danger is highest in the summer months because of higher temperatures and lower rainfall amounts. Forest fires have historically occurred in the project area, including the 1902 Yacolt Burn, which was the largest fire recorded in Washington (Wilma 2003). Portions of the action alternatives pass through forest under the jurisdiction of the WDNR or are privately-owned.

Fire protection in the project area is provided by several city fire departments (e.g., Camas, Kelso, Longview, and Vancouver); several fire protection districts in Cowlitz, Clark, and Multnomah counties, and WDNR. Fire protection districts in rural areas are staffed mostly by volunteer firefighters. WDNR provides response to wild land fires within sparsely or unpopulated forest areas not served by fire protection districts. If a wild land fire or other emergency exceeds the capacity of local jurisdictions, the Washington State Fire Service Resource Mobilization Plan is implemented to provide personnel, equipment, and other logistical resources from around the state (WDNR 2010b).

10.1.4 Air and Water Transportation

Aircraft, including private airplanes, helicopters, and commercial aviation, use the airspace above the project area (see Chapter 12, Transportation). Several private airports, airstrips, and general aviation airports are within the project area, including the following: Pearson Field, Grove Field, Green Mountain Airport, and Goheen Airport in Clark County (SWRTC 2008); Southwest Washington Regional airport near Kelso in Cowlitz County; and Portland-Troutdale Airport in Multnomah County. Portland International Airport (PDX) is a regional airport in Portland with domestic and international passenger and freight service.

Because of their height, transmission towers can pose a hazard to aircraft. Any towers taller than 200 feet (generally, double-or triple-circuit towers and towers used at river crossings) and transmission lines exceeding that height are considered an obstruction by the Federal Aviation Administration (FAA) and may require flashing warning lights for aircraft safety. Shorter towers and line clearances can also be considered obstructions depending on their proximity to airport runways. As obstructions, they must be marked according to FAA rules, which may require installing lighting on each tower and marker balls on conductors across spans (FAA 2000) (see Section 3.7, Obstruction Lighting and Marking).

The Columbia River from Vancouver, Washington to Lewiston, Idaho is a 355-mile-long inland barge channel maintained at a minimum depth of 14 feet. Downstream of the mouth of the Willamette River, the Columbia River is dredged to a depth of 44 feet for large ships. Ten million tons of commercial cargo each year passes by the project where it crosses the Columbia River (Pacific Northwest Waterways Association 2010). The Columbia River also has recreational boating and other watercraft traffic.

10.1.5 Acts of Vandalism, Sabotage, and Terrorism

Although infrequent, vandalism and theft at BPA facilities has occurred in the past. Typical vandalism includes removing bolts and copper grounding straps and other copper wire, and shooting at towers, transmission lines, and insulators. Vandalism and theft at BPA facilities may continue in the future and never be entirely eliminated. BPA estimates theft and vandalism directly costs ratepayers $500,000 to $1 million per year to replace stolen or damaged equipment (see Chapter 23, Intentional Destructive Acts). Lost revenue and economic losses to electricity consumers from power interruption adds "indirect costs" (Blair 2009).

10.1.6 Vegetation Management

Managing vegetation around transmission facilities is necessary for a variety of reasons, including keeping electricity from transmission lines and other electrical equipment from flashing to the ground, preventing trees from falling into towers and conductors, reducing fire risk in the right-of-way, and ensuring access to tower sites. This same vegetation management can potentially harm humans, wildlife or crops unless appropriate practices are followed. Exposure to herbicides, traveling on unimproved roads, felling or topping trees, using sharp tools, machinery and heavy equipment, and working around high voltage transmission lines and transformers can create health and safety risks.

BPA's vegetation management is guided by its Transmission System Vegetation Management Program EIS (BPA 2002). BPA adopted an integrated vegetation management strategy for controlling vegetation along its transmission line rights-of-way. This strategy involves choosing the appropriate method for controlling the vegetation based on its type and density, the natural resources present at a particular site, landowner requests, regulations, and costs. BPA may use a number of different methods: manual (hand-pulling, clippers, chainsaws), mechanical (roller-choppers, brush-hogs), biological (insects or fungus for attacking noxious weeds), and herbicides (Thompkins 2011). All herbicides sold and distributed in the U.S. must be registered with EPA. This means that EPA must conclude that they can be used without posing unreasonable risks to people or the environment, based on scientific evidence.

BPA's vegetation management program is based on National Electric Safety Code (NESC) requirements. The NESC requires tree trimming and removal to prevent "…grounding of the circuit through the tree." Electric contact between a tree and an energized conductor can occur even when the two do not touch. In the case of high-voltage lines, electricity can arc across an air gap. The distance varies with the voltage at which the line is operated. BPA has established minimum distances that a tree can be to a transmission line. The NESC also designates how close a worker can come to energized lines.

10.2 Environmental Consequences

General impacts that would occur for all action alternatives are discussed below, followed by impacts unique to each alternative.

10.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Create a permanent and known health and safety condition

Impacts would be **moderate** where project activities would cause the following:

- Create a known but rare or infrequent health and safety condition

Impacts would be **low** where project activities would cause the following:

- Create a risk to health and safety that could largely be mitigated

No impact would occur where there is no possible risk to human health and safety.

10.2.2 Impacts Common to Action Alternatives

10.2.2.1 Construction

All construction activities would be guided by site- and task-specific safety plans prepared by BPA and its contractors.

Public Health and Safety

Safeguarding worker and public health and safety during construction is a priority for BPA. BPA would construct this project over a 30-month period from 2013 to 2015. The initial phases would involve clearing, surveying, and acquiring land in fee and easements. Construction activities would include road, tower, and substation construction, installing conductors, counterpoise, ground wire, and fiber optic cable, connecting the new line and other existing lines to the new substations, and tower site restoration including reseeding disturbed areas. The completed transmission line could be located in forested land, in sparsely populated areas, or in or near highly populated urban areas. The line would cross highways, local roads, railroads, and rivers and streams.

Heavy equipment, cranes, helicopters, fuels, and blasting materials would be used during construction and installation of towers, conductors, fiber optic cable, counterpoise, ground wire, substations, and access roads. The general public would not be allowed in construction areas and would not be at risk of injury. **No** impacts would occur. By following all safety requirements and implementing mitigation measures, construction activities would create temporary, **low** impacts to worker health and safety.

The road system used by construction crews would be a mix of public, private, and BPA access roads across public and private land. Access roads would be needed to every tower site, requiring new or widened roads where they do not already exist. Some roads that could be used for construction are currently used for timber harvest activities by private timber companies and WDNR. Residents use other roads for daily commutes within their communities.

Increased traffic on highways and roads during construction could create potential safety issues to the public. BPA and its contractors would adhere to safety standards by developing traffic control plans as required or needed, obtaining permits where required, using flaggers, and properly handling fuels or other hazardous materials. Additional traffic during construction would be temporary. Impacts to public health and safety from increased traffic would be **low**.

Toxic and Hazardous Substances

Construction activities would require small quantities of toxic and hazardous substances and would generate small quantities of hazardous waste. These substances may include fuels (diesel, gasoline), lubricants, hydraulic fluids, other petroleum products, antifreeze, paints, wood preservatives, cleaning products, and herbicides. Resulting hazardous or other regulated waste may include used oil, used oily rags, or other used fluids and wastes. BPA would follow strict internal procedures and comply with all health and safety regulations for handling toxic and hazardous substances and hazardous waste. If a spill occurs, BPA would respond and remove the spilled material immediately and restore the area. Because of the small quantities of toxic and hazardous substances generated and the unlikely occurrence of spills, **no-to-low** impacts would occur.

Unreported (non-BPA) hazardous waste sites may be encountered anywhere along the action alternatives during construction and may pose a potential risk and liability to BPA. If contaminated media (soil, surface water, or groundwater) is encountered during construction, work would be stopped, and a qualified environmental specialist would be contacted to evaluate conditions. The environmental specialist would characterize the nature and extent of contamination to evaluate the threat to human health and the environment. Appropriate remedial actions, including notifications to the appropriate environmental regulatory agencies (EPA, Ecology, ODEQ, and local health departments), and approvals by the appropriate agency, would be implemented to reduce the hazards to safe levels so that construction work could proceed.

Because BPA would initiate prompt response and cleanup activities, **no-to-low** impacts would occur from unreported hazardous waste sites.

Fire

Construction activities would require vehicles and equipment that could increase the risk of fire in fire-prone wild land areas. Vehicles would be equipped with fire suppression equipment, including shovels, fire extinguishers, and a water supply. Construction activities would be coordinated with the responsible local fire agency for advisories on fire danger and to establish guidelines and communications. Workers would also follow all guidelines and plans developed by the underlying landowner. BPA and its contractors would develop site-specific safety plans that would include a section on fire safety, required fire suppression equipment, and local fire and emergency contacts (Hoffman 2011). Because BPA and its contractors would use proper precautions and be aware of conditions during construction, impacts would be **low**.

10.2.2.2 Operation and Maintenance

Public Health and Safety

Transmission lines can cause serious electric shocks if certain precautions are not taken. These precautions include building the lines to minimize shock hazard. Action alternatives would cross highways, railroads, and rivers. For safety reasons, all existing and new BPA lines are designed and constructed in accordance with NESC. NESC specifies the minimum allowable distance between the lines and the ground, and BPA clearance standards are equal to or greater than NESC. These requirements determine the edge of the right-of-way and the height of the line, that is, the closest point that houses, other buildings, and vehicles are allowed to the line.

For the proposed 500-kV line, standard minimum clearance of the conductor above the ground is 29 feet. The clearance requirement over highways is 45.5 feet; other clearances (railroads, rivers, trees, etc.) are determined on a case-by-case basis. The action alternatives would be designed to meet or exceed these requirements.

BPA does not permit any uses of the right-of-way that are unsafe or might interfere with constructing, operating, or maintaining the transmission facilities. These restrictions are part of the legal rights BPA acquires for its transmission line easements. Because land use restrictions established through easements with landowners and NESC requirements would minimize hazards from operations of the line and substations, impacts would be **low**.

Vehicles and helicopters are used to perform required tasks along the line, roads, and at substations. Activities include safety inspections and inspections for encroachments, repair, and vegetation management. Similar to construction, the general public would not be allowed in areas where maintenance activities are occurring and would not be at risk of injury. **No** impacts would occur. By following all safety requirements and implementing mitigation measures, maintenance activities would create temporary, **low** impacts to worker health and safety.

Living and Working Safely Around High-Voltage Transmission Lines

Though BPA designs its lines for safety, people must take certain precautions if they live next to transmission lines or find themselves playing, recreating, or working under or near transmission lines. For example, it is important never to bring conductive materials—including TV antennas, irrigation pipes or water streams from an irrigation sprinkler—too close to the conductors. Also, vehicles should not be refueled under or near conductors. A free BPA booklet is available that describes safety precautions for people who live or work near transmission lines (see *Living and Working Safely Around High-Voltage Transmission Lines* at http://www.bpa.gov/corporate/pubs/Public_Service/LivingAndWorking.pdf).

Maintenance vehicles would travel along the same road system used for construction. Increased traffic on roads because of sporadic maintenance activities would be negligible and subsequent impacts to public health and safety would not occur or would be **low**.

Unauthorized access or trespass could increase the risk of fire, accidents, and illegal dumping, which could affect public health and safety. Because BPA would use signs, locked gates at some access roads, and otherwise limit access to the right-of-way, impacts to public health and safety from unauthorized public access and use would be **low**.

Toxic and Hazardous Substances

Impacts to public health and safety from toxic and hazardous substances used during operation and maintenance of the transmission line and substations would be the same as for construction.

Some equipment at the new substations may contain diesel and other types of oil, including gas circuit breakers that contain small amounts of hydraulic oil (see Chapter 3, Project Components). Any oil-containing equipment would be designed with proper containment and spill control devices as required. BPA would prepare a site-specific Spill Prevention Control and Countermeasures (SPCC) plan for the new substations if regulatory volumes for oil are met and if it is determined that the substations are located in areas where there is drainage connectivity to waters of the U.S. These plans are specific to each substation and include the location of oil-containing equipment, volume of oil contained in the equipment, spill containment and controls, and the location and types of spill response equipment. Spills, if they occur, would be promptly cleaned up. **No-to-low** impacts from oil-containing equipment would occur because of containment, controls, and response actions. Impacts, if any, would be temporary because response would likely be quick and effective.

Fire

BPA follows its Transmission System Vegetation Management Program to maintain safe clearances between vegetation and transmission lines in accordance with NESC requirements. These strict guidelines also prevent fires that could occur from electricity arcing from conductors to treetops or from trees (danger trees) falling into the conductors. Trees that need to be cleared from the right-of-way and any that could fall into the line (danger trees) are marked and removed. Impacts would be **low** because the right-of-way would be maintained with safe clearances and distances in accordance with BPA's Transmission System Vegetation Management Program and NESC requirements.

Routine maintenance on transmission facilities is typically done in the warmer months when fire danger can be high. All maintenance vehicles are equipped with fire safety equipment. BPA would follow all fire safety requirements that may be in place by large public or private commercial landowners including WDNR, PacifiCorp, Sierra Pacific Holding Company, Longview Timber Corporation, and Weyerhaeuser Company. For these reasons, impacts would be **low**.

Air and Water Transportation

A single-circuit 500-kV tower would average between 120 and 150 feet tall, depending on terrain and right-of-way configurations along each action alternative. Towers at the Columbia River crossing (there are four existing transmission lines that cross the river at this location) could be up to 280 feet tall. This additional height would be required to keep conductors high enough over the river to allow for river traffic under the line. FAA regulations generally prohibit aircraft from flying below an elevation of 500 feet. Most towers and conductors would be less than 500 feet tall except in areas where the new line might cross steep canyons. Near airports and flight paths, the FAA may require BPA to add obstruction lighting (see Section 3.7, Obstruction Lighting and Marking). BPA would notify the FAA and construct towers in accordance with FAA guidelines (FAA 2000). Because of this close coordination with the FAA, safety impacts to air transportation would be **low**.

One Columbia River crossing tower would be placed on a high point in the river bottom at Ione Reef. This location is not in the river channel or otherwise in the navigable portion of the river, which would avoid water transportation safety issues (see Chapter 12, Transportation). BPA would notify the United States Coast Guard (USCG) and the Corps and construct towers in accordance with USCG and Corps guidelines. BPA would obtain a Section 10 permit from the Corps and adhere to marking requirements of the USCG and the Corps. A Section 10 permit is required for work in, over, or under navigable waters of the U.S. Because the project would not place towers within the navigable portion of the Columbia River, **no-to-low** safety impacts would occur to commercial and recreational river traffic.

Acts of Vandalism, Sabotage, and Terrorism

Any vandalism or theft at the proposed BPA facilities would have the potential to compromise the safety of equipment and utility workers, causing electrocution, fires, and possibly disrupting power. However, these risks are extremely low since the more frequent occurrences are minor acts of vandalism or theft that are quickly repaired and have little to no effect on transmission facility operations or worker safety, and major acts of vandalism, theft, sabotage, or terrorism are rare (see Chapter 23, Intentional Destructive Acts). In addition, BPA uses helicopters to patrol and inspect the 15,000-mile federal transmission system in the Pacific Northwest.

Helicopter inspection of the new line would occur twice a year. Helicopter teams look for damaged insulators, damaged support members, washed-out roads, hazardous vegetation, encroachments and problems indicating that a repair may be needed. Aerial inspections are typically followed by annual ground inspections for each line. BPA follows NERC guidelines for security including the reporting of threats and incidents.

The risk from theft, vandalism, or acts of sabotage and terrorism would be **low -to-moderate**. If some acts of sabotage and terrorism occur, they could create significant damage and power disruption, but the possibility of such acts causing catastrophic results is remote given past experience and routine inspections. Damage from theft, vandalism, or acts of sabotage and terrorism, if any, would be temporary. Damage would be repaired and power restored as quickly as possible.

Vegetation Management

Vegetation would be managed along existing and new rights-of-way for safe operation of the line and substations and to allow access to the transmission line. Any action alternative would need continual vegetation maintenance because of its location west of the Cascade Mountains where the climate is conducive to rapid and dense vegetation growth.

The action alternatives would cross public and private land on existing and new rights-of-way that would require vegetation clearing. Tall vegetation would not be allowed to grow within the transmission line right-of-way. Tall trees that grow outside of the right-of-way that could fall into the line would also be removed. In deep valleys with sufficient clearance between the tops of the trees and the conductors, trees could be left in place. At tower sites, all trees, snags, brush, and stumps (more than 22 inches in diameter) would be felled and removed, including root systems, from a 50-foot by 50-foot area (see Section 3.11, Vegetation Clearing). Cleared vegetation would be shredded and scattered onsite, composted in the right-of-way, or hauled off site using project access roads.

Workers using manual and mechanical methods for vegetation control are subject to accidents involving falling trees, heavy machinery, chains saws, or moving over rough terrain. Workers would be trained to use heavy machinery and chainsaws and would be equipped with all appropriate personal protective equipment necessary for each task and piece of equipment. BPA would follow strict standard safety procedures and all regulations regarding worker safety. The general public would not be allowed in areas where vegetation management is occurring and would not be at risk of injury.

The application of herbicides may expose workers if handled carelessly. Workers would be licensed as an applicator in the respective state either by the Washington State Department of Agriculture (WSDA) or the Oregon Department of Agriculture (ODA). Workers would be trained to apply herbicides and use application equipment and equipped with all appropriate personal protective equipment necessary for each task and piece of equipment. BPA would strictly follow standard safety procedures and all regulations regarding worker safety and would be guided by its Transmission System Vegetation Management Program EIS (BPA 2001).

The general public may be exposed to herbicides through drift or spills. BPA notifies known landowners when a vegetation management or herbicide project is being planned and scheduled to allow for responses back to BPA with concerns, questions, or directives for herbicide spraying on their property. Landowner response might include information to help

BPA determine appropriate application methods and mitigation measures (such as herbicide-free buffer zones around springs or wells; or organic food farms, aquaculture facilities, or other sensitive areas). When landowners request that herbicides not be applied on their property, BPA has complied with those requests, and works with property owners to strategize non-chemical ways to deal with vegetation hazards on the right-of-way (i.e., noxious weed management plans, replacement vegetation efforts) that works for both the landowner and BPA.

To avoid impacts to domestic water supply wells and other domestic water sources, BPA would strictly follow the guidelines set forth in its Transmission System Vegetation Management Program including maintaining adequate buffers and herbicide-free zones around any potential water sources (see Chapter 15, Water).

BPA continues to fine tune vegetation efforts by communicating intended maintenance practices to landowners and providing an opportunity to respond and help design vegetation management techniques consistent with reliable transmission lines and current landowner practices on managing their land. Site-specific vegetation management plans are created to consider different land management efforts and techniques on different parcels of land, incorporating comments and suggestions from property owners/managers to ensure vegetation is managed in a manner acceptable to both parties.

Because BPA would implement effective controls according to BPA's Transmission System Vegetation Management Program EIS and is committed to working with existing landowners to accommodate their concerns and needs, impacts would be **low**.

10.2.2.3 Sundial Substation

The Sundial substation site, the end of Segment 52 south of the Columbia River, and connector lines between the Sundial substation site and BPA's existing Troutdale Substation would be constructed within three areas of the RMC site (see Section 10.1.2.3, Reynolds Metals Company Site). The post-demolition RA human health risk assessment conducted in 2006 concluded that soils in the three areas were within the EPA's and ODEQ's acceptable risk range for all contaminants. Regardless, special care may need to be taken during excavation for the substation and towers. Before construction work would begin, EPA and ODEQ would be notified and plans would be in place to address and mitigate any known or potential areas of contamination that may be encountered. Because information about known contaminants is available for the three sites, debris and contaminated soil has been removed, and the existing health risk levels are considered acceptable by EPA and ODEQ, impacts would be **low**.

10.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 10.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

The impacts on public health and safety from the substation sites near Castle Rock would be the same as those listed in Section 10.2.2, Impacts Common to Action Alternatives.

10.2.4 West Alternative and Options

The West Alternative includes 600 feet of improved access road within Institutional Control Area No. 5 of BPA's Ross Complex (see Section 10.1.2.1, BPA Ross Complex, and Figure 10-1). New towers (towers 25/110 and 25/111) would be constructed nearby. Road improvement would typically include blading the existing road and applying additional rock if needed. Because of this site, BPA would not do any blading and would only add rock to the road surface. For towers, BPA would position temporary tower disturbance areas so that they did not interfere with the site. During construction and maintenance activities, BPA's environmental specialist at the Ross Complex would be notified of these activities and alerted to any changes. EPA and WDOE would be notified of the proposal and BPA would carry out any recordkeeping requirements as required. As long as the existing cap at Institutional Control Area No. 5 is not disturbed during construction or maintenance activities, there would be **no** impact to the site. Where the West Alternative shares Segment 52 (crossing the Reynolds Metals site) with other alternatives, it would have a **low** hazardous substance impact, the same as the Sundial substation site.

10.2.5 Central Alternative and Options

The Central Alternative includes one segment (Segment 28, east of Amboy and Yacolt), one tower (Tower 28/8), and a new access road located on the far eastern edge of the former International Paper Company Mill site (see Section 10.1.2.2, International Paper Company Mill and Solid Waste Site). This location is likely not within areas potentially contaminated by prior mill operations. Available information on the International Paper Company is limited and is archived in Ecology records. The level of impact at this location would be **low** because the site would be investigated further and would be mitigated if the Central Alternative is selected. Where the Central Alternative shares Segment 52 (crossing the Reynolds Metals site) with other alternatives, it would also have a **low** hazardous substance impact.

10.2.6 East and Crossover Alternatives and Options

The impacts on public health and safety from the East Alternative and the Crossover Alternative would be the same as those listed in Section 10.2.2, Impacts Common to Action Alternatives. Where these alternatives share Segment 52 (crossing the Reynolds Metals site) with other alternatives, it would also have a **low** hazardous substance impact.

10.2.7 Recommended Mitigation Measures

Mitigation measures included as part of the project have been identified (see Table 3-2). The following additional mitigation measures have been identified to further reduce or eliminate adverse public health and safety impacts by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Notify the USCG and their Notice to Mariners of the planned construction schedule for building the line across the Columbia River.
- Notify property owners and adjacent landowners of the type and frequency of potential herbicide application to avoid conflicts, such as chemical applications next to organic farms or similar uses.

10.2.8 Unavoidable Impacts

Constructing and maintaining transmission lines, substations, and access roads include some activities that increase the risk of injury to workers. Workers would follow all required safety requirements and precautions; however, accidents may still occur. Likewise, during some construction and maintenance activities, minor increases in traffic accident risk due to additional traffic on area roads may occur. Although infrequent, acts of vandalism and sabotage would likely continue to occur with varying impacts to the perpetrator, BPA personnel who respond to these emergencies, and the general public.

10.2.9 No Action Alternative

If the project were not built, the health and safety impacts related to the proposed project would not occur. However, the already existing health and safety conditions in the project area would continue to present health and safety risks to individuals in the area. In addition, because reinforcement of the BPA transmission system would not occur under the No Action Alternative, this alternative could eventually lead to diminished reliability of the existing transmission system as loads continue to grow. If this eventually leads to brownouts and possibly blackouts, it could disrupt essential public safety services that rely on adequate and continuous electrical power.

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Chapter 11 Socioeconomics

This chapter describes socioeconomic conditions and resources in the project area, and how the project alternatives could affect these conditions and resources. Related information can be found in Chapter 1, Purpose and Need; Chapter 5, Land; Chapter 6, Recreation; Chapter 7, Visual Resources; Chapter 8, EMF; and Appendix H, Environmental Justice Tables.

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

11.1 Affected Environment

Socioeconomic conditions and resources include population and housing, employment and income, public services, utilities and infrastructure, government revenue, property values, and land-generated income such as agricultural production and private timber production. In addition, existing quality of life and other values important to individuals who live or visit the project area are considered.

11.1.1 Population and Housing

About 1.26 million people live in Cowlitz, Clark, and Multnomah counties, in communities ranging from concentrated urbanized areas to sparsely populated rural areas. The population of the cities and towns in the project area range from about 1,500 in Yacolt to about 162,000 in Vancouver (see Table 11-1).

Table 11-1 Populations of Counties, Cities, and Towns, 2010

Geographic Area	Population
Cowlitz County	**102,410**
Castle Rock	1,982
Kelso	11,925
Longview	36,648
Clark County	**425,363**
Amboy	1,608
Battle Ground	17,571
Brush Prairie	2,652
Camas	19,355
Hockinson	4,771
Vancouver	161,791
Yacolt	1,566
Multnomah County	**735,334**
Fairview	8,920
Troutdale	15,962
Total	**1,263,107**
Source: U.S. Census Bureau 2011	

In 2010, in Cowlitz County about 58 percent lived in the incorporated cities of Castle Rock, Kelso, Longview, Kalama, and Woodland (OFM 2011). The population of these cities ranged from about 1,982 (Castle Rock) to 36,648 (Longview) (see Table 11-1). For Cowlitz County, about 43 percent of the people lived in rural, unincorporated communities such as Yale, Lexington, Ariel, or Cougar, or in rural county areas (Washington State Office of Financial Management (OFM) 2011; Cowlitz County 2010a).

In 2010, half of the people in Clark County lived in the incorporated cities of Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal, Woodland, and Yacolt (OFM 2011). The largest city in Clark County is Vancouver, with about 162,000 people (see Table 11-1). In 2010, about half of the people in Clark County lived in rural, unincorporated areas, such as Amboy, Brush Prairie, Chelatchie Prairie, Fargher Lake, Hockinson, and Meadow Glade (OFM 2011).

The current populations of Clark (over 400,000) and Cowlitz (over 100,000) counties are expected to increase by over 30 percent between 2010 and 2030 (OFM 2007). This would be a population increase of more than 120,000 for Clark County and 30,000 for Cowlitz County. The current population of Multnomah County (over 700,000) is expected to increase by about 12 percent between 2010 and 2030 (Oregon Office of Economic Analysis 2004).

Temporary housing in Cowlitz, Clark, and Multnomah counties includes rental housing, hotel/motel accommodations, and campgrounds and RV parks. The 2009 vacancy rate in the Portland-Vancouver-Beaverton Metropolitan Statistical Area for rental housing was about 4 percent (U.S. Census Bureau 2009a). At this rate, there likely were about 8,700 housing units available for rent in 2009 (U.S. Census Bureau 2010). Temporary accommodations are plentiful in the Portland-Vancouver metropolitan area and in Kelso and Longview, Washington, but are more limited in the communities in the eastern portions of the project area. Cowlitz County offers more than 1,000 hotel and motel rooms. Clark County offers more than 2,500 hotel and motel rooms, and Multnomah County more than 15,000. Availability fluctuates throughout the year, with more demand for temporary lodging in the outlying areas during the summer. Permanent housing availability per county is not discussed due to the short-term nature of construction employment, although many thousands of homes are available in all three counties.

11.1.2 Employment and Income

In 2008, about 3.7 million people age 16 and over were employed in the Seattle-Tacoma-Olympia and Portland-Vancouver-Beaverton economic areas (U.S. Bureau of Economic Analysis 2010a). Employment in this regional labor market is well-distributed across a variety of industries. The largest shares of employment in individual sectors are in government and wholesale and retail trade, at 14 percent each. Health care services and manufacturing each employ 9 percent of the region's labor. Professional services, construction, and accommodation and food sectors each employ 7 percent. Real estate, finance and insurance; arts, entertainment, and recreation; and farm sectors each represent 5 percent or less of overall employment (U.S. Bureau of Economic Analysis 2010a). The annual unemployment rate in the combined economic areas was about 9 percent in 2009 (U.S. Bureau of Economic Analysis 2010a), representing about 300,000 people. Economists expect the unemployment rate in the region to fall gradually in the coming years (Williams 2011). The Congressional Budget Office projects the unemployment rate could fall to nearly 5 percent in 2016 (Elmendorf 2011).

The average total compensation per worker is about $80,000 for local-government workers in Cowlitz County, $87,000 in Clark County, and $97,000 in Multnomah County. These amounts include both the average wage and the costs of benefits (U.S. Department of Labor, Bureau of Labor Statistics, 2010 and 2012).

In 2008, the average per-capita income in the combined economic areas was about $43,000, and the total personal income was about $333 million (U.S. Bureau of Economic Analysis 2010b). Average per capita income in 2009 in Clark County was about $36,000 and in Cowlitz County was about $30,000.

11.1.3 Public Services and Infrastructure

Fire protection in the cities and towns is provided by municipal fire departments in Vancouver, Camas, and Longview, Washington, and Gresham, Oregon (also serves Troutdale and Fairview); the remaining towns rely on rural fire districts. All districts have mutual aid agreements with surrounding departments and districts, and, in the event of a large or unusual emergency, a district would likely call in additional personnel and equipment from neighboring districts. WDNR provides fire protection for more than 12 million acres of state lands. WDNR has mutual aid agreements with most county fire districts, local departments, and other state agencies.

Municipal police departments are located in Castle Rock, Kelso, Longview, Battle Ground, Camas, and Vancouver, Washington, and Fairview and Troutdale, Oregon, and each county has a sheriff's office. The Washington State Patrol has law-enforcement authority throughout the state of Washington, and the Oregon State Police has authority throughout Oregon. In Oregon, the Multnomah County Sheriff's Office would coordinate with the U.S. Coast Guard and the Portland Harbor Master as appropriate for incidents involving the Columbia River. If a large disaster or other event exceeding the resources of any affected department occurred, neighboring departments would share and coordinate resources. Many departments have experienced budget cuts in recent years, and have lost staff or have limited capacity to investigate and respond to incidents in some areas, especially those far from administrative centers or requiring specialized equipment or vehicles.

Water and wastewater services are provided by city and county utilities and local water and sewer utility districts. Water in rural areas or outside of various utility districts is provided by private wells and well systems, sometimes serving multiple users. Wastewater control in areas without sewer districts is provided by septic tanks, drain fields, and holding tanks.

Please see Chapter 5, Land, for a discussion of schools in the project area.

11.1.4 Government Revenue

State, county, and local governments rely on a variety of taxes and revenue sources to fund public services and programs.

11.1.4.1 Tax Revenue

Different forms of tax revenue include the following:

Sales and Use Tax

Washington's principal source of tax revenue is the retail sales and use tax, which yielded almost $7 billion in fiscal year 2010. The sales tax is paid for goods and services purchased within Washington. The use tax is paid when goods and services are purchased outside of Washington, but used within the state. Sales tax rates vary throughout the project area since counties and cities can add to the base state tax rate of 6.5 percent (1.1 to 1.9 percent additional tax depending on location in Clark or Cowlitz counties). The yield of the retail sales tax to city and county governments in Clark and Cowlitz counties was about $100 million in 2010 (Washington Department of Revenue 2010a). Oregon does not charge a sales tax.

Income Tax

Washington has state and local business and occupation (B&O) taxes in lieu of an income tax. The cities of Longview and Kelso also assess B&O taxes at a rate of 0.1 percent of gross operating revenue for most businesses. In Oregon, businesses and corporations pay income taxes at the state, and in some cases, the local level. The state assesses personal income taxes based on a rate that varies depending on filing status and level of income, but ranges from 5 to 11 percent of taxable income (Oregon Department of Revenue 2009). Corporations doing business in Oregon pay an excise tax on net income. Corporations not doing business in Oregon, but with income from an Oregon source, also pay income tax. Multnomah County assesses a tax rate of 1.45 percent on the net income of firms doing business in the county (City of Portland 2011). Employers within the Tri-Met District Boundary (which includes most of Multnomah County) pay a 0.69 percent payroll tax on the wages of their workers (Tri-Met 2011). BPA, as a federal agency, is exempt from paying Washington's B&O tax and Oregon's income tax.

Lodging Tax

Washington and Oregon charge lodging taxes, such as the 2-3 percent charges in Cowlitz and Clark counties, and up to 13.5 percent in Multnomah County.

Timber Harvest Tax

In Washington, timberland owners pay a 5 percent excise tax on the stumpage value when timber is harvested. The revenue is split, with 4 percent going to the county where harvest occurs and 1 percent to the state general fund. Distributions of the timber excise tax in 2010 produced about $1 million for Cowlitz County and about $423,000 for Clark County (Washington Department of Revenue 2010a).

Property Tax

Real and personal property are subject to property tax in Oregon and Washington. Real property includes land and any improvements, such as buildings attached to the land. Personal property is not affixed to the land. In Washington, local governments administer the property tax. Property tax collections in calendar year 2009 in Cowlitz County were about $94 million and in Clark County about $471 million (Washington Department of Revenue 2010a). Property tax collections in fiscal year 2008-2009 in Multnomah County were about $1 billion (Oregon Department of Revenue 2009).

Other Taxes

Other taxes include fuel taxes, license taxes, and real estate excise taxes.

11.1.4.2 Revenue from Washington State Trust Lands

Land within the project area held in trust by the State of Washington (WDNR) provides revenue for separate trusts managed for various public services, such as public schools, the capitol campus, and other state institutions. The revenue generated for each of those trusts from timber harvested statewide ranged from $4 million to $65 million in fiscal year 2009 (see Table 11-2). With the exception of the State Forest Land Trust, revenue generated from trees harvested in a particular county would not necessarily benefit the services in that county. A portion of the revenue from timber harvests on land in the State Forest Land Trust (the last row in Table 11-2) is distributed back to counties where timber harvests occur.

Table 11-2 Washington State Trust Land Beneficiaries, Acres, and Timber Sales Statewide, 2009

Trust[1]	Beneficiaries	Acres[2]	Timber Sales[2] ($ millions)
Capitol Building Trust	State Capitol Campus	110,000	8
Charitable, Educational, Penal, and Reformatory Institutions Trust	WA State Institutions	69,000	4
Common School Trust	Public Schools (K-12)	1,800,000	34
Agricultural School Trust and Scientific School Trust	WA State University	84,000	4
State Forest Lands	County, State General Fund, WDNR	625,000	65
Total		**2,688,000**	**115**

Notes:
1. Includes only trusts with land in the project area.
2. Statewide amounts; data specific to Cowlitz and Clark counties is not available.
Sources: WDNR 2009a, 2009b

The county-level distributions vary from year to year, depending on harvest levels, prices, and other factors. In recent years, distributions from the State Forest Land Trust to counties have averaged around 70 percent of total county-level timber-harvest revenues (Saunders 2010, 2012). Of the State Forest Lands Trust's fiscal year 2009 revenues, about $700,000 went to Clark County and about $1.7 million went to Cowlitz County.

11.1.5 Property Value

The value of property can be measured in several ways. The price at which property is bought and sold under competitive conditions determines the market price. County assessors assess the value of real property for tax-collection purposes. Assessors estimate the value of residential properties based on the recent sale price of nearby, similar properties. They estimate the value of most commercial and industrial properties based on the potential use or revenue-generating potential of the property (Washington Department of Revenue 2005). The assessed value of real property in 2009 was about $8 billion in Cowlitz County, $40 billion in

Clark County, and $59 billion in Multnomah County (Washington Department of Revenue 2010c; Oregon Department of Revenue 2009). Due to market adjustments from the recent recession, the market value of property has generally trended downward because of foreclosures, financing difficulties, unemployment, sluggish economic conditions, reduced demand, and excess housing supply. Homeowners have often found themselves with mortgage balances higher than the value of their home.

In addition to fee-owned property, BPA has existing easements in the project area that were obtained when the existing transmission lines were built. These easements, depending on the original agreement, allow BPA to use but not own the land, and restrict the types of activities and uses allowed in the right-of-way. Each transmission line easement specifies the present and future right of BPA to clear the easement area (both on and off the right-of-way) of all types of trees, shrubs, brush, and other vegetation. In many cases, the landowner has been able to reserve the right to grow and maintain non-woody, low-growing plants, such as agricultural crops or vegetative cover that do not require structural support. The transmission line easement also specifies the present and future right to clear the right-of-way of any and all structures, above and below ground improvements or infrastructure, and fire and electrical hazards. BPA has compensated landowners for such easement rights.

Building BPA's existing transmission lines may have changed other uses of some properties depending on a line's location and the shape and size of, and improvements on the property. If the easement effectively severed an area (stranded use) from the remaining property, then payment was made for that damage at the time the easement was secured (severance damage). This and other factors were considered to determine the loss in value within and outside of a specific easement area.

11.1.6 Agricultural Production

Agricultural land makes up about 9 percent of the total land area in Cowlitz, Clark, and Multnomah counties: about 4 percent (30,700 acres) in Cowlitz County, about 20 percent (78,360 acres) in Clark County, and about 10 percent (28,510 acres) in Multnomah County. Of the total land in agriculture about 35 percent is harvested cropland (U.S. Department of Agriculture 2009a, 2009b). The amount of land in agriculture has decreased in these counties over the past two decades by about 17 percent. The 2007 Census of Agriculture identified 3,145 farms which, on average, are about 50 acres each (U.S. Department of Agriculture 2009a, 2009b). Crops grown in the project area include forage for livestock such as hay, nursery stock, grapes, berries, and Christmas trees. Livestock production within the project area includes poultry and cattle (Washington State Department of Agriculture 2009) (see Chapter 5, Land).

In 2007, crops in Cowlitz, Clark, and Multnomah counties produced about $157 million (in 2010 dollars) in revenues. Although the total value of agricultural production was positive in each of these counties, the number of farms with net losses exceeded the number of farms with net gains in each county. Besides generating revenue from production directly, agricultural lands and farms contribute to the region's economy by providing open space and other valuable amenities that contribute to the quality of life for residents and visitors.

11.1.7 Private Timber Production

Lands used for private timber production make up about 47 percent of the land area in Cowlitz, Clark, and Multnomah counties: 64 percent (477,600 acres) in Cowlitz County (Cowlitz County

Planning Division 1976), 38 percent (159,500 acres) in Clark County (Clark County Community Planning Office 2010) and 15 percent (45,400 acres) in Multnomah County (Multnomah County 2007).

Private timberland owners harvested about 114 million board feet of timber from about 4,500 acres in Cowlitz, Clark, and Multnomah counties in 2009, about 62 percent of the total timber harvest in these counties (WDNR 2009b; Oregon Department of Forestry 2009). About 86 percent of this timber was harvested in Cowlitz County. Stumpage values for softwood timber in the Pacific Northwest in 2008 to 2009 averaged about $200 per thousand board feet (Haynes et al. 2007).

11.1.8 Community Values

This section discusses existing values important to the community that were identified by members of the public in EIS scoping comments. Included in this discussion are community values such as quality of life, property-related amenities, recreation and tourism, the natural environment, transmission system reliability, and public health and safety.

11.1.8.1 Quality of Life

Many people who live in the project area have identified the rural character of the landscape, deeply-rooted history, small, close-knit communities, high-quality public services, and distance from industrial development and “the tell-tale signs of civilization” as defining the quality of life they enjoy. These attributes are recognized by economists as being important to a person’s quality of life. Economists identify different categories of goods and services that increase personal well-being in different ways, both directly and indirectly as inputs to the production of other valuable goods and services. Common categories include human capital (e.g., knowledge and skills), human-built capital (e.g., roads, buildings, utilities), social capital (e.g., laws, cultural norms, relationships), and natural capital (e.g., rivers, forests, soil, and air) (O’Sullivan and Sheffrin 2001; Case and Fair 2004).

The region’s stock of natural capital—its natural environment—produces many types of goods and services that contribute to the quality of life of residents and visitors. These goods and services, such as scenic views, open space, and opportunities for solitude, quiet, and recreation, directly improve the well-being of people who enjoy them as they live, work, and visit nearby. The region’s stock of social capital also influences the quality of life. Social scientists define social capital as the network of connections that individuals build within a community that creates reciprocity with, and trust in, members of that community and institutions that represent their interests (Ritchie and Gill 2004). Events or issues that could generate change in communities can affect their stock of social capital and the quality of life of their residents.

Changes that highlight value differences within communities about economic development, environmental quality, and perceptions of risks and benefits can generate corrosive community reactions that may strain existing interpersonal relationships and erode existing stocks of social capital (Marshall et al. 2004; Freudenburg 1997). Changes that adversely affect social capital may reduce a community’s ability and capacity to work efficiently to address a wide range of challenges and disruptions, reducing quality of life in the community.

11.1.8.2 Property-Related Amenities

Individuals enjoy benefits from amenities in the natural environment surrounding their homes, such as scenic views, solitude and quiet, a sense of safety, and a sense of privacy. Visitors also enjoy these benefits. Some of the value of these amenities is included in the market price of property. In some cases, however, the market price may not fully account for the value people derive from property-related amenities. The characteristics of the property-related amenities vary considerably throughout the area, from property to property, and from individual to individual. This variation makes the property-related amenities difficult to describe in detail. A particular amenity, e.g., sense of privacy, may be important to one property owner, but not to their neighbor, or may make an important contribution to the market price of one property but not to others nearby. In general, natural and landscaped amenities are important to property owners in rural, urban and suburban areas, and may contribute to the value people derive from their property.

11.1.8.3 Recreation and Tourism

Economists estimate the value of recreational services by looking at two factors: the amount of money people spend to participate in a recreational activity, and the difference (called consumer surplus) between what they are willing to spend and what they actually spend. The recreational goods people purchase include everything from permits and equipment, such as hunting rifles and fishing rods, to the gas, food, and lodging purchased during a recreational trip. Travel-related spending in the three counties in 2008, in 2010 dollars, ranged from about $430 million in Cowlitz County to about $2.6 billion in Multnomah County (Washington Department of Commerce 2009; Oregon Tourism Commission 2010). Consumer surplus is important because it registers improvements in economic well-being: if someone can pay just a little to enjoy fishing, boating, or some other activity that is of high value to them, then he or she is economically better off.

The average consumer surplus per person per day for common recreational activities in the project area ranges from $26 for hiking to $83 for wildlife watching (Loomis 2005, adjusted to 2010 dollars). The economic importance of recreation is increasing in importance overall: more people are recreating more often, and willing to pay greater amounts to do so. In recent years the amount people are willing to pay per person for a day of outdoor recreation has grown faster than inflation, about $1 per year (Rosenberger and Loomis 2001). Expenditures are important because they generate jobs and income in the communities where they occur. The opportunity to enjoy large increases in consumer surplus can influence some households to locate near the area's recreational resources, with indirect effects on the area's labor and consumer-spending markets.

11.1.8.4 Natural Environment

Visual resources, water resources, wetlands, vegetation, wildlife, and fish are present in the project area (see Chapters 7, Visual; 15, Water; 16, Wetlands; 17, Vegetation; 18, Wildlife; and 19, Fish). These resources contribute to personal well-being in several ways, including the following:

- Knowing that they exist
- Having the option to enjoy them directly

- Ensuring that their children enjoy them in the future
- Engaging in recreation, subsistence hunting, sightseeing, or some other direct use

Some of the species found in the area, including the Northern spotted owl and several species of Pacific salmon, have received federal threatened or endangered status. Many people place a considerable value on the continued survival of such species. The value placed by residents on protecting threatened, endangered, and rare species similar to those that might be found in the area ranges from $42 to $333 per year per household, depending on the species (Richardson and Loomis 2009). Research suggests that a household's willingness to pay to protect sensitive plant species generally is lower than the willingness to pay for mammals and birds, but likely higher than their willingness to pay for insects or reptiles (Martin-Lopez et al. 2007).

11.1.8.5 Transmission System Reliability

A reliable supply of electricity is an important contributor to the quality of life of the region's residents and the stability of its economy. The Pacific Northwest currently enjoys a reliable supply of electricity at rates lower than those paid in many parts of the country. Considerable uncertainty surrounds the specific value of reliable electricity and the costs of unreliable electricity, especially at a local level (Eto et al. 2001). National estimates suggest that the annual cost of power interruptions in the U.S. is around $80 billion per year, with most of the cost concentrated in the commercial and industrial sectors. The cost to the Pacific Northwest is estimated at about $3 billion per year (LaCommare and Eto 2004).

The cost of power interruptions manifests in different ways across commercial, industrial, municipal, and residential customers, and the public that depends on the goods and services electric power sustains. Commercial, industrial and municipal customers may experience costs when infrastructure, such as machinery, computers, and networks, stops functioning. Commercial and industrial customers may lose revenues and incur unexpected labor and material costs. Some revenues lost during an outage may be partially or wholly offset if, for example, workers work overtime after an outage to meet deadlines, or customers delay rather than cancel purchases. Residential customers may incur direct costs for items such as batteries, eating out, and food spoilage, and intangible costs such as the time required to reset appliances, disruptions in plans, and anxiety about power outages. The public may experience costs when traffic lights, elevators, and other public infrastructure fails, causing delays and increasing the risk of accidents. The average cost a U.S. residential electricity customer incurs from a power outage ranges from about $2.60 for momentary disruptions to $3.60 for sustained interruptions, per outage, in 2010 dollars. The average cost per outage for a commercial customer ranges from $726 to $1,280, and the average cost to an industrial customer ranges from $2,272 to $5,072, in 2010 dollars (LaCommare and Eto 2004).

11.1.8.6 Public Health and Safety

Between 2003 and 2007, annual fatality rates among workers who installed and repaired transmission lines in the U.S. fluctuated between 11 and 20 per 100,000 workers. During this period, these workers experienced injuries at a rate of between 4 and 5 per 100 workers per year, and job-related illnesses at a rate between 0.4 and 1 per 100 workers per year. The most common causes of injury or illness were overexertion, contact with equipment and other objects, and falls (U.S. Department of Labor, Bureau of Labor Statistics 2009).

Transmission lines and electrical substations generate EMF, which many people perceive as risks to their personal health and well-being, or they are concerned about radio and TV interference. The perceived health implications of EMF often generate controversy among people living or working near transmission lines. Most people in the U.S. are continually exposed to EMF, which are present wherever electricity flows. Many studies have investigated the possibility of health risks from exposure to EMF, but few have found conclusive evidence that any exist (von Winterfeldt et al. 2004; Florig 1992) (see Chapter 8, EMF and Appendices F and G).

11.1.9 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations states that each federal agency shall identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low income populations. The Order further stipulates that the agencies conduct their programs and activities in a manner that does not have the effect of excluding persons from participation in, denying persons the benefits of, or subjecting persons to discrimination because of their race, color, or national origin.

Evaluating whether a proposed action could have disproportionately high and adverse impacts on minority or low income populations typically involves: 1) identifying any potential high and adverse environmental or human health impacts, 2) identifying any minority or low income communities within the potential high and adverse impact areas, and 3) examining the spatial distribution of any minority or low income communities to determine if they would be disproportionately affected by these impacts.

Guidelines provided by the Council on Environmental Quality (CEQ) (1997) and the EPA (1998) indicate that a minority community may be defined where either 1) the minority population comprises more than 50 percent of the total population, or 2) the minority population of the affected area is meaningfully greater than the minority population in the general population of an appropriate benchmark region used for comparison. Minority communities may consist of a group of individuals living in geographic proximity to one another, or a geographically dispersed set of individuals who experience common conditions of environmental effect. Further, a minority population exists if there is “more than one minority group present and the minority percentage, as calculated by aggregating all minority persons, meets one of the above-stated thresholds” (CEQ 1997).

The CEQ and EPA guidelines indicate that low income populations should be identified based on the annual statistical poverty thresholds established by the U.S. Census Bureau. Like minority populations, low income communities may consist of individuals living in geographic proximity to one another, or a geographically dispersed set of individuals who would be similarly affected by the proposed action or program. The U.S. Census Bureau defines a poverty area as a census tract or other area where at least 20 percent of residents are below the poverty level (U.S. Census Bureau 2009b).

Both the CEQ and EPA guidelines note that larger and more populated geographic areas may have the effect of “masking” or “diluting” the presence of concentrations of minority and low income populations (CEQ 1997, EPA 1998). The three potentially affected counties (Cowlitz, Clark, and Multnomah) encompass large areas, ranging in size from 466 to 1,166 square miles. The potential existence of “high concentration pockets” of minority and low income communities in the vicinity of the alternatives was evaluated by reviewing 2000 Census data at the census tract block group level. A block group is a smaller geographic subdivision of a census tract and typically contain between 3,000 and 6,000 people. Analysis at this level allows a review of the characteristics of surrounding populations at a finer geographic resolution than analysis at the census tract level.

11.1.9.1 Minority Populations

As reported in 2000, the state of Washington had a minority population of about 21 percent, with 79 percent identifying as White alone, 8 percent identifying as Hispanic or Latino, 6 percent identifying as Asian or Pacific Islander, 3 percent identifying as Black or African American, and 1 percent identifying at Native American or Alaskan Native (see Table 11-3). The remaining percentage identified as some other race alone or of two or more races. Overall, the state is more diverse than counties in the project area. Cowlitz County's minority population was about 10 percent with a Hispanic population of 5 percent. Clark County's minority population was about 13 percent with a 5 percent Hispanic population (U.S. Census Bureau 2000a).

Block groups crossed by the project were aggregated by their representative counties (see Table 11-3; individual block group data is in Appendix H). The Cowlitz County aggregate had a minority population of 7 percent, the Clark County aggregate had a minority population of 10 percent, and the Multnomah County aggregate had a minority population of 15 percent. For all sets of aggregate data, minority population percentages were less than their representative counties and the state.

Table 11-3 Race and Ethnicity by Block Group,[1] County, and State

Geographic Area[2]	Total Population	Percent of Total Population						
		White	American Indian or Alaskan Native	Asian or Pacific Islander	Black or African American	Hispanic or Latino	Some Other Race Alone	Two or More Races
Washington State	**5,894,121**	**78.9**	**1.4**	**5.8**	**3.1**	**7.5**	**0.2**	**3**
Cowlitz County	92,948	89.9	1.4	1.4	0.5	4.6	0.1	2.2
Aggregated Block Groups	26,695	93.3	1.1	0.7	0.3	2.4	0.1	2.2
Clark County	345,238	86.6	0.7	3.5	1.6	4.7	0.1	2.6
Aggregated Block Groups	70,843	90.4	0.7	2.4	1.1	3.1	0.1	2.2
Oregon State	**3,421,399**	**83.5**	**1.2**	**3.1**	**1.6**	**8**	**0.1**	**2.4**
Multnomah County	660,486	76.5	0.9	6	5.5	7.5	0.2	3.4
Block Group 1, Census Tract 102	2,927	85.3	1.2	4.3	1.6	4	0.5	3.1

Notes:
1. Data compiled as part of the 2000 Census are the most recent available data at the census block group level.
2. There are 71 block groups crossed by the I-5 Project. Block groups were aggregated at the county level. See Appendix H for specific block-level data.
Source: U.S. Census Bureau 2000a

11.1.9.2 Low-Income Populations

Washington had a median household income of $45,776 in 1999 with about 10 percent of its population below the poverty level. Median household income in Cowlitz County was lower than the state average at $39,797 with a higher poverty level at 14 percent. Median household income in Clark County was somewhat higher than the state at $48,376 with a comparable poverty level to that of the state at 9 percent. Block groups crossed by the project were aggregated by their representative counties (see Table 11-4 and Appendix H for individual block group data).

Table 11-4 Low-Income Populations[1] by Block Group,[2] County, and State

Geographic Area[3]	Total Population	Median Household Income ($)	Total Population below the Poverty Level	Percent of Population below the Poverty Level (%)
Washington State	**5,765,201**	**45,776**	**612,370**	**10.6**
Cowlitz County	91,364	39,797	12,765	14
Aggregate Block Group	26,098	45,722	2,245	8.6
Clark County	341,464	48,376	31,027	9.1
Aggregate Block Group	70,389	55,114	4,985	7.1
Oregon State	**3,347,667**	**40,916**	**388,740**	**11.6**
Multnomah County	645,584	41,278	81,711	12.7
Block Group 1, Census Tract 102	2,902	54,875	344	11.9

Notes:

1. Low-income populations are identified if the percent of the population below the poverty level is equal to or greater than 20 percent of the total population.
2. Data compiled as part of the 2000 Census are the most recent available data at the census block group level. The total population in this table is based on Summary File 3, which is a sample of the population, and is less than the total population presented in Table 11-3.
3. There are 71 block groups crossed by the I-5 Project. Block groups were aggregated at the county level. See Appendix H for specific block-level data.

Sources: U.S. Census Bureau 2000b, 2000c

The Cowlitz County aggregate had a median household income of $45,722, which was comparable to state income levels. The poverty level for the Cowlitz County aggregate was about 9 percent. The Clark County aggregate median household income was $55,114 with 7 percent poverty level. Overall, the aggregated block groups had median incomes comparable to or higher than their representative counties and the state, and much lower poverty levels.

Block Group 1 in Census Tract 410.02 in Clark County may be a low-income area, based on the most recent available data (1999). Block Group 1 in Census Tract 410.02 had about 23 percent of the population below the poverty level and median household income equivalent to just 50 percent of the Washington State median (see Appendix H for individual block group data).

Oregon had a median household income of $40,916 in 1999 with 11 percent of its population below the poverty level. Median household income in Multnomah County was slightly higher than the state median at $41,278. Multnomah County had a slightly greater percentage (12.7 percent) of its population below the poverty level than the state. There is only one block group within Multnomah County in the project area. This block group had a median household income higher than the state median at $54,875, with a comparable poverty level of 12 percent. None of the other block groups or the counties within the project area had 20 percent or more of residents below the poverty level (see Table 11-4).

11.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

11.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- A reduction in the supply of housing or the capacity of public services, utilities, or infrastructure required to satisfy demand
- A reduced level of government revenues by an amount sufficient to reduce the capacity of public services or infrastructure
- A change to the market price of agricultural products or timber at the regional or national level
- A permanent impact to a disproportionate low income or minority population
- A full percentage point of change to the rate of unemployment

Impacts would be **moderate** where project activities would cause the following:

- A substantially increased level of use of existing stocks of housing, utilities, and public services and infrastructure
- A measurably reduced level of government revenues, but by an amount that does not degrade the capacity of public services and infrastructure
- A change to the market price of agricultural products or timber at the local level
- An impact during construction to a disproportionate low income or minority population
- A half percentage-point change to the rate of unemployment

Impacts would be **low** where project activities would cause the following:

- Little effect on the supply of or level of use of housing or utilities, public services and infrastructure, government revenues, or the market prices of agricultural products or timber
- A 1/10 of 1 percent change in the unemployment rate

No impact would occur where project activities would have no effect on the supply of or level of use of housing or public services and infrastructure, government revenues, or the market prices of agricultural products or timber; no effect to a disproportionate low income or minority population; and an imperceptible change to the unemployment rate.

11.2.2 Impacts Common to Action Alternatives

11.2.2.1 Population and Housing

At the peak of construction, the project would employ about 200 construction workers, about 150 of whom would be from outside the local area. These non-local workers would temporarily increase local populations by about 180 persons (assuming some non-local workers would be accompanied by their families). Many of the construction workers would provide their own housing, such as campers or trailers, but require a place to park them; others would require motel rooms, rentals and other temporary housing. There would be a short-term increase in the demand for temporary housing in the project area, but existing temporary housing near the project (see Section 11.1.1, Population and Housing) would be sufficient to accommodate non-local workers and their families without creating a discernable change in availability, a **no-to-low** impact on housing during construction. Existing BPA staff would operate and maintain the new transmission line and associated facilities, so there would be no long-term impact on the population and the demand for housing.

11.2.2.2 Employment and Income

Construction activities would create a short-term increase in employment; at the peak of construction, the project would directly provide about 200 jobs. Indirect impacts would also occur as construction-related workers and suppliers spend their earnings on goods and services in the area, generating additional demand for labor, but these effects likely would be too small to be discernible relative to the size of the regional economy. If construction occurs during a period with low unemployment (not the current condition), workers would likely come from other projects and the net impact on local employment would be near zero. If construction occurs during a period of high unemployment, local, skilled workers could be hired, and the net impact on regional employment would be about 200 jobs (about 0.005 percent of the labor force in the region). Based on the current rate of unemployment in the economic area (approximately 300,000 unemployed), the jobs provided by the project would not cause a perceptible change in this rate. This change would be imperceptible even if all jobs were new jobs; in the case of this project, some of the workers will already be employed, so the project would have no impact on unemployment.

Construction activities would cause a short-term increase in income through construction-related spending on labor, materials, and land. The project would involve increased expenditures of about $24 million for existing BPA contractors and staff, and $88 million on wages and benefits for non-BPA contract workers, of which about $22 million would go to workers from within the area and $66 million would go to workers from elsewhere. Additional direct income would be generated for business owners, landowners, and workers from expenditures of about $89 million for construction materials and about $77 million for land and easement acquisitions. The overall, direct impact on income, for the entire construction period, would be equivalent to about 0.01 percent of total personal income in the area in 2009, which is barely measureable and a **low** impact. Indirect increases in income would occur as those receiving income spend it locally on goods and services. The indirect impact likely would be smaller than the direct impact on income.

During operation and maintenance, the project would have no long-term direct impact on employment and no impact on private income, as BPA plans to operate and maintain the new transmission line with existing staff. The project could have long-term, indirect effects on employment, such as effects on the flow of goods and services, such as timber from the lands occupied or affected by the right-of-way, substations, and access roads. However, these changes would likely be too small to be discernable relative to the size of the regional economy. Also, by improving the reliability of electricity delivery in the region, the project would encourage businesses who need high-quality power to locate and invest in the area, which could provide jobs. Improved reliability would allow commercial, industrial, and residential consumers to avoid costs from power interruptions.

11.2.2.3 Public Services and Infrastructure

Given the nature of the project, overall long-term impacts on most, if not all, public service and infrastructure providers from the project likely would be too small to be discernible. Because the project would not permanently increase employment or population in the area, no overall impact to schools, police, fire, or medical services would occur. However, during project construction activities, there could be temporary and periodic higher demand for some public services.

Serious construction-related accidents would increase the demand for emergency medical, police, and fire services. This could cause short-term, localized decreases in the ability of these service providers to meet existing demands if such demands exceeded current capacity. Similarly, during operation and maintenance activities, any project-related accidents that occur could temporarily increase demand for emergency medical, police, and fire services in remote locations, again resulting in short-term, localized decreases in the ability of service providers to meet existing demand if such demands exceeded current capacity. However, most of the time there would be no impacts.

During construction, water would be used as the main method of dust control on access roads, and at tower and substation sites. Water is mixed with backfill to bring the soil to the right moisture content for compaction. Water is also used for fire prevention in areas where dry grasses create a fire hazard. Water would be taken from a permitted local source, either from landowners or municipalities, to minimize haul distance and costs. Because a permit is required, a local municipality can evaluate in advance whether they can meet this added demand and would not likely approve the permit if the supply was not available.

The Castle Rock substation sites would not have water or sewage utilities so no wastewater would be generated. The Sundial substation site would require water and sewage supply and treatment and these facilities would be designed and coordinated with the local municipality, Troutdale.

Impacts on public services and infrastructure that do materialize likely would be **low**, as they would not diminish the supply of services and infrastructure for other purposes.

11.2.2.4 Government Revenue

Short-term increases in government revenue would result from taxes on direct and indirect project-related spending during construction, and from the harvest of the existing stock of privately owned timber in and near the existing and new right-of-way, substations, and access roads. Additional short-term increases in revenue to state trusts would occur if the project results in the harvest of timber from trust lands that otherwise would not be harvested until later. Some of the timber-related increase would be offset if state and private timberland managers decided to reduce harvest on other lands.

The project would cause long-term decreases in government revenue by diminishing the base value of property subject to property taxation, reducing future timber-related revenue from state trust lands, and decreasing future revenue from taxes on private timber harvests and some agricultural products.

Tax Revenue from Project-Related Spending

As a federal government agency, BPA is exempt from taxes on project-related expenditures. Its contractors are not exempt, and would pay applicable taxes on project-related purchases. These direct expenditures and subsequent spending of project-related earnings by workers and contractors would create short-term, indirect increases in revenue for Oregon, Washington, and the counties and local jurisdictions in the project area, from several sources: sales and use taxes (in Washington), income taxes (in Oregon), lodging tax, timber harvest tax, property tax, fuel tax, and real estate excise tax.

Sales and Use Tax

Washington would assess sales or use taxes on materials purchased for the project. Whether it assesses sales or use tax would depend on where the materials are purchased (in Washington or another state), who purchases them (BPA on behalf of a project contractor, or directly by project contractors), and where the materials are installed (in Washington or Oregon). Assuming sales or use taxes are paid on the full cost of the project's materials, which BPA currently estimates at about $100 million, Washington would collect sales and use taxes on project materials of about $8 million. This amounts to about 0.1 percent of the total sales and use tax collections in Washington in 2010.

Workers who spend personal income earned from the project on goods and services they purchase in Washington would also pay sales taxes. BPA expects to spend about $88 million on wages and benefits for contract workers. Assuming that most of the workers on the project from within the region come from Washington and spend all of their income in Washington, and workers from outside the region spend half of their income in Washington, sales tax collections directly stemming from workers' spending would be about $4.3 million over the life of the project. This amounts to about 0.06 percent of the total sales and use tax collections in Washington in 2010.

The project would preclude the production of some agricultural crops, such as nursery stock and Christmas trees, which are subject to sales and use tax if sold retail in Washington. If all these crops are sold in Washington and none are exported, the value of retail sales tax that would have been collected except for this project (using the West Alternative, where the largest impact would occur), would be about $590,000, or about 0.008 percent of total sales and use tax collections in Washington (using 2010 tax rates). If 10 percent of Christmas trees are sold in Washington (Pacific Northwest Christmas Tree Association 2012), actual lost sales tax revenue for trees would be about $41,000. Adding this amount to lost tax revenue from nursery stock (assuming all stock is sold locally which is unlikely) would be about $216,000. Of this amount, for the West Alternative, about $31,000 would be lost tax revenue to local governments (about $1,300 for the Central and Crossover alternatives, and $0 for the East Alternative) and the rest to the state. Other crops affected by the project, regardless of the action alternative, such as strawberries and blueberries, are food crops (including hay used as animal feed) meant for human consumption, and are not subject to the sales and use tax.

Income Tax

Workers living in Oregon and non-residents working in Oregon who meet minimum Oregon-earned income thresholds would pay Oregon income taxes. The amount of income tax collected from this project would depend on the number of workers from Oregon and the amount of project-related labor income earned in Oregon. Assuming all workers from the region were from Oregon and 25 percent of the non-resident workers' income was earned and taxable in Oregon, the project would cause $3.2 million in income tax for Oregon over the life of the project. This amounts to about 0.03 percent of the total personal income-tax collections expected in the 2009 to 2011 biennium. To the extent that corporations working on the project pay income taxes in Oregon and business and occupation (B&O) taxes in Washington, the amount of tax collections would be somewhat higher, although the amount of corporate income or gross receipts that would be attributable to the project is difficult to determine, given available information. Businesses in Washington involved in retailing, wholesaling, or manufacturing agricultural products may pay less B&O tax each year if the reduction in crop production reduces their gross receipts. Similarly, businesses involved in retailing, wholesaling, or manufacturing timber products may pay more or less B&O tax if the project increases or decreases their gross receipts.

Lodging Tax

Workers who stay in temporary lodging in Oregon or Washington would pay lodging taxes. Assuming all non-resident workers seek temporary housing in hotels in Cowlitz and Clark counties during the work week (5 days) for the duration of the project (18 months), and the average rate paid is $50 per night, about $67,500 in lodging tax would be collected over the life of the project. This amounts to about 7 percent of the total lodging tax collected in Clark and Cowlitz counties in 2010.

Timber Harvest Tax

The project may cause a short-term, direct increase in the timber-harvest tax revenue of affected counties and the state government in Washington by triggering harvest of the existing mature timber stock on private lands in and near the new right-of-way, and for the substations and access roads. Depending on economic feasibility, either the grower/landowner would harvest the timber themselves, or, BPA would harvest the timber after an appraisal is completed and an easement is negotiated and secured. Harvest of existing mature timber stock on existing BPA right-of-way would likely not contribute to an increase in tax revenue as this timber may be owned outright by BPA through fee-owned title or owned by BPA as reflected in existing easement language. As a federal agency, BPA does not pay taxes and there would be no timber-harvest tax revenue generated in these cases.

Any increases in revenue would be offset if, because of the unplanned harvest on the cleared lands, landowners decide not to harvest trees on other lands. The project would create a long-term decrease in timber-harvest tax revenue by precluding future timber production on these lands. The short-term, direct increase and the long-term direct decrease in tax revenue for each action alternative are presented in Sections 11.2.3 through 11.2.7.

Property Tax

BPA would acquire land rights (easements) from private property owners for constructing, operating, and maintaining the transmission line and access roads. The property owner would retain ownership of the property and continue to pay property tax on the entire parcel, including the land within BPA's easement. BPA would purchase property for its substations (and possibly substation access roads) in Cowlitz and Multnomah counties. Because BPA is a federal agency and exempt from paying local property taxes, the counties would not collect property taxes on the property acquired in fee for the substation and substation access roads.

Direct decreases in property taxes would occur for properties BPA acquires and removes from the tax rolls. The value of property tax collections to Cowlitz County for the Baxter Creek substation site was $1,168 in 2009. The value of collections to Cowlitz County for the Monahan Creek substation site (both parcels combined) was $1,596 in 2009. Additional decreases may occur for those properties on which it secures an easement that constrains use of the property (severance, loss of use, etc.) and reduces assessed value, but data are insufficient to quantify these decreases. Increases or decreases may occur if land in agricultural production, currently assessed under Washington's Current Use Special Valuation (CUSV) program, is reassessed as non-agricultural land. Data are not sufficient to determine how much property may be subject to this type of reassessment, or what the net effect on property tax collections would be. Indirect decreases in property taxes could occur for nearby residential properties if the project reduces the quality of amenities, or commercial properties if the project affects the income-generating potential of the site. BPA has not been presented with any evidence on previous projects that this has occurred. Available data are insufficient to fully quantify the impacts, but the project's overall impact on property tax revenues likely would be too small to have a discernible effect, relative to the influence of other factors, such as population and economic growth, and new development, and given that the area directly affected by the project is small compared to the total area of the affected counties (for more discussion of the project's potential impact on property values, see Section 11.2.2.5, Property Values).

Fuel Tax

Undoubtedly some amount of tax would be collected from fuel consumption. The amount attributable to the project would depend on consumption and future fuel prices at the time of consumption; the actual amount cannot be reliably estimated from the data that is currently available.

Real-Estate Excise Tax

The value of compensation paid to private landowners in Washington for easements and land purchased for the project would be subject to Washington's real estate excise tax (WAC 458-61A-111) unless the property is taken under condemnation or the imminent threat of condemnation. The amount of tax collected would vary depending on the amount of compensation negotiated for land and easements and their location.

Overall, the project's direct spending during construction and maintenance likely would have no adverse impact on tax revenue for Cowlitz, Clark, and Multnomah counties. The long-term decrease in timber-harvest tax revenue during operation may, in some years, exceed either Cowlitz or Clark county's average compensation cost per employee and have a **high** impact on the two counties.

Revenue from Washington State Trust Lands

WDNR manages state trust lands to provide revenue for several trusts, primarily by producing timber. The project may create a short-term increase in the trusts' revenue from these lands by triggering the harvest of existing mature timber stock in and adjacent to new right-of-way and on any lands that would be occupied by a substation or access roads. Harvest of existing timber stock on existing right-of-way would likely not contribute to an increase in revenue for WDNR because this timber may be owned outright by BPA through fee-owned title or owned by BPA as reflected in the existing easement language.

The value of short-term increases in government revenue for each action alternative and substation site is quantified in Sections 11.2.3 through 11.2.7. In some cases, additional trees would be cut adjacent to the right-of-way for safety purposes, which would increase short-term revenue beyond the values reported in Sections 11.2.3 through 11.2.7. The potential additional revenue increase is reported separately as a percentage applied to the calculated revenue from harvests within the right-of-way, and varies by alternative and option depending on the location of the new right-of-way relative to existing rights-of-way (e.g., if the new right-of-way is adjacent to an existing right-of-way on one side, additional trees would be harvested outside the right-of-way on only one side). Any increase in revenue would be offset if WDNR decided to reduce harvest on other lands but the extent of the offset is unknown. Additional revenue would come from BPA's payment of compensation for any state trust lands acquired for the project or for the easements themselves on trust lands. The appraisal process would also consider whether the transmission facilities would diminish the utility of a portion of the timberland property if the line effectively severs this area from the remaining property (severance damage).

The project would create long-term decreases in government revenue generated from state trust lands in three ways:

- Elimination or reduction of timber production on private timberlands that would be cleared in or next to the new right-of-way or for the substations and access roads
- Increase in the costs of managing private timberland near the new right-of-way, resulting, for example, from project-related restrictions on timber-harvest techniques, such as cable logging, or increases in risks to safety from logging near the right-of-way
- Reduction in the ability of private landowners to generate additional types of revenue, such as from growing trees to sequester carbon, on the cleared lands

The long-term decreases in government revenue for each action alternative, related to the impacts described in the first bullet above, are quantified in Sections 11.2.4 through 11.2.7. Measuring the impact entails converting the future impacts on timber-harvest revenue to an equivalent, single number, called the present value, using a discount rate of 4 percent per year (Row Kaiser and Sessions 1981). The decrease in revenue is reported for the acres of trees within right-of-way newly acquired for this project. For existing right-of-way, BPA likely has already negotiated compensation for forgone future revenue from timber production. Data are unavailable to quantify the decrease in government revenue from the impacts described in the second and third bullet points above. To the extent that each of these impacts occurs, potential mitigation for the decrease in government revenue is discussed in Section 11.2.8, Recommended Mitigation Measures.

The decrease in revenue during operation may, in some years, exceed either Cowlitz or Clark county's average compensation cost per employee and have a **high** impact on the two counties.

11.2.2.5 Property Values

The proposed transmission line is not expected to have long-term impacts on property values in the area for a variety of reasons. Whenever land uses change, the concern is often raised about the effect the change may have on property values nearby. Zoning and permits are the primary means by which most local governments protect property values. By restricting some uses, or permitting them only under certain conditions, conflicting uses are avoided. Some residents consider transmission lines to be an incompatible use adjacent to residential areas. Nonetheless, the presence of transmission lines in residential areas is fairly common.

Appraisals conducted by licensed appraisers are the mechanism used to estimate property values. Factors such as size, amenities, condition and the selling price of comparable properties are generally used for such appraisals.

The question of whether nearby transmission lines can affect residential property values has been studied many times in the United States and Canada over the last 20 years or so, with mixed results. In the 1990s, BPA contributed to the research when it looked at the sale of 296 pairs of residential properties in the Portland, Oregon and Vancouver, Washington, metropolitan areas and in King County, Washington. The study evaluated properties adjoining 16 BPA high-voltage transmission lines (subjects) and compared them with similar property sales located away from transmission lines (comparable sales). All sales were in 1990 and 1991. Study results showed that the subjects in King County were worth about 1 percent less than their matched comparable sales, and the Portland/Vancouver area subjects were worth almost 1.5 percent more (Cowger and Bottemiller 1996).

BPA updated this study in 2000 using 1994 to 1995 sales data, reviewing the sales of 260 pairs of residential properties in the King County and Portland/Vancouver metropolitan areas. The residential sales analysis identified a small but negative impact of from 0 to 2 percent for those properties adjacent to the transmission lines as compared to those where no transmission lines were present. Although this study identified a negative effect, the results are similar to the earlier study and the differences are relatively small (Bottemiller et al. 2000). In 2003, the Appraisal Journal published a BPA article titled, "Further Analysis of Transmission Line Impact on Residential Property Values" (Wolverton and Bottemiller 2003). This article concluded that the data did not support a finding of a price effect on properties abutting high voltage transmission line rights-of-way.

Other studies include "High-Voltage Transmission Lines: Proximity, Visibility, and Encumbrances Effects," by James Chalmers and Frank Voorvaart, published in The Appraisal Journal in 2009. This article concluded that half of the major studies evaluating property value effects from high voltage lines found no effect; the other half found property value declines of 3 to 6 percent, generally not beyond 200 to 300 feet from the lines, with declines dissipating over time.

BPA has initiated new studies to re-examine the potential impact of transmission lines on residential property values in urban areas. Based on a study of home sales between 2005 to 2007 (on homes sold adjacent to high voltage lines and comparable homes sold away from lines), the soon to be finalized findings for the new study in the Portland area (including Clark County, Washington, and Clackamas and Washington counties, Oregon) indicate declines in the overall average residential property values of 1.65 percent. The Seattle metro area (King County, Washington) in the new study indicated a decline of 2.43 percent in the overall average priced home. However, homes in the Seattle study with average selling prices of $996,775 indicated a decline of 11.23 percent (Bottemiller 2012).

For rural areas, a 2010 study involved several hundred sales of rural land in various locations across central Wisconsin that considered the placement of the easement across the tract (Jackson 2010). Four location categories were used: middle, edge, clipping, and diagonal. The results indicated that property sales diminished by about 4 percent for the middle pattern and 2 percent for the diagonal pattern. No diminished property value was observed for either the edge or clipping pattern sales. An Appraisal Journal article in the Winter 2012 edition entitled “High-voltage Transmission Lines and Rural, Western Real Estate Values,” authored by James A. Chalmers, concluded “The research reported here is certainly consistent with the findings in the published literature that property value effects cannot be presumed and are generally infrequent.”

Studies of impacts during periods of physical change, such as new transmission line construction, generally have revealed greater short-term than long-term impacts. However, most studies have concluded that other factors, such as general location, size of property, improvements, condition, amenities, and supply and demand factors in a specific market area are far more important criteria than the presence or absence of transmission lines in determining the value of residential real estate.

The new transmission line would cross over or near current and potential future residential areas depending on the alternative (see Chapter 5, Land). A temporary decrease in property values (and salability) might occur on an individual basis as a result of the new transmission line for these and potentially for nearby properties along the action alternatives. However, these decreases would be highly variable, individualized, and unpredictable. Constructing the transmission line is expected to have no appreciably measurable impact on long-term residential property values along the action alternatives or in the general vicinity. Non-project impacts, along with other general market factors, are already reflected in the market value of properties in the area. These conditions are not expected to change appreciably.

Timberlands cleared in or near the right-of-way that remain cleared and unable to produce timber would decrease in value because growing timber for production and revenue would be prohibited. In addition, if the right-of-way crossed in an orientation that separates a portion of a parcel from another and cannot be used as before (i.e., a “stranded [or severed] use”), the value of the whole parcel could be diminished. BPA would provide compensation to the owners of property BPA acquires or for which it secures an easement, or for other properties where the project would impair the owner’s reasonable use of the property. BPA would pay market value to nonfederal landowners established through the appraisal process for any new land rights required for this project. The appraisal process takes all factors affecting value into consideration, including the impact of transmission lines on property value. The appraisals may reference studies conducted on similar properties to support their conclusions. The strength of any appraisal depends on the individual analysis of the property, using neighborhood-specific market data to determine market value. Current sales at the time of appraisal reflecting economic conditions present in the market place at that time would be used, creating an appraisal that reflects appropriate value trends. Compensation for removing vegetation for new rights-of-way would be determined through the appraisal process for the new easement. For existing BPA rights-of-way, BPA would not pay for trees if they are already owned by BPA either through fee-owned title or through the existing easement. Payment for trees off the existing right-of-way, for example, danger trees, would depend on the terms of the existing easement.

Where BPA needs to acquire easements for additional access roads, and the landowner is the only other user, market compensation is generally 50 percent of the roads full fee value. If other landowners share the access road, compensation is usually something less than 50 percent. For fully improved roads, the appraiser prepares an appraisal of the easement reflecting the current improved condition of the road together with the land value beneath the road. If BPA acquires an easement for the right to construct a new access road and the landowner has equal benefit and need of the access road, market compensation is generally 50 percent of full fee value of the land; if the landowner has little or no use for the new access road to be constructed, market compensation for the easement is generally close to full fee value of the land.

BPA projects rarely require relocating residents, businesses, or farm operations. Occasionally, personal property such as farm equipment or stored materials must be moved. Reasonable and necessary expenses for relocation of these items are fully reimbursable, unless the appraiser deems these items to be realty and compensated for in the property appraisal. BPA ensures that the landowner is fully informed of the relocation process if it appears that relocation would be necessary. The Federal Highway Administration's brochure entitled "Your Rights and Benefits as a Displaced Person," is available at the following website: http://www.fhwa.dot.gov/realestate/rights/.

The Uniform Relocation Assistance and Real Property Acquisition Policies Act calls for fair and equitable treatment of those whose real property would be acquired or who would be displaced as a result of the project. In general, the act limits BPA to paying compensation equal to the fair market value of land purchased for the project or for the diminution in fair market value resulting from an easement or impairment of use. BPA may pay more than fair market value for a residential property if its current market value is less than the sum of mortgage and related debt the owner owes on it. That is, BPA would take into consideration current economic conditions. BPA would not pay compensation to owners of other property, such as residences outside but near the right-of-way, if they should experience a decline in market value.

BPA considers condemnation (exercising the power of eminent domain) as a last resort, and avoids using it as much as possible. BPA’s standard practice is to negotiate a mutually acceptable purchase agreement for new easements from landowners for the land rights needed for the transmission lines, access roads, and substations. If, after good faith negotiations, BPA and a landowner are unable to agree on terms of a purchase, BPA would ask the U.S. Department of Justice to begin condemnation proceedings in the U.S. District Court on its behalf. A landowner may request that the condemnation process be used if they are unwilling to negotiate. In very limited cases, adjustments to right-of-way location may be made or feasible alternative means of access may be found.

11.2.2.6 Agricultural Production

The project would create short-term and long-term decreases in revenue farmers earn from agricultural production on lands directly affected by the project, if such production were prohibited. The decrease may be offset if a farmer is allowed to grow a substitute, less-profitable crop, but insufficient information exists to determine the size of this offset.

Construction of towers and access roads would permanently remove land from agricultural production. Operation of the new line may permanently remove the ability of landowners to grow certain crops on the right-of-way. For agricultural land within existing BPA easements, the landowners may be able to reserve the right to grow and maintain non-woody, low-growing plants, such as agricultural crops or vegetative cover with a mature height not to exceed 4 feet and that do not require structural support. For the purpose of this analysis, production of hay and silage, strawberries, and some nursery crops would be allowed within the right-of-way. Blueberries, grapes, and Christmas trees would not be allowed. If landowners desire to grow woody plants, structure-supported crops, or vegetation exceeding 4 feet on an existing BPA right-of-way, they would need to contact BPA and secure a written agreement allowing such use if BPA determines that such use is safe and does not, or would not, cause any interference with the safe operation of the lines. The landowner would be restricted from planting any agricultural crops or vegetative cover including trees, shrubs, brush, or other vegetation covered by the reservation or written agreement within a 50-foot radius of all poles or towers.

Construction and maintenance of the project could cause crop damage, a temporary impact. BPA would assess and pay for the damage caused. Typically there is little decrease in productivity or increase in management costs on agricultural land next to towers and access roads, or within the right-of-way for crops that are allowed to remain. If it is necessary to modify an irrigation system due to the construction of the transmission facilities, the appraisal process would include an estimate of the cost. If the landowner has reserved rights or entered into an agreement with BPA to grow crops within the right-of-way, the landowner would be responsible for the control of weeds within the right-of-way if weeds were not introduced by project construction. BPA does not conduct aerial spraying of herbicides, so drift is not an issue for agricultural production on land next to the right-of-way.

The project likely would have no impact on the overall demand, supply, or price of crops in the regional agricultural markets, although noticeable, but **low** impacts may occur if the affected lands would have produced solely for a niche market, such as locally grown, organic produce. These farmers, individually or collectively, may feel that the impact on their operations is larger, relative to the scale of their operations, than the overall market impact.

The short-term losses of production during construction activities and long-term decreases in revenue from agricultural land permanently removed from production for each action alternative are quantified in Sections 11.2.4 through 11.2.7. The analysis of long-term losses assumes that the crop currently grown in the right-of-way would have been grown in perpetuity, and annual revenues are discounted at an annual rate of about 2 percent (U.S. Office of Management and Budget 2011). Potential tax impacts from revenue changes are discussed in Section 11.2.2.4, Government Revenue.

11.2.2.7 Private Timber Production

The project may create short-term increases and long-term decreases in the revenue derived from timber production on private land. The short-term increase may occur if existing mature timber that otherwise would continue to grow would, instead, be harvested on lands that would be cleared in or adjacent to new right-of-way or for the substations and access roads. This would likely be the case where it is economically feasible for large commercial growers to harvest the timber themselves. For growers with smaller holdings, it may not be feasible to harvest the timber themselves; in this case, BPA would harvest the timber after an appraisal is completed and an easement is negotiated and secured. Harvest of existing timber stock on existing right-of-way would likely not contribute to an increase in revenue for the landowner because this timber may be owned outright by BPA through fee-owned title or owned by BPA as reflected in existing easement language. Any short-term increases in revenue could be offset if, because of the unplanned harvest on the cleared lands, landowners decide not to harvest trees on other lands. The short-term increases in revenue for each action alternative and substation site are quantified in Sections 11.2.3 through 11.2.7.

In some cases, trees would be cut adjacent to the right-of-way for safety purposes. This additional harvest would increase short-term revenue beyond the values reported in Sections 11.2.3 through 11.2.7. The value of the potential increase varies by alternative and option, and depends on the amount of timber adjacent to the new right-of-way and its ownership.

The long-term decreases in revenue derived from timber production would occur in three ways:

- Elimination or reduction of timber production on private timberlands lands that would be cleared in or next to the new right-of-way or for the substations and access roads
- Increased costs of managing private timberland near the new right-of-way, resulting, for example, from project-related restrictions on timber-harvest techniques, such as cable logging, or greater risks to safety from logging near the right-of-way
- Elimination or reduction of the potential to generate non-harvest related revenue (e.g., payments for ecosystem services, such as carbon sequestration or habitat protection) on private timberlands that would be cleared in or next to the new right-of-way or for the substations and access roads

The long-term decreases in revenue for each action alternative and substation site, related to the impacts described in the first bullet above, are quantified in Sections 11.2.3 through 11.2.7. Measuring the impact entails converting the future impacts on timber-harvest revenue to an equivalent, single number, called the present value, using a discount rate of 4 percent per year (Row Kaiser and Sessions 1981). The decrease in revenue is reported for the acres of trees within right-of-way newly acquired for this project. For existing right-of-way, BPA likely has already negotiated compensation for forgone future revenue from timber production. Data are unavailable to quantify the decrease in revenue resulting from the impacts described in the second and third bullet points above. To the extent that each of these impacts occurs, potential mitigation for the decrease in government revenue is discussed in Section 11.2.8, Recommended Mitigation Measures. The expected changes in the value of private timber production for each action alternative are quantified in Sections 11.2.4 through 11.2.7.

The project likely would have no impact on the price of private timber in regional markets, although it may decrease the price at the local level during construction (a **low** impact). The actual impact would depend not just on the project's direct impact on the timber-harvest level, but also on the extent to which forest landowners adjust harvest on other lands in response.

11.2.2.8 Community Values

BPA received many comments about the potential effects the project could have on existing quality of life and other values. The following sections evaluate how the alternatives could generally affect people who hold these values.

Quality of Life

The project could affect the well-being of residents by altering the supply of amenities, such as cohesive neighborhoods and the natural environment, that reflect the area's social capital (productive relationships among individuals and entities) and natural capital (the natural environment). The project, itself a form of human-built capital, could directly affect the level of social capital and natural capital in the project area. The project could create long-term increases in well-being, for example, if it increases the value of amenities, such as by promoting greater goodwill among citizens having an interest in the project. It could cause long-term decreases in well-being, for example, if it generates discord between individuals with different views about the project's desirability.

Property-Related Amenities

The project would cause short-term decreases in the value of amenities, such as peace and quiet, for residents that would be affected by increased noise, traffic, and other aspects of construction. It would cause long-term decreases in the value of amenities, such as being close to forested open space and far from industrialized lands, for residents of properties near the transmission line, substations, and access roads.

Public Health and Safety

The project could create a short-term decrease in the economic well-being of workers or others who experience a project-related illness or accident during the construction period. Fatalities or chronic conditions from project-related illnesses and accidents could cause long-term decreases in well-being for construction workers and their families. Industry-wide illness and fatality rates suggest workers could experience about nine injuries, one illness, and a small chance of a fatality during the year with the peak level of activity, with lower levels during periods with less intense activity (U.S. Department of Labor, Bureau of Labor Statistics 2009). The public could experience accidental injuries or deaths during construction and operation of the transmission line and substations. The economic costs of injuries, illnesses, and deaths could be large to individuals and their families, but likely would not have a discernible effect on the overall value of safety and health for the public.

The project would create a long-term decrease in the well-being of landowners, residents, workers, and visitors who perceive that the project would expose them to higher risks from EMF, electrocution, and project-related accidents.

Recreation and Tourism

The project would cause a short-term, temporary decrease in the value of recreational activities on affected lands and waters as construction displaces or interferes with recreation. It would cause a long-term, permanent increase in the value some people derive from recreational activities where new or improved access roads enhance accessibility or other qualities people desire (e.g., improved visibility or hunting quality from clearings). The project would cause a long-term permanent decrease in the value some people derive from recreational activities if the project diminished accessibility, visual aesthetics, sense of solitude, or other characteristics people desire or currently enjoy (see Chapter 6, Recreation).

Changes in the value of recreational opportunities resulting from the project would affect the behavior of recreationists, who likely would make fewer visits to areas with diminished value and more visits to areas with higher value. Where the right-of-way and access roads would cross forest habitat, for example, wildlife watchers may make fewer trips to see species that depend on unfragmented forest and more trips to see those that prefer forest edges. The changes in behavior may occur entirely within the project area or they may extend beyond its boundaries. In response to any reduction in the value of hiking opportunities in the area, for example, some hikers might decide to go hiking on other unaffected trails within the project area, or choose to travel to trails outside of the project area. To the extent that the project's effects on recreation resources lead recreationists to alter their spending patterns, it would affect levels of sales, employment, and earnings in related businesses.

Natural Environment

The project would cause long-term decreases in the value of the benefit some people enjoy from the existence of the plants, animals, and other resources that the project would affect. Some impacts would occur through the reduced value of recreation and tourism, as described above. Additional decreases in value would occur from and via increased costs for taxpayers, landowners, and others to anticipate, monitor, and respond to impacts to the natural environment.

Transmission System Reliability

The project would create long-term increases in the contribution of BPA's transmission system to the economic well-being of electricity consumers. The project would allow BPA to meet its obligations to provide firm transmission service to its customers. By improving the reliability of electricity delivery in the region, the project would encourage businesses who need high-quality power to locate and invest in the area, which could provide jobs. Improved reliability would allow commercial, industrial, and residential consumers to avoid costs from power interruptions, such as a business losing revenues when it must cease production, residents losing food to spoilage, or police responding to accidents when traffic controls fail.

11.2.2.9 Environmental Justice

None of the action alternatives would affect minority populations disproportionately. The minority populations in the cities, counties and census tracts evaluated are not of sufficient size to be a disproportionate population under CEQ guidelines for Environmental Justice.

The West Alternative would include an area (Census Tract 410.02, Block Group 1) with a low-income population that is disproportionate to populations living elsewhere in the alternative's affected counties (see Table 11-4 and Appendix H for individual block group data). However, effects to residents in that census tract are the same in range and extent as to all other census tracts and populations along the West Alternative, and to the other alternatives which do not contain any low-income populations. Therefore, the West Alternative does not affect this population any differently than other populations along the alternative route. The impacts from this project on low-income or minority populations would not be disproportionate and none would fall under the goals and procedures of EO 12898. Accordingly, there would be no disproportionate impacts to these groups.

BPA has considered all input from persons or groups regardless of race, income status, or other social and economic characteristics. Public scoping was held for the project and included an extended public comment period. Interested parties were encouraged to provide written input via the project website, U.S. mail, or fax, as well as by telephone. All comments received as part of the scoping process were posted on the project website: http://www.bpa.gov/go/i-5. Comments will continue to be accepted throughout the NEPA process for the project (see Section 1.6, Public Involvement and Major Issues).

11.2.2.10 Sundial Substation

BPA would purchase 40 acres for the substation and access road from the Port of Portland. The location of the substation, access road, and transmission lines could affect all or portions of lots 8, 9, or 11 within the Troutdale Reynolds Industrial Park, depending on the final design and location of proposed facilities. The Port is preparing to make land available within the industrial park for commercial and industrial uses in a phased development. Phase I is underway. Phase II is expected to include the development of Lot 11, which could be available from 2012 to 2015. Phase III is expected to include the development of Lots 8 and 9, which could be available from 2015 to 2017 (Port of Portland 2011). The Port expects to sell future lots for around $6 per square foot. The actual sale price likely will vary depending on site characteristics and market conditions at the time of sale. The Port sold one lot from the Phase I development in 2008 for $5 per square foot (Multnomah County 2011).

> BPA would purchase about 25 to 50 acres for each of the proposed substations and substation access roads, with exact acreage depending on the parcel selected and the final substation and access road design.
>
> For purposes of this analysis, 40 acres was assumed as a reasonable amount of land to purchase for the substation sites.

If BPA purchases property in the industrial park for Sundial Substation and the substation access road, the Port of Portland would be unable to sell or lease this property for other commercial or industrial uses. BPA would pay market value to nonfederal landowners established through the appraisal process for any new land rights required for this project (see Section 11.2.2.5, Property Values). If, by purchasing the land for the substation, the project reduces the price the Port can receive for nearby lots or changes the configuration of the development in a way that reduces the potential value of the remaining lots, the project could cause a decrease in revenue for the Port of Portland. If it has the reverse effect, it would increase revenue. If BPA displaces a private landowner who otherwise would pay property taxes on the land, it could create a long-term decrease in revenue for Multnomah County, a **moderate** impact, although it likely would not diminish the county's workforce and infrastructure.

11.2.3 Castle Rock Substation Sites

11.2.3.1 Casey Road

BPA would purchase the property for the Casey Road site and access road from WDNR. WDNR uses the property for timber harvest and it also is classified as farmland of statewide importance. Portions of the property have been recently logged. Timber harvested from the site during construction would create a short-term increase of about $158,900 in timber-harvest revenue from state trust lands (see Section 11.2.2.4, Government Revenue, for assumptions). Logging

> Impacts common to action alternatives are in Section 11.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

this timber would produce revenues for the Agricultural and Scientific Schools Trust and State Forest Lands. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. Converting this property from state trust land to a substation site would cause a long-term decrease in state revenue from forgone future harvests with a total present value of $124,100 (see Section 11.2.2.4 for assumptions). The revenue reduction likely would have a **moderate** impact on Cowlitz County's ability to meet all demands for public services, although it would not diminish the county's workforce and infrastructure.

11.2.3.2 Baxter Road

BPA would purchase the property for the substation site and access road from Sierra Pacific Industries. The property is classified as farmland of statewide importance and is used for timber harvest. Sierra Pacific Industries paid $1,168 in property taxes for the parcel to Cowlitz County in 2009. This represented about 0.001 percent of total property tax collections in Cowlitz County in 2009. The project would cause a long-term decrease in annual property tax collections in Cowlitz County.

During construction, timber harvests from clearing the site would increase timber-harvest tax revenue by about $2,900 for Cowlitz County and about $700 in state revenue. Precluding future timber harvests on the site during operation would cause a long-term decrease in state and county timber-harvest taxes, with a total present value of about $7,900 for Cowlitz County and about $2,000 for the state.

Timber harvests from clearing the site would also cause a short-term increase about $71,300 in the revenue derived from timber production on private land (see Section 11.2.2.7, Private Timber Production, for assumptions). Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. Converting the land from private timber production would cause a long-term decrease in revenue for Sierra Pacific Industries, with a present value of about $198,000 from forgone future timber harvests (see Section 11.2.2.7 for assumptions).

The revenue reduction likely would have a **moderate** impact on Cowlitz County's ability to meet all demands for public services, although it would not diminish the county's workforce and infrastructure. The change in timber production likely would have no impact on market prices for timber.

11.2.3.3 Monahan Creek

BPA would purchase the property for the substation and access road. The property is classified as farmland of statewide importance and prime farmland. Trees cover portions of the property; other portions are used for grazing. The landowners paid $1,596 in property taxes to Cowlitz County in 2009. This amount represented about 0.001 percent of total property tax collections in Cowlitz County in 2009. Because BPA would not pay property taxes once it acquires the property, the project would create a long-term decrease in annual property tax collections in Cowlitz County.

During construction, timber harvest from clearing the site would increase timber-harvest tax revenue by about $1,200 for Cowlitz County and about $300 in state revenue. Operation would preclude future timber harvests on the site and would cause a long-term decrease in state and county timber-harvest taxes, with a total present value of about $3,400 for Cowlitz County and about $900 for the state.

Timber harvests from clearing the site would also cause a short-term increase of about $30,900 in the revenue derived from timber production on private land (see Section 11.2.2.7, Private Timber Production, for assumptions). Converting the land from private timber production, assuming the landowner otherwise would use it for timber harvest, would cause a long-term decrease of about $85,800 in revenue for the private landowner from forgone future timber harvests on the cleared land (see Section 11.2.2.7 for assumptions).

The revenue reduction likely would have a **moderate** impact on Cowlitz County's ability to meet all demands for public services, although it would not diminish the county's workforce and infrastructure. The change in timber production likely would have no impact on market prices for timber.

11.2.4 West Alternative and Options

The only socioeconomic factors that would vary under the West Alternative and its options are government revenue, agricultural production, and private timber production. This is also true of the other three alternatives and their options. Accordingly, the following discussions of the action alternatives focus on these three socioeconomic factors.

11.2.4.1 Government Revenue

The West Alternative would affect government revenue in Washington from state trust lands and from timber-harvest taxes.

Washington State Trust Land Revenue

During construction, the West Alternative would cause an increase of about $2,390 in timber-harvest revenue from state trust lands by triggering harvest of existing mature timber stock on lands cleared for the project (see Table 11-5).

Greater increases during construction would occur for West Options 2 and 3. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. If the value of the trees outside of the right-of-way that may be harvested because they could interfere with construction or operation of the line is included in the total, the increase would be about 21 percent greater than shown in Table 11-5 for West Option 2 and about 15 percent greater for West Option 3 (see Section 11.2.2.4, Government Revenue, for assumptions). The increase for each individual landowner could be greater or less than the total increase. The short-term increase in revenue during construction represents a small change (a fraction of a percent) compared to the annual statewide revenue for the trusts, which was $115 million in 2009.

Table 11-5 Value of Timber Cleared From State Trust Lands (in 2011 dollars)[1,2,3]

Alternatives and Options	Trust							Total
	Capitol Building	Institutions[4]	Common School	Agricultural	Scientific School	State Forest Lands[5]		
						Clark	Cowlitz	
West Alternative	**$0**	**$0**	**$2,390**	**$0**	**$0**	**$0**	**$0**	**$2,390**
West Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	+$52,410	N/C	N/C	N/C	N/C	+$52,410
West Option 3	N/C	N/C	+$36,650	N/C	N/C	N/C	N/C	+$36,650
Central Alternative	**$167,100**	**$157,600**	**$753,400**	**$3,640**	**$110,600**	**$950,900**	**$132,700**	**$2,276,000**
Central Option 1	N/C	N/C	+$12,490	N/C	+$74,850	N/C	+$168,300	+$255,600
Central Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Central Option 3	N/C	N/C	-$76,590	N/C	N/C	-$355,360	N/C	-$431,950
East Alternative	**$48,540**	**$0**	**$493,600**	**$0**	**$25,920**	**$388,600**	**$308,700**	**$1,265,400**
East Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
East Option 2	+$53,590	N/C	-$11,750	N/C	-$25,920	+$244,100	N/C	+$260,000
East Option 3	N/C	N/C	+$66,260	N/C	N/C	+$104,600	N/C	+$170,900
Crossover Alternative	**$48,540**	**$0**	**$650,400**	**$0**	**$79,220**	**$706,800**	**$132,700**	**$1,618,000**
Crossover Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C

Notes:
N/C – No net change from the action alternative
1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Calculated for timber that would be cleared from the right-of-way, substations, and access roads.
3. Totals may not sum due to rounding. See Section 11.2.2.4, Government Revenue, for assumptions used to quantify these values.
4. Includes charitable, educational, penal, and reformatory institutions.
5. Represents the revenue from timber harvest in Clark and Cowlitz counties; actual revenue impacts to the counties would vary depending on a variety of factors which are adjusted annually. In recent years, counties received about 70 percent of total harvest revenue from State Forest Lands.
Sources: Herrera 2010, Warren 2009, WDNR 2010c

Over the life of the project, the West Alternative would decrease revenue from future timber harvests that would have occurred on land required for the project, with a net present value of about $1,860 (see Table 11-6). Greater decreases would occur with West Options 2 and 3. On an annualized basis, the long-term decrease likely would be small, relative to the annual statewide timber sales for each trust.

The revenue reduction likely would have a **moderate** impact on Cowlitz County's ability to meet all demands for public services, although it would not diminish the county's workforce and infrastructure.

Table 11-6 Net Present Value of Revenue from Future Timber Harvests that Would Have Occurred on State Trust Lands but for the Project (in 2011 dollars)[1,2,3,4]

Alternatives and Options	Trust							Total
	Capitol Building	Insti-tutions[5]	Common School	Agri-cultural	Scientific School	State Forest Lands[6]		
						Clark	Cowlitz	
West Alternative	**$0**	**$0**	**$1,860**	**$0**	**$0**	**$0**	**$0**	**$1,860**
West Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	+$40,950	N/C	N/C	N/C	N/C	+$40,950
West Option 3	N/C	N/C	+$28,630	N/C	N/C	N/C	N/C	+$28,630
Central Alternative	**$130,500**	**$123,100**	**$588,600**	**$2,850**	**$86,390**	**$742,900**	**$103,700**	**$1,778,000**
Central Option 1	N/C	N/C	+$9,760	N/C	+$58,470	N/C	+$131,500	+$199,700
Central Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Central Option 3	N/C	N/C	-$59,830	N/C	N/C	-$277,620	N/C	-$337,450
East Alternative	**$37,920**	**$0**	**$385,600**	**$0**	**$20,250**	**$264,500**	**$241,200**	**$949,500**
East Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
East Option 2	+$41,870	N/C	-$9,180	N/C	-$20,250	+$190,700	N/C	+$203,100
East Option 3	N/C	N/C	+$51,770	N/C	N/C	+$81,730	N/C	+$133,500
Crossover Alternative	**$37,920**	**$0**	**$508,100**	**$0**	**$61,890**	**$552,200**	**$103,700**	**$1,264,000**
Crossover Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C

Notes:
N/C – No net change from the action alternative
1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Calculated for timber that would be cleared from the right-of-way, substations, and access roads.
3. Totals may not sum due to rounding. See Section 11.2.2.4, Government Revenue, for assumptions used to quantify these values.
4. Calculated in perpetuity.
5. Includes charitable, educational, penal, and reformatory institutions.
6. Represents the revenue from forgone timber harvest in Clark and Cowlitz counties; actual revenue impacts to the counties would vary depending on a variety of factors which are adjusted annually. In recent years, counties received about 70 percent of total harvest revenue from State Forest Lands.
Sources: Herrera 2010, Warren 2009, WDNR 2010c

Tax Revenue from Private Timber Harvest

During construction, the West Alternative would cause an increase of about $940 (see Table 11-7) in the timber-harvest tax revenue of affected counties and the state government in Washington by triggering harvest of existing mature timber stock on private lands cleared for the project. This near-term increase would be the same with West Options 1 and 2, but larger with West Option 3. The West Alternative also would cause a long-term decrease in timber-harvest tax revenue during operation, by precluding future timber production on the cleared lands, with a total net present value of about $2,610 (see Table 11-8). This long-term decrease would be the same with West Options 1 and 2, but larger with West Option 3. The short-term increase and long-term decrease in timber-tax revenue would represent small changes compared to the annual tax-revenue collections from harvests in Clark and Cowlitz counties.

The revenue reduction likely would have a **moderate** impact on Cowlitz County's ability to meet all demands for public services, although it would not diminish the county's workforce and infrastructure. The change in timber production likely would have no impact on market prices for timber.

Table 11-7 Value of Tax Revenue from Timber Cleared from Private Lands (in 2011 dollars)[1,2,3]

Alternatives and Options	Tax Revenue Recipient			Total
	Cowlitz County	Clark County	State of Washington	
West Alternative	**$750**	**$0**	**$190**	**$940**
West Option 1	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	N/C	N/C
West Option 3	N/C	+$1,630	+$410	+$2,040
Central Alternative	**$38,370**	**$14,390**	**$13,190**	**$65,950**
Central Option 1	-$890	N/C	-$220	-$1,110
Central Option 2	-$9,080	N/C	-$2,270	-$11,350
Central Option 3	-$360	-$7,640	-$2,000	-$10,000
East Alternative	**$49,640**	**$25,830**	**$18,870**	**$94,340**
East Option 1	-$7,520	N/C	-$1,880	-$9,400
East Option 2	N/C	-$6,720	-$1,680	-$8,400
East Option 3	N/C	-$910	-$230	-$1,140
Crossover Alternative	**$1,890**	**$27,950**	**$7,460**	**$37,300**
Crossover Option 1	N/C	N/C	N/C	N/C
Crossover Option 2	$3,220	N/C	+$810	+$4,020
Crossover Option 3	$4,490	N/C	+$1,120	+$5,610

Notes:
N/C – No net change from the action alternative
1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Calculated for timber that would be cleared from the right-of-way and access roads.
3. Totals may not sum due to rounding.
Sources: Herrera 2010, Warren 2009, WDNR 2010c

Table 11-8 Net Present Value of Tax Revenue From Future Timber Harvests that Would Have Occurred on Private Lands but for the Project (in 2011 dollars)[1,2,3,4]

Alternatives and Options	Tax Revenue Recipient			Total
	Cowlitz County	Clark County	State of Washington	
West Alternative	**$2,090**	**$0**	**$520**	**$2,610**
West Option 1	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	N/C	N/C
West Option 3	N/C	+$4,530	+$1,130	+$5,670
Central Alternative	**$106,600**	**$39,960**	**$36,640**	**$183,200**
Central Option 1	-$2,470	N/C	-$620	-$3,090
Central Option 2	-$25,220	N/C	-$6,310	-$31,530
Central Option 3	-$1,000	-$21,220	-$5,560	-$27,780
East Alternative	**$137,900**	**$71,750**	**$52,410**	**$262,100**
East Option 1	-$20,890	N/C	-$5,220	-$26,110
East Option 2	N/C	-$18,660	-$4,660	-$23,320
East Option 3	N/C	-$2,530	-$630	-$3,160
Crossover Alternative	**$5,260**	**$77,640**	**$20,730**	**$103,600**
Crossover Option 1	N/C	N/C	N/C	N/C
Crossover Option 2	$8,940	N/C	+$2,240	+$11,170
Crossover Option 3	$12,480	N/C	+$3,120	+$15,600

Notes:
N/C – No net change from the action alternative
1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Calculated for timber that would be cleared from the right-of-way and access roads.
3. Totals may not sum due to rounding.
4. Calculated in perpetuity.
Sources: Herrera 2010, Warren 2009, WDNR 2010c

11.2.4.2 Agricultural Production

During construction, the West Alternative would cause a decrease in revenue of about $820,000 by removing crops both inside and outside of the right-of-way (see Table 11-9). Some of this removal would be temporary; for example, crops removed for a temporary access road across an agricultural field needed for access to the right-of-way. The decrease would be larger with West Options 2 and 3. This represents a small proportion of the annual agricultural production revenues in Cowlitz, Clark, and Multnomah counties (about 0.5 percent of the revenue generated in 2007, in 2010 dollars). The decrease could be a greater proportion of agricultural revenue for individual landowners.

Over the life of the project, operation of the West Alternative would cause a decrease in revenue, with a net present value of about $5,100,000, by permanently eliminating landowners' ability to produce crops within the tower footprints (see Table 11-10). This long-term decrease would be larger with West Options 2 and 3. Landowners may not grow crops over 4 feet or crops requiring support structures within the entire right-of-way. Assuming landowners stop growing these crops in the right-of-way, the West Alternative would cause an additional long-term decrease in revenue, with a net present value of about $7,200,000 (see Table 11-10). The decrease would be the same under all options. The long-term decrease would be small, relative to the annual value of agricultural production in Cowlitz, Clark, and Multnomah counties. The decrease could be proportionally more significant for an individual landowner.

The change in agricultural production likely would have no impact on regional prices for agricultural products. At the local level, impacts could be **low-to-moderate** if local prices for a particular product are affected by limited supply.

Table 11-9 Value of Crops Removed from Production During Construction (in 2011 dollars)[1,2,3,4]

Alternatives and Options	Type of Crop						Total
	Blue-berries	Christmas Trees	Grapes[5]	Hay/Silage	Nursery Stock	Strawberries	
West Alternative	**$0**	**$130,000**	**$94,000**	**$2,400**	**$290,000**	**$310,000**	**$820,000**
West Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	N/C	+$650	N/C	N/C	+$650
West Option 3	N/C	N/C	N/C	+$790	N/C	N/C	+$790
Central Alternative	**$0**	**$2,800**	**$0**	**$160**	**$0**	**$0**	**$3,000**
Central Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Central Option 2	N/C	N/C	N/C	-$160	N/C	N/C	-$160
Central Option 3	+$35,000	N/C	N/C	N/C	N/C	N/C	+$35,000
East Alternative	**$0**	**$0**	**$0**	**$160**	**$0**	**$0**	**$160**
East Option 1	N/C	N/C	N/C	-$160	N/C	N/C	-$160
East Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C
East Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Alternative	**$0**	**$2,800**	**$0**	**$0**	**$0**	**$0**	**$2,800**
Crossover Option 1	N/C	N/C	N/C	+$650	N/C	N/C	+$650
Crossover Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C

Notes:
N/C – No net change from the action alternative
1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Calculated for crops that would be cleared from the right-of-way and access roads.
3. Totals may not sum due to rounding.
4. Calculated in perpetuity.
5. Grapes are the crop produced on land the Washington State Department of Agriculture data classifies as a vineyard.
Sources: Cross et al. 1991; Julian et al. 2011; USDA NASS 2009a, 2009b; Washington Department of Agriculture, 2009.

Table 11-10 Net Present Value of Revenue from Crops that Farmers Would Have Grown but for the Project (in 2011 dollars)[1,2,3]

Alternatives and Options	Type of Crop						Total
	Blue-berries	Christmas Trees	Grapes[4]	Hay/Silage	Nursery Stock	Straw-berries	
Crops on Land that Would be Occupied by Tower Footprints and Access Roads within and outside Right-of-Way							
West Alternative	**$0**	**$830,000**	**$710,000**	**$14,000**	**$1,900,000**	**$1,600,000**	**$5,100,000**
West Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	N/C	+$4,700	N/C	N/C	+$4,700
West Option 3	N/C	N/C	N/C	+$4,300	N/C	N/C	+$4,300
Central Alternative	**$0**	**$110,000**	**$0**	**$5,100**	**$0**	**$0**	**$120,000**
Central Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Central Option 2	N/C	N/C	N/C	-$5,100	N/C	N/C	-$5,100
Central Option 3	+$400,000	N/C	N/C	N/C	N/C	N/C	+$400,000
East Alternative	**$0**	**$0**	**$0**	**$5,300**	**$0**	**$0**	**$5,300**
East Option 1	N/C	N/C	N/C	- $5,100	N/C	N/C	- $5,100
East Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C
East Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Alternative	**$0**	**$110,000**	**$0**	**$0**	**$0**	**$0**	**$110,000**
Crossover Option 1	N/C	N/C	N/C	+$3,700	N/C	N/C	+$3,700
Crossover Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crops not Allowed in the Right-of-Way[5]							
West Alternative	**$0**	**$4,200,000**	**$2,900,000**	**$0**	**$0**	**$0**	**$7,200,000**
West Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C
West Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Central Alternative	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Central Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Central Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Central Option 3	+$970,000	N/C	N/C	N/C	N/C	N/C	+$970,000
East Alternative	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
East Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
East Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C

Alternatives and Options	Type of Crop						Total
	Blue-berries	Christmas Trees	Grapes[4]	Hay/Silage	Nursery Stock	Straw-berries	
East Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Alternative	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
Crossover Option 1	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 2	N/C	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 3	N/C	N/C	N/C	N/C	N/C	N/C	N/C

Notes:
N/C – No net change from the action alternative
1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Totals may not sum due to rounding.
3. Calculated in perpetuity.
4. Grapes are the crop produced on land the Washington State Department of Agriculture data classifies as a vineyard.
5. Calculated in perpetuity.
Sources: Cross et al. 1991; Julian et al. 2011; USDA NASS 2009a, 2009b; Washington Department of Agriculture, 2009.

11.2.4.3 Private Timber Production

Construction of the West Alternative would cause an increase of about $18,810 (see Table 11-11) in the revenue derived from timber production of large commercial growers by triggering harvest of existing mature timber stock on lands that would be cleared for the project. This short-term increase would be the same with West Options 1 and 2, and larger with West Option 3. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. If the value of the trees that may be harvested because they could interfere with construction or operation outside of the right-of-way is included in the total, the increase would be about 7 percent greater than shown in Table 11-11 for the West Alternative and options (see Section 11.2.2.7, Private Timber Production, for assumptions). The increase for each individual landowner could be greater or less than the total increase.

Over the life of the project, the West Alternative would cause a long-term decrease in revenue, with a net present value of about $52,260 (see Table 11-12), from timber harvests that would have occurred, but for the project, on private timberlands. The increase would be the same with West Options 1 and 2, and larger with West Option 3.

The decrease in timber production likely would have no impact on market prices for timber.

Table 11-11 Value of Timber Cleared from Private Lands (in 2011 Dollars)[1,2,3,4]

Alternatives and Options	Longview Timberlands LLC	PacifiCorp[5]	Sierra Pacific Industries	Weyerhaeuser Company	Other Private[6]	Total
West Alternative	**$12,470**	**$0**	**$0**	**$6,340**	**$0**	**$18,810**
West Option 1	N/C	N/C	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	N/C	N/C	N/C	N/C
West Option 3	+$40,810	N/C	N/C	N/C	N/C	+$40,810
Central Alternative	**$502,200**	**$35,960**	**$108,300**	**$672,600**	**$0**	**$1,319,000**
Central Option 1	N/C	N/C	-$22,230	N/C	N/C	-$22,230
Central Option 2	-$112,630	N/C	-$108,280	-$6,120	N/C	-$227,030
Central Option 3	+$44,690	-$30,220	N/C	-$214,480	N/C	-$200,010
East Alternative	**$500,000**	**$38,500**	**$108,300**	**$1,240,000**	**$0**	**$1,887,000**
East Option 1	-$142,890	N/C	-$108,280	+$63,150	N/C	-$188,030
East Option 2	-$41,290	N/C	N/C	-$126,640	N/C	-$167,930
East Option 3	-$22,740	N/C	N/C	N/C	N/C	-$22,740
Crossover Alternative	**$191,500**	**$82,650**	**$0**	**$472,000**	**$0**	**$746,200**
Crossover Option 1	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 2	N/C	N/C	+$80,460	N/C	N/C	+$80,460
Crossover Option 3	N/C	N/C	+$101,700	+$10,670	N/C	+$112,400

Notes:

N/C – No net change from the action alternative

1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Calculated for timber that would be cleared from the right-of-way and access roads.
3. Totals may not sum due to rounding.
4. See Section 11.2.2.7, Private Timber Production, for assumptions used to quantify these values.
5. PacifiCorp harvests timber for wildlife habitat on its mitigation lands.
6. Assumes $0: BPA acquires timber through easement negotiations because it is not cost-effective for small private landowners to harvest themselves.

Sources: Herrera 2010, Warren 2009

Table 11-12 Net Present Value of Revenue from Future Timber Harvests that Would Have Occurred on Private Lands but for the Project (in 2011 dollars)[1,2,3,4,5]

Alternatives and Options	Longview Timberlands LLC	PacifiCorp[6]	Sierra Pacific Industries	Weyerhaeuser Company	Other Private[7]	Total
West Alternative	**$34,640**	**$0**	**$0**	**$17,620**	**$0**	**$52,260**
West Option 1	N/C	N/C	N/C	N/C	N/C	N/C
West Option 2	N/C	N/C	N/C	N/C	N/C	N/C
West Option 3	+$113,300	N/C	N/C	N/C	N/C	+$113,300
Central Alternative	**$1,395,000**	**$99,880**	**$300,800**	**$1,868,000**	**$0**	**$3,664,000**
Central Option 1	N/C	N/C	-$61,750	N/C	N/C	-$61,750
Central Option 2	-$312,820	N/C	-$300,760	-$16,990	N/C	-$630,570
Central Option 3	+$124,100	-$83,930	N/C	-$595,730	N/C	-$555,550
East Alternative	**$1,389,000**	**$106,900**	**$300,800**	**$3,444,000**	**$0**	**$5,241,000**
East Option 1	-$396,880	N/C	-$300,760	+$175,400	N/C	-$522,240
East Option 2	-$114,670	N/C	N/C	-$351,740	N/C	-$466,410
East Option 3	-$63,150	N/C	N/C	N/C	N/C	-$63,150
Crossover Alternative	**$531,900**	**$229,600**	**$0**	**$1,311,000**	**$0**	**$2,073,000**
Crossover Option 1	N/C	N/C	N/C	N/C	N/C	N/C
Crossover Option 2	N/C	N/C	+$223,500	N/C	N/C	+$223,500
Crossover Option 3	N/C	N/C	+$282,400	+$29,630	N/C	+$312,000

Notes:

N/C – No net change from the action alternative

1. The value for each option represents the net change from the action alternative. It was calculated as the total value added by the option minus the total value in the segments the option replaces.
2. Calculated for timber that would be cleared from the right-of-way and access roads.
3. Totals may not sum due to rounding.
4. See Section 11.2.2.7, Private Timber Production, for assumptions used to quantify these values.
5. Calculated in perpetuity.
6. PacifiCorp harvests timber for wildlife habitat on its mitigation lands.
7. Assumes $0: BPA acquires timber through easement negotiations because it is not cost-effective for small private landowners to harvest themselves.

Sources: Herrera 2010, Warren 2009

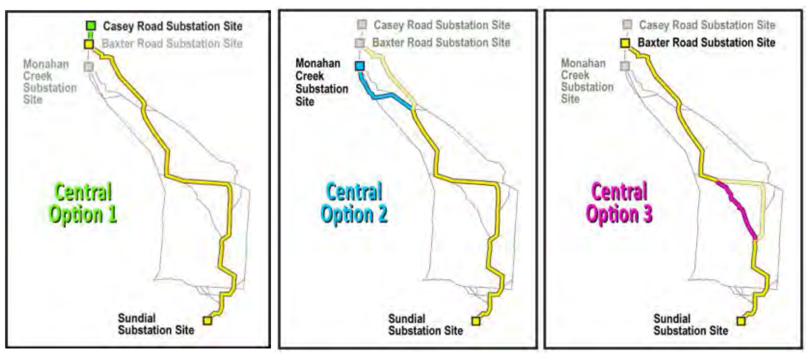
11.2.5 Central Alternative and Options

11.2.5.1 Government Revenue

The Central Alternative would affect government revenue in Washington from state trust lands and from timber-harvest taxes.

Washington State Trust Lands Revenue

During construction, the Central Alternative would cause an increase of about $2,276,000 (see Table 11-5) in timber-harvest revenue from state trust lands by triggering harvest of mature timber stock on lands cleared for the project. This short-term increase in revenue represents a small change (about 2 percent) compared to the annual revenue from timber sales for the trusts statewide, which was $115 million in 2009. Trees harvested on State Forest Lands Trust land would increase near-term revenue for the state, as well as Clark and Cowlitz counties, which are beneficiaries of this trust.



Larger increases during construction would occur for Central Option 1, but smaller increases for Central Option 3 (there would be no change for Central Option 2). Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. If the value of the trees that may be harvested because they could interfere with construction or operation outside of the right-of-way is included in the total, the increase would be about 29 percent greater than shown in Table 11-5 for the Central Alternative and Central Option 2, and about 27 percent greater for Central Option 1 and Central Option 3 (see Section 11.2.2.4, Government Revenue, for assumptions). The increase for each individual landowner could be greater or less than the total increase.

Over the life of the project, the Central Alternative would create a long-term decrease in revenue, with a net present value of about $1,778,000 (see Table 11-6) from forgone future harvests on the cleared lands. Greater decreases would occur for Central Option 1, but smaller decreases for Central Option 3. On an annualized basis, the long-term decrease likely would be small, relative to the annual statewide timber sales for each trust. The decrease in annual revenue would have a **high** impact on Cowlitz County or Clark County if it exceeds the average compensation cost per worker and triggers a reduction in workforce or infrastructure available for providing public services.

Tax Revenue from Private Timber Harvest

Construction of the Central Alternative would cause a short-term increase of about $65,950 (see Table 11-7) in the timber-harvest tax revenue of affected counties and the state government in

Washington, by triggering harvest of existing mature timber stock on private lands cleared for the project. The increase would be smaller with Central Options 1, 2, and 3. The Central Alternative would cause a long-term decrease in timber-harvest tax revenue during operation, by precluding future timber production on the cleared lands, with a total net present value of about $183,200 (see Table 11-8). The decrease would be smaller with the central options. The short-term increase and long-term decrease in timber tax revenue would represent small changes compared to the annual tax-revenue collections from harvests in Cowlitz and Clark counties. The decrease in annual revenue would have a **high** impact on Cowlitz County or Clark County if it exceeds the average compensation cost per worker and triggers a reduction in workforce or infrastructure available for providing public services.

11.2.5.2 Agricultural Production

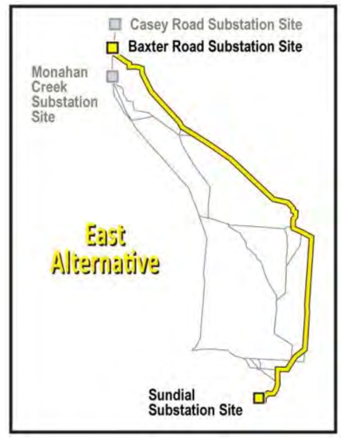
Construction of the Central Alternative would cause a short-term decrease in revenue of about $3,000 by removing crops both inside and outside of the right-of-way (see Table 11-9). Some of this removal would be temporary; for example, crops removed for a temporary access road across an agricultural field needed for access to the right-of-way. The decrease would be smaller with Central Option 2, but larger with Central Option 3. This represents a small proportion of the annual agricultural production revenues in Cowlitz, Clark, and Multnomah counties (about 0.005 percent of the revenue generated in 2007, in 2010 dollars, a level unlikely to be discernable in the regional economy). The decrease could be a greater proportion of agricultural revenue for individual landowners.

Operation of the Central Alternative would cause a long-term decrease in revenue, with a present value of about $120,000, by permanently eliminating landowners' ability to produce crops within the tower footprints (see Table 11-10). The decrease would be smaller with Central Option 2, but larger with Central Option 3. Landowners may not grow crops over 4 feet or crops requiring support structures within the entire right-of-way. Assuming landowners stop growing these crops in the right-of-way, the Central Option 3 would cause an additional long-term decrease in revenue, with a present value of about $970,000 (see Table 11-10). The long-term decrease would be small, relative to the annual value of agricultural production in Cowlitz, Clark, and Multnomah counties. The decrease could be proportionally more significant for an individual landowner. The change in agricultural production likely would have no impact on regional prices for agricultural products. At the local level, impacts could be **low-to-moderate** if local prices for a particular product are affected by limited supply.

11.2.5.3 Private Timber Production

Construction of the Central Alternative would cause a short-term increase of about $1,319,000 (see Table 11-11) in the revenue derived from timber production on private land by triggering harvest of existing mature timber stock on lands that would be cleared for the project. The increase would be smaller under Central Options 1, 2, and 3. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. If the value of the trees that may be harvested because they could interfere with construction or operation outside of the right-of-way is included in the total, the increase would be about 17 percent greater than shown in Table 11-11 for the Central Alternative and options (see Section 11.2.2.7, Private Timber Production, for assumptions). The increase for individual landowners could be greater or less than the total increase. Over the life of the project, operation of the Central Alternative would cause a long-term decrease in revenue, with a net present value of about $3,664,000 (see Table 11-12), from forgone future timber harvests on the cleared lands. The decrease would be greater under Central Options 1, 2, and 3. The change in timber production likely would have no impact on market prices for timber.

11.2.6 East Alternative and Options



11.2.6.1 Government Revenue

The East Alternative would affect government revenue in Washington from state trust lands and from timber-harvest taxes.

Washington State Trust Land Revenue

Construction of the East Alternative would cause a short-term increase of about $1,215,000 (see Table 11-5) in timber-harvest revenue from state trust lands by triggering harvest of existing mature timber stock on lands cleared for the project. This increase in revenue represents a small change (about 1 percent), compared to the annual revenue from timber sales for the trusts statewide, which was $115 million in 2009. Trees harvested on State Forest Lands Trust land would increase near-term revenue for the state, as well as Clark and Cowlitz counties, which are beneficiaries of this trust.

The increase would be larger under East Options 2 and 3. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. If the value of the trees that may be harvested because they could interfere with construction or operation outside of the right-of-way is included in the total, the increase would be about 26 percent greater than shown in Table 11-5 for the East Alternative and East Option 1, about 31 percent greater for East Option 2 and about 27 percent greater for East Option 3 (see Section 11.2.2.4, Government Revenue, for assumptions). The increase for each individual landowner could be greater or less than the total increase.

Over the life of the project, operation of the East Alternative would cause a long-term decrease in revenue, with a net present value of about $949,500 (see Table 11-6) from forgone future harvests on the cleared lands. The decrease would be larger under East Options 2 and 3. On an annualized basis, the long-term decrease likely would be small, relative to the annual statewide timber sales for each trust.

The revenue reduction likely would have a **moderate** impact on the ability of Cowlitz County, Clark County, or both to meet all demands for public services, although it would not diminish either county's workforce and infrastructure.

Tax Revenue from Private Timber Harvest

Construction of the East Alternative would cause a short-term increase of about $94,340 (see Table 11-7) in the timber-harvest tax revenue of affected counties and the state government in Washington, by triggering harvest of existing mature timber stock on private lands cleared for the project. Over the life of the project, the East Alternative would cause a long-term decrease in timber-harvest tax revenue during operation, by precluding future timber production on the cleared lands, with a total net present value of about $262,100 (see Table 11-8). Both the short-term increase and the long-term decrease would be smaller under each of the options. The short-term increase and long-term decrease in timber-tax revenue would represent small changes compared to the annual tax-revenue collections from harvests in Cowlitz and Clark counties.

The revenue reduction likely would have a **moderate** impact on the ability of Cowlitz County, Clark County, or both to meet all demands for public services, although it would not diminish either county's workforce and infrastructure.

11.2.6.2 Agricultural Production

There is essentially no agricultural impact from the East Alternative during construction and operation, except for the tower footprints themselves, which would cause a long-term decrease in revenue (under all but East Option 1), with a present value of about $5,300, by permanently eliminating landowners' ability to produce crops within the tower footprints (see Table 11-10). The long-term decrease would be small, relative to the annual value of agricultural production in Cowlitz, Clark, and Multnomah counties. The decrease could be proportionally more significant for an individual landowner. The change in agricultural production likely would have no impact on regional prices for agricultural products. At the local level, impacts could be **low-to-moderate** if local prices for a particular product are affected by limited supply.

11.2.6.3 Private Timber Production

During construction, the East Alternative would cause a short-term increase of about $1,887,000 (see Table 11-11) in revenue derived from timber production on private land by triggering harvest of existing mature timber stock on lands that would be cleared for the project. The increase would be smaller under each of the options. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. If the value of the trees that may be harvested because they could interfere with construction or operation outside of the right-of-way is included in the total, the increase would be about 17 percent greater than shown in Table 11-11 for the East Alternative and options (see Section 11.2.2.7, Private Timber Production, for assumptions). Over the life of the project, the increase for each individual landowner could be greater or less than the total increase. The East Alternative would cause a long-term decrease in revenue, with a net present value of about $5,241,000 (see Table 11-12), from forgone future timber harvests on the cleared lands. The decrease would be smaller under each of the options. The change in timber production likely would have no impact on market prices for timber.

11.2.7 Crossover Alternative and Options

11.2.7.1 Government Revenue

The Crossover Alternative would affect government revenue in Washington from state trust lands and from timber-harvest taxes.

Washington State Trust Lands Revenue

During construction, the Crossover Alternative would cause an increase of about $1,618,000 (see Table 11-5) in timber-harvest revenue from state trust lands by triggering harvest of existing mature timber stock on lands cleared for the project. This short-term increase in revenue represents a small change (about 1.5 percent) compared to the annual revenue from timber sales for each trust statewide, which was $115 million in 2009. Trees harvested on State Forest Lands Trust land would increase near-term revenue for the state, as well as Clark and Cowlitz counties, which are beneficiaries of this trust.

The increase would be the same under each of the options. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands. If the value of the trees that may be harvested because they could interfere with construction or operation outside of the right-of-way is included in the total, the increase would be about 26 percent greater than shown in Table 11-5 for the Crossover Alternative and its options (see Section 11.2.2.4, Government Revenue, for assumptions). The increase for each individual landowner could be greater or less than the total increase.

Over the life of the project, the Crossover Alternative would cause a decrease in revenue, with a net present value of about $1,264,000 (see Table 11-6) from forgone future harvests on the cleared lands. This long-term decrease would the same under each of the options. On an annualized basis, the long-term decrease likely would be small, relative to the annual statewide timber sales for each trust.

The revenue reduction likely would have a **moderate** impact on the ability of Cowlitz County, Clark County, or both to meet all demands for public services, although it would not diminish either county's workforce and infrastructure.

Tax Revenue from Private Timber Harvest

During construction, the Crossover Alternative would cause an increase of about $37,300 (see Table 11-7) in the timber-harvest tax revenue of affected counties and the state government in Washington, by triggering harvest of existing mature timber stock on private lands cleared for the project. The Crossover Alternative would cause a long-term decrease in timber-harvest tax revenue during operation, by precluding future timber production on the cleared lands, with a total net present value of about $103,600 (see Table 11-8). Both the short-term increase and the long-term decrease would be larger under Crossover Options 2 and 3. Increases and decreases in timber-tax revenue would represent small changes relative to annual tax revenue collections from harvests in Cowlitz and Clark counties.

The revenue reduction likely would have a **moderate** impact on the ability of Cowlitz County, Clark County, or both to meet all demands for public services, although it would not diminish either county's workforce and infrastructure.

11.2.7.2 Agricultural Production

During construction, the Crossover Alternative would cause a decrease in agriculture crop revenue of about $2,800 by removing crops both inside and outside of the right-of-way (see Table 11-9). Some of this removal would be temporary; for example, crops removed for a temporary access road across an agricultural field needed for access to the right-of-way. The decrease would be larger with Crossover Option 1. This represents a small proportion of the annual agricultural production revenues in Cowlitz, Clark, and Multnomah counties (about 0.005 percent of the revenue generated in 2007, in 2010 dollars, a level unlikely to be discernable in the regional economy). The decrease could be a greater proportion of agricultural revenue for individual landowners.

Over the life of the project, the Crossover Alternative would cause a decrease in revenue, with a present value of about $110,000, by permanently eliminating landowners' ability to produce crops within the tower footprints (see Table 11-10). This long-term decrease would be larger with Crossover Option 1. Landowners may not grow crops over 4 feet or crops requiring support structures within the entire right-of-way. Assuming landowners stop growing these crops in the right-of-way, the Crossover Alternative would cause no additional long-term decrease in revenue. The long-term decrease would be small, relative to the annual value of agricultural production in Cowlitz, Clark, and Multnomah counties. The decrease could be proportionally more significant for an individual landowner, although landowners who grow new crops less than 4 feet high can make up for a part of that revenue. The change in agricultural production likely would have no impact on regional prices for agricultural products. At the local level, impacts could be **low-to-moderate** if local prices for a particular product are affected by limited supply.

11.2.7.3 Private Timber Production

During construction, the Crossover Alternative would cause an increase of about $746,200 (see Table 11-11) in the revenue derived from timber production on private land by triggering harvest of existing mature timber stock on lands cleared for the project. The increase would be larger under Crossover Options 1 and 2. Some of the increase would be offset if timberland managers decide to reduce harvest on other lands in response to project-induced timber harvest. If the value of the trees that may be harvested because they could interfere with construction or operation outside of the right-of-way is included in the total, the increase would be about 14 percent greater than shown in Table 11-11 for the Crossover Alternative and its options (see Section 11.2.2.7, Private Timber Production, for assumptions). The increase for each individual landowner could be greater or less than the total increase.

Over the life of the project, the Crossover Alternative would cause a long-term decrease in revenue, with a present value of about $2,073,000 (see Table 11-12), from forgone future timber harvests on the cleared lands. The decrease would be larger under Crossover Options 2 and 3. The change in timber production likely would have no impact on market prices for timber.

11.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3 2. The following additional mitigation measures have been identified to further reduce or eliminate adverse socioeconomic impacts by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Where appropriate, site transmission facilities to avoid WDNR lands planned for wind farms or other income generating opportunities.
- Use the Federal Highway Administration’s Temporary Waiver to address relocations where landowners may owe more money than their house is worth, and BPA requires them to sell and relocate. The purpose of the temporary waiver is to make the landowner whole so that they can move into comparable housing. The temporary waiver is in effect until December 31, 2012. BPA could make the decision to continue to use this process even if the Federal Highway Administration decides not to extend it after 2012.
- Compensate the state trusts, using the appraisal process, to establish market value for state timber trust lands within the right-of-way and for access roads. Alternately, consider purchasing and donating similar timberlands elsewhere that would provide the same unencumbered market value as the affected lands.
- Compensate owners, using the appraisal process, to establish market value for private timberlands lands within the right-of-way and for access roads. Alternately, consider purchasing and donating similar timberlands elsewhere that would provide the same unencumbered market value as the affected lands.
- Compensate owners using the appraisal process to establish market value for agricultural related lands within the right-of-way and for access roads. Alternately, consider purchasing and donating similar agricultural lands elsewhere that would provide the same unencumbered market value as the affected lands.
- Compensate landowners using the appraisal process to establish the market value for any demonstrated increases in management costs related to the project right-of-way, substations, access roads, and other project-related factors.
- Minimize construction, operation, and maintenance activities around agricultural land or timberland during active production or harvest periods.

11.2.9 Unavoidable Impacts

After appropriate mitigation actions have been taken, assuming they would be implemented in full, the project could still produce several unavoidable impacts. The project could decrease human health and safety because of the risks of accidents for workers and the public. The project also could decrease the perceived value of some elements of natural and social capital that contribute to the social and economic well-being of some households, businesses, communities, or groups. If mitigation does not fully address other direct and indirect costs of the project (e.g., future earnings from displaced activities, such as timber harvest or agricultural production), these unaddressed costs would become unavoidable impacts.

11.2.10 No Action Alternative

Without the project, the changes to revenues and expenditures, and the resulting socioeconomic impacts discussed in this chapter, would not occur. Trees inside and next to the project's right-of-way and access roads in forest lands would likely eventually be harvested, providing revenue for state trusts and private producers, and tax revenue for states and counties. Agricultural land inside and next to the project's right-of-way and access roads could eventually be developed for residential or commercial purposes, or used to grow trees or crops as they are today. New development, changes in land use, wildfire, or other natural or human-induced events may affect the views, sense of solitude, or other amenities current property owners or others within the project area enjoy. The specific timing, nature, or characteristics of these and other changes are impossible to predict.

Without the project, in the short-term, increased congestion on the region's transmission grid could directly increase the costs of using the existing transmission system (see Chapter 1, Purpose and Need). In the long-term, increased congestion would likely generate direct and indirect costs to electricity consumers by reducing transmission-system reliability in parts of Washington and Oregon. The costs of electricity outages to residential, commercial, and industrial customers are described in Section 11.1.8.5, Transmission System Reliability. Reduced reliability could contribute to some firms' decisions to relocate from Washington and Oregon to other states, resulting in fewer employment opportunities and reduced income for workers in Washington and Oregon. It also could cause companies that may be considering investing or locating in the region to make investments elsewhere, reducing the potential for long-term economic growth.

Increased incidence of brownouts could cause some residential and commercial property owners to invest in back-up electricity generators, incurring costs they otherwise would avoid. These investments, however, could increase the employment opportunities and incomes for workers and business owners who specialize in the sale and installation of such equipment, potentially offsetting some of the adverse employment-and income-related consequences of not investing in the project. Increased frequency of major disruptions in electricity service could also increase response times and reduce the availability of law-enforcement and fire-protection services for handling routine emergencies. These effects could diminish the quality of life for residents in the region.

Chapter 12 Transportation

This chapter describes existing transportation resources in the project area, and how the project alternatives could affect these resources. Related information on emissions can be found in Chapter 21, Air Quality and Chapter 22, Greenhouse Gases.

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

12.1 Affected Environment

The transportation system in the project area includes public highways and roads, private logging and other private local roads, public transit, railroads, public and private airports and airstrips, and marine traffic (see Maps 12-1A through 12-1D).

12.1.1 Highways, State Routes, and Local Roads

Regional highway access to the project area is provided by I-5, the major north/south interstate freeway serving the west coast of the United States from southern California north through Oregon and Washington to the Canadian border (see Maps 12-1A through 12-1D). I-5 crosses the Columbia River between Oregon and Washington over the Interstate Bridge. I-205 was constructed as a bypass facility through the Portland/Vancouver metropolitan area and crosses the Columbia River over the Glenn Jackson Bridge. In Oregon, I-84 provides access to the general vicinity of Troutdale (SWRTC 2008).

Several state routes provide access to the project area including SR 14, SR 411, SR 500, SR 502, and SR 503. SR 14 provides the main east-west access from southwest to southeast Washington along the north bank of the Columbia River. SR 411, also commonly referred to in the project area as the West Side Highway, serves Longview, Kelso, the West Side Highway community, and Castle Rock, Washington (see Map 12-1A). The West Side Highway parallels the Cowlitz River and I-5, beginning at an interchange with SR 432 in Longview and traveling north past a spur route, under SR 4, and across the Cowlitz River It then becomes concurrent with I-5 Business in Castle Rock and ends at the interchange with I-5, I-5 Business, and SR 504 (SWRTC 2008).

SR 500 allows for east-west travel across Clark County (see Map 12-1D). It crosses I-205, provides access to the Orchards area, and traverses rural Clark County to the Camas urban area. SR 500 intersects SR 14 in Camas and carries traffic to and from the Westfield Vancouver shopping mall. SR 502 extends from the I-5/NE 179th Street interchange northward to NE 219th Street, where it turns eastward toward Battle Ground. SR 503 extends northward from its intersection with SR 500 and carries traffic between the Vancouver urban area and north through Battle Ground. SR 503 extends into Cowlitz County (SWRTC 2008).

Hundreds of county roads exist in the project area. In addition to the named and improved roads, many other roads exist in remote areas of Clark and Cowlitz counties. Examples of these other roads include private logging roads and roads used to access private property. Roads within cities and towns are typical cross streets found in urban areas (see Maps 12-1A through 12-1D).

12.1.2 Public Transit

The Cowlitz Transit Authority provides bus service to Kelso and Longview through its Community Urban Bus Service (CUBS). Other areas of Cowlitz County have limited public transportation opportunities. CUBS connects with the rural service provided by Lower Columbia Community Action Council, Columbia County Rider, and Wahkiakum on the Move, at the Transit Transfer Facility.

Clark County Public Transportation Benefit Authority (C-TRAN) provides public transit service in Clark County and into Oregon. C-TRAN's service boundary (effective June 1, 2005) includes the City of Vancouver, its urban growth boundary, and the city limits of Battle Ground, Camas, La Center, Ridgefield, Washougal, and the Town of Yacolt. C-TRAN operates a fixed route bus system on urban and suburban routes, and commuter bus service to Portland, Oregon and some service to downtown Vancouver and MAX light rail with three reservation-based connector routes serving Camas, Ridgefield, and La Center (SWRTC 2008).

12.1.3 Railroads

Passenger and freight rail lines operate in the project area (see Maps 12-1A through 12-1D). Burlington Northern Santa Fe (BNSF) owns two mainline rail lines that carry freight and passengers through Cowlitz and Clark counties. The BNSF Seattle/Vancouver line has 70 to 80 trains operating along the I-5 corridor each day, and the BNSF Vancouver/Eastern Washington line handles about 40 trains per day (SWRTC 2008). Clark County also owns the 33-mile short line Lewis and Clark Railroad (also known as the Portland Vancouver Junction Railroad, the Chelatchie Prairie Railroad, or the Clark County Railroad). Amtrak's Cascades and Coast Starlight lines provide service between Portland/Vancouver and Kelso and to cities north and south of the area. Amtrak's Empire Builder provides passenger service between Portland and Chicago and runs east-west along the north side of the Columbia River in Clark County. Union Pacific (UP) rail lines run close to the project area where they enter Troutdale from the east and split into two routes approaching Portland.

12.1.4 Airports

The Southwest Washington Regional Airport (also known at the Kelso-Longview Airport) (see Map 12-1A) and the Woodland State Airport are the only public airports in Cowlitz County. The Kelso-Longview Airport is a general aviation airport on 109 acres owned by the City of Kelso. The airport has 70 hangars, 46 tie-downs, and one 4,391-foot runway. The Woodland State Airport has one 1965-foot runway. There are several private airstrips and heliports in Cowlitz County, including Cougar Flat Airstrip and Flying K Ranch near Castle Rock; Cougar Heliport, Lewis River Golf Course Airport, and Mount St Helen's Aero Ranch Airport in the vicinity of Lake Merwin and Yale Lake; and St. Johns Medical Center Heliport and Walters Arv Ultralight Airport in the Longview-Kelso area (see Map 12-1A through 12-1C).

General aviation airports in Clark County include the historic Pearson Field and Grove Field. Pearson Field, operated by the City of Vancouver, is 2 miles southeast of downtown Vancouver off SR 14 on 134 acres owned by the National Park Service (NPS) (see Map 12-1D). Over 170 aircraft are based at Pearson Field, with about 30 percent corporate-owned. The airport has one 3,275-foot runway. Pearson Field is part of the Vancouver National Historic Reserve Historic District, listed on both the National Register of Historic Places and the Washington

Heritage Register (Houser 2011). Grove Field is a Basic Utility Stage I Airport operated by the Port of Camas/Washougal, located in the Fern Prairie area 5 miles north of Camas. Grove Field has a 2,710-foot runway and hangar space for over 60 aircraft (AirNav 2011; SWRTC 2008).

There are also a number of private airports in Clark County, including Green Mountain Airport in Vancouver and Goheen Airport near Battle Ground (see Map 12-1D). Green Mountain Airport is a 23-acre facility 9 miles east of downtown Vancouver that has a 2,000-foot runway, six hangars, and 10 tie-downs. Goheen Airport is 3 miles north of Battle Ground. It has one 2,565-foot turf runway and provides a base for 18 airplanes. Other private airports and airstrips operate in Amboy, near the East Lewis River crossing of the West Alternative, near the Lewis River crossing of the East Alternative, Battle Ground, Brush Prairie, Camas, Vancouver, and Washougal (AirNav 2011; SWRTC 2008).

Portland International Airport (PDX) is a regional airport in Portland, Oregon with domestic and international passenger and freight service, operated by the Port of Portland (see Map 12-1D). PDX has three runways at 11,000 feet, 9,825 feet and 6,000 feet. In 2006, PDX served 14 million passengers. About 23,000 short tons of air freight moves through the airport per month. The Port of Portland also operates Portland-Troutdale Airport, which is southeast of the proposed Sundial substation site. The airport has one 5,399-foot runway and over 150 aircraft are based there (AirNav 2011; SWRTC 2008).

12.1.5 Marine Traffic

The Columbia River is a major pathway for marine traffic in the region, helping to connect ports as far inland as Lewiston, Idaho with the Pacific Ocean. Like the rest of the river, general marine traffic occurs at the location of the proposed transmission line crossing of the Columbia River north of Troutdale. Large cargo ships and commercial marine traffic stop downriver at Terminal Six near the City of Vancouver, Washington where the river is dredged up to a depth of 43 feet. Other tug and barge activity can continue to move upriver past the site of the transmission line crossing of the Columbia River to ports along the Columbia and Snake rivers if their hulls can clear the 14 foot minimum depth of the inland barge channel.

Recreational boating occurs on the Columbia River and also on other major rivers, like the Cowlitz and Lewis rivers, and their tributaries within the project area. Recreational boating also occurs on Yale Lake and Lake Merwin. Some small aircraft also use local lakes and rivers.

12.2 Environmental Consequences

General impacts common to all action alternatives are discussed below, followed by impacts unique to each alternative.

12.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Sustained increases in traffic levels on local or regional roads or highways, or sustained disruptions or delays to, or stopping these or other transportation resources such as public transit, railroads, airports or marine traffic.

Impacts would be **moderate** where project activities would cause the following:

- Occasional increases in traffic levels on local or regional roads or highways, or intermittent disruptions or delays to these or other transportation resources such as public transit, railroads, airports or marine traffic.

Impacts would be **low** where project activities would cause the following:

- Rare increases in traffic levels on or damage to local or regional roads or highways, or rare effects on other transportation modes such as public transit, railroads, airports or marine traffic.

No impact would occur to transportation resources if there is no effect on vehicle traffic or on other transportation resources such as public transit, railroads, airports or marine traffic.

12.2.2 Impacts Common to Action Alternatives

12.2.2.1 Construction

Highways, State Routes, and Local Roads

Impacts to transportation would include increased traffic and potential delays to motorists along transportation corridors from substation or line construction activities, transport of construction equipment and supplies, improvements to segments of public or private roads, and construction of new access roads if they are near or intersect with public or private roads.

Temporary and intermittent disruptions to traffic flow on roads would occur during the 30-month construction period where heavy equipment and materials are transported on local roads for construction of new or improved access roads, clearing of existing or new rights-of-way, and construction of towers and substations. Traffic could be interrupted or slowed for brief periods of time from construction vehicles entering or exiting access roads or blasting near a road (to protect cars from flying debris). Also, there would be a short-term traffic delay, or detour required, where the right-of-way crosses I-5 and other highways or smaller roadways and the conductors are strung via helicopter or caterpillar pull. A traffic control plan would be developed for submittal to the appropriate city, county, or state road or highway departments. Disruptions would be scheduled, short term, and intermittent and existing roads could likely accommodate these short periods of increased traffic causing a **moderate** impact during construction.

Both light and heavy-duty vehicles would access construction sites on rights-of-way, substation sites, and areas where there would be new and improved access roads. Equipment and materials would be transported to staging areas and construction sites via semi-trucks. Staging areas would be along or near rights-of-way. Because the number and location of construction spreads (crews and equipment required) has not been determined yet, the origins of the contractors and their workers hired to construct facilities, and equipment suppliers and staging area locations are unknown. However, the approximate size of the work force is known (see Chapter 3, Project Components and Chapter 11, Socioeconomics), and BPA has estimated the approximate number of trucks required during construction. A limited increase in daily traffic volume on highways would occur, with an estimate of 45 vehicles per day anticipated to deliver workers, materials, and equipment to construction sites. With an estimated average of

100 commute miles per day per vehicles, the 45 vehicle trips would result in about 4,500 miles per day driven on highways, state routes, and local roads. The addition of these vehicles could interrupt or slow traffic for certain periods of time. This would be a **moderate** impact.

Existing local, private roads or public roads and highways would be used during construction for transport of materials and construction crews, including I-5, I-205, I-84, SR 14, SR 500, SR 503, and SR 411 (see Maps 12-1A through 12-1D).

A typical crew can usually construct 10 miles of transmission line in about 4 months, so traffic congestion from construction would likely be present for 1 to 4 months in one area before the next 10-mile section is constructed and other roads are used.

Trucks carrying heavy construction materials and equipment could damage existing roads if they are not adequate for this use. All loads transported on state and county roads would be within legal size and load limits, or have valid oversize or weight permits. BPA would repair any damage to existing roads following construction. Project vehicles could track dust, soils and other materials from construction sites onto public roads. Erosion control measures would include stabilization of construction entrances and exits to prevent sediment from being transported onto adjacent roadways (see Chapter 14, Geology and Soils and Chapter 15, Water). With appropriate size and load limits, truck operation effects on existing roads would be a **low** impact.

Development of access roads would include improving existing BPA access roads, improving existing county roads if needed, building new access roads, and potentially constructing and removing temporary access roads to tower sites within agricultural fields. Improvements to existing roads could involve clearing brush, grading and laying down gravel, widening roads, smoothing out curves, and adding or replacing culverts, ditches, rolling-dips, or water bars. New and improved access road-related impacts to other resources such as land use, visual resources, cultural resources, soils, water resources, wetlands, vegetation, wildlife, and fish are discussed in the resource-specific chapters in this EIS.

Public Transit, Railroads, Airports, and Marine Traffic

Construction activities would have **no-to-low** impacts on public transit services because the activities would be temporary, and because any necessary service disruption would be coordinated with the applicable transit agency before construction.

Crossings of railroads would be timed to avoid interrupting freight train or passenger service, and if necessary, appropriate coordination and crossing permits would be obtained from the affected railroad operator. Construction would result in **no-to-low** impact on rail.

The FAA requires that project designs be submitted for approval if a proposed structure or conductor/ground-wire would be constructed 200 feet or more above the ground or water, or if any part of the proposed transmission line would be within a prescribed distance of an airport (Melzer 2010). Such structures would require marking with special lighting, paint, or marker balls, as directed by the FAA (see Section 3.7, Obstruction Lighting and Marking). The Columbia River transmission line crossing would require construction of towers up to 280 feet tall (see Chapter 3, Figure 3-1) on the banks of the river and on a high point in the river bottom at Ione Reef. These towers and lines would require review by the FAA, and would meet applicable FAA lighting and marking requirements. Conformance with all FAA requirements as part of project design and construction would result in **no** impact on airports.

The tower at Ione Reef is not in the river channel, which would help to avoid marine traffic. Interruptions and delays related to construction of this tower would be temporary. BPA would follow United States Coast Guard notification and marking requirements. Small private recreational boats would be diverted from construction activities. As with small crafts on the Columbia River, boaters would be diverted from any other navigable river crossing construction activities. **No-to-low** impact would occur to commercial and recreational boat traffic because river crossing construction activities would be short term.

12.2.2.2 Operation and Maintenance

Highways, State Routes, and Local Roads

Once the line is operating, project-related traffic on any roads would be minimal and infrequent. Maintenance traffic would normally be a few maintenance vehicles along the right-of-way several times a year and helicopters flying overhead twice a year. These infrequent activities would not negatively affect roads or traffic along any of the action alternatives over the life of the project. Large vehicles such as flatbed trucks or a crane may be required to replace or repair the transmission line and towers on occasion, which could cause minor disruption to local traffic for brief periods. This would be a temporary, **no-to-low** impact.

Public Transit, Railroads, Airports, and Marine Traffic

Operation of the project would not require any activities that could affect public transit or rail lines or schedules, so there would be **no** impact on these transportation resources. Maintenance activities could cause minor disruption to local traffic or rail lines or schedules for brief periods depending on the activity. This would be a temporary, **no-to-low** impact.

Where transmission lines are near airports and where towers and conductors are above a certain height, aviation safety requirements must be determined by the FAA. Maintenance activities within any airport's airspace or airport approaches would conform to FAA requirements causing **no** impact to airport operations.

Transmission line crossings of all navigable rivers, including the Columbia River, would be high enough that recreational boats and marine traffic (barge and vessel) would pass under unhindered causing **no** impact on marine traffic during operations. Any maintenance work at these crossings would occur infrequently and would not substantially interfere with or disrupt recreational boating and marine traffic. At most, any recreational boats or marine traffic present during maintenance would be temporarily diverted away from any in-water maintenance activities, a **no-to- low** impact.

12.2.2.3 Sundial Substation

Construction work at the Sundial site may disrupt traffic on local roads including Sundial Road within the Port of Portland industrial complex as equipment and trucks enter or exit the substation site. The main access to the industrial park is Sundial Road, which would also be the main access used for construction. The work would create temporary and short-term disruptions and delays to existing truck traffic and workers entering and exiting the industrial park. Because of the industrial nature of the site, traffic disruptions are not uncommon but temporary delays would continue over an extended period causing **moderate** impacts.

Sundial Substation would not be a manned substation. During operation, BPA personnel would visit the substation infrequently. Maintenance activities at the substation would also occur infrequently. Because traffic volumes for these activities would be low, substation maintenance would cause **no-to-low** impacts on traffic and roads in the industrial complex.

As described above, near airports and flight paths, and for towers over 200 feet tall, the FAA may require that BPA add lighting to the towers (see Section 3.7, Obstruction Lighting and Marking). BPA would notify the FAA and construct and illuminate towers in accordance with FAA guidelines (FAA 2000). Because BPA would conform to all FAA requirements as part of project design, there would be **no** impact on the Portland International or Portland-Troutdale airports.

12.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 12.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

12.2.3.1 Casey Road

This site is relatively remote; access to the site would not require the construction or relocation of any roads, but would require some road improvement on roads not generally used by the public but used by logging trucks. Construction and maintenance-related traffic and delays would cause temporary delays to logging trucks in the area. This would be a **low** impact because while vehicle trips would be fairly frequent during construction of the substation, these trips and other construction activities would be scheduled and logging activities could possibly be scheduled around these activities. Construction-related vehicles using Casey Road and the West Side Highway (SR 411) could interrupt or slow traffic for long periods as fill material is transported to the substation site, a **moderate** impact. Similar to Sundial Substation, Casey Road Substation would also be unmanned and maintenance activities would be scheduled and infrequent, a **no-to-low** impact.

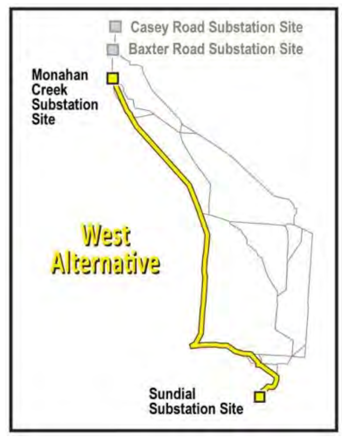
12.2.3.2 Baxter Road

Similar to the Casey Road site, the Baxter Road site is relatively remote but logging activities do occur around this site. Some rural residential homes occur along Beebe Road, a rural road off West Side Highway (SR 411) leading to the substation site. Construction and maintenance-related traffic and delays would cause temporary delays to logging trucks in the area. This would be a **low** impact because while vehicle trips would be fairly frequent during construction of the substation, these trips and other construction activities would be scheduled and logging activities could possibly be scheduled around these activities. Construction-related vehicles using Beebe Road and the West Side Highway (SR 411) could interrupt or slow traffic for long periods as fill material is transported to the substation site, a **moderate** impact. Similar to the Sundial and Casey Road substations, Baxter Road would also be unmanned and maintenance activities would be scheduled and infrequent, a **no-to-low** impact.

12.2.3.3 Monahan Creek

The Monahan Creek site is not as remote as the Casey Road and Baxter Road sites but would require much less access road work. The substation site is directly off Delameter Road. Traffic delays would occur mostly to local commuters on this road during substation construction. Temporary increases in vehicle trips transporting construction material to and from the site would occur. Traffic delays would occur from vehicles slowing to observe construction activities and infrequent detours may be required for safety reasons. Temporary traffic delays or detours would cause **moderate** impacts. Operation and maintenance activities would cause **no-to-low** impacts to traffic because the substation would be unmanned and maintenance activities would be scheduled and infrequent.

12.2.4 West Alternative



The West Alternative would cross several highways and state routes (I-5, I-205, SR 14, SR 411, SR 500, SR 502, and SR 503), and many other roads, including public arterials (Pacific Avenue, Hansen Road, Lewis River Road, NE 399th Street, NE 219th Street, NE 179th Street, NE 119th Street, NE Saint Johns Road, NE Andresen Road, NE Fourth Plain Boulevard, and NE 58th Street), and private access roads. The alternative would also cross railroads (BNSF Railway, Columbia and Cowlitz Railway, and Portland-Vancouver Junction Railroad), and would be within 5,000 feet of three airports (Green Mountain Airport, Grove Field Airport, and Portland-Troutdale Airport) and a small grass airstrip near the East Lewis River crossing, just west of the existing BPA right-of-way (see Maps 12-1A though 12-1D).

The West Alternative would need the fewest miles of new (30) and improved (34) access roads of all the action alternatives (see Table 12-1).

The West Alternative could use about 174 miles of existing roads in the project area during construction and long-term maintenance to access the right-of-way and substations, including highways, state routes, public arterials, and private roads (see Maps 12-1A though 12-1D and Table 12-2). Construction vehicles can include cars and pickup trucks transporting workers and crews to the construction site or can include larger vehicles like bucket trucks and flatbeds that are transporting cranes, backhoes, bulldozer, and other large pieces of equipment to the site (see Section 3.14, Construction Schedule and Work Crews). While construction is temporary, crews can remain in an area completing a particular clearing or construction activity for a few weeks. A new or the same crew can then return to the same area many months later to start a new phase of construction or construction activity (see Section 3.14). At this time, these roads have been identified as a possibility for use during construction and long-term maintenance of the project because of their proximity to the alternative. If BPA decides to build the project and at the time of construction, the chosen contractor would decide which roads actually meet construction requirements, are available for use, and would provide the most efficient access to the project. At that time, required permits, road improvements, and easements would be completed to secure road use and utility (e.g., railroad) crossings.

New and improved roads within rights-of-way would have **no** impact on transportation because they would not be public. These same roads though may provide unintended access from trespassers and cause unauthorized uses (see Chapter 5, Land). New and improved roads outside of the right-of-way may affect local transportation during operation by improving some existing roads currently used for other purposes. New roads might encourage traffic in areas where there was none before. Generally, these roads would have a **low-to-moderate** impact on local traffic depending on length of construction activities in a particular area and if these activities cause delays or detours. Because of the infrequent nature of maintenance activities during the operation of the line, **no-to-low** impacts would occur during these activities.

Table 12-1 Length of New and Improved Access Roads

Alternatives and Options	Within Existing or Proposed Right-of-Way (miles)[1]		Outside Existing or Proposed Right-of-Way (miles)[1]	
	New Access Roads	Improved Access Roads	New Access Roads	Improved Access Roads
West Alternative	**20**	**14**	**10**	**20**
West Option 1	N/C	-1	+1	N/C
West Option 2	+2	+1	N/C	-2
West Option 3	+1	+2	+1	N/C
Central Alternative	**16**	**9**	**25**	**109**
Central Option 1	+1	+3	+1	+11
Central Option 2	+1	-2	+2	-7
Central Option 3	N/C	-1	N/C	-8
East Alternative	**13**	**12**	**21**	**161**
East Option 1	+2	-4	N/C	-7
East Option 2	+1	-1	-3	-26
East Option 3	N/C	N/C	-1	N/C
Crossover Alternative	**15**	**14**	**19**	**78**
Crossover Option 1	+3	N/C	N/C	+1
Crossover Option 2	+1	+5	N/C	+4
Crossover Option 3	+1	+6	N/C	+4

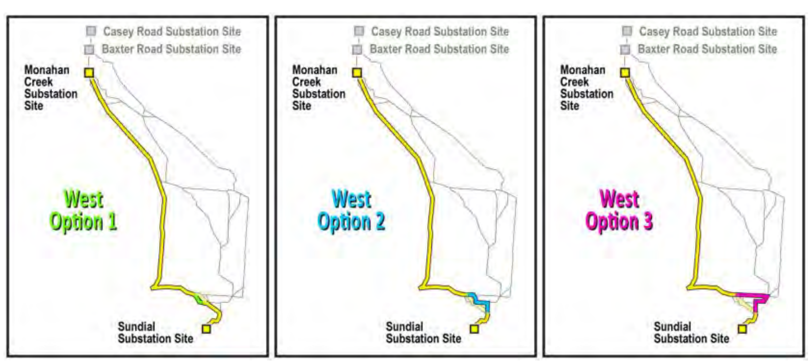
Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the miles of new or improved roads in the option minus the miles of new or improved roads in the segments the option replaces.

Source: BPA 2012

12.2.4.1 West Options 1, 2, and 3



Most of the same existing access roads or types of roads would be used for any of the options in areas with developed roadways with urban traffic patterns. West Option 3 would potentially use more existing roads than the West Alternative, including SE

Blair Road and NE 58th Street. Construction traffic would be temporary and minor compared to existing traffic in the area and maintenance traffic would be much less.

Impact levels on transportation would be the same as the West Alternative.

Table 12-2 Existing Roads That Could Be Used During Construction

Alternatives and Options	Existing Roads (miles)
West Alternative	**173.6**
West Option 1	-1.0
West Option 2	+7.6
West Option 3	+16.9
Central Alternative	**180.7**
Central Option 1	-2.2
Central Option 2	-25.9
Central Option 3	+4.6
East Alternative	**154.6**
East Option 1	-12.0
East Option 2	+25.4
East Option 3	+1.1
Crossover Alternative	**147.6**
Crossover Option 1	+11.7
Crossover Option 2	+10.0
Crossover Option 3	+10.2

Note:

1. The value for each option represents the net change from the alternative. It was calculated as the miles added by the option minus the miles in the segments the option replaces.

Source: BPA 2012

12.2.5 Central Alternative

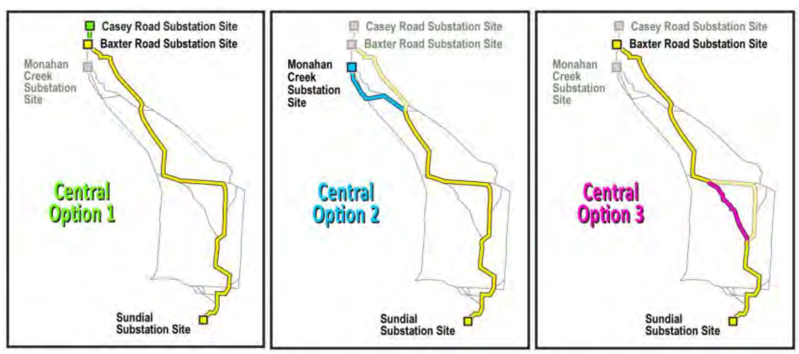
The Central Alternative would cross several highways and state routes (I-5, I-205, SR 14, SR 411, SR 500, SR 502, SR 503, and SR 504), many other roads, including public arterials (Zillig Road, Lewis River Road, NE Yale Bridge Road, and SE Blair Road), and private access roads, including transit routes for timber harvest and private property access. The alternative would also cross railroads (BNSF Railway, Columbia and Cowlitz Railway, and Portland Vancouver Junction Railroad), and would be within 5,000 feet of the Portland-Troutdale Airport (see Maps 12-1A though 12-1D).

The Central Alternative would need 41 miles of new access roads, the most of all action alternatives, and would need 118 miles of improved access roads outside the right-of-way (see Table 12-1). Much of the Central Alternative is more rural than the West Alternative with fewer existing roadways and somewhat less overall roadway capacity to accept construction traffic, although existing traffic is likely to be less than the West Alternative.

The Central Alternative could use about 181 miles of existing roads in the project area (see Table 12-2 and Maps 12-1A through 12-1D). Similar to the West Alternative, construction and maintenance crews would use any number of these roads at different times to access right-of-way, towers, or substation sites. The construction contractor would identify these roads for use at the time of construction (see Section 12.2.4, West Alternative).

Similar to those described in impacts common to action alternatives and the West Alternative, new and improved roads within rights-of-way would have **no** impact on transportation because they would not be public. These same roads though may provide unintended access from trespassers and cause unauthorized uses (see Chapter 5, Land). New and improved roads outside of the right-of-way may affect local transportation during operation by improving some existing roads currently used for other purposes. New roads might encourage traffic in areas where there was none before. Generally, these roads would have a **low-to-moderate** impact on local traffic depending on length of construction activities in a particular area and if these activities cause delays or detours. Because of the infrequent nature of maintenance activities during the operation of the line, **no-to-low** impacts would occur during these activities.

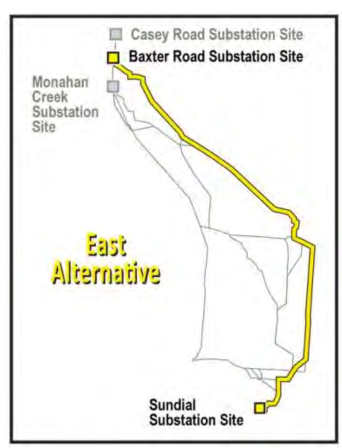
12.2.5.1 Central Options 1, 2, and 3



Central Option 1 would not add any additional crossings of public roads although many logging roads would be crossed. Central Option 2 would add a crossing of SR 411 and remove the crossing of SR 504. Central Option 3 would use additional local roads, including NE Cedar Creek Road, and NE 379th Street. Differences in impacts of the options compared to the Central Alternative would be temporary or intermittent, and would not cause a significant change in transportation impacts.

Impact levels on transportation would be the same as the Central Alternative.

12.2.6 East Alternative



Similar to the West and Central Alternative, the East Alternative would cross several highways and state routes (I-5, SR 14, SR 503, and SR 504) and many other roads, including public arterials (Rock Creek Road, Lewis River Road, Yale Bridge Road, and SE Blair Street), and private access roads, including transit routes for timber harvest and private property access. The alternative would also cross the BNSF Railway and the Columbia and Cowlitz Railway. It is also within 5,000 feet of a small paved private airstrip just south of the Lewis River crossing and the Portland-Troutdale Airport (see Maps 12-1A though 12-1D).

Much of the East Alternative is more rural than the West Alternative with fewer existing roadways and generally less overall capacity to accept construction traffic based on the number and design capacity of roads. Existing traffic on those roads is correspondingly less. The East Alternative would need 34 miles of new access roads, similar to the Crossover Alternative, and 173 miles of improvements to access roads—more than any other alternative (see Table 12-1).

The East Alternative could use about 155 miles of existing roads in the project area (see Table 12-2 and Maps 12-1A through 12-1D). Similar to the previous alternatives, construction crews would use any number of these roads at different times to access right-of-way, towers, or substations.

Similar to those described in impacts common to action alternatives and the previous alternatives, new and improved roads within rights-of-way would have **no** impact on transportation because they would not be public. These same roads though may provide unintended access from trespassers and cause unauthorized uses (see Chapter 5, Land). New and improved roads outside of the right-of-way may affect local transportation during operation by improving some existing roads currently used for other purposes. New roads might encourage traffic in areas where there was none before. Generally, these roads would have a **low-to-moderate** impact on local traffic depending on length of construction activities in a particular area and if these activities cause delays or detours. Because of the infrequent nature of maintenance activities during the operation of the line, **no-to-low** impacts would occur during these activities.

12.2.6.1 East Options 1, 2, and 3

Similar to Central Option 2, East Option 1 would cross West Side Highway, but remove the crossing of SR 504. East Option 2 would require 2 fewer miles of new access roads and 27 fewer miles of improved access roads. East Option 3 would add about 1 mile of existing roads. Differences in impacts compared to the East Alternative would be temporary or intermittent, and insignificant.

Impact levels on transportation would be the same as the East Alternative.

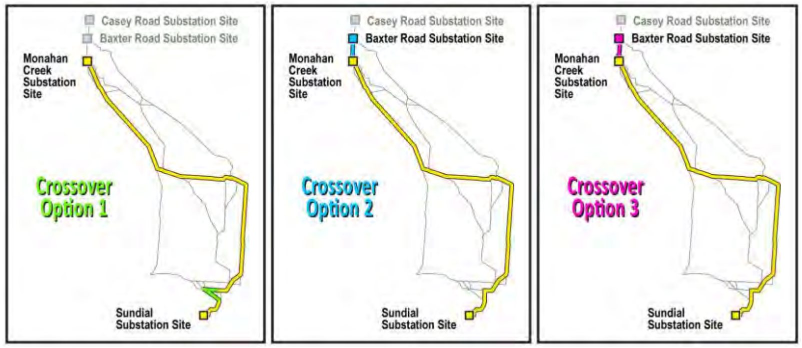
12.2.7 Crossover Alternative

Transportation impacts along this alternative would be the same as those along the northern portion of the West Alternative north of the Lewis River, and the southern portion of the East Alternative south of Yale Dam. Where the Crossover Alternative runs west to east, transportation impacts would be the same as those for the Central Alternative between the Merwin and Yale dams. Much of the Crossover Alternative is more rural than the West Alternative with fewer existing roadways and less overall capacity to accept construction traffic, although less existing traffic is likely to occur here than near the West Alternative. The Crossover Alternative would need 34 miles of new access roads, similar to the East Alternative, and would need 92 miles of improvement to access roads (see Table 12-1).

The Crossover Alternative could use about 148 miles of existing roads in the project area (see Table 12-2 and Maps 12-1A through 12-1D). Similar to other action alternatives, construction crews would use any number of these roads at different times to access right-of-way, towers, or substation sites.

Similar to those described in impacts common to action alternatives and the previous alternatives, New and improved roads within rights-of-way would have **no** impact on transportation because they would not be public. These same roads though may provide unintended access from trespassers and cause unauthorized uses (see Chapter 5, Land). New and improved roads outside of the right-of-way may affect local transportation during operation by improving some existing roads currently used for other purposes. New roads might encourage traffic in areas where there was none before. Generally, these roads would have a **low-to-moderate** impact on local traffic depending on length of construction activities in a particular area and if these activities cause delays or detours. Because of the infrequent nature of maintenance activities during the operation of the line, **no-to-low** impacts would occur during these activities.

12.2.7.1 Crossover Options 1, 2, and 3



Crossover Option 1 would add 3 miles of new access road, and 1 mile of improved access road. By extending the right-of-way from the Monahan Creek substation site to the Baxter Creek substation site, Crossover Option 2 and Crossover Option 3 would cross additional roads mostly used for logging activities. Crossover Options 2 and 3 would require improvements of 9 to 10 more miles of access road. Differences in impacts compared to the Crossover Alternative would be minor.

Impact levels on transportation would be the same as the Crossover Alternative.

12.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional mitigation measure has been identified to further reduce or eliminate adverse transportation impacts by the action alternatives. If implemented, this measure would be completed prior to, during, or immediately after project construction unless otherwise noted.

- Notify interested parties of construction and maintenance activities and schedules and traffic delays and detours.

12.2.9 Unavoidable Impacts

Unavoidable transportation impacts remaining after mitigation would be temporary delays, detours, and interruption to local traffic during construction and even less traffic during maintenance activities.

12.2.10 No Action Alternative

The No Action Alternative would have **no** impact on transportation because no new transmission lines, towers, access roads, or substations would be constructed. Transportation resources would likely expand through future development, but temporary impacts from operation and maintenance of existing transmission lines and substations in the project area would continue unchanged on current road systems.

Chapter 13 Cultural Resources

This chapter describes cultural resources in the project area, and how the project alternatives could affect these resources.

Words in **bold** and acronyms are defined in Chapter 32, Glossary and Acronyms.

13.1 Affected Environment

Cultural resources are nonrenewable resources associated with human occupation or activity related to history, architecture, archaeology, engineering, and culture. **Historic properties**, as defined by 36 CFR 800, the implementing regulations of the National Historic Preservation Act (NHPA), are a subset of cultural resources that are eligible for inclusion in the National Register of Historic Places (NRHP). They are defined as any district, site, building, structure, artifact, ruin, object, work of art, or natural feature important in human history at the national, state, or local level. Historic properties include both historic and **pre-contact** resources. Pre-contact resources are those that pre-date contact between Euro-Americans and Native Americans.

Previous cultural resource studies have been completed in certain portions of the project area resulting in the identification of known cultural resources. However, given its size, most of the project area has not been surveyed for cultural resources making it likely there are previously undiscovered cultural resources in the project area. The probability of encountering previously undiscovered cultural resources along the action alternatives varies. Topographic features and known sites are strong predictors of the presence of cultural resources (e.g., cultural sites are more common in flat areas near water sources). The distribution of both known and unknown cultural resources along the action alternatives is likely to be unequal because specific landforms and water bodies vary among the alternatives. For example, relatively flat land next to a river with historic fish runs, or near a natural travel corridor where historic Indian place names are found would have a greater likelihood of cultural resources than steep slopes or uplands away from a river or stream.

Based on existing models, the location of known cultural sites, and land features, BPA developed a predictive analysis of the likelihood of encountering previously undiscovered cultural resources for each action alternative (see Section 13.2.2.1, Predictive Analysis and Cultural Resource Sensitivity Scores).

The project is within three physiographic regions primarily in Washington, with a small portion in Oregon: the Willapa Hills, Southern Cascades, and the Portland Basin. The archaeological record indicates that this area has been occupied by human populations for at least 10,000 years (Ozbun, et al. 2011). The project extends through lands traditionally inhabited by two Native American groups: the Cowlitz and the Chinook. Most of the project area is within the traditional territory of the Cowlitz, which includes a large portion of inland southwest Washington from the Columbia River to the foothills of the Cascade Range. The area was also traditionally frequented by the Klickitat who historically resided east of the Cascade Range, but ventured into southwest Washington to procure root crops and berries and occasionally resided in Cowlitz territory. During the winter, Cowlitz villages of four to five houses and 30 to 50 people and sometimes up to 300 people were established along the Cowlitz River from its confluence with the Columbia River to 40 miles upstream. Some people would stay in the villages year round, but most left in May and traveled to prairies to collect and process roots.

Seasonal fishing camps were also established to catch salmon and other fish (Ozbun, et al. 2011).

The southern end of the project is within the traditional territory of the Chinookan group known as the Multnomah. Their territory extended just south of the mouth of the Kalama River to the vicinity of the Sandy River. Chinook villages were also near the Columbia River between the mouths of the Cowlitz and Washougal rivers. Chinook winter villages tended to be larger than those of the neighboring Cowlitz. The Chinook wintered in cedar-gabled structures usually occupied by two to four related families, but households of 10 or more families were also known to occur. In early spring, families would leave the villages for seasonal camps where they gathered and processed resources. Important fish resources included salmon, sturgeon, steelhead, and eulachon. Important plant resources included roots, mainly wapato and camas, and berries (Ozbun, et al. 2011).

The arrival of Europeans and other non-Native Americans in the Pacific Northwest in the late eighteenth century greatly altered the traditional native way of life. Disease, traders, missionaries, and new technology had considerable impacts on the Native American people. Diseases such as malaria are estimated to have decimated native populations by 30 percent or more by the early 1800s. The fur trade introduced new goods and new modes of exchange into complex traditional trading systems. By about 1810, posts were established in the interior regions from the Pacific coast, and these posts were the first permanent non-Native American settlements in the region. The British Hudson's Bay Company (HBC) dominated this trade by the 1820s and continued to be the primary foreign presence in the region until the 1850s. Fort Vancouver in modern Vancouver, Washington, was the regional headquarters of the HBC fur trade empire (Ozbun, et al. 2011).

By 1846, most Euro-American settlements in the area were south of the Columbia River, or in areas along the Deschutes in central Oregon, and Cowlitz and Skookumchuck rivers in southwestern Washington. American settlements became commonplace in the 1850s after the establishment of the Oregon Territory in 1848, which gave inhabitants legal claims and rights, as did the passage of the Donation Land Claim Act by Congress in 1850. This increase in Euro-American settlements led to attempts to establish treaties between the settlers and the Tribes. In 1855, Isaac Stevens, the Washington Territorial Governor, tried to persuade the Chinook, Cowlitz, and other groups in Western Washington to cede most of their lands to the U.S. Government. This attempt was unsuccessful and no treaties were signed with the Chinook or the Cowlitz. Some Chinookan groups who resided in Oregon did sign a treaty with the Oregon Superintendent of Indian Affairs in 1851, but this treaty was never ratified. This left most Chinookan groups and all Cowlitz groups without a treaty with the U.S. government for lands (Ozbun, et al. 2011).

BPA was created in 1937 during the Great Depression to transmit and market Columbia River hydropower generated by the Bonneville and Grand Coulee dams. The impact of BPA on the Pacific Northwest, which saw 3,000 circuit miles of transmission lines constructed and interwoven into existing transmission lines from 1939 to 1945, was immense. During World War II, BPA's "Master Grid" energized important wartime industries such as shipyards in Portland and Vancouver, and airplane plants in the Puget Sound region (Kramer 2009). BPA played a major role in the promotion of public power in the Pacific Northwest, leading to the formation of public utility districts and, with the Rural Electrification Administration, many rural cooperatives. Such efforts delivered low-cost power, expanded electric service regionally, and contributed to the modernization and growth of small Pacific Northwest communities in the years following World War II (Kramer 2009).

13.1.1 Area of Potential Effect

As defined by the National Historic Preservation Act (NHPA), the **area of potential effects** (APE) is the geographic area where historic properties could be changed as a result of the project. The APE for each action alternative is 500-feet wide along the existing and proposed rights-of-way, varying acreage for the four substation sites (Sundial: 40 acres, Monahan: 67 acres, Baxter: 47 acres, Casey: 63 acres), and 50-feet wide for the proposed new and improved access roads outside of the right-of-way.

13.1.2 Pre-Contact and Historic Archaeological Sites

Background research on previous work done within the APE indicated that 39 **archaeological resources** have been previously documented in the APE. This includes 33 archaeological resources recorded in the Washington Department of Archaeology and Historic Preservation (DAHP) database and six resources identified in previous survey reports, but not officially recorded. These 39 archaeological resources consist of 17 pre-contact sites, 17 **historic sites**, and five multi-component sites (i.e., where both pre-contact and historic cultural materials are present). The pre-contact sites include four village locations, 10 **lithic** scatter sites, and three isolated artifact (i.e., a single artifact) sites. The 17 recorded historic sites include two farmstead sites, two abandoned roads, five cemeteries, two grave markers, one debris scatter, one mine, one rock feature site, one aircraft crash site, one hydroelectric site, and one site consisting of irrigation system remnants (Ozbun, et al. 2011).

Many of the recorded pre-contact sites in the APE are near major waterways including Lacamas Lake, the Washougal River, and the Columbia River. Fewer archaeological sites have been identified in upland areas in the eastern and northern portions of the project area. Similarly, few archaeological sites have been identified in the APE for the eastern and northern portions of the action alternatives. However, fewer archaeological surveys have been conducted in these areas. Most known archaeological resources in the APE are along southern portions of the actions alternatives, specifically segments 25, 40, and 52, an indication of both the importance of certain areas within these segments to pre-contact and historic populations and that more cultural resource studies have been conducted in these areas (Ozbun, et al. 2011).

Of the 39 resources recorded within the APE, only one site, the pre-contact Parkersville site, has been determined eligible to the NRHP (National Register of Historic Places). Three resources have been determined not eligible for listing in the NRHP and the remaining 35 resources, including both recorded and unrecorded sites, have not been evaluated for eligibility (Ozbun, et al. 2011).

13.1.3 Traditional Cultural Properties

Federal agencies are responsible under the NHPA to work with tribal and other cultural communities to identify Traditional Cultural Properties that may be affected by federal undertakings. A **Traditional Cultural Property** (TCP) is a property type that can be listed on the NRHP. Similar to other potentially eligible property types, the significance and eligibility of a TCP is “derived from the role the property plays in a community’s historically rooted beliefs, customs and practices" (Parker and King 1998). These sites are important in maintaining a community's historic identity and help preserve and perpetuate traditional knowledge and culture. The nature of a TCP depends on the meaning given to it by the living cultural community, and that community must play a central role in the identification, evaluation, and treatment of the property (Hutt 2006).

Traditional Cultural Properties may be a single site, a district, or a cultural landscape. They may be archaeological, historic or **ethnographic** in nature. Ethnographic is defined here as identifying with a specific culture or group. The TCP setting is variable and may include urban neighborhoods, rural communities, natural settings, or prominent landform features. A wide range of community resources important to ethnic groups throughout the United States are considered TCPs, including communities such as the German Village in Columbus, Ohio, or Chinatown in Honolulu, Hawaii. In the Pacific Northwest, much of the focus of TCP evaluation has been on American Indian communities, and the 1992 amendment to the NRHP specifically notes that properties of religious and cultural significance to Indian Tribes may be determined to be eligible for listing on the NRHP (16 USC 470a(d)(6)(A)).

Many Native American communities displaced from their traditional homelands by European settlement maintain ongoing cultural links with their historic traditional use areas. They recognize TCPs that are often outside of their modern reservation settings based on pre-European contact settlement and subsistence activities. These TCPs include traditional hunting areas, plant gathering and fishing sites, village locations, archaeological sites, rock image sites, places of historical importance, places that are featured in tribal legends, historic trails, burial grounds, ceremonial use areas, and sacred landscapes. Many variables can contribute to a sacred landscape, such as **myth-time stories** attached to the location. These stories detail creation beliefs for the Tribes and hold religious significance. Sacred landscapes have a strong socio-cultural connection to tribal people.

There are 27 locations classified as ethnographic cultural resources either within or within the immediate vicinity of the action alternatives. Ethnographic resources include many listed from ethnographic research and historic documents (e.g., maps) and others identified in consultation with the Cowlitz Indian Tribe. These resources are specific locales with particular cultural significance to the Tribes. Should BPA decide to build this project and select an alternative that may impact one or more of these ethnographic resources, BPA would seek to avoid the resource, or determine its eligibility as a TCP and consider means of addressing any adverse effects.

13.1.4 Historic Resources

There are 16 previously recorded historic resources within the project area. **Historic resources** are defined as extant buildings, structures and objects that will meet the minimum age requirement for eligibility for listing in the NRHP within 5 years. A resource must be at least 50 years old to be eligible, must have historic significance under one or more designated criteria, and it must have retained its integrity. Of the 16 historic resources identified, three have been determined eligible for the NRHP, five have been determined not eligible and eight have not been evaluated. BPA's transmission network, which includes all existing BPA transmission lines and facilities constructed up to 1974, is a historic resource that is considered to be eligible to the NRHP.

13.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below (including a discussion of the predictive analysis), followed by impacts unique to each alternative.

13.2.1 Impact Levels

Impact levels are based on available information or on the potential of an area or site to have cultural resources that could be affected. BPA will conduct a cultural resource survey of the preferred alternative and consult with the appropriate entities.

Impacts would be **high** where project activities would cause the following:

- adversely affect NRHP eligible sites or "**red-flags**" (cultural resources to which potential effects are considered difficult or impossible to avoid)

Impacts would be **moderate** where project activities would cause the following:

- adversely affect any known archeological resources that have not yet been evaluated as eligible for the NRHP
- adversely affect historic resources that have not yet been evaluated as eligible for the NRHP

Impacts would be **low** where project activities would cause the following:

- Affect a cultural resource determined to be ineligible for the NRHP

No impacts would occur if no known, eligible resources are adversely affected.

13.2.2 Impacts Common to Action Alternatives

Construction of substations, towers, staging areas, placement of temporary pulling and tensioning sites, counterpoise installation, access road improvements and new road construction, and limited installation of wood poles for fiber optic cable (fiber would generally be installed on the towers) have the potential to damage or destroy any cultural resources that are present. Visual elements that alter the character or setting of cultural resource sites are forms of disturbance, as are direct physical impacts to site integrity. Increased access to cultural resources from project construction, operation, and maintenance can increase vandalism and looting.

If existing substations, transmission lines and towers that are eligible for listing on the NRHP are altered or replaced as part of the project, there could be an adverse effect on these properties based on the historic nature of some of BPA's infrastructure.

BPA attempts to avoid known sites whenever possible and uses trained cultural resource monitors on large-scale projects to ensure unidentified sites are not inadvertently affected. Sites are identified using several methods including archaeology, oral history, and historical research. Archaeological sites would be delineated both by surface observations and subsurface testing before construction to avoid physically disturbing sites during construction. Appropriate mitigation procedures would be in place to stop construction activities and determine protective measures (e.g., avoidance) if artifacts are found (see Table 3-2). Unknown sites should not be disturbed with these procedures in place.

Operation and maintenance of the transmission line and substations would not directly affect cultural resources as the area will have been surveyed before project construction and any impacts to the sites will have been previously determined and mitigated if needed. Maintenance of towers or access roads would not affect known resources. If any maintenance activities need to occur outside of tower locations or off access roads, a review of sensitive areas would be required to avoid disturbing cultural resources.

13.2.2.1 Predictive Analysis and Cultural Resource Sensitivity Scores

Given the general inaccessibility of the proposed routes for the action alternatives and the extensive area covered by the APE, BPA developed a predictive analysis to assess the potential for cultural resources along each alternative. A background review and literature search was performed for the route segments, access roads and substation sites. The review included environment, archaeology, **ethnography**, and history data within the APE. Cultural resource data specific to the segments, access roads and substations were then compiled to estimate the cultural sensitivity of each action alternative. Using the Washington Statewide Predictive Model and known cultural resources, each individual route segment was given a cultural sensitivity "score." The cultural sensitivity score provides a basis for comparison among the action alternatives and reflects both the number and significance of known cultural resources within each route segment and for each substation, as well as the probability of encountering previously undiscovered cultural resources.

The Washington Statewide Predictive Model uses environmental variables such as elevation, slope, soils, aspect, proximity to water, surface geology, and landforms as predictors of cultural resources. The model also uses background data compiled from the Washington State DAHP database and the Oregon State Historic Preservation Office (SHPO) database, and other historic materials such as Sanborn Fire Insurance maps and Metsker maps.

Information was also compiled from ethnographic research and historic documents, and from the Cowlitz Indian Tribe. The Cowlitz identified specific areas of importance to them that were flagged for the analysis.

BPA calculated sensitivity scores for each alternative and option to determine which of the action alternatives may have a higher likelihood of cultural resource impacts. The four background areas noted above (environmental, archaeological, ethnographic and historic) were studied independently to determine their "raw" scores, which were then added together for a total score for each segment and then each alternative and option. Each variable was given a number on a scale of 0-100, "normalized" within its variable, and then these four values were calculated to get a median score for each segment. The route segments were then added together to give a total score for each alternative and option (see Table 13-1). Access roads were assigned to route segments for the calculation of the cultural sensitivity scores. Substation site scores were calculated separately and then added to the alternative or option scores. The higher the sensitivity score, the more likely there are cultural resources located in the alternative or option. For a complete description of the scoring system, please see Appendix I.

Table 13-1 Cultural Resource Sensitivity Scores[1, 2]

Alternatives and Options	Cultural Sensitivity Score	Previously Identified Sites within the APE for the Action Alternatives		
		Archaeological	Historic	Ethnographic
West Alternative	**498**	**27**	**18**	**13**
West Option 1	+21	+1	N/C	N/C
West Option 2	+53	-6	-5	-1
West Option 3	+42	-4	N/C	N/C
Central Alternative	**435**	**17**	**1**	**5**
Central Option 1	+12	-1	N/C	+3
Central Option 2	+51	-1	+3	+6
Central Option 3	-26	N/C	+4	N/C
East Alternative	**394**	**14**	**6**	**12**
East Option 1	+11	-1	N/C	-2
East Option 2	+31	+3	N/C	+1
East Option 3	-5	N/C	N/C	N/C
Crossover Alternative	**463**	**12**	**9**	**8**
Crossover Option 1	+57	-1	N/C	+3
Crossover Option 2	+35	+1	N/C	+2
Crossover Option 3	+34	+1	N/C	+2

Notes:

1. The scores for each option represent the net change from the action alternative. They were calculated as the total score of the option's segments minus the total score of the segments the option replaces.
2. Substation sites are included in the sensitivity scores.

Source: AINW 2011

13.2.2.2 Sundial Substation

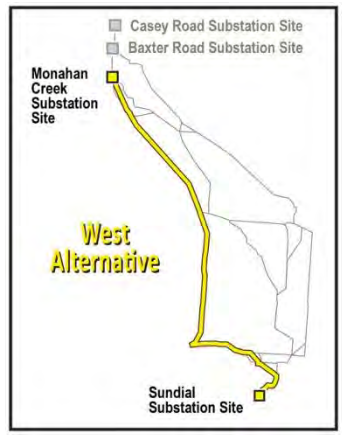
The Sundial site has a cultural sensitivity score of 25. The site has a high probability for historic resources because it is close to BPA's Troutdale Substation, a historic property that has been determined eligible to the NRHP. This site has a very low probability for archaeological or ethnographic resources, due to the site's location in a previously-disturbed industrial area near other substations, and because the presence of existing transmission lines makes it more likely that archaeological resources have been damaged or destroyed by construction of the existing infrastructure. Because the historic Troutdale Substation could be affected by the project, impacts at the Sundial site would be **moderate**.

13.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 13.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

The Monahan Creek and Baxter Road sites have the same cultural sensitivity score of 24. This higher score is likely due to their proximity to creeks. The Casey Road site has the lowest score at 15. The three substation sites are in remote areas that have been previously logged and are next to existing transmission lines that may have disturbed archaeological resources previously. Logging activities and transmission lines in the area may also contribute to a higher possibility that historic resources are present (i.e., historic transmission lines and historic logging camps). Because there are historic transmissions lines present in the area of the Monahan Creek, Casey Road and Baxter Road sites, impacts would be **moderate**.

13.2.4 West Alternative and Options



The West Alternative is the most likely culturally sensitive action alternative because it crosses areas within large population centers that contain a greater number of known sites (see Table 13-1). A greater number of sites are known probably because more cultural surveys have been completed in these areas compared to the other alternatives, and also because the areas are more suitable for habitation because of environmental factors (i.e., access to resources, and flatter topography).

Segments in the southern half of the West Alternative have the highest probability of cultural resources present (segments 25, 40, 46, and 52). These segments are in highly populated areas containing a number of previously recorded sites. Segments that have resources at proposed tower sites are 2, 4, 9, 25, 36b, 41, 45, 50, and 52. In Segment 25, known sites that could be disturbed by towers include a trail, a historic grave marker, an ethnographic fishing location, a cemetery, a lithic scatter, and an ethnographic prairie. Segment 4 has ethnographic village sites, the historic Northern Pacific Railroad site, and the Ostrander Tunnel and Portal. Segment 52 (the southernmost segment common to all action alternatives) has a lithic scatter, a historic site, and the Parkersville site, which is listed on the NRHP. The other segments also have sites that include trails, and ethnographic villages.

West Option 1 removes three segments with known cultural resources and substitutes two segments with known resources. Segment 40 has resources including a historic road and a historic grave marker. Segment 46 has some of the same resources, including the same historic marker.

West Option 2 removes the same three segments as West Option 1 and also removes Segment 50; all four removed segments have towers proposed at known cultural resource locations. However, West

Option 2 adds four new segments which also have cultural resources at proposed towers sites: segments 36, 36a, 37, and 43. These resources include a village and ethnographic prairie.

West Option 3 removes four segments that have proposed towers at known cultural resources and adds three segments (36, 36a and 37) that have known resources at tower sites.

Because the West Alternative and its options have NRHP eligible sites or red-flags at proposed tower locations, have unevaluated sites at tower locations and have historic transmission resources that may be impacted by project activities, the West Alternative and its options would create **moderate-to-high** impacts on cultural resources.

13.2.5 Central Alternative and Options

The Central Alternative has the second lowest cultural sensitivity score. This is partially because this alternative is in a less-populated area with fewer previous surveys completed. The segments that have the highest score and are more likely to have cultural resources that could be affected are segments 4 and 52.

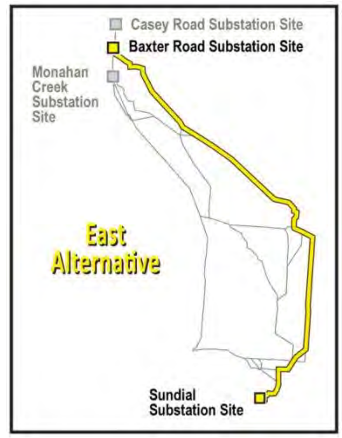
The Central Alternative has five segments (10, 28, 52, B and F) that have known cultural resources at proposed tower locations. These resources include trails, villages, and lithic scatters.

Central Option 1 adds Segment A, which has the same trail at a tower location as segments B and F. Central Option 2 removes these two segments, but adds three other segments that could also cause impacts to resources because of tower location (segments 1, 4, and 5). These resources include an ethnographic village site.

Central Option 3 removes Segment 28 that has known resources (ethnographic trail and prairie) at proposed tower locations and adds Segment 30, which also has a proposed tower on the same ethnographic trail.

Because the Central Alternative has historic BPA transmission lines present and the Central Alternative and its options have NRHP eligible sites or red flags located at a proposed towers, the Central Alternative and its options would create **moderate-to-high** impacts to cultural resources.

13.2.6 East Alternative and Options



The East Alternative has the lowest cultural sensitivity score, likely because it does not cross through as many highly populated areas, is in an area with more topography, steeper slopes and higher elevations, and is less likely to have been used by Tribes as often as the other action alternatives. Two segments that have a higher probability of affecting cultural resources are segments 3 and 52. Segment 3 has two ethnographic resources that could be affected by tower construction. Segment 52 is common to all alternatives (see Section 13.2.4, West Alternatives and Options).

Although the East Alternative has the lowest probability to affect cultural resources, it does have towers proposed at known cultural resources. These are in segments 52, B, F, K, O, and W. These known resources include historic military roads, trails, and lithic scatters.

For East Option 1, which has a higher sensitivity score than the East Alternative segments it replaces, segments B and F are removed and are replaced by segments 3, 7, 11, and J. Segment 3 has several known cultural resources and has a high sensitivity score. Segment 3 is the only new segment that has known cultural resources that may be affected by direct tower impacts (village site).

For East Option 2 segments O, Q, and S are removed and replaced by segments U, V, P, 35, and T, but only one of the added segments (Segment U) has a known cultural site that may be affected by a proposed tower (trail). East Option 3 adds only one segment (Segment R), which replaces Segment Q, resulting in nearly the same sensitivity score. There are no known sites at proposed tower locations.

Because the East Alternative and its options have NRHP sites or red-flags at proposed tower locations, unevaluated sites at proposed tower locations, and areas where BPA's historic transmission system is present, the East Alternative and its options would create **moderate-to-high** impacts to cultural resources.

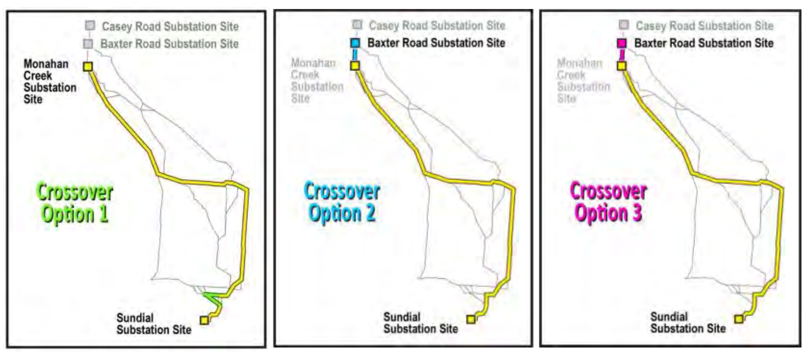
13.2.7 Crossover Alternative and Options

The Crossover Alternative has the second highest cultural sensitivity score. The likely reason for the higher score is that this alternative has a number of segments that occur in highly-populated areas and more surveys have been conducted in those areas. The segments that have the highest probability of impacts to cultural resources are the same as the Central Alternative: segments 4 and 52. South of Segment 4, the probability for impact to cultural resources lowers dramatically (see Sections 13.2.4, West Alternative and Options, and 13.2.5, Central Alternative and Options).

Within the Crossover Alternative, seven segments have towers proposed at known cultural resources: segments 2, 4, 9, 52, N, O, and W. Resources that could be affected by the proposed towers are the same from segment to segment and include trails, village sites, and lithic scatters.

For Crossover Option 1, segments 47, 48, and 50 replace Segment 51. Segments 47 and 50 both have towers that may impact sites (ethnographic prairies and a village site).

For Crossover Option 2, segments C and E are added and only Segment C has a tower where it could affect a historic military road. Crossover Option 3 adds segments D and E. A proposed tower affecting the historic military road is in both segments.



Because the Crossover Alternative and its options have NRHP sites or red flags at proposed tower locations, unevaluated sites and historic transmission infrastructure, the Crossover Alternative and its options would cause **moderate-to-high** impacts to cultural resources.

13.3 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. No additional mitigation measures have been identified to further reduce or eliminate adverse cultural resource impacts by the action alternatives.

13.4 Unavoidable Impacts

Some effects of the project may not be physical or direct in nature. The new transmission line could affect the viewshed of nearby sites or culturally significant areas that have yet to be identified. While these effects could be partially mitigated by various construction methods, including double-circuiting, they cannot be eliminated completely. BPA will continue to conduct studies (including a cultural resource survey on the preferred alternative) and consult with appropriate entities to identify resources and the effects that could result from each action alternative.

13.5 No Action Alternative

The No Action Alternative would have no impact on cultural resources in the project area because no new transmission lines, towers, access roads, or substations would be constructed. Impacts from operation and maintenance of existing lines and substations would continue unchanged. Impacts from disturbances from other activities in the area such as logging, land development, and transportation and other infrastructure improvements would continue.