



Department of Energy

Bonneville Power Administration
P.O. Box 491
Vancouver, Washington 98666-0491

TRANSMISSION BUSINESS LINE

January 14, 2003

In reply refer to: T-DITT-2

To: **People Interested in the Kangley-Echo Lake Transmission Line Project**

Bonneville Power Administration (BPA) has completed a supplemental draft Environmental Impact Statement (SDEIS) for the proposed Kangley-Echo Lake Transmission Line Project. The proposed line in central King County, Washington is needed to accommodate electrical growth and reliability concerns in the Puget Sound area. The SDEIS analyzes four additional transmission alternatives not analyzed in detail in the draft Environmental Impact Statement (DEIS) issued in June 2001, and a number of non-transmission alternatives. This letter provides information about upcoming public meetings, describes the next steps for the project, and provides you with contact information if you have questions.

Background

Last summer we held six scoping meetings and received over 1600 comments that helped us focus our environmental review. Based on those comments, BPA analyzed several transmission line routing alternatives, including: a no-action and non-transmission alternatives and four routes outside of the Cedar River Watershed. The non-transmission alternative study found that a high level of load reduction or additional generation is required to defer the line. In addition, the economic value of the energy loss savings from the new line is considerable, possibly exceeding the cost of the project. We also looked at the impacts of the new alternatives along with the impacts of the previous alternatives analyzed in the DEIS. However, the preferred route is still Alternative 1, which parallels an existing BPA transmission line through the Cedar River Municipal Watershed. If BPA decides to build the line, we would mitigate for any impacts to the watershed to ensure a safe drinking water supply for the Seattle area.

Because the SDEIS is unusually long (over 1800 pages, including appendices), we are circulating a summary of the document with a compact disk (CD) that contains the entire document, with appendices. If you requested a copy of the document, the summary is enclosed. If you would like to review the full hard copy of the SDEIS and appendices or view the entire document electronically, copies have been distributed to the local libraries (list of libraries enclosed). In addition, we have scheduled four public meetings to receive input on the SDEIS and to answer your questions.

Public Meetings

The public meetings are listed below and will have an open house format for the first two hours, BPA presentations for thirty minutes and formal comments for the last ninety minutes. The meetings are listed on the following page.

Monday, February 3rd

12:00 p.m. - 4:00 p.m.
Mt. Si Senior Center
411 Main Avenue South
North Bend, Washington

Wednesday, February 5th

4:00 p.m. - 8:00 p.m.
Maple Valley Community Center
22010 SE 248th Street
Maple Valley, Washington

Tuesday, February 4th

4:00 p.m. - 8:00 p.m.
Seattle Center Rainier Room
305 Harrison Street
Seattle, Washington

Thursday, February 6th

4:00 p.m. - 8:00 p.m.
Tahoma Senior High School
18200 SE 240th St
Covington, Washington

In addition, there will be a three-hour meeting to discuss the Non-Transmission study results on:

Tuesday, February 4th

12:00 p.m. - 3:00 p.m.
Seattle Center Rainier Room
305 Harrison Street
Seattle, Washington

How to Comment

Comment deadline is March 1, 2003. There are a number of ways to comment. You can submit comments at one of the public meetings listed above, mail them to BPA, Communications – KC-7, P.O. Box 12999, Portland, Oregon 97212, fax them to 503-230-3285 or email them to BPA at comment@bpa.gov. Please include the name of this project with your comments.

Next Steps

We will release a final Environmental Impact Statement July 2003 and a decision will be documented in the Record of Decision, currently scheduled for release August 2003.

For More Information

If you need more information about the project, please call toll-free at 1-888-276-7790. You can access previous project documents on the Transmission Business Line Web site at www.transmission.bpa.gov/projects. Thank you for your continued interest in this project.

Sincerely,

/s/ Lou Driessen

Lou Driessen,
Project Manager

Enclosures:

Summary of SDEIS (if previously requested)
Comment Form
Reference Library List

Kangley-Echo Lake Transmission Line Project

Supplemental Draft Environmental Impact Statement

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

Cooperating Agency: U.S. Department of Agriculture, Forest Service (USFS)

Title of Proposed Project: Kangley-Echo Lake Transmission Line Project

State Involved: Washington

Abstract: BPA is proposing to build a new transmission line to accommodate increasing demand for electricity and address reliability concerns in the Puget Sound area. The Proposed Action would construct a new line that would connect to an existing transmission line near the community of Kangley, and then connect with BPA's existing Echo Lake Substation. The major purpose of this proposal is to improve system reliability in the King County area. An outage on an existing line during times of heavy use, such as during a winter cold snap, could cause voltage instability and a loss of power in the King County area. System planners have projected total system load using normal growth in demand and determined that system instability could develop as early as the winter of 2002-03.

Besides meeting this need for system reliability, this project would enhance the United States' delivery of power to Canada as required under the Columbia River Treaty of 1961.

BPA described and analyzed transmission route alternatives in a draft environmental impact statement (DEIS) released in June 2001. The DEIS identified a preferred alternative that would parallel an existing BPA transmission line through the Cedar River Municipal Watershed. BPA received over 700 comments from landowners, agencies, tribes and special interest groups on the DEIS. Many of the comments suggested BPA re-evaluate the range of alternatives considered and prepare a supplemental draft environmental impact statement (SDEIS).

After reviewing the comments and refining the cost estimates associated with BPA's preferred alternative, BPA decided to prepare this SDEIS to re-evaluate alternatives not analyzed in detail in the DEIS. The added transmission alternatives, all located outside of the Cedar River Watershed, were initially considered but dropped from detailed analysis. They are identified as Alternatives A, B, C, and D. Alternatives A and C are located to the west of the Cedar River Watershed boundary. Alternatives B and D cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Under all transmission alternatives, Echo Lake Substation would be expanded about three acres to the east and new equipment to accommodate the new line would be installed.

BPA is also considering a Non-Transmission Alternative and the No Action Alternative.

For additional information, contact:

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Bonneville Power Administration
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Cle Elum Ranger District
803 W. 2nd Street

Cle Elum, WA 98922
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Email: frogalski@fs.fed.us

For more copies of this document, please call 1-800-622-4520 and ask for the document by name. The SDEIS Summary is also available on the Internet at: www.efw.bpa.gov.

For additional information on DOE National Environmental Policy Act activities, please contact Carol Borgstrom, Director, Office of NEPA Policy and Compliance, EH-42, U. S. Department of Energy, 1000 Independence Avenue S.W., Washington D.C. 20585, phone: 1-800-472-2756.

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Summary

➔ For Your Information

Words in bold are defined in sidebars or in the glossary.

A **kilovolt** is one thousand volts.

Load - The amount of electric power or energy delivered or required at any specified point or points on a system. Load originates primarily at the energy-consuming equipment of customers.

A **megawatt** is one million watts, or one thousand kilowatts. A megawatt is enough power to light 10,000 100-watt lightbulbs.

Voltage is the driving force that causes a current to flow in an electrical circuit.

A **brownout** is a partial reduction of electrical voltages that causes lights to dim and motor-driven devices to lose efficiency.

A **blackout** is the disconnection of the source of electricity from all electrical loads in a certain geographical area.

In this Summary:

- The Purposes and Need for Action
- Alternatives
- Affected Environment
- Impacts

This summary covers the major points of the supplemental draft environmental impact statement (**SDEIS**) prepared for the Kangley-Echo Lake Transmission Project proposed by the Bonneville Power Administration (**BPA**). The Proposed Action involves constructing a new 500-**kilovolt (kV)** line in central King County, Washington. The new line would connect an existing line near the community of Kangley to BPA's existing Echo Lake Substation nine miles to the north. The project would also involve expansion of that substation to accommodate the new transmission line. BPA is also considering other transmission and non-transmission alternatives. As a federal agency, BPA is required by the National Environmental Policy Act (**NEPA**) to take into account potential environmental consequences of its proposal and take action to protect, restore, and enhance the environment during and after construction. Preparation of this environmental impact statement (**EIS**) assists in meeting those requirements.

S.1 Purposes and Need for Action

S.1.1 Background summary

BPA's existing transmission system in the Puget Sound area provides reliable power to customers throughout the Northwest, and to other regions and Canada. As population grows, however, the need for electrical energy increases. Winter **loads** in the Puget Sound area alone are forecasted to increase 150-200 **megawatts (MW)** per year over the next decade, an average annual growth rate of 1.6 percent.

BPA is required to ensure its transmission system can reliably serve customer power needs under all operating conditions, including times of peak use (maximum demand). BPA system planners now anticipate peak use could exceed existing system capacity as soon as winter 2002-03. When system capacity is exceeded, the **voltage** on transmission lines can drop below acceptable levels, causing **brownouts**, or can cause automatic devices to disconnect lines and cut off power entirely, causing a **blackout**. To avoid these unplanned outages, system

operators may try selectively **dropping** or **shedding loads**, purposefully disconnecting some customers to prevent equipment damage or widespread loss of load. Whether planned or unplanned, electrical outages can be inconvenient, costly and even dangerous to customers, especially in winter during a cold snap.

Consequently, BPA needs to improve its transmission system to ensure continued reliable electrical power for Puget Sound area customers and other regions.

S.1.2 BPA's Purposes

"Purposes" are goals to be achieved while meeting the need for the project. These objectives are used to evaluate alternatives proposed to meet the need. BPA will use the following purposes to choose among the alternatives:

- Facilitate the orderly planning of the region's power system [Northwest Power Act (16 USC section 839(3)(B))];
- Increase BPA system capacity to meet growing customer demand for electricity (Northwest Power Act 16 USC section 839(4) and 16 USC 839a(4)(A)(i));
- Maintain BPA transmission system reliability [Federal Columbia River Transmission Act (16 USC 838b(d); Northwest Power Act 16 USC section 839(2) and 16 USC 839a(4)(A)(i)];
- Maintain environmental quality [Northwest Power Act 16 USC 839(3)(C)];
- Minimize impacts to the human environment through site selection and transmission line design (National Environmental Policy Act 42 USC 4321 et seq., and Endangered Species Act 16 USC 1531 et seq.)
- Minimize costs to BPA's ratepayers [Northwest Power Act 16 USC 839(2) and 16 USC 839a(4)(A)(ii)] while meeting BPA's long-term transmission system objectives for the area.

S.2 Alternatives

BPA conducts region-wide transmission planning studies annually. Looking several years into the future to ensure reliable electric service, the studies use a computer model called a "power flow" to represent the system as it is expected to operate. The studies indicate a new transmission line is needed by winter 2002-03 to reliably serve potential peak load in the Puget Sound area during an "extreme" cold weather event and by winter 2005-06 to serve even "normal" peak winter load.

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Based on this information, an energization date of fall 2002 for a new line was proposed.

BPA described and analyzed transmission route alternatives in a draft environmental impact statement (DEIS) released in June 2001. The DEIS identified a preferred alternative that would parallel an existing BPA transmission line through the Cedar River Municipal Watershed (CRW). BPA received over 700 comments from landowners, agencies, tribes and special interest groups on the DEIS. Many of the comments suggested BPA re-evaluate the range of alternatives considered and prepare a supplemental draft environmental impact statement.

After reviewing the comments and refining the cost estimates associated with BPA's preferred alternative, BPA decided to prepare this SDEIS to re-evaluate alternatives not analyzed in detail in the DEIS. The added transmission alternatives, all located outside of the CRW, were initially considered but dropped from detailed analysis. They are identified as Alternatives A, B, C, and D (see Map 1). Alternatives A and C are located to the south and west of the Cedar River Watershed. Alternatives B and D cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Under all transmission alternatives, Echo Lake Substation would be expanded about three acres to the east and new equipment to accommodate the new line would be installed.

BPA is also considering a Non-Transmission Alternative and the No Action Alternative.

➔ For Your Information

A **single-circuit** line has one electrical circuit per structure.

Tap - Point at which a transmission line is connected to a substation or other electrical device to provide service to a local load.

S.2.1 Proposed Action

BPA proposes to build a **single-circuit** 500-kV transmission line from a **tap** point on an existing 500-kV line near Kangley, Washington, to its Echo Lake Substation near North Bend, Washington. The proposed route for this line, also called Alternative 1, is nine miles long (see Map 2). Five miles of the proposed route would go through the Cedar River Municipal Watershed. In addition, Echo Lake Substation would be expanded about three acres to the east and new equipment would be installed there to accommodate the new line.

This alternative was proposed because it would be located immediately parallel to an existing 500-kV transmission line. Locating a new line next to an existing one minimizes right-of-way (**ROW**) clearing needed for the new line and reduces construction of additional access roads (only 2.9 miles of new access roads needed). About 0.6 miles of access road would be removed from service. However, the Proposed Action would displace two residences and a barn near Kangley, and impact a proposed subdivision.

The estimated construction cost for the transmission line is \$23.5 million, plus the estimated \$6.5 million for expanding the

➔ **For Your Information**

Mitigation — Steps taken to lessen the effects predicted for a resource. They may include reducing the impact, avoiding it completely, or compensating for the impact. Some mitigation, such as adjusting the location of a tower to avoid a special resource, is taken during the design and location process. Other mitigation, such as reseeding access roads to desirable grasses and avoiding weed proliferation, is taken after construction.

substation. The additional cost of **mitigation** measures would increase the Proposed Action's overall cost by about \$5 million, for a total project cost of \$35 million. The following mitigation measures are proposed:

- use of special design elements such as micropile footings;
- erection of towers in the Cedar River Municipal Watershed using a helicopter;
- use of vegetable oil in place of hydraulic fluids within the CRW;
- use of temporary mats to cross wetlands instead of permanent fill;
- use of special surveying techniques to minimize vegetation cutting;
- use of special clearing criteria to minimize clearing;
- use of helicopter within the CRW to remove cut trees to designated central areas, then removal by log trucks;
- restricting ground-disturbing activities to the dry season (May through September);
- use of erosion specialists and monitors for erosion control;
- purchasing land as replacement habitat for habitat affected by the proposed project;
- purchasing insurance for the unlikely event that drinking water quality is degraded;
- wetland mitigation including careful cutting and removal of only vegetation that are tall-growing species, reseeding where vegetation has been removed, and purchase of lands that contain wetlands and creeks and have other environmental/social benefits;
- special mitigation (best management practices) within the CRW concerning noxious weed removal/control and general vegetation management for wildlife habitat;
- special care along creeks important to fish habitat and water quality by removing only tall-growing vegetation within and immediately next to the ROW and replanting/seeding low growing vegetation;
- no vehicular crossing of the Cedar River within the CRW including no vehicular use of the current bridge within the CRW and no crossing of the Cedar River by a helicopter with a load of logs;

- use of two double-circuit towers to cross the Cedar River within the CRW and no clearing of vegetation near the Cedar River. Remove two existing towers and put the new line and the existing 500-kV line onto the new double-circuit towers.

The following equipment and activities would be part of the Proposed Action (most are shared in common with the other transmission alternatives):

S.2.1.1 Transmission Structures

About 47 lattice steel transmission towers would support the 500-kV transmission line. These structures average 135 feet high, with the average span between towers about 1,150 feet.

➔ For Your Information

Micropiles — A type of footing that involves augering holes about 6 inches in diameter to a depth of approximately 30 feet, inserting 1 steel bar into the holes, then grouting the bar in place using a cement grout. Using micropiles reduces the amount of ground disturbance required.

For the Proposed Action, BPA is proposing a new type of footing that requires less ground disturbance. The new footing design would use what are known as **micropiles** instead of the standard footing designs. Site grading would not be required. Brush clearing would only be necessary for the tracked equipment to operate. Most vegetation would not need to be uprooted. Tree stumps at footing sites may need to be ground down to ground level or removed, but could be crushed, bent over, broken or trimmed to the ground. The tower leg normally embedded in the ground would be above ground, so limited excavation would be required other than drilling. This method of securing the footing to the tower leg would typically disturb an area of about 10 square feet per tower leg for a total of 40 square feet at each tower site. BPA estimates that this new design would reduce the area of site disturbance within the CRW by about 16 acres, and about 16 acres on land outside the CRW.

Towers would be lifted into place in the CRW by sky-crane helicopters to reduce disturbance.

S.2.1.2 Conductors and Insulators

Conductors, wires that carry electrical current on a transmission line, are suspended from towers with insulators. Insulators are made of nonconductive materials (porcelain or fiberglass) that prevent electric current from passing through the towers to the ground. Conductors are installed on the insulators, often by helicopter, after the towers have been built. Then two overhead **ground wires** are attached to the top of the towers for lightning protection. There is also a series of wires (called counterpoise) buried in the ground and a grounding well at each structure to establish a low resistance path to earth, usually for lightning protection. Finally, one fiber optic cable needed for communications would be strung on the new line.

➔ For Your Information

Ground wire is wire that is strung from the top of one structure to the next; it shields the line against lightning strikes.

➔ For Your Information

Danger trees — *Trees (or high growing brush) in or alongside the right-of-way, which are hazardous to the transmission line.*

S.2.1.3 Right-of-Way Clearing

BPA would acquire easements to build, operate and maintain the new transmission line across public and private properties. The Proposed Action would require 150-feet of new right-of-way over nine miles.

If tall trees outside the 150-foot easement could fall and damage the line, BPA would acquire rights that allow BPA to remove these “**danger trees**.” BPA would also acquire rights to use private roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire an access road easement that allows BPA to construct a new road.

For safe and uninterrupted operation of the transmission line, vegetation within the ROW would then need to be cleared. BPA would develop a clearing plan to guide the construction contractor hired to clear off and on the ROW. The plan would specify the allowable vegetation heights along and at varying distances from the line. Generally, all tall-growing vegetation (trees and woody brush) would be removed from the 150-foot right-of-way, as well as identified danger trees outside the ROW.

Where the Proposed Action crosses the CRW, BPA would use different clearing criteria that would take fewer trees. This “stable tree” criteria would leave trees considered stable in place, even though they may be tall enough to fall into the transmission line.

S.2.1.4 Access Roads

Easements — BPA normally acquires access road easements and develops and maintains permanent road access to each of its transmission line structures. Surfaced with crushed gravel, access roads are designed for trucks and equipment used during construction and maintenance of the line and may include short spur roads (roads that go to a structure if the structure is not located on a trunk road).

Easements for new roads outside the proposed transmission line ROW would be 50 feet wide. Typically, new or existing access roads would be graded to provide a 16-foot travel surface, with an additional 4-6 feet to accommodate curves. However, due to the use of the new tower footing design (micropiles) and use of helicopter tower erection, there would be no need for heavy equipment (track hoe and crane) for all but one of the transmission towers. Ground crews would require only smaller vehicles, including track-mounted or multi-tire vehicles, such as log trucks, to complete clearing and installation. As a result, access road requirements can be reduced in the Cedar River Watershed, in particular the width of the roads (from 16 feet to 10-14 feet). This means most existing roads do not need to be widened and

BPA can reduce road requirements by 10-15 acres. (In those areas where access is or would be inadequate for a logging truck, trees would either be left on the ground or taken out by helicopter.) Precise access road locations would be coordinated with landowners to minimize impacts on property.

Stream Crossings — New and existing access roads may cross rivers and both perennial and intermittent streams. No new bridges or stream crossings would be constructed and no new culvert locations across streams are needed for this project.

Gates — Access roads that cross private timberlands and lands managed by the CRW would be gated and locked in accordance with the wishes of landowners and land managers. BPA would install nine gates.

S.2.1.5 Staging Areas

During transmission line construction, tower steel, electrical conductors, insulators and hardware are often stockpiled at sites called staging areas. The contractor(s) hired to construct the line could secure temporary rights to establish staging areas somewhere near the center and at both ends of the proposed line. To facilitate construction efficiency, staging areas tend to be located next to major highways and often are former industrial storage yards. When helicopters are used to build the transmission line structures, staging areas are typically used to pre-assemble the towers for helicopter delivery to tower sites and are used as fueling sites for those helicopters. Staging areas are only used during construction. Although the staging area locations have not yet been determined, none would be located within the CRW.

➔ For Your Information

A **bay** is an area set aside in a substation for special equipment.

S.2.1.6 Substation Facilities

Expansion of Echo Lake Substation would include construction of a new 500-kV **bay** (terminal) on BPA property immediately east of the substation. The size of the expansion would be 150 feet by 750 feet. The site would be cleared, fenced and graded. A short section of the existing road around the substation would be realigned to the east.

S.2.1.7 Maintenance

Once the new line is built, BPA would manage vegetation on the new rights-of-way as it does on existing ROWs and substation sites. This includes manual, mechanical, biological and chemical (herbicide) maintenance activities. BPA uses an integrated vegetation management (IVM) approach, which looks at existing environmental conditions and selects a vegetation management strategy best suited to these conditions. If threatened or endangered fish, animal, or plant species listed under the Endangered Species Act (**ESA**) are found along a

transmission line route, buffer zones are defined around these areas and no herbicides are used. This practice also applies to riparian areas. The IVM plan would insure that the mitigation measures identified in the EIS and implemented during construction would be carried forward and maintained throughout the life of the line.

At the landowner's request, no herbicides would be used in the Cedar River Watershed. BPA has not used herbicides in the Watershed for the past 16 years.

S.2.2 Alternative 2

Alternative 2 would originate from a tap point about 1.5 miles east of the tap point for the Proposed Action and traverse northwest about three miles before continuing north paralleling the existing Raver-Echo Lake Transmission Line into Echo Lake Substation. This alternative would be approximately nine miles long.

Alternative 2 has all the components of the Proposed Action, but would require 2.7 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 2 was explored because it would avoid impacting two residences and a small subdivision affected by the Proposed Action.

The estimated cost for Alternative 2 is \$22.5 million, plus the estimated \$6.5 million for the substation expansion. The cost of mitigation measures would increase the overall cost for Alternative 2 by \$4 million, for a total project cost of \$34 million. Mitigation measures would largely be the same as those proposed for the Proposed Action.

S.2.3 Alternative 3

Alternative 3 would begin at the same tap point as Alternative 2. From this point, it would traverse northeasterly then turn north-northwesterly to Echo Lake Substation. This alternative would be about 10.2 miles long, or about 1 1/4 miles longer than the Proposed Action. It would also require additional clearing because none of the route is next to the existing line. Alternative 3 was considered to better meet Western Electricity Coordinating Council reliability criteria, which requires its members to study all outages of two parallel lines on the same ROW if the outage has a statistical frequency of more than one occurrence in 300 years. The benefit of this routing alternative is that it provides enough separation from the existing line to provide increased reliability. Alternative 3 has the same components as the Proposed Action, but requires about 6.4 miles of new access roads; no roads would be abandoned.

The estimated cost for the transmission line is \$25.5 million, plus the estimated \$6.5 million for the substation expansion. Mitigation measures similar to those proposed for the Proposed Action could increase costs by an additional \$5 million, for a total project cost of around \$37 million.

S.2.4 Alternative 4A

Alternative 4A would begin at the same tap point as Alternative 2 (see Map 2). About one-third of the way along Alternative 2, this alternative turns northwest to connect with the Proposed Action. Alternative 4A has the same components as the Proposed Action, with about the same transmission line length (9.5 miles), and similar new access road requirements (2.7 miles). About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. It was considered to avoid the two residences and the small subdivision adjacent to the Proposed Action, while avoiding a second separate crossing of the Cedar River further upstream from the existing crossing.

The estimated cost for Alternative 4A is the same as the Proposed Action, \$23.5 million plus the estimated \$6.5 million for expanding the substation. Mitigation measures could add \$5 million more in costs to bring the overall project cost for Alternative 4A to \$35 million. Proposed mitigation measures for this alternative are largely the same as those for the Proposed Action.

S.2.5 Alternative 4B

Alternative 4B would begin at the same tap point as Alternative 2. About half way along Alternative 2, this alternative would traverse southwest to connect with the Proposed Action. Alternative 4B has the same components as the Proposed Action, with an equivalent transmission line length (9.2 miles). It would require about 2.2 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 4B was considered for the same reasons identified in Alternative 4A, plus the added benefit of taking advantage of established clearing in the CRW for the existing 115-kV transmission line parallel to Pole Line Road, and using this county road for access to the proposed power line.

The estimated cost for Alternative 4B is the same as the Proposed Action, \$23.5 million plus the estimated \$6.5 million for expanding the substation. The cost of mitigation measures could increase Alternative 4B's costs by \$5 million, for a total project cost of \$35 million. The

mitigation measures proposed for Alternative 4B are largely the same as those for the Proposed Action.

S.2.6 Alternative A

Alternative A would require construction of about 20 miles of new 500-kV transmission line on mostly rural residential land, on mostly existing ROW. The alternative would use a vacant ROW between the tap point along the existing transmission line near Kangley, to a point near Covington Substation, immediately north of a portion of an existing 230-kV transmission line (see Map 1). Some new ROW would need to be acquired around the northeast side of Covington Substation to connect two transmission line ROWs, which is adjacent to Covington Substation. Connecting these two existing transmission line ROWs may require removing/relocating approximately 25 homes and displacing two undeveloped tax lots. In all, Alternative A impacts 401 tax lots along its route, 242 of which are developed.

BPA is considering an option for this alternative (Option A1) that would impact fewer homes. This option would run through Covington Substation (see Map 3) on mostly BPA-owned land.

The existing single-circuit 230-kV line from Covington Substation to the north to a tap point on an existing double-circuit 500-kV transmission line would need to be torn down and replaced with a new double-circuit transmission line. This new transmission line would have a 230-kV line on one side and a 500-kV line on the other. The 500-kV circuit would tap one of the vacant 500-kV circuits, on an existing double-circuit 500-kV line coming from the west to take the power into Echo Lake Substation (see Map 1).

The estimated construction cost for Alternative A is \$44.5 million, plus the estimated \$6.5 million to expand the substation. General mitigation measures (described below) could boost this cost by \$2.5 million, for a total project cost of \$53.5 million. In addition, the use of tubular poles to mitigate views from homes very near the new line would add \$3.5 million in costs, bringing the total to \$57 million for this alternative.

If Option A1 (crossing mainly BPA land near Covington Substation) were pursued, the estimated construction cost is \$37 million. This is less than the original Alternative A because of reduced property acquisition costs. The substation expansion and general mitigation measures would boost this total by about \$8.5 million and tubular poles would cost an additional \$3.5 million, for a potential total project cost of \$49 million.

The following mitigation measures are proposed for Alternative A:

- minimizing wetland impacts and mitigate for any fill and tree removal in wetlands;

- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the City of Kent's watershed;
- measures needed for the approximately 401 landowners potentially affected;
- special care for construction near residences, particularly when removing small existing buildings and disrupting areas currently used as extensions of residents' properties (such as extending backyards into the vacant ROW).

As previously noted, Alternative A uses a vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative A were selected, a new 500-kV single-circuit line may need to be built in the future at an estimated cost of \$19 million. This cost also needs to be considered when evaluating this alternative.

S.2.6.1 Transmission Structures

The single-circuit 500-kV line between the tap point near Kangley would be supported by single-circuit towers approximately 135 feet high, and the double-circuit line between Covington and the vacant circuit of the Maple Valley-Echo Lake line would be supported by towers approximately 180 feet high. Tangent structures and several dead-end structures would be used. For most of this alternative, BPA would use plate, grillage, and rock anchor footings. BPA would use micropile footings in the city of Kent's watershed.

S.2.6.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.6.3 Right-of-Way Clearing

Alternative A would require 150 feet of new ROW width over about one mile. For Option A1, about one-quarter mile of new ROW would be needed.

Clearing would be required within the existing ROW where trees have been allowed to grow. Some trees outside the ROW, if

determined to be unhealthy or danger trees, would need to be removed. A total of 397 acres of vegetation would be impacted by clearing (118 acres, or 30 percent of this total, would be forested stands permanently converted to non-forest use).

S.2.6.4 Access Roads

About 6.6 miles of new access road would need to be acquired to build and maintain the new transmission line.

S.2.6.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.6.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.6.7 Communication and Maintenance

See the Proposed Action.

S.2.7 Alternative B

For this alternative, 35.6 miles of the existing 345-kV single-circuit transmission line and towers between Stampede Pass and Echo Lake Substation would be torn down and new double-circuit towers erected to accommodate two new 500-kV lines. Alternative B would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation (see Map 1). The new double-circuit line would operate on one side at 345-kV (like the existing line) and the other at 500-kV. The new double-circuit line would be built mostly on existing ROW, but would impact 110 tax lots, of which 20 are developed. No homes would be displaced. This alternative crosses the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

The estimated construction cost for Alternative B is \$77 million, plus the estimated \$6.5 million to expand the substation. Mitigation measures (described below) could boost this cost by \$4 million, for a total project cost of \$87.5 million. The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;

- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on USFS-managed lands;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 110 landowners potentially affected; and
- surveys required for Survey and Manage and Threatened and Endangered species.

S.2.7.1 Transmission Structures

Alternative B would replace the existing 150-foot double-circuit towers that are over 50 years old with 180-foot double-circuit towers. Tangent structures and several dead-end structures would be used. BPA would use plate, grillage, and rock anchor footings for this alternative.

S.2.7.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.7.3 Right-of-Way Clearing

The new transmission line would be built mostly on existing ROW with the exception of a short segment within the Wenatchee National Forest, where the line would tap the Schultz-Raver No. 2 500-kV Transmission Line. BPA would acquire special use permits from the Forest Service and easements from other property owners where BPA does not already have a permit or easement.

About 250 acres of vegetation would need to be cleared within and adjacent to the existing Rocky Reach-Maple Valley line ROW to accommodate the double-circuit line. Of that total, 210 acres, or 84 percent, would be forested stands permanently converted to non-forest use.

S.2.7.4 Access Roads

Alternative B would follow an existing transmission line ROW; therefore, new access road construction would be limited to improving the existing trunk access and spur roads, reconstructing some spur roads to improve drainage, and constructing some new, short spur roads to any new tower locations. About two miles of new access road would need to be acquired to build and maintain the new transmission line. BPA would acquire access road easements on existing roads to access

the transmission line ROW or road use permits from the Forest Service. When no existing roads are near the ROW, BPA would acquire special use permits allowing construction of new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

S.2.7.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.7.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.7.7 Communication and Maintenance

See the Proposed Action.

S.2.8 Alternative C

Alternative C has two options, Option 1 and Option 2. Option C1 is approximately 10.1 miles long and Option C2 is approximately 10.6 miles long (see Map 1). Both would require new ROW away from existing transmission lines. Option C1 would begin at Raver Substation and proceed 2.5 miles west immediately north of and parallel to an existing double-circuit 500-kV transmission line on new 150-foot-wide ROW, before turning north and traveling about 7.6 miles on new 150-foot ROW through the rural residential areas of Ravensdale and Hobart. The proposed line would then tap the vacant circuit on an existing double-circuit 500-kV transmission line, west of Echo Lake Substation, just north of State Route 18 (**SR 18**). Power would be carried by this existing transmission line into Echo Lake Substation, following the completion of a short segment at Echo Lake Substation similar to that described at the north end of Alternative A.

Option C2 would begin at a tap point on an existing 500-kV double-circuit transmission line near Kangley, about 2.8 miles northeast of Raver Substation, and traverse about 4.5 miles west within a vacant transmission line ROW immediately north of a 230-kV transmission line, before turning north and continuing on the same alignment as Option C1 into Echo Lake Substation.

Both options would cross primarily private land. Option C1 would cross 128 tax lots, of which at least 54 are developed; 30-35 homes could be displaced. Option C2 would cross 134 tax lots, of which 56 are developed; 23-28 homes could be displaced.

The estimated construction cost for Option C1 is \$46.5 million, which includes the estimated \$6.5 million to add new equipment to Raver Substation. Adding the estimated \$6.5 million to expand Echo Lake Substation and \$5.5 million in estimated general mitigation costs would boost the total project cost to \$58.5 million. In addition, the use of tubular poles to mitigate views from homes near the new line would add \$1.2 million in costs, bringing the total to \$59.7 million for this alternative.

If Option C2 were pursued, the estimated construction cost is \$32.5 million, plus the estimated \$6.5 million cost of expanding Echo Lake Substation. General mitigation measures could boost this total by \$4 million and tubular poles would cost an additional \$1.2 million, for a potential total project cost of \$44.2 million.

The following mitigation measures are proposed for both Alternative C options:

- minimizing wetland impacts;
- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the city of Kent's watershed;
- measures needed for the landowners potentially affected (128 under Option C1; 134 under Option C2); and
- special care for construction near residences, particularly when removing trees adjacent to the ROW.

As previously noted, Alternative C uses a portion of the vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative C were selected, a new 500-kV single-circuit line may need to be built in the future at an estimated cost of \$9 million. This cost also needs to be considered when evaluating this alternative.

S.2.8.1 Transmission Structures

Both options would use single-circuit 500-kV towers approximately 135 feet high. Tangent structures and several dead-end structures would be used. BPA would use plate, grillage, and rock anchor footings for both options.

S.2.8.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.8.3 Right-of-Way Clearing

Option C1 would require 150 feet of new ROW width over about 10.1 miles. Option C2 would require 150 feet of new ROW over about 6.1 miles.

For Option C1, about 195 acres of vegetation would need to be cleared, of which about two-thirds (130 acres) would be forested stands permanently converted to non-forest use. For Option C2, about 206 acres of vegetation would need to be cleared, of which 56 percent would be permanently converted forested stands.

S.2.8.4 Access Roads

Option C1 would require approximately 8.7 miles of new access roads, while Option C2 would require about 8 miles of new access roads.

S.2.8.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.8.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

Option C1 would start at Raver Substation and similar equipment as is proposed at Echo Lake Substation would be installed at Raver Substation.

S.2.8.7 Communication and Maintenance

See the Proposed Action.

S.2.9 Alternative D

Alternative D would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation over 35.6 miles of new single-circuit 500-kV transmission line.

Alternative D has two options, Option D1 and Option D2. Option D1 is located immediately adjacent to and south of the existing 345-kV line; Option D2 is located immediately adjacent to and north of this line. Either option would entail acquiring and clearing a new

150-foot wide ROW and building a new 500-kV single-circuit transmission line. Option D1 crosses 134 tax lots, of which 32 are developed; 11-14 homes would be displaced. Option D2 crosses 121 tax lots, of which 22 are developed; eight homes would be displaced. Both options cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

The estimated construction cost for Option D1 is \$55.5 million, plus the estimated \$6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by \$10.5 million, for a total project cost of \$72.5 million.

The estimated construction cost for Option D2 is \$53 million, plus the estimated \$6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by \$11 million, for a total project cost of \$70.5 million.

The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;
- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on Forest Service managed lands;
- potential relocation of roads;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 134 landowners potentially affected by Option D1 and 121 landowners potentially affected by Option D2.
- surveys required for survey and manage and threatened and endangered species; and
- requirements to mitigate for potential impacts to threatened and endangered species and survey and manage species that are discovered.

S.2.9.1 Transmission Structures

Alternative D (either option) would be supported by steel towers approximately 150 feet tall, about the same height as most of the

existing towers supporting the Rocky Reach–Maple Valley line that would be next to this new line. BPA would use tangent structures, several dead-end structures, and plate, grillage, and rock anchor footings for this alternative.

S.2.9.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.9.3 Right-of-Way Clearing

The new transmission line would be built on new ROW. BPA would acquire a special use permit on National Forest land and easements on private land where BPA does not already own these rights. Options D1 and D2 would require 150 feet of new ROW width over about 35.6 miles.

In general, where new ROW is obtained, a strip of land about 150 feet wide would be cleared to allow for tower construction and conductor clearance. About 769 acres of vegetation would need to be cleared within the new ROW for Option D1. Of that amount, 82 percent (632 acres) would be forestland permanently converted to non-forest use. For Option D2, 776 acres of vegetation would be cleared, of which 89 percent (694 acres) would be permanently converted forestland.

S.2.9.4 Access Roads

About 13.6 miles of new access road would need to be acquired to build and maintain the new transmission line for Option D1 and 13.2 miles for Option D2. This would result in the clearing of 33 acres for Option D1 and 32 acres for Option D2. BPA would acquire access road easements on existing roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire easements that allow BPA to construct new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

S.2.9.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.9.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.9.7 Communication and Maintenance

See the Proposed Action.

S.2.10 Non-Transmission Alternative

Some commentors suggested that a variety of non-transmission alternatives such as Demand-Side Management (**DSM**), Distributed Generation (**DG**), large-scale generation (**G**) and Demand Response (**DR**), could defer or eliminate the need for a new transmission line. BPA examined the following:

Demand Response (DR) Programs — DR programs are a potential source of load reduction that could be exercised during a cold snap to prevent overloads on the Covington transformers. These options include Direct Load Control (**DLC**), interruptible/curtailable (non-firm) rates, and demand bidding (i.e., the Demand Exchange) to reduce loads when needed during system peaks. These types of solutions can be an effective approach to achieve load reductions because they directly address the capacity nature of the problem.

DR programs can be categorized into two major types: 1) price-based dispatch programs that offer customers incentives to voluntarily curtail load during the peak; and 2) pre-arranged contracts with customers (such as interruptible/curtailable rates or direct load control) that would require a customer to reduce loads during the system peak for a fixed price at BPA's request. These programs differ in their implementation and potential for providing load relief as discussed below. In this analysis we evaluate both price-based dispatch and interruptible/curtailable for their capability to provide the needed capacity to BPA.

Price-based dispatch programs are voluntary programs in which the price for curtailment or interruption is determined through a price convergence mechanism (i.e., auction, bidding system, etc.) between load serving entities and customers. Customers can choose the point at which the price available to them is high enough to offset their productivity losses from reducing or shutting-off their load. If the price offered by the load serving entity is high enough, then sufficient load reduction can, in all probability, be purchased at that price. While price-based dispatch programs result in a particularly efficient process of load reduction, they do not provide firm or guaranteed reductions in system load when needed.

Interruptible/curtailable contracts differ from the price-based dispatch programs because the terms (i.e., number of times/year the customer can be curtailed, maximum hours per interruption, and notification period for interruption) and the price (fixed component) are pre-determined and bound with an enforceable contract. By securing a contract for the load reduction, the available peak load relief is more

certain for planning purposes. This type of program is better suited for the type of system conditions driving the need for the transmission line, where extreme but infrequent weather conditions result in high levels of load relief required over relatively few hours of the year.

Demand-Side Management Measures — DSM measures are typically considered energy efficiency measures rather than peak shaving programs. However, certain measures such as heating efficiency and weatherization will reduce heating loads and have an impact on peak demand reduction so they were included in the economic screen.

Generation and Distributed Generation — There are a variety of generation options that could help to defer the transmission line, including both existing and new generation. In the course of this study we identified 277 MW of additional capacity that could potentially be available from existing generators in the Puget Sound area. An additional 270 MW of capacity is currently under construction. Together, these plants could provide up to 170 MW of relief at Covington Substation. Another 2,700 MW of capacity are either permitted or planned, although it is uncertain how much, if any, of this capacity will eventually be constructed.

BPA makes assumptions about the disposition of existing generators when it conducts its studies of the power flows across critical transmission system elements. BPA generally assumes that all generators in the Puget Sound area would be running to meet the extremely heavy loads during a cold snap. However, this analysis uncovered approximately 390 MW of capacity at several generating stations in the area that is not running for BPA's load flow studies. This capacity could potentially be called upon by BPA during the target hours.

In addition to the existing facilities, a number of new, large power plants have been proposed for the Puget Sound area since the late 1990s. Nearly all of these plants would be large natural gas-fired, combined-cycle combustion turbine plants. Together, these plants would add approximately 3,000 MW of generating capacity. Of course, many if not most of these projects will never be built. Still, even one of the larger projects could reduce the need for the transmission project.

Regional Availability of Natural Gas — One issue is the availability of natural gas, and the ability of the region's natural gas system to deliver the gas to all of the existing and new natural gas-fired generators in the Puget Sound area. As generating capacity would be needed by BPA during the highest loads of a cold snap, this time period would almost certainly experience extremely high coincident demand for natural gas. Like electricity transmission, the natural gas delivery system has a fixed peak delivery capacity; once the limits of the system are reached, there is very little that can be done on short notice to

increase deliveries. BPA relies on gas-fired generators to operate to avoid a Puget Sound-area blackout during a cold snap. Whether generators would be able to obtain firm gas supplies with the incentive level BPA can offer might not be known until the implementation phase.

Existing Distributed Generation — In addition to the existing large generation discussed above, there are also small-scale distributed generators in the Puget Sound region. According to estimates, existing idle DG at local industrial sites, banks, hospitals etc., amounts to approximately 60 MW in the region. This translates to less than 20 MW available at Covington Substation after applying the appropriate load flow factors. This idle capacity could potentially be called upon by BPA during the target hours.

New Distributed Generation — Small-scale, distributed generation can often serve as a substitute for investment in transmission or distribution circuits. However, in this case, the potential overload is sufficiently large and the load area sufficiently diverse such that distributed generation does not appear to be an economically viable alternative.

Renewable Generation and Emerging Technologies — Renewable generation such as wind and solar were not considered for this study, because their resource characteristics are a poor match for BPA's needs to defer the project. Wind energy was excluded because the Puget Sound Area is not home to a commercial-grade wind resource. Solar was excluded because the critical hours occur during the winter months when solar radiation is scarce, and many of the target hours occur during the evening. Fuel cells do not suffer from these disadvantages, and were considered for the high-level screen. However, their extremely high cost makes them unattractive as a substitute for the project.

S.2.11 No Action Alternative

The No Action Alternative is often called the no-build alternative. The environmental impacts described for each of the alternatives described above would not occur. The No Action Alternative does not mean there would never be a need for future transmission projects, only that no line would be considered for construction in this general area in the near future.

S.2.12 Alternatives Considered but Eliminated from Detailed Study

A wide variety of alternatives was considered. The following were eliminated when they were judged to not meet the purpose and need:

- **Building an underground transmission line** — Excessively high costs (as much as 10 times more) of this option prevented its further consideration. BPA considers undergrounding a tool for limited, special situations.
- **Energy conservation** — While BPA- and utility-sponsored conservation programs in the region have helped to reduce power demand, the magnitude of savings that can be accomplished is too small to defer the need for the new transmission line.
- **Load curtailment plan** — BPA has a curtailment plan in place that calls for cuts to firm transmission customers in the Puget Sound area when system conditions (such as a potential overload) require. While this plan can reduce load temporarily to protect the system, it is not a reasonable long-term solution to the region's additional transmission needs.
- **Transmission line route variations** — Other transmission line routes, some proposed by the public during the environmental scoping process, were considered.
- **Flexible AC Transmission Systems (FACTS)** — BPA invests in technological improvements that boost transmission capacity whenever it is cost efficient. Known as Flexible AC Transmission Systems, these advances in power electronics enhance the controllability and usable capacity of alternating current (AC) transmission systems. The current problem in the Puget Sound area, however, is lack of surplus transmission capacity. If the existing line goes out of service during a cold weather event, existing transformers and the underlying low voltage (230-kV) system will be overloaded. While it is theoretically possible to reroute power flow through other transformers and lines in the area with one or more FACTS devices, this would be a temporary solution at best. There is little margin left in the system. Remaining capacity, if any, will run out shortly. At that point a new line would be needed.
- **Revise the Columbia River Treaty** — BPA does not have authority to unilaterally change the terms of the treaty.

S.3 Affected Environment

S.3.1 Land Use

Most of the project area lies within unincorporated King County. The easternmost one-third of Alternatives B and D runs through Kittitas County from the King County border near Snoqualmie Pass to Stampede Pass. A small portion of Alternatives A and C are in the vicinity of two small incorporated cities, Maple Valley and Covington. With the exception of land within those municipalities, local land use planning is under each county's jurisdiction.

Alternatives 1 through 4, B, and D primarily cross forested land that is managed for natural resource conservation (National Forests), watershed protection and/or timber production. For example, two-thirds of Alternatives B and D is located within the boundaries of the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Alternatives 1 through 4 cross the Cedar River Municipal Watershed.

Other uses in the vicinity of some alternatives are rural residential development, urban areas, and mineral extraction (aggregate).

Only Alternative A crosses any incorporated land: 3.6 miles within the cities of Covington and Maple Valley.

S.3.2 Recreation

Many recreational resources are located in and around Alternatives A through D. By comparison, there are no recognized recreation sites within the project areas for Alternatives 1 through 4. Even informal, dispersed recreation is minimal around Alternatives 1 through 4 because public access is restricted in the CRW and on private timberlands traversed by these alternatives.

Alternative A crosses Elk Run Golf Course, a public course located on private land and land leased from King County. On land immediately under the ROW and existing line, Maple Valley plans an active recreation area, including ball fields, and bus barn development. Design has been completed and construction will begin soon. Plans include a perimeter trail that would connect to the Cedar River and planned Cedar to Green River Trails (Starbord, 2002).

As Alternative A turns north at Covington Substation, it passes through the city of Covington between Gas Line Right-of-Way Park, which is currently being developed, and the Soos Creek Park and Trail, which is planned to extend into Covington. North of Covington, Alternative A passes between Lake Youngs Watershed and Shadow Lake, then crosses through the Peterson Lake Natural Area and the Cedar River Trail, which connects Maple Valley and Renton along Highway 169 and the Cedar River.

Approximately 22 miles of Alternatives B and D (both Options D1 and D2) cross through National Forest land from the Yakima River east of Keechelus Lake to about midway between exits 38 and 42 on the I-90 corridor. The land allocations assigned to public land in this area show maintenance of recreational opportunities is a primary objective. Acquisition and exchange of land have occurred recently, but there are no plans to add to existing recreational facilities (Rogalski, 2002). Federal recreational resources of note in the vicinity include:

- Alpine Lakes Wilderness Area, located north of I-90 near Snoqualmie Pass, which is currently being analyzed for expansion.
- Pacific Crest Trail, which crosses the existing BPA ROW west of Surveyors Lake and east of the Iron Horse State Park Gate.
- Tinkham Campground, located between existing BPA ROW and I-90, east of exit 42.
- McClellan Butte Trail, with its trailhead at exit 42.
- The ski area at Snoqualmie Pass has ski trails and mountain bike trails that run underneath or adjacent to Alternatives B and D.

The remainder of the length of Alternatives B and D (approximately 14 miles) crosses a mix of public and private land. Though outside the National Forest, this length is located within the Mountains-to-Sound Greenway Trust and a mix of state, federal, and privately funded recreational resources has been established.

Recreational resources outside the National Forest boundary include the following:

- Iron Horse State Park and John Wayne Pioneer Trail, which parallel the I-90 corridor from Rattlesnake Lake through private lands to National Forest lands near Lake Keechelus and the Yakima River. Parts of this converted railroad line trail parallel the BPA ROW and the proposed alternatives cross the trail in four locations. It is managed cooperatively by the Forest Service and State.
- Ollalie State Park, located east of the Upper Twin Falls Trailhead.
- Upper and Lower Twin Falls Trailhead, Twin Falls Natural Area, and Twin Falls Trail, located east of exit 34 along the south side of I-90.
- Camp Waskowitz, with about 40 acres north of the South Fork along I-90 accessed off of 150th and approximately 330 acres south of the South Fork Snoqualmie River. A

portion of the 330 acres extends up to the existing line. Most of the property is used for hiking and outdoor educational sites. Outhouses and “infrequently used shelter houses” are located up along the existing line and some Christmas trees have been planted under the existing line.

- Snoqualmie Valley Trail, which extends from the John Wayne Pioneer Trail and Rattlesnake Lake recreation area down the Snoqualmie River Valley.
- Rattlesnake Mountain Scenic Area, Rattlesnake Mountain Trail, and Rattlesnake Lake Recreation Area. Rattlesnake Lake Recreation Area is more than 1.5 miles south of the existing BPA ROW on Cedar Falls Road off Exit 32. The existing BPA ROW runs along the east side, then passes through the northern end of the Rattlesnake Mountain Scenic Area approximately 0.75 mile south of Snoqualmie Point Trailhead where it crosses the Rattlesnake Mountain Trail.

West of the Rattlesnake Mountain Scenic Area, the existing BPA ROW turns southwest toward Echo Lake Substation after crossing the Rattlesnake Mountain Trail. Here it crosses Weyerhaeuser Real Estate Company land that has been identified for a planned trail connection between the Tiger Mountain State Forest and Rattlesnake Mountain Scenic Area (Konigsmark, 2002).

Alternative C passes just west of Ravensdale Park and along the east side of Big Bend along the Cedar River just north of Kent-Kangley Road. At its north end, this segment crosses Tiger Mountain State Forest.

S.3.3 Geology and Soils

The topography, geology, and soils of the project area are key factors affecting the susceptibility of different areas to erosion and sedimentation. Erosion and sedimentation can cause degradation of water quality and affect fisheries and other habitat.

Topography — The project areas can be subdivided into three *physiographic* provinces: a southern lowland area (Puget Lowlands) in Green Valley and a northern mountainous area, which includes Taylor Mountain, Brew Hill, Rattlesnake Mountain, and the intervening Raging River Valley (Rosengreen, 1965), and the foothills and peaks of the Cascade Mountains. Proportionally, Alternatives A and C encounter more lowland than the other alternatives. The project area for Alternatives B and D, by comparison, is predominantly mountainous.

➔ **For Your Information**

Glacial drift — Sand, gravel, boulders, etc., moved and deposited by a glacier or by water arising from its melting ice.

Lowland areas are underlain by **glacial drift**; Alternatives B and D are dominated by volcanic rock.

Geology and Soils — The project area is along the western margin of the South Cascade Range, which are composed primarily of volcanic, volcanoclastic and associated sedimentary rocks that have folded and faulted over the years. Continental glaciers have contributed to the resulting surface deposits and landforms. Soils are typical of those found in the western Cascades of Washington, including soil deposited directly by streams and rivers, glaciers and glacial outwash streams; residual soils (an accumulation of rock debris and soil formed by weathering); colluvial soil transported downslope; and volcanic ash from nearby Cascade volcanoes that mixed with the other soil types.

Seismology — The project area is in a moderately active earthquake region that has been subjected to many quakes of low to moderate strength, and occasional strong shocks, during the Pacific Northwest's 170-year historical record. Recently, the area experienced a 6.8 earthquake centered near Olympia. The seismicity of the region results from the ongoing subduction of the Juan de Fuca Plate beneath the North American Plate along the Cascadia Subduction Zone.

S.3.4 Water Resources

Precipitation — Precipitation patterns in the project area are under the prevailing marine influence of the Pacific Ocean, which produces mild, wet falls and winters, relatively dry summers, and mild temperatures year round. Most of the precipitation falls as rain in the southern lowlands of the project area, while a mixture of rain and snow falls on the upper portions of the northern mountainous area. Annual precipitation in the project area averages between 40 and 60 inches in the Kent area along the western extension of Alternative A, to more than 180 inches at Stampede Pass at the east end of Alternatives B and D. In general, the annual precipitation amounts increase from west to east as elevation increases. There is a distinct wet season; over 75 percent of the total annual precipitation falls between October and April.

Floodplains — The **Federal Emergency Management Administration (FEMA)** has not mapped floodplains for the entire project area, usually doing so only in populated areas. However, FEMA has mapped the 100-year floodplain along the Cedar River a short distance downstream from the project area. Based on this mapping, it appears that the 100-year floodplain just west of the watershed is initially limited to a narrow area along the active Cedar River channel. Farther downstream, however, in the vicinity of Alternative A's northern route, the Cedar River flows into a broad valley where the floodplain averages 1,000 to 1,500 feet in width.

FEMA has also mapped the floodplain of the South Fork Snoqualmie River in the vicinity of North Bend. Here the floodplain is also generally confined to a narrow area along the active channel and appears to have the same geomorphic conditions upstream where Alternatives B and D cross the river twice. FEMA has not mapped the reach of the Yakima River Valley where Alternatives B and D cross the Yakima River. However, the valley is generally broad and flat in this area and several bog areas occur, tending to indicate periodic flooding. Flooding in the Yakima River is controlled to a certain degree by operation of the Keechelus Lake Reservoir, which is about four miles upstream of the proposed river crossing.

Remaining waterways in the project area, including the Raging River and its tributaries, and tributaries to the Cedar and South Fork Snoqualmie rivers, are in moderately incised channels. As such, these streams do not have significant floodplains and flooding generally would not rise above the incised channels.

➔ For Your Information

Sole source aquifer - An aquifer designated by the Environmental Protection Agency which provides at least half of an area's drinking water.

Groundwater — There are no **sole-source aquifers** designated or proposed by the Environmental Protection Agency (EPA) in the project area. However, there are numerous domestic and public supply wells and wellhead protection programs (City of Kent, City of Covington) located within the project area. The principal groundwater aquifers are in glacial outwash deposits in the southern lowland area. These aquifers are locally developed for domestic and some farm consumption in the communities of Selleck and Kangley. In the northern mountainous area, the community of Halmar Gates, near the end of Kerriston Road, likely uses groundwater for domestic consumption. Wells in this area would produce groundwater from the underlying bedrock. Potential aquifers in alluvium, outwash and ice contact drift deposits also exist between North Bend and Twin Falls State Park along the Snoqualmie River Valley.

Water in the Cedar River, which provides unfiltered drinking water to 1.3 million people, is also partially derived from groundwater sources. As such, contamination of the groundwater could impact the drinking water supplies. Activities in the Watershed that could affect the groundwater supply are strictly controlled.

Water Quality — The project area includes portions of the Cedar River Municipal Watershed, where water quality is very high. Both water quality and quantity are important components of the CRW's ability to provide a clean and reliable drinking water supply. The Cedar River is listed for fecal coliform at points two miles and 10 miles downstream (west) of the Alternatives A and C crossings, respectively. The upper Yakima River is listed as temperature-impaired at a point seven miles downstream from where Alternatives B and D cross it. Two segments of the South Fork Snoqualmie River are listed as pH-impaired at points 1,000 feet upstream from the Alternatives B and D western

crossing and 2,000 feet downstream from the Alternatives B and D eastern crossing.

S.3.5 Fisheries

Each of the transmission alternatives would cross some fish-bearing streams and an unknown number of non-fish-bearing streams.

The fish resources in the study area include resident and anadromous species. Resident species live their life cycles within the watershed. Anadromous species are hatched in freshwater, then spend part of their life at sea before returning to their home waters to spawn.

Along the route of some alternatives, surrounding trees and vegetation produce conditions well suited as **anadromous** fish-rearing habitat. Other streams support only resident fish. Shade produced by forest stands adjoining these fish-bearing streams are often a primary control on water temperature and fish habitat health.

S.3.5.1 Special-Status Fish Species

Special-status fish species include those that are listed, proposed, or candidates for listing as threatened or endangered under the federal ESA, or that are regarded as species of concern by the U. S. Fish and Wildlife Service (**USFWS**), or that are listed as species of concern (including endangered, threatened, sensitive and candidate categories) according to the Washington Department of Fish and Wildlife (**WDFW**).

Federally Listed Species — All transmission alternatives could affect two species of fish listed as either threatened or endangered under the ESA: Puget Sound chinook salmon and Puget Sound bull trout. Alternatives B and D (Options D1 and D2) could affect two additional species of fish, Middle Columbia steelhead and Columbia River bull trout, listed as threatened under the ESA.

Federal Candidate Species — All transmission alternatives could affect one species of fish that is a candidate for listing under the ESA: the Puget Sound/Strait of Georgia **ESU** coho salmon. Although the National Marine Fisheries Service (**NMFS**), in its proposal, found listing to be “not warranted,” the species has not been withdrawn from candidate status and may be listed in the future. Coho salmon are potentially present in streams crossed by each of the transmission alternatives.

Federal Species of Concern — The USFWS has identified the Pacific lamprey and river lamprey as species of concern potentially occurring in the project area. Both Pacific and river lamprey are potentially present in streams crossed by each of the transmission alternatives.

➔ For Your Information

Anadromous fish — Chinook, coho and sockeye salmon and steelhead trout, which hatch in fresh water, spend part of their life at sea, and then migrate up rivers to their home waters to spawn.

➔ For Your Information

Evolutionarily Significant Unit (ESU) — A salmon population or group of populations that are substantially reproductively isolated from other conspecific population units, and contributes substantially to ecological/genetic diversity of the biological species as a whole.

Essential Fish Habitat — All transmission alternatives could affect two fisheries protected by federal Essential Fish Habitat (EFH) provisions: the chinook salmon and coho salmon fisheries. All streams in the project area are included in designated EFH for these two fisheries. Some streams are included because they may support spawning, rearing and migratory use by chinook and coho salmon. Others are included because they are situated upstream of areas used by salmon, and the salmon are sensitive to water quality in these streams.

Washington State Special-Status Species — Chinook salmon, bull trout, and river lamprey are state candidates for listing by the WDFW.

National Forest Plan Fish Protection Strategies — The U.S. Forest Service (USFS) manages two National Forests in the project area, the Mt. Baker-Snoqualmie National Forest and the Okanogan-Wenatchee National Forest. USFS also manages lands on the fringes of these two national forests within the project area. In 1993, USFS and the Bureau of Land Management (BLM) developed the Northwest Forest Plan to set guidelines for the management of the natural environment in Pacific Region National Forests. The goals of the Northwest Forest Plan are designed to protect forest ecosystems and allow renewable use of forest material, but they also include protection for riparian areas and waters. As part of the plan, the Aquatic Conservation Strategy (ACS) was developed. This strategy protects salmon and steelhead habitat on federal lands managed by USFS and BLM. The Northwest Forest Plan Standards and Guidelines define the process by which proposed projects are determined to be in compliance with the ACS objectives (ACSOs). If either Alternative B or D (Options D1 or D2) is chosen as the preferred alternative, USFS-managed lands would be involved, and the appropriate level of analysis for ascertaining impacts to ACSOs would need to be completed.

S.3.6 Wildlife

Analysis of wildlife focused on species that are: species federally-listed as threatened or endangered; federal species of concern; USFS “*Survey and Manage*” species, sensitive and proposed sensitive species, *Management Indicator Species (MIS)*, and species of interest; and Washington State-listed threatened, endangered, sensitive or *monitor species*. Species found in the project area include:

Forest Community Dependent Species — A number of forest community species, including invertebrates, were identified as potentially occurring within (e.g., nesting in, foraging in, or traveling through) the project area. These include northern spotted owls, great gray owls, marbled murrelet, black-backed woodpecker, northern

goshawks, merlins, pileated woodpeckers, Vaux's swifts, band-tailed pigeons, blue grouse, fisher, six species of bats, and seven species of terrestrial mollusks.

Riparian Community Dependent Species — Seven riparian community species were identified as potentially occurring within the project vicinity. They include: bald eagle, great blue herons, osprey, willow flycatchers, harlequin ducks, Aleutian Canada goose, mink and Van Dyke's salamanders.

Aquatic Community Dependent Species — Seven aquatic community species were identified as potentially occurring within the project vicinity. These include: the Cascades frog, northern red-legged frog, Cascade torrent salamander, Oregon spotted frog, tailed frog, western toad and Fender's soliperlan stonefly.

Species Dependent on Unique Habitats — Two wildlife species, the Larch Mountain salamander, and the peregrine falcon were identified as potentially occurring within the project vicinity and having a primary association with unique habitat types.

Early Regeneration Community Dependent Species — Three wildlife species preferring young forest surroundings were identified as potentially occurring within the project vicinity: elk, black-tailed deer, western bluebirds, and four species of butterfly.

S.3.7 Vegetation

Vegetation communities found in the vicinity of the transmission line alternatives vary considerably in their general characteristics and species composition. The project area for Alternatives 1 through 4 is almost entirely within forests that have been maintained in timber production for most of the last 150 years. Located further west, Alternative A is generally characterized by highly disturbed, intensely managed vegetation communities typically found in cleared and maintained transmission line corridors and surrounding residential and commercial development. Alternative B is also a highly disturbed, intensely managed transmission line corridor; however, the area immediately adjacent to the corridor is relatively undisturbed and infrequently managed. Alternative C (Options C1 and C2) is typified by moderately disturbed managed vegetation communities typical of rural and suburban development. Alternative D (Options D1 and D2) generally contains vegetation communities with low-to-moderate disturbance and low management intensity.

Vegetation cover types were determined by the type of dominant plants (e.g., tree, grass, shrub), the species of dominant plants (e.g., Douglas fir, alder, and maple), and the regeneration stage of a given forested stand. For Alternatives 1 through 4, vegetation cover types in the CRW HCP database were reviewed and consolidated into 12

categories. The vegetation along Alternative A is dominated by rural-residential and suburban development cover types, and by the managed shrubland communities typical of existing transmission line corridors. For Alternatives B and D (Options D1 and D2), analyses of existing vegetation communities were based on USFS stand data, resulting in six additional categories for mature forests and managed rural-residential areas. The vegetation for Alternative C, particularly Option C1, presents an intermediate condition between development-dominated Alternative A and the forest dominated Alternatives 1 and D (Options D1 and D2). The rural residential managed cover type is most prevalent of any cover type along Option C2.

The **Proposed Action** (Alternative 1) — is dominated by coniferous forest stands in the mature coniferous regeneration cover type. The north leg of the Proposed Action tends to be mixed coniferous-deciduous forest. The south leg of the Proposed Action has more conifer-dominated stands. A thin riparian strip along the Raging River contains several large old conifers, including Douglas fir and western red cedar trees over 35 inches diameter breast height (dbh).

Alternative 2 — is dominated by coniferous forest stands in the mature coniferous regeneration cover type. The extreme southern end of Alternative 2 passes through a young Douglas fir plantation. Alternative 2 also passes through young Douglas fir plantations just southeast of the point where it joins Segment D along the existing transmission line ROW (see Map 8 for segments on Alternatives 1-4).

As with the Proposed Action, the portion of Alternative 2 that follows Segment D tends to have more mixed forest to the west and more conifers to the east. This alternative crosses a thin stand of older Douglas fir and western red cedar at the Raging River.

Alternative 3 — generally passes through older, more mature coniferous regeneration and mid-regeneration coniferous stands, and less non-forested area. There are no mature deciduous stands. The project area of Alternative 3 includes approximately six acres of wetlands and numerous cover types in the lakes/rivers/streams category.

At least two older, mature Douglas fir stands were found during field studies for Alternative 3. These were off Pole Line Road near Taylor Creek and along Binus Creek Road. Trees in these stands were over 32 inches dbh and averaged 160 feet in height. Increment cores from these trees showed these stands to be over 70 years old.

Alternative 4A — is dominated by mature coniferous regeneration cover type. This alternative also crosses the same young Douglas fir plantation that is crossed at the south end of Alternative 2. Most of the younger stands within the project area were found along Segment D,

toward the north end of the alternative. The areas north of Selleck and Pole Line Road, where Alternative 4A crosses from Segment E to Segment C, are dominated by mature coniferous regeneration stands.

Alternative 4B — is dominated by mature coniferous regeneration forest cover type. It is similar to Alternative 4A in that it begins in a young, Douglas fir plantation, then passes through older coniferous areas before joining Segment D. From there, stand age tends to drop and cover type becomes more mixed forest.

Alternative A — is dominated by rural-residential and suburban development cover types, and by the managed shrubland communities typical of existing transmission line corridors. Over 40 percent of Alternative A's study area is in developed or rural-residential cover types. Less than a quarter of the area is in conifer-dominated forest. Of the coniferous forest present, most is less than 35 years old, and conifers up to 75 years old dominate only 4 percent of the total study area. While remnant older trees are likely present in the Alternative A area, no stands were identified that are dominated by trees older than 75 years.

Alternative B — lies within the existing transmission line corridor that extends westward from Stampede Pass to Echo Lake Substation. In the eastern two-thirds of Alternative B, vegetation communities adjacent to the existing corridor are dominated by coniferous forest stands. Most of these are mature stands, especially near the eastern end of Alternative B.

Within the portion of Alternative B cleared for operation and maintenance of the transmission line, vegetative cover types are dominated by managed shrublands and patches of managed early regeneration coniferous stands. Most of the young regenerating conifers are Douglas fir. In higher elevations (generally above 3,500 feet), Pacific silver fir seedlings that have volunteered from adjacent mature stands are also present. Since no transmission line is currently hung from the south side of the tower arms, the need to keep that side of the corridor cleared has not been as great as on the north side of the ROW. As a result, most of the young coniferous regeneration stands in the ROW are found along the southern edge of the transmission line corridor.

Alternative C (Option C1) — presents an intermediate condition between the development-dominated Alternative A and the other forest-dominated alternatives. Total developed and rural residential area is under 25 percent, and forested communities of any kind account for approximately two-thirds of the project area. However, as with Alternative A, conifer-dominated communities within the

Option C1 area are primarily young stands under 35 years old. Mid-regeneration coniferous stands (20 to 35 years old), mid-regeneration mixed stands (10 to 30 years old), and early regeneration coniferous stands (less than 20 years old) account for 31 percent of the study area. Rural residential managed landscape has the highest percentage cover of any type.

Alternative C (Option C2) — shares the northern portion of the Option C1 alignment and so has similar percentages of cover types: total developed and rural-residential areas account for 25 percent; forested communities of any kind cover about two-thirds of the project area; and rural residential managed landscape has the highest percent cover of any type. Conifer-dominated communities are primarily young stands under 35 years old. Mid-regeneration coniferous and mixed stands, and early regeneration coniferous stands account for 34 percent of the study area.

Alternative D (both Options D1 and D2) — passes through National Forest land managed by the Okanogan-Wenatchee and Mt. Baker-Snoqualmie National Forests from Stampede Pass heading west toward North Bend. Vegetation within the area of this alternative is 86 percent forested, with 61 percent of the area in coniferous forest. Options D1 and D2 contain the oldest and largest conifer stands of all the alternatives. Almost 18 percent of the conifer stands are in the range of 75 to 250 years in age, and another 18 percent are approaching 75 years old. Development and rural residential areas account for less than 6 percent of the study area.

The area around Echo Lake Substation is grass/forb/shrub, with small mixed coniferous-deciduous stands. The perimeter area to about 100 feet around the substation is surrounded by gravel and non-native grasses.

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S.3.8 Wetlands

Wetlands perform many important functions, including flood storage and flood flow moderation, filtering pollutants and sediments before they enter streams, and providing foraging, breeding, cover, and rearing habitat for many wildlife species.

A total of 90 wetlands were identified within the ROWs of the transmission alternatives. Wetland vegetation classes include palustrine emergent, scrub-shrub, open water, riverine, unconsolidated bottom and forested wetlands as defined by Cowardin et al. (1979).

➔ For Your Information

Depressional areas — Wetland areas that receive water from overland runoff and precipitation.

Commonly these wetlands are associated with **depressional areas** that receive water from overland runoff and precipitation. They are generally greater than 1 acre and include a mosaic of wetland and upland areas following small variations in topography. Several wetlands were also found to be associated with the riparian area of **low-gradient** streams. Wetlands east of Snoqualmie Pass are generally associated with riparian fringes and floodplains of streams. Hydrology of these wetlands depends on stream flows and flooding. Just west of Snoqualmie Pass, wetlands are predominantly located on sloped areas and were fed by groundwater discharge seeps.

Wetland buffers inside the Cedar River Watershed, private timberlands and National Forests are generally intact and dominated by a mix of shrubs and young forest. Wetland buffers within existing power line ROWS have been cut to allow conductor span, and generally have low shrub and herbaceous cover. Wetland buffers in the more urban areas (Alternatives A and C [Options C1 and C2]) typically consist of grasses, shrubs, or trees.

Common dominant wetland plant species include red alder, western hemlock, willow, salmonberry, Douglas' spiraea, soft rush, creeping buttercup, skunk cabbage, piggy-back plant, and slough sedge.

S.3.9 Visual Resources

The visual project area includes numerous landscape types, including the Cedar River Municipal Watershed, private timberlands, National Forest land, rural residential uses and pastureland in unincorporated communities, and some limited higher density uses in incorporated areas.

S.3.10 Socioeconomics

The project area is located within rural areas of King and Kittitas counties and the incorporated cities of Covington and Maple Valley. Other cities near the project area are North Bend, Snoqualmie and Black Diamond. The routes of most alternatives pass predominantly through forested areas with little population, although there are varying degrees of rural residential and/or denser residential use along each route.

King County is the most populated county in Washington. King County and the state have both experienced substantial increases in their populations since 1960, with growth rates exceeding the national average. Although population growth experienced by King County has been rapid, the state as a whole has been growing at an even faster rate. The average annual covered wage in King County of \$47,000 was above the state average annual covered wage of \$37,000 in 1999, the

latest information available. Average annual covered wage in Kittitas County was \$22,400, significantly lower than the state annual coverage wage. Household income in the incorporated communities near the project alternatives had fewer households below the poverty level than did King and Kittitas counties as a whole. Eight percent of King County residents and almost 20 percent of Kittitas County residents fell below the poverty level in 1999, the latest information available. This compares to 6.5 percent in North Bend, 4 percent in Covington, and 1.7 percent in Maple Valley.

The ethnicity of the project vicinity is predominantly Caucasian and the remainder primarily African-American, American Indian, Pacific Islander, and Asian. King County as a whole has a higher minority population (greater than 20 percent) than does Kittitas County (11 percent). The project vicinities all have lower percentages of minorities than their respective counties.

The main economic activities in King County are manufacturing, shipping and trade, agriculture, business services, shipbuilding, fishing, wood products, and tourism. Total employment in King County has grown gradually over the past six years. King County has consistently had lower rates of unemployment than the statewide average during the last decade. Employment in King County is nearly one-third in services, slightly higher than the distribution of employment for the state of Washington as a whole, with nearly 28 percent of all jobs in the state attributable to the services sector. This sector is dominated by the business services industry, which accounts for nearly one-third of King County's services sector jobs. Government employment is the dominant sector in Kittitas County.

S.3.11 Cultural Resources

The project area is rich in cultural history. Portions of the project area have been and continue to be used traditionally by members of many Indian tribes. Members have used the area for camping, fishing, hunting, gathering berries, trading with other tribes and as a traveling route. BPA has asked potentially affected tribes to identify tribal concerns about potential **traditional cultural properties (TCPs)** (locations that may not contain physical remains, but hold heritage importance for their association with cultural traditions) within the project area. The corridors for Alternatives B and D, for example, contain previously identified TCPs near Rattlesnake Mountain and in the Snoqualmie River drainage. Another traditional cultural use site, Lookout Mountain, occurs within the Cedar River Watershed, but is more than one mile from any of the alternatives (SPU 1999:3.6-4).

Other existing cultural resource sites, prehistoric and historic, described in various records and literature were researched. No

➔ For Your Information

Traditional Cultural Properties
A traditional cultural property is defined generally as one that is eligible for inclusion in the National Register of Historic Places because of its association with cultural practices or beliefs (e.g., traditions, beliefs, practices, lifeways, arts, crafts, and social institutions) of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community.

registered historic sites – structures or districts – are located within a quarter mile of the proposed ROW for each alternative, although three are located within one mile of one or more of the alternatives. The Selleck National Historic District, for example, is the closest cultural resource site and is separated from Alternative 2 by a road and more than 700 feet.

Of the cultural resources identified through archival and map research, only the former Barneston townsite (including Hemlock and the related Japanese settlement) and the Pedro Felise cabin (no longer standing) occur on or within the 150-foot right-of-way of BPA's proposed alternative routes. The probability for encountering prehistoric cultural resources along any of the four action alternatives varies by landform and increases along the Cedar River.

There is a high probability of encountering historic-period cultural resources in the project area, such as remnants of historic-period logging activities. Many historic-period cultural resources have been identified in archival sources and maps, although few have been formally inventoried or even verified on the ground by cultural resource professionals.

S.3.12 Noise, Public Health and Safety

S.3.12.1 Transmission-line Noise

Audible noise — usually characterized as a hissing, crackling sound sometimes accompanied by a hum — can be produced by transmission lines. Usually this happens during foul weather which, based on meteorologic records near the route of the proposed transmission line, is expected to occur less than 9 percent of the time.

Along the alternative routes of the proposed 500-kV transmission line, existing noise levels depend on land use and on whether there is an existing transmission line. Background noise levels in remote areas depend on ambient conditions: wind, rain, traffic or other human activity nearby. For example, levels associated with rain on foliage will be up to 50 dBA. During foul weather, median levels of audible noise from an existing 500-kV line at the ROW edge would be about the same (50 dBA).

BPA design criterion for median levels of audible noise during foul weather is 50 ± 2 dBA at the edge of the right-of-way. Transmission lines are classified as industrial and may cause a maximum permissible noise level of 60 dBA to intrude into residential property. During nighttime hours (10 p.m. to 7 a.m.), the maximum permissible limit for noise from industrial to residential areas is reduced to 50 dBA. This latter level applies to transmission lines that operate continuously. The state of Washington Department of Ecology accepts the 50 dBA level at

the edge of the right-of-way for transmission lines, but has encouraged BPA to design lines with lower audible noise levels (WDOE, 1981).

King County additionally defines a rural area where the maximum sound arising from an industrial area (say, a transmission line) is limited to 57 dBA, with a reduction to 47 dBA during nighttime hours and on weekends and holidays.

S.3.12.2 Electric and Magnetic Fields (EMF)

Transmission lines, like all electrical devices and equipment, produce EMF. While electric-field strength tends to be constant, magnetic-field strength can vary depending on the design of and distance from the line, the amount of electrical load on the line, and even meteorological factors. In all cases, field strength decreases rapidly with distance.

There are no national standards for EMF from power facilities such as transmission lines. Washington does not have a standard. BPA has an electric field standard of 9kV/m maximum on the ROW and 5kV/m at the edge of the ROW, which it applies to all transmission lines, including those already existing in the study area.

S.3.12.3 Toxic and Hazardous Substances

Because a transmission line and substations already exist in the project area, routine maintenance procedures for such facilities are already occurring. These generate minimal amounts of hazardous waste. BPA uses herbicides sparingly when managing vegetation in rights-of-way. All herbicides used by BPA must be approved by the EPA and must also go through a BPA environmental review process. Only trained crew members are allowed to apply herbicides, and they are required by law to follow label directions. BPA does not use herbicides in the Cedar River Watershed.

S.3.12.4 Fire

The City of Seattle permits fire suppression activities in the Cedar River Watershed and requires that activities in the Watershed follow strict fire control regulations. This policy is consistent with safe and reliable operation of the existing transmission lines.

The USFS and Weyerhaeuser require that vehicles traveling and working on their land carry fire suppression tools during the fire season. All BPA vehicles used for maintenance of transmission lines are equipped with such tools.

Fires on or near the ROW can jeopardize safe and reliable operation of transmission lines. Besides physical damage from heat and flames, smoke and hot gases from a fire can cause arcing between lines,

between lines and a tower, or between lines and the ground. Such occurrences can pose a threat to the safety of personnel in the vicinity, such as firefighters, and can result in line outages.

To prevent fires and other hazards, safe clearances are maintained between the tops of trees and the existing lines in the corridors. Electricity can arc from the conductor to a tree top. Generally, trees are not allowed to grow over 20 feet high on the ROW. Trees that need to be cleared from the ROW or that could cause such an arc are removed. BPA also prohibits storage of flammable materials on its ROWs.

➔ For Your Information

Corona — *Corona occurs in regions of high electric field strength on conductors, insulators, and hardware when sufficient energy is imparted to charged particles to cause ionization (molecular breakdown) of the air.*

S.3.12.5 Radio/TV Interference

Corona on transmission-line conductors can generate electromagnetic noise in the frequency bands used for radio and television signals. The noise can cause radio and television interference (**RI** and **TVI**). However, correct design of a line can mitigate corona generation and keep radio and television interference at acceptable levels.

S.3.13 Air Quality

King County, inclusive of the project area, is designated as a marginal ozone maintenance area, a moderate carbon monoxide maintenance area, and a moderate particulate matter maintenance area. A maintenance area designation means that King County is not currently but was previously listed as a non-attainment area for these three pollutants but had not exceeded the National Ambient Air Quality Standard (**NAAQS**) for the three years prior to its designation as a maintenance area. Alternatives B and D cross over the Cascade Mountains and would be located in Kittitas County as well as King County. Kittitas County is an attainment area; the **NAAQS** are met for all criteria pollutants in Kittitas County.

S.4 Impacts

To analyze potential impacts from construction, operation and maintenance of the alternatives, resource specialists analyzed actions using a scale with four impact levels: **high, moderate, low** and **no** impact. The impact discussion also lists **mitigation** that could reduce impacts and cumulative impacts of the alternatives.

S.4.1 Land Use Impacts

The **Proposed Action** — would cross each of the main land uses in the area: forest production, watershed protection, and rural residential. The majority of land crossed would be forestland, where

between lines and a tower, or between lines and the ground. Such occurrences can pose a threat to the safety of personnel in the vicinity, such as firefighters, and can result in line outages.

To prevent fires and other hazards, safe clearances are maintained between the tops of trees and the existing lines in the corridors. Electricity can arc from the conductor to a tree top. Generally, trees are not allowed to grow over 20 feet high on the ROW. Trees that need to be cleared from the ROW or that could cause such an arc are removed. BPA also prohibits storage of flammable materials on its ROWs.

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S.4.1 Land Use Impacts

The **Proposed Action** — would cross each of the main land uses in the area: forest production, watershed protection, and rural residential. The majority of land crossed would be forestland, where

impacts would be low. It would parallel the ROW of the existing transmission line, converting only negligible amounts of forestland to utility use. It would require 2.9 miles. However, where it would traverse the communities of Kangley and Selleck, it would displace two residences and a small barn and prevent the development of one lot of a proposed four-lot subdivision. Land-use impact: **moderate**.

Alternative 2 — would cross forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.7 miles of new access roads. Land-use impact: **low**.

Alternative 3 — would require clearing a separate new ROW, but would cross only forestland, converting negligible amounts to utility use. It would come within 650 feet of two residences on its north end, but placement of the line in the eastern portion of the corridor could minimize this impact. It would require 6.4 miles of new access roads. Land-use impact: **low**.

Alternative 4A — would cross only forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.7 miles of new access roads. Land-use impact: **low**.

Alternative 4B — would cross only forestland and, because it shares most of its route with the Proposed Action (paralleling an existing line), would convert only negligible amounts of forestland to utility use. It would require 2.2 miles of new access roads. Land-use impact: **low**.

Alternative A — Location of the transmission line outside existing BPA-owned land around Covington Substation would affect as many as 25 homes and two tax lots in the subdivision located at the corner of SE Wax Road and Covington Way. Alternative A would require 6.6 miles of new access roads. Alternative A would be considered to have a **high** land use impact.

By comparison, Option A1 would displace up to three homes located on private property just east of the substation. It may also occupy an area where BPA was planning to construct a new large maintenance headquarters building. Land-use impact: **moderate**.

Alternative B — would require rebuilding the existing transmission facility within existing ROW, allowing less ground disturbance and vegetation clearing than construction in new ROW. This alternative crosses predominantly land zoned for forest use and some limited rural residential land and would not displace any dwellings. Alternative B requires 2 miles of new access roads. Alternative B would be considered to have **low** land use impact.

Alternative C, Option C1 — the north-south segment of Alternative C, which is common to both Options C1 and C2, would

require clearing of new ROW. It runs almost entirely through rural residential land and would displace between 23 and 28 dwellings. The rest of Option C1, also requiring newly-cleared ROW, runs across more rural residential and some forestland. This option could displace an additional seven dwellings (total of 30 to 35 homes for this option). Option C1 would require 8.7 miles of new access roads. Overall, Option C1 would have a **high** land use impact. In all, the 10.1-mile length of Option C1 could cross 128 tax lots, at least 54 of which are developed.

Alternative C, Option C2 — Option C2 does not displace any additional homes beyond the 23-28 displaced along the north-south portion. Along its 10.6-mile length, it would cross mainly rural residential land (including 134 tax lots, of which 56 are developed), but also some forestland zoned for mineral extraction. It would require 8 miles of new access roads. Option C2 would have a **high** land use impact.

Alternative D, Option D1 — Option D1 would require acquisition of additional ROW across land predominantly zoned forest, but also some rural residential areas. Clearing of these new ROWS would conflict with National Forest land management goals outlined for the area by the Northwest Forest Plan and Snoqualmie Pass Adaptive Management Area Plan. Specifically, clearing of vegetation would not meet the intent of managing for late-successional habitat and maintenance of connectivity emphasis areas on National Forest lands. Aquatic conservation strategy objectives are also not likely to be met. In addition, Option D1 would displace between 11 and 14 homes and possibly prevent development on up to five additional unused tax lots as a result of easement expansion south of the existing line. Along its 35.6-mile length, this alternative would cross more than 134 tax lots, at least 32 of which are developed. Clearing of danger trees would impact tax lots adjacent to the new ROW. Additional land use concerns along this option include potential impacts to existing cabins and lots at Roaring Creek, a development west of Lake Keechelus. The new line would also directly conflict with the new North Bend Gravel Mine that is proposed by Cadman on Weyerhaeuser land east of North Bend. Option D1 would require 13.6 miles of new access roads. This option would likely have a **high** land use impact.

Option D2 — land use impacts related to Option D2 would be similar to Option D1, although less new ROW would be required since a portion of the ROW already has sufficient width to accommodate an additional transmission line near the ski areas at Snoqualmie Pass. It would cross a minimum of 121 tax lots, at least 22 of which are developed. Clearing of danger trees would impact tax lots adjacent to the new ROW. Option D2 would displace about eight homes. It requires 13.2 miles of new access roads. It would have a **high** land use impact.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on land use.

S.4.2 Transportation Impacts

Most alternatives: **No** impact. Because of tower locations and height clearances for lines spanning roadways, none of the alternatives would restrict future expansion or acquisition of public road or railway ROW. Alternative A, however, would have a **low** impact on the urbanized area of Covington as a result of converting a portion of easement (now covered by paved ingress and egress routes in the Covington Square Shopping Center area) to transmission line use.

S.4.3 Recreation Impacts

The **Proposed Action** and **Alternatives 2, 4B, A, B, C and D2** — would have **no** to low impact on recreation. Option D1 would have a moderate experiential impact because it crosses several recreation areas.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on recreation.

S.4.4 Geology and Soils

The **Proposed Action, Alternatives 2, 4A, 4B, B, and C** — would have a **low** impact. Alternatives 3, A and D would have moderate to high impacts because they cross soils with more potential for erosion.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would

be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — no impact on soils.

S.4.5 Floodplains

All alternatives — **No to low** impact. No towers or roads would be built in designated floodplains. Construction activities above stream channels could cause more peak runoff, but only in the short term.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — no impact on floodplains.

S.4.6 Water Quality — Streams

Most **transmission alternatives**, except Alternatives 3, B and D would have **low** impacts to streams.

Alternative 3, B and D — would have **low to moderate** impacts because of the erosion potential of soil crossed and vegetation removal.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — no impact on stream water quality.

S.4.7 Water Quality — Groundwater

Most **transmission alternatives**, except Alternatives 3, B and D would have **low** impacts to water quality.

Alternative 3, B and D — would have **low to high** impacts because of the erosion potential of soil crossed and vegetation removal, and presence of well-head protection programs.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on groundwater quality.

S.4.8 Fisheries

All **transmission alternatives**, except Alternatives B and D: **low to moderate** impact with extensive mitigation. Construction of any line would necessitate careful steps to lessen potential impacts on fish. BPA would ensure that all actions potentially affecting fish habitat — riparian vegetation removal, road construction, culvert installation, bedrock blasting and other soil disturbances — would meet or exceed applicable regulations.

Alternatives B and D — would have **low to high** impacts. Impacts would be created by more clearing of riparian vegetation and erosion potential on upland areas.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on fisheries.

S.4.9 Wildlife

All **transmission alternatives**, except Alternatives B and D: **low to moderate** impacts from vegetation and tree clearing in ROWs, with extensive mitigation to preclude greater impacts. Impacts on specific species are:

- threatened/endangered/sensitive species — **moderate**. Any reduction in habitat for these species, however small, is considered to have relatively greater impact than reduction in habitat for non-threatened species.
- forest species — **low**. The relative amount of forest habitat that would be cleared is small and this habitat type is common in the project area.

- riparian species — **low to moderate**. As above, the relative amount of riparian habitat impacted would be small, but vegetation removal could result in a loss of productivity in adjacent aquatic habitat as well.
- aquatic species — **moderate**. Line construction could reduce the quantity and quality of both wetland and stream habitat.
- unique habitat species — **low**. Few if any of these species are likely present in the project area.
- early regeneration species — **no to low**. Construction would actually increase habitat for these species, particularly elk and deer, although the increase in foraging habitat would not appreciably benefit western bluebirds.

Alternatives B and D — would have **low to high** impacts. Clearing on National Forest lands would have a high impact on several sensitive Survey and Manage species.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on wildlife.

S.4.10 Vegetation

The **Proposed Action** would disturb 152 acres of vegetation. ROW clearing and soil compaction and movement in forested areas would create most impacts, which vary depending on vegetation type. The impact on individual vegetation communities would be **low**. The impact on coniferous forested communities would be **moderate**. A potentially high impact from noxious weed colonization in disturbed areas could be mitigated to have a **low** impact. Overall vegetation impact: **low to high**.

Alternative 2 would disturb 155 acres. Impact is the same as the Proposed Action.

Alternative 3 would disturb 187 acres. Impact is the same as the Proposed Action.

Alternatives 4A would disturb 164 acres. Impact is the same as the Proposed Action.

Alternative 4B would disturb 175 acres. Impact is the same as the Proposed Action.

Alternative A would disturb 397 acres. Impact is the same as the Proposed Action, except low impact on coniferous forest.

Alternative B would disturb 250 acres. Impact is the same as the Proposed Action.

Alternative C (Option C1) would disturb 195 acres. Impact is the same as the Proposed Action.

Alternative C (Option C2) would disturb 206 acres. Impact is the same as the Proposed Action, except low impact on coniferous forest.

Alternative D (Option D1) would disturb 769 acres. Impact is the highest of the alternatives.

Alternative D (Option D2) would disturb 776 acres. Impact is the highest of the alternatives.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — no impact on vegetation.

S.4.11 Wetlands

The **Proposed Action** would affect 14 acres of wetlands. Impacts vary depending on wetland type. The impact on forested wetlands due to ROW clearing would be **high**. The impact on scrub-shrub and open water wetlands would be **none to moderate**. Impacts on wetland water quality and wildlife would be **low**. Overall wetlands impact: **low to high**.

Alternative 2 would also affect 14 acres of wetlands. Impact is the same as the Proposed Action.

Alternative 3 would affect 6 acres of wetlands. Impact is the same as the Proposed Action.

Alternatives 4A would affect 14 acres of wetlands. Impact is the same as the Proposed Action.

Alternative 4B would affect 15 acres of wetlands. Impact is the same as the Proposed Action.

Alternative A would affect 17 acres. **No** impact on forested wetlands; **moderate** impact on scrub-shrub and open water wetlands, although mitigation could offset this.

Alternative B would affect 27 acres. **No** impact on forested wetlands; **moderate** impact on scrub-shrub and emergent wetlands, which could be offset with mitigation.

Alternative C (Option C1) would affect 10 acres. Impact is the same as Alternative B.

Alternative C (Option C2) would affect 8 acres. Impact is the same as Alternative B.

Alternative D (Option D1) would affect 18 acres. **High** impact on forested wetlands; **no** impact on scrub-shrub and emergent wetlands.

Alternative D (Option D2) would affect 16.5 acres. **No to high** impact. Same as Option D1.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on wetlands.

S.4.12 Visual Resources

The **Proposed Action** — **Moderate to high** impact on some Kangley area residents for whom the transmission lines would be dominant visual features. **Low** impact on occasional recreationalist, visitors, or employees in CRW. **Low to moderate** impacts on views from cars or aircraft in near vicinity.

Alternative 2 — **Moderate** impact on some Selleck residents. **Low** impact on occasional recreationalist visitors, or employees in CRW. **Low** impacts on local motorists' or aircraft views.

Alternative 3 — **Low to moderate impact** on some Kerriston Road residents. **No to low** impact on occasional recreationalist visitors, or employees in CRW. **No to low** impacts on local motorists' or aircraft views.

Alternatives 4A and 4B — would have the same impact as Alternative 2. Overall visual resources, **low to moderate** impact.

Alternative A — **Moderate** to **high** impact on residents in and around Maple Valley and Covington, for whom taller towers would be dominant visual features. **Moderate** impacts on local recreationalists and motorists; **low** impact on aircraft views.

Alternative B — **Moderate** impact on limited number of residents along route due to slightly taller towers. **Moderate** impact on recreationalists at nearby ski/ wilderness areas and motorists on I-90. **Low** impact on aircraft views.

Alternative C (Option C1) — **Moderate** to **high** impact on some Ravensdale, Hobart and Landsburg/South Hobart residents, for whom new towers would be dominant visual features. **High** impacts on recreationalists along Cedar River and Tiger Mountain trails and on local motorists. **Low** impact on aircraft views.

Alternative C (Option C2) — **Moderate** to **high** impact on Hobart area (including Landsburg/South Hobart) residents, for whom new towers would be dominant visual features. **High** impact on recreationalists along Cedar River and Tiger Mountain trails. **Moderate** to **high** impact on local motorists. **Low** impact on aircraft views.

Alternative D (Option D1) — **Moderate** to **high** impact on residents near Twin Falls State Park, in the Edgewick area, and along Upper Yakima River, due to second set of towers. **Moderate** to **high** impacts on recreationalists at nearby ski/wilderness areas and on motorists on I-90 and local roads near North Bend and Twins Falls State Park. **Low** impact on aircraft views.

Alternative D (Option D2) — **Low** to **high** impacts. Same as Option D2.

Non-Transmission Alternative — Because no construction of the transmission line or related access roads would occur until the transmission line is needed, there would be no immediate construction-related impacts under the Non-Transmission Alternative. Impacts would be similar to the No Action Alternative. When it is determined there is a need for the new transmission line, then the impacts would be equivalent to those identified in this supplemental draft environmental impact statement.

No Action Alternative — **no** impact on visual resources.

S.4.13 Socioeconomics

All construction alternatives would have **no** to **low** impacts on the project area's socioeconomic features. There would be no impact on local lodging, employment, population or business access. Impacts would be low from minor increases in local spending by project workers and removal of a small amount of timberland from production. The

project is expected to have marginal impact on overall community values.

Alternatives A and C — **No to moderate** impact. Same as Proposed Action except for **low to moderate** impact on community values due to number of displaced homes and **no** impact on timber resources.

Non-Transmission Alternative — **Low to high** impact to area employment. If increased capacity were needed, it is unlikely the line could be built in time to avoid outages.

No Action Alternative — **High** impact due to the potential for transmission system collapse, brownouts and blackouts affecting not only the immediate Northwest, but regions to the south and north. Commerce and industry would be adversely affected as the quality and reliability of power decreased. Some businesses and their employees could decide to relocate to an area where the power supply is more reliable. Loss of businesses and an unstable power supply could influence whether some people move to the area.

S.4.14 Cultural Resources

The **Proposed Action** would not cross any inventoried or identified cultural resource sites. The potential for unknown sites is minimal due to steep terrain along the route. Cultural resources impact: **low**.

Alternative 2 would cross the western proposed site boundary of the Japanese Camp at Barneston townsite. It would also pass within one-half mile of the Selleck National Historic District. Cultural resources impact: **moderate**.

Alternative 3 would pass near flat land on which historic-period cultural resources are identified on archival maps. Cultural resources impact: **moderate**.

Alternatives 4A and 4B would have low impacts along most of their routes (the portion shared with the Proposed Action). However, they would have moderate impacts where they would cross a highly sensitive landform north of the Selleck National Historic District. Overall cultural resources impact: **low to moderate**.

Alternative A has an estimated **moderate to high** impact. Two-thirds of route crosses relatively flat ground with high potential for culturally sensitive areas, both historic and prehistoric, particularly in Cedar River Valley.

Alternative B has an estimated **low to moderate** impact. Nearly half of route crosses steep terrain with little potential for culturally sensitive sites or resources. Further surveys would be necessary to confirm.

Alternative C (Option C1) has an estimated **moderate** to **high** impact. Has highest potential among alternatives for encountering cultural sites. Crosses flat land through Cedar River valley with potential prehistoric resources and crosses developed areas with potential historic-period resources.

Alternative C (Option C2) has an estimated **moderate** to **high** impact. Same as Alternative C1.

Alternative D (Option D1) has an estimated **moderate** impact. Substantially higher level of ground disturbance and vegetation clearing increase the risk of impacting cultural resources. Further surveys would be necessary to confirm.

Alternative D (Option D2) has an estimated **low** impact. Same as Alternative B.

The **Non-Transmission Alternative** and the **No Action Alternative** would have **no** impact on cultural resources.

S.4.15 Noise

All construction alternatives would have **no** to **low** impact. Incremental noise from the new line would not be discernible in most cases. Alternative 3, which does not parallel an existing line, may produce new, low-level audible noise, but in a largely unpopulated area.

The **Non-Transmission Alternative** and the **No Action Alternative** would have **no** impact on noise.

S.4.16 Public Health and Safety

All construction alternatives would have **no** to **low** impact. Incremental EMF generated by a new line would be minor because most of the land passed through is unpopulated. There would be no impact from toxic or hazardous substances, and only low impacts related to fire danger and radio/TV interference, both of which can be mitigated.

Non-Transmission Alternative — This alternative could create similar impacts as the No Action Alternative.

No Action Alternative — **High** impact due to the potential for transmission system collapse, brownouts and blackouts, which could affect public health and safety services, security devices, and other vital functions throughout the Northwest.

S.4.17 Air Quality

All construction alternatives would have **no** long-term impact. Minimal, short-term construction impacts would be limited to dust and engine exhaust. No burning of cleared vegetation would be allowed in most of the alternatives; some burning may be allowed along Alternative 3, if approved by the landowners.

Non-Transmission Alternative — This alternative could create more emissions due to greater use of wood stoves by residents or operation of new gas-fueled power plants in region.

No Action Alternative — **no** impact on air quality.