Appendix D Final Wetlands Technical Report

Final Wetlands Technical Report

Bonneville Power Administration
Kangley-Echo Lake Transmission Project

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The analysis in this technical report is generally based on typical construction activities and impacts for transmission lines. Detailed information for this project has been updated as much as possible. However, the most current information about this project is in the Final Environmental Impact Statement.

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1.0 Executive Summary

This report describes the existing conditions and potential impacts on vegetation from the proposed Bonneville Power Administration (BPA) Kangley-Echo Lake Transmission Line Project. This report serves as the primary basis for the vegetation discussion in the National Environmental Policy Act (NEPA) environmental impact statement (EIS) prepared for the project.

1.1 Alternatives

This EIS evaluates five alternative routes for constructing a new 500-kilovolt (kV) electrical transmission line intended to increase the reliability of the Seattle metropolitan area's transmission system. This increased reliability would reduce the potential for rolling brownouts or blackouts that could transpire by the winter of 2002-2003 if the current rate of development continues and if severe winter weather were to cause inordinate power demand.

The transmission line would start at the Schultz-Raver No. 2 500-kV transmission line near the unincorporated community of Kangley in central King County, Washington and travel approximately 9 miles (mi.) to the Echo Lake Substation, located north of the Kangley area and southwest of North Bend (Figure 1).

1.1.1 Construction Methods

BPA would construct all of the action alternatives using the existing practices described below for building transmission lines and substations. BPA would build or improve access roads as necessary. If additional easements for right-of-way (ROW) or access roads were needed, additional rights would be obtained from landowners. BPA typically uses existing, cleared staging areas in which to store and assemble materials or structures.

After the structures are in place and conductors are strung between the structures, BPA would restore disturbed areas.

The following sections describe in greater detail the sequential steps that BPA typically takes to construct a transmission line.

1.1.1.1 Right-of-Way Requirements

BPA would obtain easements from landowners for the new transmission line ROW, and easements for the access roads outside of the transmission line ROW easements. The easements give BPA the right to construct, operate, and maintain the line and access roads. A 150-foot (ft.) ROW width is assumed for the 500-kV line.

Fee title to the land comprising the easement generally remains with the owner, subject to the provisions of the easement. The easement prohibits large structures, tall trees, storing of flammable materials, and other activities that could be hazardous to people or could endanger the transmission line. Activities that do not interfere with the transmission line or endanger people are usually not restricted.

Rights (usually easements) for new access roads would be acquired from property owners, as necessary. A 50-ft. ROW easement generally would be acquired for new access roads measuring about 16 ft. wide, and 20 ft. of ROW would be required for any existing access roads.

1.1.1.2 Clearing

The height of vegetation within the ROW would be restricted to provide safe and reliable operation of the line. Trees would be cleared within the ROW as well as outside of the ROW to prevent trees from falling onto the lines. A clearing advisory would be generated using ground information from cross section data. This clearing advisory would specify a safe vegetation height along and at varying distances from the line. The amount of vegetation removed would be based on this clearing advisory and local knowledge of regional conditions such as weather patterns, storm frequency and severity, general tree health, and soils. Other factors that influence the amount of clearing along the line are the line voltage; vegetation species, height, and growth rates; ground slope; conductor elevation above the ground; and clearance distance required between the conductors and other objects.

Merchantable timber purchased from private owners would be marketed and non-merchantable timber would be left lopped and scattered, piled, chipped, or would be taken off-site. Contractors would be required to use equipment that leaves low-growing vegetation in place instead of dirt blades on bulldozers for clearing. Other specialized brushing/mulching equipment may also be required. Additional best management practices (BMPs) for timberland would also be used.

At the tower sites, all trees, brush, and snags would be felled. Stumps would be removed at these sites only if they interfere with tower and guy installation. The site would be graded to provide a relatively level work surface. The total amount of clearing required for this project is unknown at this time.

An additional amount of land would be cleared for roads that are needed off the ROW and for roads determined to be in poor condition and requiring upgrading by BPA.

1.1.1.3 Access Road Construction and Improvement

An access road system within and outside of the ROW would be used to construct and maintain a new line. Access roads would be 16 ft. wide, with additional road widths of up to 20 ft. for curves. In addition to new access roads, existing access roads may need to be improved. Roads generally would be surfaced with gravel, and appropriately designed for drainage and erosion control. The access roads would generally have grades of 6% or less for erodible soils and 10% or less for resistant soils. The maximum grades would be 15% for trunk roads and 18% for spur roads. No permanent access road construction would be allowed in cultivated or fallow fields.

Clearing and construction activities for new access roads would disturb an area about 20 ft. wide, depending on terrain. New roads would be constructed within the ROW wherever possible, but where conditions dictate otherwise, roads would be constructed and used outside of the ROW. Construction of new roads is recommended only to access new towers to avoid greater wetland or stream impacts. In several places, new access roads would be constructed in uplands within the new transmission line corridor to avoid wetlands that occur within the existing alignment.

Dips, culverts, and waterbars would be installed within the roadbed to provide drainage. Fences, gates, cattle guards, and additional rock would be added to access roads as necessary.

Where temporary roads are used, any disturbed ground would be repaired and, where land use permits, the road would be reseeded with grass or other appropriate seed mixtures. After construction, access roads would be used for line maintenance. Where ground must be disturbed for maintenance activities, the roadbed would be repaired and reseeded as necessary.

The amount of new roads required for this project would vary depending on the alternative chosen and the feasibility of using existing roads along the line.

1.1.1.4 Storage, Assembly, and Refueling Areas

Construction contractors usually establish storage areas near the transmission line where they can stockpile materials for structures, spools of conductor, and other construction materials. These areas would be accessible from major highways. Structural steel would be delivered in pieces on flatbed trucks and would be assembled on-site. A mobile crane may be needed to handle the bundles. If the terrain were too steep at the actual tower site, general assembly yards would be used to erect the tower in pieces. The structure would then be transported to the tower site by truck or helicopter. Because trucks and helicopters need to refuel often, these construction areas could also be used for refueling.

1.1.1.5 Tower Site Preparation

Site preparation begins with removing all vegetation from a tower site. In areas of uneven topography, the site would be graded to provide a level work area. An average area of 30,000 square feet (150 by 200 ft.) would be disturbed at each tower site. Additional areas that could be disturbed include the site where the conductor is strung and pulled. These disturbances could be as large as a 370-ft. radius from the tower center.

Bulldozers would be used to clear and construct any new access roads to the transmission line towers and any new tower site landings. Manual methods, including chainsaws and brush hogs, would be used to clear the new ROW. BMPs would be used during clearing and construction to reduce impacts.

In addition to clearing the ROW for the transmission line towers, construction crews would remove selected trees outside of the ROW. This additional clearing would be done to reduce the possibility of blowdown. Blowdown occurs when newly exposed trees fall after the initial clearing process because they have not developed the root structure to remain standing once they become more fully exposed to strong winds.

1.1.1.6 Towers and Tower Construction

Steel lattice towers would be erected to support the transmission line conductors. The new towers would be similar in design to those used in the existing Schultz-Raver No. 2 500-kV transmission line. The height of each tower would vary by location and surrounding land forms. Towers would average 135 ft. high and would be spaced about 1,100 to 1,200 ft. apart. Under Alternatives 1 and 2 (described in the next section), where the new line would parallel a portion of the existing Raver-Echo Lake transmission line, towers would be staggered so that a tower from one line would not contact a tower from the other line in the unlikely event that a tower falls.

Most towers used on the proposed line would be “tangent” or “suspension” towers. This type of tower is designed to support conductors strung along a virtually straight line with only small turns or angles. “Deadend” towers would also be used on a limited basis where stresses on the transmission line conductors would have to be equalized because of changes in direction, because of the need to support an excessively long span, or where a span crossing is needed for extremely steep or rugged terrain or a river. Deadend towers use more insulators and heavier steel than

tangent or suspension towers, thus making them more visible. Deadend towers also are more costly to build than suspension towers.

The towers would usually be constructed from the ground, rather than using helicopters. The equipment used depends on the weight and size of the towers and such site conditions as weather and soil characteristics. Most 500-kV lines would be built using mobile cranes; helicopter tower erection could be used if access was not available or if sensitive resources would be encountered.

Steel towers would be assembled in sections near the tower site. Each tower contains three components: the legs, body, and bridge. The bridge is the uppermost portion of the tower and serves as the attachment point for the insulators that support the conductors.

Steel towers are anchored to the ground by footings. Each tower requires four footings placed in holes that have been excavated, augered, or blasted. Large machinery, such as backhoes or truck-mounted augers, would be used to excavate the footings. Topsoil would be stockpiled during excavation. The design of the footings would vary based upon soil properties, bedrock depth, and the soundness of the bedrock at each site. Typically, towers would be attached to steel plates or grillages placed within the excavated area. The areas would then be backfilled with excavated material or concrete. Topsoil would then be replaced to restore the original ground surface.

Typical footings for single-circuit towers include 4- by 4-ft. plates placed 10 to 12 ft. deep for suspension towers and 12.5- by 12.5-ft. grillage placed 14 to 16 ft. deep for heavy dead-end towers. On average, for an entire transmission line project, each footing would occupy an area about 10 by 10 ft. to a depth of 15 ft. if bedrock was not encountered. The holes in which the plates and grillage would be installed must be large enough to provide about 1 ft. of clearance on each side of the plate or grillage. If bedrock were encountered and had properties that allowed anchor borings, holes would be drilled and steel rods grouted into the rock. These rods would either be attached to a concrete footing or welded directly to a tower member and embedded in compacted backfill. If rock properties were not suitable for anchor rods, the rock may be blasted to obtain adequate footing depth.

As the towers were built, heavy machinery would disturb the ground surface and/or compact soils at the tower site and along access roads. Noise and dust also would be generated by the machinery.

1.1.1.7 Conductors, Overhead Ground Wires, and Insulators

The wires or lines that carry the electrical current in a transmission line are called conductors. Alternating-current transmission lines such as the proposed line require three wires or sets of wires, each of which is referred to as a “phase.” Three 1.3-in. Bunting conductors would be included for each phase. Each bundle is 16 by 20 in.

Conductors are not covered with insulating material. Instead, air is used for insulation. Conductors are physically separated by insulators on transmission towers.

After the transmission towers are in place, workers would attach a smaller steel cable to the towers and then pull the conductor under tension through the towers. Conductors would be attached to the structure using glass, porcelain, or fiberglass insulators. Insulators prevent the electricity in the conductors from moving to other conductors on the tower, the tower itself, and the ground. As the conductors are strung, the ground surface would be disturbed at the tensioning sites, and noise and dust would be generated by the machinery.

Transmission towers elevate conductors to provide safe clearance for people and structures within the ROW. The National Electrical Safety Code (NESC) establishes minimum conductor heights. The minimum conductor-to-ground clearance for a 500-kV line is a little more than 29 ft. Greater clearances would be provided by BPA over county roads and highways, railroads, and river crossings.

One or two smaller wires, called overhead ground wires, would also be attached to the top of the transmission towers. Overhead ground wires would protect the transmission line against lightning damage. The diameter of the wire would vary from 0.375 to 0.625 in.

1.1.1.8 Substation Additions

Under the current proposal, the Echo Lake Substation would be expanded to the east on land owned in fee title by BPA. The size of the expansion would be 300 by 750 ft. The site would be cleared in the same manner as the ROW for the transmission line. The site would include a fenced yard and a graded and graveled parking lot. The existing road around the substation would be realigned to the east to accommodate this expansion. New transformers, switches, and other equipment would be installed in the expanded area. A continuous ground wire would also be installed.

1.1.1.9 Site Restoration and Clean-up

Disturbed areas around the towers, conductor reels, and pull site locations would be reshaped and contoured to be consistent with their original condition. Access roads would be repaired.

Disturbed areas would be reseeded with grass or an appropriate seed mixture to prevent erosion. The seed mixture would include native plant species and would be free of noxious weeds. All solid waste from construction would be removed and properly disposed offsite, and equipment would be removed from the ROW.

1.1.2 Alternative Rights-of-Way

A portion of the action alternatives would be located within the Cedar River Municipal Watershed. The alternatives would begin at the Schultz-Raver No. 2 500-kV transmission line and generally travel northward to the Echo Lake Substation. (See Figure 2.) Under all alternatives, the transmission line ROW would be 150 ft. wide. Miles of new access roads were calculated for a 20-ft. ROW within a 0.25-mile buffer on each transmission line alternative.

1.1.2.1 Alternative 1: Preferred Alternative

The alignment for Alternative 1 would be immediately adjacent and parallel to a portion of the existing 12-mi. Raver-Echo Lake transmission line from a point approximately 3 mi. north of Raver (S26, T22N, R7E) to the Echo Lake Substation (S11, T23N, R7E). This alternative would be approximately 9 mi. long and would require about 0.8 mi. of new access roads. The existing 150-ft. ROW would be widened to 300 ft., with the widening and new line located east of the existing corridor.

1.1.2.2 Alternative 2

Alternative 2 would originate from tap point #2 (Figure 2) located approximately 2 mi. east of the tap point #1 for Alternative 1 (S25, T22N, R7E). The line would traverse approximately 3 mi. to

S11, T22N, R7E before continuing north along the same alignment as Alternative 1, paralleling the existing Raver-Echo Lake transmission line, and terminating at the Echo Lake Substation (S11, T23N, R7E). This alternative would be approximately 9 mi. long and would require about 2.8 mi. of new access roads.

1.1.2.3 Alternative 3

Alternative 3 would begin at the tap point #2 (S25, T22N, R7E); traverse northeast to S8, T22N, R8E; and then turn north-northwesterly to the Echo Lake Substation (S11, T23N, R7E). This alternative would be approximately 10.2 mi. long and would require about 6.4 mi. of new access roads.

1.1.2.4 Alternative 4a

Alternative 4a would begin about one-third of the way along Alternative 2 (S24, T22N, R7E) and traverse northwest to connect with Alternative 1 over 1 mi. (S23, T22N, R7E) further south from where Alternative 2 reconnects (S11, T22N, R7E). This alternative would be approximately 9.5 mi. long and would require about 2.3 miles of new access roads.

1.1.2.5 Alternative 4b

Alternative 4b would begin slightly north of Alternative 4a (S24, T22N, R7E), along Alternative 2, and traverse west to connect with Alternative 1 further south from where Alternative 4a reconnects (S23, T22N, R7E). This alternative would be approximately 9.5 mi. long and would require about 2.3 miles of new access roads.

1.1.2.6 No Action Alternative

Under the No Action Alternative, a new 500-kV electrical transmission line would not be built. As a result, transmission line capacity could be reached or exceeded as early as 2002-2003 if a cold winter were to occur in the Seattle metropolitan area and the existing Raver-Echo Lake transmission line were to go out of service. Relying upon the existing transmission system during periods of increased demand and compromised reliability could result in brownouts or rolling blackouts in the area. Thus, residents, businesses, and government agencies could experience as much as several days without electricity. Loss of electricity for lights and heating could halt business and government activities. Residents would have to rely upon other energy sources for heating, cooking, and lighting, such as wood and gas fireplaces, stoves and barbecues, oil lamps and candles, etc.

1.2 Key Issues for Wetlands

Wetlands are susceptible to degradation from excavation, fill, and clearing. Federal, state, and local agencies require the disclosure of potential impacts to wetlands associated with the construction and maintenance of the transmission line.

The majority of wetlands that would be affected are associated with forested habitats that would be permanently altered, by removal of trees and construction of access roads, with construction of the transmission line. Moderate to high levels of impact to wetlands would occur with the construction of any of the proposed transmission line alternatives.

Impacted wetland functions associated with vegetation clearing and access road construction are wildlife habitat, water quality improvement, flood storage, moderation of flood flow, and groundwater discharge and recharge. In forested wetlands, permanent impacts would occur where herbaceous vegetation and trees are removed. These wetlands would be permanently maintained as scrub-shrub or emergent wetlands. Minimizing the disturbance to soil structure during clearing would reduce impacts to water quality, flood storage, and flood flow moderation functions.

Where possible, BPA would place new roads and tower structures outside of wetland areas to avoid permanently altering wetland hydrology and soils through excavation or fill.

1.3 Major Conclusions

A total of 23 wetlands were identified within the project area during the October 2000 site reconnaissance. An additional 31 wetlands were identified during the reconnaissance of the preferred Alternative 1 in April 2001. Alternative 3 would result in the least impact to wetlands with a total of 6 acres (ac.) of clearing impacts. Impacts to wetlands associated with the construction of the transmission line would be limited to the clearing of vegetation and construction of access roads. Operation and maintenance impacts would be similar except with less severity. Potential fill and excavation impacts from the construction of towers would be avoided by strategically locating towers outside of wetland areas and by spanning wetlands.

The majority of wetlands within the proposed ROWs are forested. Permanent impacts to wetland functions would occur from the removal of trees and the maintenance of shrub communities within the 150-ft. transmission line ROW. Key wetland functions that would be degraded from construction of the transmission line are wildlife habitat, flood storage and flood flow moderation, and water quality. Identifying and avoiding wetland resources before and during construction, and limiting disturbance to the minimum necessary when working in and immediately adjacent to wetlands, would minimize wetland impacts. New road construction could carry sediment into wetlands, affecting water quality and biological productivity; however, use of erosion control devices would minimize these indirect impacts.

2.0 Study Scope and Methodology

2.1 Data Sources and Study Methods

The collection of wetland data for the project area focused on two tasks:

- Habitat-Based Evaluation
- Field Verification

The habitat-based evaluation was initiated by reviewing existing data and literature applicable to the project area. Background review of wetlands data for the project area was based on:

- U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps (USDI 1987 map series).
- Wetland maps and other information from the Cedar River Watershed (CRW) Habitat Conservation Plan (HCP) (City of Seattle 2000).

- 1:24,000-scale orthophotos.

- U.S. Geological Survey (USGS) 7.5-minute series quadrangle topographic maps.

A basemap of potential wetland locations was created by superimposing the transmission alternatives over the wetlands location data provided by the aforementioned data sources. This map was used to aid the field survey of wetlands within the ROWs. The wetlands reconnaissance conducted in October 2000 focused on field-verifying selected areas of the wetland basemap that may be impacted. The approximate wetland boundaries were then field-mapped on the orthophotos provided by BPA.

Jones & Stokes wetland biologists located wetlands within a 500-ft. survey corridor during the week of October 23 to 27, 2000. Wetlands previously identified by King County were located. In addition, several other wetlands not identified by King County or other sources were located. A global positioning system was used to field-verify the location of each wetland. No waters of the United States were "delineated"; subsequently no jurisdictional wetland boundaries were established for the purposes of the Draft Environmental Impact Statement. Wetland biologists located wetlands, including waters of the United States, using criteria for jurisdictional wetland identification developed by the U.S. Army Corps of Engineers (Environmental Laboratory 1987), the Washington State Department of Ecology (Ecology 1997). Wetland class, rating, and size were determined at each wetland location. Wetlands were classified following the standardized national system established in Cowardin et al. (1979). Wetlands were rated and buffer widths were assigned based on the King County Environmentally Sensitive Areas Ordinance (King County Code 21A.24.320). Due to the size of the wetlands and their readily apparent signature on the aerial photographs, the boundaries were sketched on 1:24,000-scale aerial photographs and subsequently digitized electronically to the aerial orthophotos using the ArcView mapping program.

Wetlands within the 500-ft. corridor were mapped by alternative consecutively from south to north. Wetlands were numbered based upon their association with a primary alternative and the order from south to north. For example, the southernmost wetland located on Alternative 2 is wetland 2-1. Alternatives 1, 2, 4a, and 4b share portions of the same ROWs; thus, some wetlands are common to several alternatives.

In April 2001, a reconnaissance of wetlands and streams within the preferred Alternative 1 was conducted to map the locations of jurisdictional waters of the United States. The purpose of this reconnaissance was to provide BPA tower and road engineers flagged locations of jurisdictional waters in the field to better site access roads and towers to avoid impacts to the resources. Wetland biologists walked the entire 150-ft wide ROW of the preferred Alternative 1 and flagged the boundaries of waters of the United States, using criteria for jurisdictional wetland identification developed by the U.S. Army Corps of Engineers (Environmental Laboratory 1987), the Washington State Department of Ecology (Ecology 1997). Within each wetland encountered vegetation, hydrology, and soils data was recorded. Approximate wetland boundaries were sketched on the 1:24,000-scale orthophotos provided by BPA. Wetlands within the 150-foot Alternative 1 corridor were labeled according to the proposed transmission line tower moving south to north. For example, the southernmost wetland located on Alternative 1 is wetland 78/5-1. Thus, this wetland is the first wetland north of proposed tower 78/5.

Wetland impacts were calculated for Alternatives 2, 3, 4a, and 4b using the ArcView mapping program by overlaying each 150-ft. ROW on the October 2000 surveyed wetlands. The sum of potential wetland impacts from vegetation clearing was then calculated for each alternative. In

September 2001, BPA provided a map of proposed towers and access roads locations associated with the preferred Alternative 1. This map was used to calculate potential impacts to the April 2001 reconnaissance wetlands, from the vegetation clearing for the 150-foot wide proposed transmission line corridor to wetlands associated with Alternative 1. As the access road network was developed, further field reconnaissances conducted during summer 2001 resulted in hand-measured approximate impacts to wetlands from the proposed access road construction (e.g., new roads, road upgrade, culvert installation). See Section 4.0 for potential impacts on wetlands.

2.2 Agencies Contacted

Agencies contacted include the U.S. Army Corps of Engineers (Corps) and the City of Seattle.

3.0 Affected Environment

3.1 Regional Overview

The project area is located within the Cascade foothills of western Washington, between the City of North Bend and the Kangley area. A major portion of each proposed ROW passes through the CRW and private timberlands. Within the area, primary land holders, including "in fee" ROWs and easements, include BPA, Weyerhaeuser Timber Company, Washington Department of Natural Resources (WDNR), City of Seattle, and private residential landowners.

Water Resource Inventory Areas (WRIAs) designated by the Washington Department of Ecology that are crossed by the proposed ROWs include Lake Washington (#8), Snohomish River (#7), and Green River (#9).

Wetlands within the region are typical of the Puget Lowland and western Cascade Mountain foothills. Wetland soils are often formed in porous gravels, sands, and clay and silt tills derived from glacial deposits. Mixed deciduous and coniferous-forested wetlands with pockets of shrub, emergent, and open water communities are common. Wetland water sources include hillside seeps, perched water tables, overland runoff, precipitation, and flows from adjacent streams.

3.2 Regulations, Standards, and Guidelines

3.2.1 Federal

The Clean Water Act (CWA) Section 404 requires the avoidance of development in wetlands wherever practicable. Wetlands are important natural communities that deserve special consideration because of historical and current regional and statewide losses, and because of the federal laws and policies that pertain to their protection. Wetland communities in the project ROWs play a vital role in groundwater discharge, supporting stream baseflow, capturing sediment and nutrient runoff, and providing habitat for wildlife and plant species.

Under Section 404 of the CWA, the Corps and the U.S. Environmental Protection Agency (EPA) regulate the placement of dredge and fill material into waters of the United States, which include jurisdictional wetlands. Although the CWA protects wetlands, filling of wetlands can occur after a Section 404 permit is issued by the Corps.

For regulatory purposes, the federal agencies define wetlands as follows:

> Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (CFR 328.3, CFR 230.3).

Other waters of the United States include seasonal or perennial surface water features, such as streams and drainages, that are not considered wetlands because they do not meet one or more of the three mandatory technical criteria that characterize jurisdictional wetlands (i.e., hydrophytic vegetation, hydric soil, and wetland hydrology), as defined by the Corps Wetlands Delineation Manual (1987). Please see the Fisheries Technical Report for a complete discussion of these other surface water features within the project area.

3.2.2 State

Section 401 of the federal CWA requires that proposed dredge and fill activities permitted under Section 404 be reviewed by the Washington Department of Ecology (Ecology) for compliance with state water quality standards. Certification ensures that federally permitted activities comply with the federal CWA, state water quality laws, and any other state aquatic protection requirements (unless certified by the state, the federal Section 404 permit is considered invalid).

3.2.3 Local

Compliance with King County Sensitive Areas Ordinance (Ordinance #9614) is required whenever proposing a project located near or in critical areas wetlands. Wetlands within the project ROWs were rated using the criteria defined in the King County Sensitive Areas Ordinance. This ordinance categorizes wetlands into Class 1, 2, and 3 based on the size, the presence of species listed as threatened or endangered, and the number of vegetation classes present.

The King County Sensitive Areas Ordinance requires minimum buffer widths for wetlands, as determined by the wetland category. Wetland buffers are measured from the wetland edge. The King County Sensitive Areas Ordinance provides for permanent protection of wetlands and their buffers by regulation of development and other activities. Minimum buffer requirements are:

- Class 1: 100 ft.
- Class 2: 50 ft.
- Class 3: 25 ft.

In addition, and unless otherwise specified, a minimum building setback of 15 ft. is required from the edge of a wetland buffer.

3.3 Study Area

The study area for wetlands included a 500-ft. wide corridor along all of the transmission line alternatives. The primary focus of the wetlands analysis was on identifying wetlands within the proposed 150-ft. ROW centerline of each transmission line corridor. The wetlands within the 150-ft. ROW were judged most vulnerable to impacts resulting from construction and

maintenance of the transmission lines, because the ROW would be cleared of vegetation and would include access roads and transmission line towers. Figure 3 presents the location of all wetlands surveyed within the ROWs during the October 2000 reconnaissance. Table 1 presents the wetland identification numbers and vegetation classes by alternative as surveyed in October 2000.

Table 1. Summary of Wetlands Present within 150-ft. ROW by Transmission Line Alternative

Wetland ID	Vegetation Class*	King Co. Rating**	Total Acres Within 500-foot Study Corridor	WRIA
Alternative 1				
1-1	PFO	Class 2	9	#8 – Lake Washington
1-2	PFO	Class 2	67	#8 - Lake Washington
1-3	PFO	Class 2	87	#8 - Lake Washington
1-4	PFO	Class 2	51	#8 - Lake Washington
1-5	PFO	Class 2	1	#8 - Lake Washington
1-6	PFO	Class 2	8	#8 - Lake Washington
1-7	POW/PFO	Class 2	7	#7 - Snohomish River
1-8	PFO/PSS	Class 2	3	#7 - Snohomish River
1-9	PSS/PFO	Class 2	1	#7 - Snohomish River
1-10	PFO	Class 1	8	#7 - Snohomish River
Total			242	
Alternative 2				
2-1	PSS/PFO	Class 2	1	#8 - Lake Washington
2-2	PFO	Class 2	3	#8 - Lake Washington
2-3	PFO	Class 2	15	#9 - Green River
1-1	PFO	Class 2	9	#8 – Lake Washington
1-2	PFO	Class 2	67	#8 - Lake Washington
1-3	PFO	Class 2	87	#8 - Lake Washington
1-4	PFO	Class 2	51	#8 - Lake Washington
1-5	PFO	Class 2	1	#8 - Lake Washington
1-6	PFO	Class 2	8	#8 - Lake Washington
1-7	POW/PFO	Class 2	7	#7 - Snohomish River
1-8	PFO/PSS	Class 2	3	#7 - Snohomish River
1-9	PSS/PFO	Class 2	1	#7 - Snohomish River
1-10	PFO	Class 2	8	#7 - Snohomish River
Total			261	

Wetland ID	Vegetation Class*	King Co. Rating**	Total Acres Within 500-foot Study Corridor	WRIA
Alternative 3				
3-1	PFO/PSS	Class 2	22	#8 - Lake Washington
3-2	PFO/POW	Class 2	6	#8 - Lake Washington
3-3	PFO	Class 2	10	#9 - Green River
3-4	PFO	Class 2	12	#8 - Lake Washington
3-5	PFO	Class 2	10	#8 - Lake Washington
3-6	PFO/PSS	Class 2	2	#7 - Snohomish River
3-7	PFO/POW	Class 2	6	#7 - Snohomish River
3-8	PFO	Class 2	6	#7 - Snohomish River
3-9	PSS	Class 3	1	#7 - Snohomish River
Total			75	
Alternative 4a				
2-1	PSS/PFO	Class 2	1	#8 - Lake Washington
2-3	PFO	Class 2	15	#9 - Green River
1-1	PFO	Class 2	9	#8 - Lake Washington
1-2	PFO	Class 2	67	#8 - Lake Washington
1-3	PFO	Class 2	87	#8 - Lake Washington
1-4	PFO	Class 2	51	#8 - Lake Washington
1-5	PFO	Class 2	1	#8 - Lake Washington
1-6	PFO	Class 2	8	#8 - Lake Washington
1-7	PFO	Class 2	7	#7 - Snohomish River
1-8	PFO/PSS	Class 2	3	#7 - Snohomish River
1-9	PSS/PFO	Class 2	1	#7 - Snohomish River
1-10	PFO/POW	Class 1	8	#7 - Snohomish River
Total			258	
Alternative 4b				
2-1	PSS/PFO	Class 2	1	#8 - Lake Washington
2-2	PFO	Class 2	3	#8 - Lake Washington
2-3	PFO	Class 2	15	#9 - Green River
1-1	PFO	Class 2	9	#8 - Lake Washington
1-2	PFO	Class 2	67	#8 - Lake Washington
1-3	PFO	Class 2	87	#8 - Lake Washington
1-4	PFO	Class 2	51	#8 - Lake Washington
1-5	PFO	Class 2	1	#8 - Lake Washington
1-6	PFO	Class 2	8	#8 - Lake Washington

Wetland ID	Vegetation Class*	King Co. Rating**	Total Acres Within 500-foot Study Corridor	WRIA
1-7	POW/PFO	Class 2	7	#7 - Snohomish River
1-8	PFO/PSS	Class 2	3	#7 - Snohomish River
1-9	PSS/PFO	Class 2	1	#7 - Snohomish River
1-10	PFO	Class 2	8	#7 - Snohomish River
Total			261	
Substation				
Echo 1	PEM/PSS	Class 2	7	#7 - Snohomish River

*Vegetation class definitions (as defined by Cowardin et al. 1979, Classification of Wetlands and Deepwater Habitats. U.S. Fish and Wildlife Service):
PEM – Palustrine Emergent
PFO – Palustrine Forested
PSS – Palustrine Scrub-Shrub
POW – Palustrine Open Water

** King County ratings are explained in Appendix B.

A total of 23 wetlands were identified within the ROWs during the October 2000 reconnaissance for wetlands. Additional wetlands were identified during the reconnaissance of the 150-foot-wide preferred Alternative 1 in April 2001. Figure 3 illustrates the relationship between wetlands identified during the October 2000 field reconnaissance and the 500-ft. transmission line ROW. Figure 4 details the wetlands identified during the April 2001 reconnaissance of the preferred Alternative 1 within the proposed 150-ft transmission line ROW. Discrepancies between the size and shape of wetlands presented in Figures 3 and 4 are attributed to survey methods. Wetlands boundaries surveyed in April 2001 reflect the detail necessary to site access roads and towers to avoid and minimize impacts to waters of the United States, including wetlands within the preferred Alternative 1 ROW. Thus, additional wetlands were inventoried and boundaries of wetlands presented in 4 were adjusted (see Figure 4).

Wetland vegetation classes in the proposed ROWs included palustrine emergent, scrub-shrub, open water, and forested wetlands as defined by Cowardin et al. (1979). Commonly wetlands on flat bench areas were associated with depressional areas that receive water from overland runoff and precipitation. Wetlands on the north and south side of Brew Hill (Alternative 1) and wetlands generally located on slopes were fed by groundwater discharge seeps. Most wetlands were generally greater than 1 ac. in size and included a mosaic of wetland and upland areas following small variations in topography. Several wetlands were also found to be associated with the riparian strips of streams.

The majority of wetlands within the CRW have been protected from recent timber harvest and have intact mixed conifer and deciduous forested components. However, the existing roads system does cross wetlands in places, thereby reducing vegetation cover and altering surface and subsurface flows within these wetlands. The majority of wetlands located north of the CRW have been impacted by timber harvest and are currently dominated by deciduous trees and shrubs, or sapling conifers rather than the mixed deciduous/coniferous tree dominated wetlands common to the CRW. Common dominant wetland plant species included red alder, western hemlock, western red cedar, salmonberry, Douglas' spirea, skunk cabbage, piggy-back plant, and slough

sedge. (Please see Appendix A for scientific names of dominant plant species surveyed within the project area.)

Wetland buffers within the 150-ft ROW of each of the alternatives were generally intact and forested within the CRW. Wetland buffers extending within the cleared existing alignment associated with Alternative 1 have been cut to allow conductor span, and generally maintain low shrub and herbaceous cover. Wetland buffers within the private timberlands to the north of the watershed reflect the mosaic past and recent timber harvest, and are generally intact and dominated by a mix of shrubs, and young deciduous and coniferous trees.

The wetlands in the ROWs provide many functions and values that directly or indirectly benefit society. Many of the depressional and seep discharge wetlands in the ROWs are forested, located within the upper third of their respective watershed, and connected to drainages, all of which are factors that increase the flood storage and flood flow moderation wetland functions. Several wetlands are associated with the riparian fringe of streams, a factor that plays an important role in filtering pollutants and sediments before they reach the waterway. High vegetative structural complexity within the wetlands and adjacent intact forested upland communities may provide foraging, breeding, cover, and rearing habitat for many wildlife species.

Wetland buffers provide important functions, including protection of wetland functions and values, water quality improvement, wildlife habitat, and deterrence of human access and associated impacts. Vegetated buffers may reduce impacts to water quality in wetlands by controlling soil erosion and filtering out pollutants. Vegetated buffers provide essential life needs for birds and mammals that are considered to be dependent on wetlands.

3.4 Transmission Line Alternatives

3.4.1 Alternative 1: Preferred Alternative

A total of 10 wetlands, totaling 242 ac., were identified within the 500-ft. transmission line study corridor for Alternative 1 during the October 2000 reconnaissance (see Table 1). All of the wetlands identified within the 500-ft. corridor would be crossed by the proposed 150-ft. ROW centerline. The December 2001delineation of the 150-ft. preferred Alternative 1 corridor identified 30 wetlands totaling 15.1 acres. Table 2 lists the 30 wetlands surveyed during the December 2001 delineation (please refer to Figure 4 for wetland locations within Alternative 1). The discrepancy between the two surveys is attributable to the survey methods described in Chapter 2.1.

Table 2. Alternative 1 Wetlands Surveyed During the December 2001 Reconnaissance of the 150-Ft.-Wide Corridor

Wetland ID[a]	Vegetation Class[b]	King Co. Rating[c]	Total Acres Within 150-Foot Study Corridor	WRIA
78/5-1	PFO/PSS	2	0.3	#8 – Lake Washington
78/5-3	PFO	2	0.9	#8 – Lake Washington
79/1-1	PFO/PEM	2	0.4	#8 – Lake Washington
79/2-1	PFO/PSS/PEM	2	0.4	#8 – Lake Washington
79/3-1	PFO/PSS/PEM	2	0.3	#8 – Lake Washington

Wetland ID[a]	Vegetation Class[b]	King Co. Rating[c]	Total Acres Within 150-Foot Study Corridor	WRIA
79/3-2	PFO	3	<0.0	#8 – Lake Washington
79/4-2	PFO	2	<0.0	#8 – Lake Washington
79/5-1	PFO/PSS	2	2.2	#8 – Lake Washington
80/1-1	PFO/PSS	2	0.8	#8 – Lake Washington
80/2-1	PFO/PSS	2	0.1	#8 – Lake Washington
80/2-2	PFO/PSS	2	1.1	#8 – Lake Washington
80/3-4	PFO/PEM	3	<0.0	#8 – Lake Washington
80/5-1	PFO	3	0.1	#8 – Lake Washington
81/1-1	PFO	3	0.1	#8 – Lake Washington
81/4-1	PFO/PSS	2	0.9	#7 - Snohomish River
81/5-1	PFO/PSS	2	0.5	#7 - Snohomish River
81/6-1	PSS	2	0.2	#7 - Snohomish River
81/7-1	PFO/PSS	3	0.3	#7 - Snohomish River
82/4-1	PFO	2	0.5	#7 - Snohomish River
82/4-2	PFO	3	0.1	#7 - Snohomish River
82/4-3	PSS	3	<0.0	#7 - Snohomish River
82/5-2	PFO/PSS	2	0.8	#7 - Snohomish River
83/1-1	PFO/PSS	2	0.9	#7 - Snohomish River
83/1-2	PFO/PSS	2	0.5	#7 - Snohomish River
83/3-1	PFO/PSS	2	1.3	#7 - Snohomish River
83/4-1	PFO/PSS	2	0.2	#7 - Snohomish River
83/6-1	PFO/PSS	2	0.7	#7 - Snohomish River
83/6-3	PSS/PFO	3	0.2	#7 - Snohomish River
84/1-1	PSS	3	0.7	#7 - Snohomish River
84/4-4	PEM/PSS	2	0.6	#7 - Snohomish River
Total			15.1	

[a] Additional wetlands were surveyed outside of the 150-ft.-wide corridor that are not listed here.

[b] Vegetation class definitions (as defined by Cowardin et al. 1979, Classification of Wetlands and Deepwater Habitats. U.S. Fish and Wildlife Service):
PEM – Palustrine Emergent
PFO – Palustrine Forested
PSS – Palustrine Scrub-Shrub
POW – Palustrine Open-Water

[c] King County ratings are explained in Appendix B.

Large depressional wetlands occupy flat benches on the north and south slopes of Brew Hill and are often fed by groundwater seeps. Several wetlands are also associated with the riparian area of tributaries to the Raging River to the north and Rock Creek to the south of Brew Hill, within the watershed and within private lands. Many of the wetlands continue outside of the 150-ft corridor into the existing transmission line corridor and onto adjacent lands.

A majority of wetlands in this alternative have a palustrine forested vegetation community component dominated by red alder. The red alder forest is often associated with western red cedar and western hemlock in the canopy. Salmonberry, and Douglas' spirea are common wetland shrub species, with piggy-back plant, meadow buttercup, and skunk cabbage often dominating the herbaceous layer. The depressional wetlands occupying the south and north bench areas of Brew Hill provide important groundwater discharge and recharge functions, while serving as the headwaters for Rock Creek and the Raging River. These forested wetland communities also provide bird, mammal, fish, amphibian, and invertebrate habitat for a variety of species that use seasonally and perennially saturated wetlands and riparian areas for feeding, nesting, and rearing.

No wetlands were identified south of the Cedar River crossing within the Alternative 1 ROW.

3.4.2 Alternative 2

A total of 13 wetlands, totaling 261 ac., were identified within the 500-ft. study corridor for Alternative 2. Three wetlands were identified south of the junction with Alternative 1. North of this junction (which is within Alternative 1), within the CRW, there are 10 wetlands (described under Alternative 1 above).

All three of the wetlands identified within the southern portion of this alternative are located south of the Cedar River, and all three wetlands are within the proposed 150-ft. ROW. All are depressional wetlands with palustrine forested vegetation community components and areas of surface water inundation. Two of these wetlands have been altered. Tree harvesting has impacted the buffer associated with wetland 2-1, while the location of Pole Line Road has altered the hydrology of wetland 2-2. Wetland 2-3 is located within mid-seral coniferous forest and, like the other two wetlands, is associated with a depressional area within relatively flat topography.

3.4.3 Alternative 3

A total of nine wetlands, totaling 75 ac., were identified within the 500-ft. study corridor along Alternative 3. Wetlands are located to the north and south of the CRW, as well as within the watershed. Seven of nine wetlands identified within the study corridor would be crossed by the proposed 150-ft. ROW.

Most of the wetlands are associated with depressions that collect overland flows and precipitation and hold this water over prolonged periods. These wetlands provide water quality, flood storage, and flood water retention functions. Vegetation communities are predominantly palustrine forested with components of palustrine scrub-shrub with low diversity. Wetlands 3-8 and 3-4 contain open water surrounded by red alder-dominated, palustrine forested wetland.

Several wetlands are associated with the riparian fringe of streams that provide wildlife habitat and wildlife travel corridors, as well as water quality improvement, flood storage, and floodwater retention. Wetland 3-9 is a palustrine forested wetland paralleling the north and south sides of Canyon Creek. Wetland 3-5 fringes an unnamed tributary to Raging River. Wetland 3-4 contains

a large open water component forming the headwaters to Steele Creek, a tributary to the Cedar River.

3.4.4 Alternative 4a

A total of 12 wetlands, totaling 258 ac., were identified along the entire length of the Alternative 4a 500-ft. study corridor. Wetland 2-3 was identified along the portion of Alternative 4a that begins about one-third of the way along Alternative 2 (S24, T22N, R7E) and traverses northwest to connect with Alternative 1, over 1 mi. (S23, T22N, R7E) further south than where Alternative 2 reconnects (S11, T22N, R7E).

Ten of the 12 wetlands identified within the Alternative 4a 500-ft. study corridor were previously described in Section 3.4.1 for Alternative 1. The remaining two wetlands (2-1 and 2-3) are described in Section 3.4.2 for Alternative 2. However, wetland 2-3 is not within the proposed 150-ft. ROW and would not be directly impacted.

3.4.5 Alternative 4b

A total of 13 wetlands, totaling 261 ac., were identified along the entire length of Alternative 4b. Wetlands 2-2 and 2-3 were identified along the portion of Alternative 4b that begins slightly north of Alternative 4a (S24, T22N, R7E), along Alternative 2, and traverses west to connect with Alternative 1 further south than where Alternative 4a reconnects (S23, T22N, R7E).

Ten of the 13 wetlands identified within Alternative 4a were previously described in Section 3.4.1 for Alternative 1. The remaining wetlands are described in Section 3.4.2 for Alternative 2. However, wetland 2-3 is not within the proposed 150-ft. ROW and would not be directly impacted.

3.5 Access Roads

An access road system within and outside of the ROW would be used to construct and maintain the new transmission line. Access roads would be 16 ft. wide, with additional road widths of up to 20 ft. for curves. In addition to new access roads, existing access roads may need to be improved. New and improved roads generally would be surfaced with gravel, with appropriate design for drainage and erosion control.

Access roads would be located to avoid the identified wetlands where possible.

3.6 Substation

One wetland of about 7 ac. size is located within the footprint of the Echo Lake Substation expansion. Wetland E-1 is located at the base of the hillslope within a depressional area to the east and south of the current Echo Lake Substation. The wetland is a mixture of palustrine scrub-shrub and palustrine emergent vegetation communities. Water emerges within the proposed expansion area as a seep, draining over the surface to the west of the proposed substation expansion area into the existing Raver-Echo Lake transmission line ROW.

4.0 Environmental Consequences

For all transmission line alternatives, impacts to wetlands would occur during construction and operation (maintenance). Impacts to wetlands could occur during construction of new roads or

widening of existing access roads, clearing vegetation within the 150-ft. wide ROW, preparation and clearing vegetation for staging and materials storage areas, clearing vegetation for work areas, and clearing and grubbing for construction of tower footings. Operational impacts to wetlands could include the periodic removal of vegetation within or adjacent to wetlands to ensure proper clearance to conductors.

A **high impact** to wetlands would occur if the project:

- Permanently altered wetland hydrology, vegetation, and/or soils by excavation or fill, and the ecological integrity of a wetland was impaired; or
- Completely filled a wetland or destroyed a wetland function.

A moderate impact would occur if the project:

- Partially filled a wetland or degraded a wetland function. Recovery generally would require restoration and monitoring.

A **low impact** would occur if the project:

- Changed vegetation or soils for the short term but did not change hydrology; or
- Caused a short-term disruption of a wetland function.

No impact would occur if the project avoids wetlands and their buffers; if new or widened access roads do not affect wetlands and buffers; if construction, operation, and maintenance of facilities does not affect wetlands and buffers; or if the size, quality, and functions of existing wetlands are not reduced.

4.1 Construction Impacts

4.1.1 Impacts Common to All Action Alternatives

4.1.1.1 Impacts

Each transmission line ROW would cross stream channels, valleys, and other landforms supporting wetlands. The conductor would span wetlands, and new structures and roads would be sited to avoid wetlands wherever possible. A 150-ft. wide ROW generally would be cleared of all trees, except when crossing steep, deep drainages or in other locations where conductor clearance was sufficient.

Direct construction impacts within wetlands would occur from hand-clearing the ROW for conductor span, and from permanent fill resulting from access road construction. No towers would be placed in wetland areas. Although clearing of forested wetland areas would impair the ecological integrity of the wetland, no mechanical land clearing would occur in forested wetlands within the transmission line corridor. To minimize soil disturbance within forested wetlands, trees would be hand felled and stumps would remain in place. Additionally, no new access roads or towers would be placed within mature forested wetlands (as defined in Washington State Department of Ecology's Washington State Wetlands Rating System for Western Washington, Second Editions [August 1993, Publication 93-74]). Clearing activities would result in the loss of vegetation and other habitat features such as stumps, downed logs, and snags. Soil disturbance

from these activities could injure or kill plants if large portions of the plant roots or aboveground shoots were cut or damaged. Soil disturbance from land clearing would result in an increase of sedimentation within wetlands and promote erosion on steep slopes common to the Brew Hill area. The removal of forested vegetation would also effect evapotranspiration rates and would increase soil and water temperatures due to the lack of shading.

The majority of new roads would be short spurs from the existing tower locations to the new adjacent tower locations. However, new road segments would be constructed within the new corridor to avoid potential wetland impacts that would occur from constructing roads within the existing corridor. On average, existing roads are 10-feet wide, and need to be widened to 16-feet wide. Road widening would consist of grading the current road surface and adding crushed rock 4 to 6 feet beyond the current road edge. Existing drainage devices such as water bars, and roadside ditches need to be replaced or repaired. Several culverts would be installed with the construction of new roads to facilitate drainage. The placement of impervious road surface in wetlands would impair the function to infiltrate surface water and discharge groundwater, alter surface and subsurface flows, destroy wildlife habitat, and result in increases in sedimentation and pollutants entering the adjacent wetland area.

Indirect impacts to wetlands could occur from construction activities adjacent to wetlands such as staging and material storage areas, work areas, the placement of tower footings, and construction or widening of access roads and spurs. Indirect impacts to wetlands and water resources from construction activities adjacent to wetlands could result in short-term increases in sedimentation and pollutants from ground disturbance and machinery operation, the removal of upland wildlife habitat, increases in surface water temperatures from the lack of vegetative shading, and the introduction of invasive plant species such as reed canarygrass and Douglas' spirea which already grow within the existing transmission line corridor.

Wetland Impact Avoidance and Minimization—Ecology and NEPA guidelines prioritize first reducing impacts through avoidance and minimization and then rectifying and compensating for unavoidable impacts. Criteria used by BPA to select the alternative ROW included avoiding known high-quality natural resources such as wetlands and streams. Any wetlands identified along the selected transmission line ROW would be avoided where feasible. Feasibility would be determined by land ownership, road configuration, spanning to avoid wetlands, construction costs, reducing sharp angles and bends in the ROW, and access.

Vegetation Impacts—Vegetation impacts from construction would include clearing shrubs, trees, and herbaceous vegetation from wetlands and wetland buffers. Vegetation within the construction ROW would be cut and removed, leaving roots intact where possible. Trees cut within and adjacent to forested wetlands would result in a permanent modification of that wetland type to either an emergent or shrub-scrub condition. Forested wetlands where vegetation would be permanently altered to shrub-scrub and emergent communities would experience greater impacts than other wetland areas. The low-growing vegetation within herbaceous and scrub-shrub wetlands is generally compatible with the vegetation height requirements for conductor clearance.

Hydrology Impacts—Construction-related activities could impact the hydrology of wetlands within and immediately adjacent to the cleared ROW and substation facilities. Construction could affect wetland hydrology by:

- Altering the subbasin that drains to a particular wetland by diverting surface and subsurface flows from grading and road construction;

- Altering evapotranspiration by modifying vegetation; and

- Increasing soil and water temperatures as a result of less shading.

Construction within or adjacent to wetlands associated with streams or other surface water could also adversely affect those surface water resources. Factors that determine the risk of altering wetland hydrology include the source of water for the wetland (e.g., groundwater, surface runoff, or streamflow), landscape position, size, surface geology, and soils.

Clearing tree cover would cause a high-level impact (as defined in Section 4.0) to forested wetlands. Tower and road construction would generally avoid wetland areas, which would allow hydric soils within forested wetlands within the ROW to be maintained. However, wetland hydroperiod (seasonal occurrence of flooding and/or soil saturation) would change with the removal of trees and resulting reduced evapotranspiration and forest litter; increased storm runoff volumes and delivery rates to adjacent waters would be expected (Reinelt and Taylor 1997).

Water Quality Impacts—The reduction in forested cover within wetlands and construction of new roads could result in degradation of water quality (Horner et al. 1997). Construction activities could introduce sediments into wetlands and thereby degrade the water quality of the wetlands if preventive measures are not taken. The most likely source of sediment would be construction of roads, staging areas, and excavation for tower footings. Construction of tower footings could require dewatering to maintain safe working conditions and conditions suitable for pouring the footings.

Wildlife Impacts—Removal of vegetation within and adjacent to wetlands could affect wildlife habitat and use in those wetlands. Because of the need to maintain low-growing vegetation for safety, the impacts to vegetative cover in forested wetlands would be more dramatic than the impacts to other wetland areas. The change in vegetative cover from trees and snags to low-growing scrub-shrub or emergent vegetation would impact wildlife species. Wildlife that depend on forested wetlands (e.g., cavity-dwelling birds and mammals) would be most impacted by construction due to loss of habitat (Richter and Azous 1997).

4.1.1.2 Mitigation

Standard mitigation measures to minimize wetland impacts include the following:

- Locate structures and new roads to avoid wetlands and buffers.

- Avoid any activities within designated King County wetland buffers (Ordinance #9614).

- Do not perform mechanized clearing within wetlands.

- Use helicopters during construction to minimize the need for use of roads and avoid impacts to wetlands.

- Limit disturbance to the minimum necessary when working in and immediately adjacent to wetlands.

- Locate construction staging areas outside of wetlands and associated buffers.

- Delineate wetlands before final design and flag for avoidance during construction.

- Use erosion control measures when conducting any earth disturbance upslope of wetlands to ensure soil is not washed downhill during storms.

- Ensure that the hydrology of wetlands and associated streams is maintained wherever the ROW crosses these resources. This can be accomplished by ensuring that landforms are regraded to pre-existing conditions, and that connectivity is maintained between streams and wetlands.

- Stockpile wetland topsoil when excavating and redeposit soil in place for restoration following construction.

- Minimize impacts to wetlands as described in WDNR Forest Practices Rules (WAC 222) regulations.

- Return temporary construction roads to their original contours following construction to reestablish pre-project surface water flow patterns.

- Ensure noxious weed infestations do not become a problem in wetlands by washing all construction vehicles and conducting a weed inventory one year after construction to verify that weeds have not been introduced.

- Avoid clearing vegetation within forested wetlands wherever possible.

- Use vehicle crossing mats to support equipment used during construction to minimize wetland soil compaction.

4.1.1.3 Cumulative Impacts

Filling or adverse modification of wetlands would result in the incremental reduction of wetland acreage and function within the watersheds of the project area. This could be offset through mitigation and restoration of degraded wetlands within the affected watersheds.

In the future, the transmission line ROW would be a logical choice for construction of other linear projects, including additional transmission lines, fiber optic cables, or pipelines. The decision to create a new corridor in this area could increase the likelihood of such proposals.

4.1.1.4 Unavoidable Effects, Irreversible, or Irretrievable Commitment of Resources

Unavoidable effects and commitment of wetland resources would be dependent on the final siting decisions for towers, roads, and other facilities. Siting of facilities to avoid wetlands could avoid or reduce the unavoidable, irreversible, or irretrievable effects.

4.1.2 Substation Impacts

4.1.2.1 Impacts

Expansion of the substation would impact less than 1 ac. of wetlands (Table 3).

Table 3. Acreage of Wetland Impact from Vegetation Clearing by Transmission Line Alternatives

Alternative	Acres of Wetland Impact
1	13.98[1]
2	14
3	6
4a	14
4b	15
Substation	< 1
[1]As calculated using wetland boundaries surveyed in December 2001.	

The wetland that would be affected is composed of a monotypic stand of sapling red alder. Wetland functions related to wildlife habitat, flood storage and flood flow moderation, and water quality improvement are low. Functional impacts to this wetland resulting from clearing would be minimal.

4.1.2.2 Mitigation

Wetland E-1 (Figure 3) is small and could be avoided. Mitigation would be the same as described in Section 4.1.1.2.

4.1.2.3 Unavoidable Effects, Irreversible, or Irretrievable Commitment of Resources

High-level impacts to wetlands from towers, roads, and expansion of the substation could be largely avoided.

4.1.3 Alternative Transmission Line Impacts

4.1.3.1 Alternative 1: Preferred Alternative

Impacts—The 150-ft.-wide ROW would require the clearing of 14 ac. of palustrine forested wetland area supporting tall growing woody vegetation (Table 3). Although the proposed 150-ft.-wide transmission line ROW would cross stream channels, valleys, and other landforms supporting wetlands, the conductor would span wetlands, and new structures and roads would be sited to avoid wetlands and streams. Wetlands surveyed within the Alternative 1 ROW consisted primarily of palustrine scrub-shrub and palustrine forested types. The majority of wetlands were low-gradient, depressional wetlands, however several seep wetlands are present on the south and north slopes of Brew Hill. Major streams and rivers associated with wetlands within the Alternative 1 ROW include the Raging River, Rock Creek, and Cedar River.

Clearing would cause a high-level impact to forested wetlands and their buffers. The permanent alteration of forested wetland community to scrub-shrub wetland community would degrade wildlife habitat, lower flood flow and flood storage capability, alter hydrology through changes in evapotranspiration rates, lower water quality improvement functions, and increase soil and water temperatures through the reduction of shading. Scrub-shrub and open water wetlands would

experience moderate, low, or no impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained.

Alternative 1 has been designed so no fill would be placed within wetlands and streams during or following the construction of the transmission line, access roads, or the expanded substation. BPA engineers have determined that sufficient non-wetland areas are present to allow roads, staging areas, and tower locations for the project to be designed to avoid direct fill of wetlands and streams.

Mitigation—Mitigation measures specific to the wetland resources along Alternative 1 would include:

- Towers should be sited to span the sinkhole associated with wetland 1-9, resulting in no clearing impact.

- Minimize road construction and strategically site towers to avoid wetlands 1-3 and 1-4 to minimize impacts to wetlands within the headwaters of Rock Creek.

Please also refer to Section 4.1.1.2 for discussion of mitigation common to all action alternatives.

Unavoidable Effects, Irreversible or Irretrievable Commitment of Resources—Unless wetlands were avoided during construction, the project would result in the loss of wetlands from the construction of towers, clearing for the ROW and roads, and construction and filling for access roads. This commitment of wetland resources could occur in all watersheds crossed by Alternative 1.

4.1.3.2 Alternative 2

Impacts—The 150-ft. wide cleared ROW would impact a total of 14 ac. of wetlands (Table 2). Wetland impacts associated with this alternative would include all of the wetland impacts described for the shared portion of Alternative 1. Additional impacts associated with Alternative 2 would result from the portion of the ROW originating from a tap point located approximately 2 mi. east of the tap point for Alternative 1 (S25, T22N, R7E), traversing approximately 3 mi. to S11, T22N, R7E, before continuing north along the same ROW as Alternative 1.

Clearing would cause a moderate-level impact to forested wetlands. Wildlife habitat, flood flow and flood storage, and water quality functions could be degraded. Scrub-shrub and open water wetlands would experience moderate, low, or no impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained.

Mitigation—Mitigation measures specific to the wetland resources along Alternative 2 would include:

- Towers should be sited to span the sinkhole associated with wetland 1-9, resulting in no clearing impact.

- Minimize road construction and strategically site towers to avoid wetlands 1-3 and 1-4 to minimize impacts to wetlands within the headwaters of Rock Creek.

Please also refer to Section 4.1.1.2 for discussion of mitigation common to all action alternatives.

Unavoidable Effects, Irreversible or Irretrievable Commitment of Resources—Unless wetlands were avoided during construction, the project would result in the loss of wetlands from the construction of towers, clearing for the ROW and roads, and construction and filling for access roads. This commitment of wetland resources could occur in all watersheds crossed by Alternative 2.

4.1.3.3 Alternative 3

Impacts—Along Alternative 3, wetland impacts were calculated for the 150-ft. wide ROW centerline and also for the remaining 350-ft. within a 500-ft. corridor (including 175 ft. west and 175 ft. east of Alternative 3). The 150-ft. centerline for Alternative 3 would impact a total of 6 ac. of wetlands (Table 2).

In comparison to the Alternative 3 centerline, if the transmission line were located in the corridor west of the centerline, a total of 10 ac. of wetlands would be impacted, 4 ac. more than the centerline. If the transmission line were located in the corridor east of the centerline, a total of 6 ac. of wetlands would also be impacted.

Clearing would cause a moderate-level impact to forested wetlands. Wildlife habitat, flood flow and flood storage, and water quality functions could be degraded. Scrub-shrub and open water wetlands would experience moderate, low, or no impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained.

Mitigation—Mitigation measures specific to the wetland resources along Alternative 3 would include:

- Towers should be placed to span wetland 3-9 at the crossing of Canyon Creek and vegetation clearing should be avoided within the wetland.
- Constructing the line in the 150-ft. ROW centerline would minimize clearing in wetlands, compared to placing the line in the western or eastern portions of the 500-ft. corridor.
- Utilizing the existing cleared ROW paralleling Pole Line Road would reduce the amount of tree removal and associated impacts.

Please also refer to Section 4.1.1.2 for discussion of mitigation common to all action alternatives.

Unavoidable Effects, Irreversible or Irretrievable Commitment of Resources—Unless wetlands were avoided during construction, the project would result in the loss of wetlands from the construction of towers, clearing for the ROW and roads, and construction and filling for access roads. This commitment of wetland resources could occur in all watersheds crossed by Alternative 3.

4.1.3.4 Alternative 4a

Impacts—The 150-ft. wide ROW would impact a total of 14 ac. of wetlands (Table 2). Wetland impacts would include those described with the shared portions of the Alternative 1 ROW and the southern portion of the Alternative 2 ROW. Additional impacts associated with Alternative 4a were determined from 1 mi. of the ROW located between Alternatives 1 and 2. This portion of the ROW begins one-third of the way along Alternative 2 (S24, T22N, R7E) and connects with

Alternative 1 (S23, T22N, R7E) further south than where Alternative 2 reconnects (S11, T22N, R7E), before continuing north along Alternative 1.

Clearing would cause a moderate-level impact to forested wetlands. Wildlife habitat, flood flow and flood storage, and water quality functions could be degraded. Scrub-shrub and open water wetlands would experience moderate, low, or no impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained.

Mitigation—Mitigation measures specific to the wetland resources along Alternative 4a would include:

- Site towers to span the sinkhole associated with wetland 1-9, resulting in no impacts from clearing.
- Minimize road construction and strategically site towers to avoid wetlands 1-3 and 1-4 to minimize impacts to wetlands within the headwaters of Rock Creek.

Please also refer to Section 4.1.1.2 for discussion of mitigation common to all action alternatives.

Unavoidable Effects, Irreversible, or Irretrievable Commitment of Resources—Unless wetlands were avoided during construction, the project would result in the loss of wetlands from the construction of towers, clearing for the ROW and roads, and construction and filling for access roads. This commitment of wetland resources could occur in all watersheds crossed by Alternative 4a.

4.1.3.5 Alternative 4b

Impacts—The 150-ft. wide ROW would impact a total of 14 ac. of wetlands (Table 2). Wetland impacts would include all of the wetland impacts described with the shared portions of the Alternative 1 ROW and the southern portion of the Alternative 2 ROW. Additional impacts associated with Alternative 4b would result from the portion of the ROW traversing between Alternatives 1 and 2 by paralleling Pole Line Road, before continuing north along Alternative 1.

Clearing would cause a moderate-level impact to forested wetlands. Wildlife habitat, flood flow and flood storage, and water quality functions could be degraded. Scrub-shrub and open water wetlands would experience moderate, low, or no impact assuming the wetlands could be avoided or spanned and that soils, hydrology, and vegetation were maintained.

Mitigation—Mitigation measures specific to the wetland resources along Alternative 4b would include:

- Utilize the existing cleared ROW paralleling Pole Line Road, to reduce the amount of tree removal and associated impacts.
- Site towers to span the sinkhole associated with wetland 1-9, resulting in no impacts from clearing.
- Minimize road construction and strategically site towers to avoid wetlands 1-3 and 1-4 to minimize impacts to wetlands within the headwaters of Rock Creek.

Please also refer to Section 4.1.1.2 for discussion of mitigation common to all action alternatives.

Unavoidable Effects, Irreversible, or Irretrievable Commitment of Resources—Unless wetlands are avoided during construction, the project would result in the loss of wetlands from the construction of towers, clearing for the ROW and roads, and construction and filling for access roads. This commitment of wetland resources could occur in all watersheds crossed by Alternative 4b.

4.1.3.6 Access Roads

Impacts—New access roads would be required to construct each of the alternatives. Where possible, new access roads would avoid identified wetlands for any of the proposed transmission line alternatives where practical.

New road construction could carry sediment into wetlands, affecting water quality and biological productivity. However, use of erosion and sediment control devices would minimize these impacts. Wetlands within the ROW and adjacent to access roads would be subject to soil compaction and vegetation damage from vehicles carrying heavy construction machinery and transmission line structures.

Mitigation—Mitigation measures specific to the construction of access roads within the project area would include:

- Utilize existing road systems to access tower locations and for the clearing of the transmission line ROW.
- Maintain properly functioning drainage control devices.
- Avoid construction on steep slopes and geologically unstable areas.
- Avoid constructing steep road grades.
- Construct roads consistent with the WDNR Forest Practices Rules (WAC 222).

Please also refer to Section 4.1.1.2 for discussion of mitigation common to all action alternatives.

Unavoidable Effects, Irreversible, or Irretrievable Commitment of Resources—Unless wetlands were avoided during construction, the project would result in the loss of wetlands from the construction and filling for access roads. This commitment of wetland resources could occur in all watersheds crossed by the preferred alternative.

4.1.3.7 No Action Alternative

Current levels of impacts to wetland resources along the existing Raver-Echo Lake transmission line ROW would continue under the No Action Alternative.

4.2 Operation and Maintenance Impacts

4.2.1 Impacts Common to All Action Alternatives

4.2.1.1 Impacts

Maintenance of the 150-ft. transmission ROW and substations would require the periodic removal of trees to ensure a safe distance to the conductors. Tree clearing would be accomplished as routine maintenance in forested wetlands and their buffers where trees may grow to a height that conflicts with the operation of the transmission line.

Moderate-level wetland impacts would also occur where the forest cover was removed and permanently maintained as scrub-shrub or emergent vegetation.

4.2.1.1 Mitigation

Standard mitigation measures to minimize impacts to wetland resources during operation and maintenance of the transmission line would include:

- Require contractors to use manual methods within wetlands.
- Limit disturbance to the minimum necessary when working in and immediately adjacent to wetlands.
- Use erosion control measures when conducting any earth disturbance upslope of wetlands to ensure that soil is not washed downhill during storm events.
- Minimize impacts to wetlands consistent with the WDNR Forest Practices Rules (WAC 222) regulations.
- Avoid clearing vegetation within forested wetlands wherever possible.

4.2.1.2 Cumulative Impacts

Loss or modification of wetlands would result in an incremental reduction in wetland functions within the watersheds of the project area.

4.2.1.3 Unavoidable, Irreversible, or Irretrievable Impacts

Forested wetlands would be permanently modified through the removal of trees and maintenance of shrub-scrub wetland communities. Wildlife habitat, flood flow and flood storage moderation, and water quality functions would be permanently degraded. This commitment of wetland resources could occur in all watersheds crossed by the preferred alternative.

4.2.2 Access Roads

4.2.2.1 Impacts

Access roads used for maintenance of towers and the vegetation within the transmission line could carry sediment into wetlands, affecting water quality and biological productivity. Truck

travel, exposed soil, and malfunctioning drainage control devices could result in low- to moderate-level impacts.

4.2.2.2 Mitigation

Mitigation measures specific to the operation and maintenance of access roads within the project area would include:

- Utilize existing road systems to access tower locations and for the clearing of the transmission line ROW.
- Maintain properly functioning drainage control devices on all roads.
- Repair degraded road surfaces.
- Decommission unused roads.

Please also refer to Section 4.2.1.2 for discussion of mitigation common to all action alternatives.

4.2.3 Substation

No additional wetland impacts would occur from the operation and maintenance of the substation.

4.2.4 No Action Alternative

Current levels of impacts to wetlands along the existing Raver-Echo Lake transmission line ROW would continue under the No Action Alternative. No impacts related to the proposed transmission line project would occur.

5.0 Environmental Consultation, Review and Permit Requirements

Several federal laws and administrative procedures must be met by the alternatives. This section lists and briefly describes requirements that could apply to wetland elements of this project.

5.1 Discharge Permits Under the Clean Water Act

5.1.1 Section 401

Section 401 of the CWA, the State Water Quality Certification program, requires that states certify compliance of federal permits and licenses with state water quality requirements. A federal permit to conduct an activity that results in discharges into waters of the United States, including wetlands, is issued only after the affected state certifies that existing water quality standards would not be violated if the permit were issued.

5.1.2 Section 402

The CWA Section 402 program, also known as the National Pollutant Discharge Elimination System (NPDES) program, regulates the discharge of pollutants from point sources into waters of the United States (other than dredged or fill material, which is covered under Section 404).

5.1.3 Section 404

Authorization from the Corps is required in accordance with the provisions of Section 404 of the CWA when there is a discharge of dredge or fill material into waters of the United States, including wetlands. This includes excavation activities that result in the discharge of dredged material that could destroy or degrade waters of the United States.

This project, with mitigation measures as stated, would meet the standards outlined by the CWA.

5.2 Other Standards and Guidelines

5.2.1 Cedar River Watershed Habitat Conservation Plan

The CRW HCP (City of Seattle 2000) was prepared by Seattle Public Utilities to establish a comprehensive plan for long-term management of the CRW. The HCP includes numerous provisions intended to protect wetlands and riparian habitat from degradation of function and ability to support species addressed in the HCP. Many of these provisions apply management procedures such as the designation of wetland reserve areas, and the establishment of adequate wetland buffers, as part of the Stream and Riparian Conservation Strategy component of the HCP. Specifically, the HCP allows timber harvest and road construction within wetlands and wetland buffers only in limited circumstances. For activities in wetlands and their buffers, the City of Seattle would consult with the state and federal agencies regarding measures to minimize and mitigate the impacts.

5.2.2 Washington Department of Natural Resources

The WDNR Forest Practices Rules (WAC 222) describe the types of forest practices allowed under the State of Washington Forest Practices Act (RCW 76.09). They divide forest practices into four classes based on potential impacts to public resources, and they classify wetlands as either Forested, Nonforested Type A, or Nonforested Type B. Specific wetland management zones and permitted practices within each management zone are applied to each wetland class.

5.2.3 King County Department of Development and Environmental Services

The King County Department of Development and Environmental Services reviews public and private projects under the King County Sensitive Areas Ordinance (Ordinance #9614) to ensure consistency with King County Code for project activities in wetlands and wetland buffers.

6.0 Individuals and Agencies Contacted

Agencies contacted include the Corps and the City of Seattle.

7.0 List of Preparers

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Two years of experience in GIS mapping and evaluations.
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Five years of experience in wetland delineation and assessment of aquatic resources, resource inventory and classification, riparian and wetlands research, and permitting assistance.
M.S., Forestry (Riparian and Wetland Research Program), University of Montana, 1999.

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9.0 Glossary and Acronyms

This chapter contains a list of acronyms, abbreviations, and technical terms used in this report. Words that would be defined in a desk-size dictionary (for example, the College Edition of the American Heritage Dictionary) are not included.

Glossary

Access roads are constructed to each structure site first to build the tower and line and later to maintain and repair it. Access roads are built where no roads exist. Where county roads or other access is already established, short spurs are built to the structure site. Access roads are maintained after construction, except where they pass through cultivated land where the road is restored for crop production after construction is completed.

Alternatives refer to different choices or means to meet the need for action.

Aquifers are water-bearing rock or sediments below the surface of the earth.

Best Management Practices are a practices or a combination of practices that are the most effective and practical means of preventing or reducing the amount of pollution generated by non-point sources to a level compatible with water quality goals.

Culverts are corrugated metal or concrete pipes used to carry or divert runoff water from a discharge. Culverts are usually installed under roads to prevent washouts and erosion.

Cumulative impacts are created by the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions.

Cut and fill is the process by which a road is cut or filled on a side slope. The term refers to the amount of soil that is removed (cut) or added (filled).

CWA signifies the Clean Water Act, a federal law intended to restore and maintain the chemical, physical, and biological integrity of the nation's waters and secure water quality.

Danger trees or high-growing brush occur in or alongside the project right-of-way and are hazardous to the transmission line. These trees are identified by special crews and must be removed to prevent tree-fall into the line or other interference with the wires. The owner of danger trees off the right-of-way is compensated for their value. BPA's Construction Clearing Policy requires that trees be removed that meet either one of two technical categories: Category A contains any tree that in 15 years will grow within about 5 m (18 ft.) of conductors when the conductor is at maximum sag (100° C or 212° F) and is swung by 30 kg per sq/m (6 lb per sq/ft.) of wind (93 kph or 58 mph); Category B represents any tree or high-growing bush that after 8 years of growth will fall within about 2 m (8 ft.) of the conductor when it reaches maximum sag (80° C or 176° F) in a static position.

Dead ends are heavy towers designed for use where the transmission line loads the tower primarily in tension rather than compression. Dead ends are used in turning large angles along a line or in bringing a line into a substation.

Easement is a grant of certain rights to use a piece of land, which then becomes a "right-of-way." BPA normally acquires easements for its transmission lines. Easement includes the right to enter the ROW to build, maintain, and repair facilities.

Emergent plants have their bases submerged in water.

Endangered species are those officially designated by the USFWS and/or the NMFS as being in danger of extinction throughout all or a significant portion of their range.

Floodplain refers to a portion of a river valley adjacent to the stream channel that is covered with water when the stream overflows its banks during flood stage.

Footings are the supporting base for the transmission towers. They are usually steel assemblies buried in the ground for lattice-steel towers.

Forb is any herbaceous plant that is not a grass or grasslike.

Ford is a travelway across a stream where water depth does not prevent vehicle movement. Ford construction can include grading and stabilizing streambanks at the approaches and adding coarse fill material within the channel to stabilize the roadbed.

GIS signifies Geographic Information System, a computer system that analyzes graphical map data.

Ground wire (overhead) is wire strung from the top of one tower to the next; it shields the line against lightning strikes.

Hydrology addresses properties, distribution, and circulation of water.

Hydroperiod is the seasonal occurrence of flooding and/or soil saturation.

Insulators are ceramic or other nonconducting materials used to keep electrical circuits from jumping to ground.

Intermittent refers to periodic water flow in creeks or streams.

Jurisdictional wetlands are areas that are consistently inundated or saturated by surface or ground water at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil conditions.

Kilovolt is one thousand volts.

Lattice steel refers to a transmission tower constructed of multiple steel members that are connected together to make up the tower's frame.

Low-gradient refers to gentle slopes.

Mitigation is the step(s) taken to lessen the potential environmental effects predicted for each resource impacted by the transmission project. Mitigation may reduce the impact, avoid it completely, or compensate for the impact. Some mitigation, such as adjusting the location of a tower to avoid a special resource, is enacted during the design and location process. Other mitigation, such as reseeding access roads with desirable grasses and avoiding weed proliferation, is taken after construction.

National Environmental Policy Act (NEPA) requires an environmental impact statement on all major federal actions significantly affecting the quality of the human environment.
(42 U.S.C. 4332 2(2)(C))

Noxious weeds are plants that are injurious to public health, crops, livestock, land, or other property.

100-year floodplains are areas that have a 1% chance of being flooded in a given year.

Perennial streams and creeks have year-round water flows.

Permeability refers to the capability of various materials to transport liquids.

Pulling site is a staging area for machinery used to string conductors.

Revegetation is reestablishment of vegetation on a disturbed site.

Right-of-way (ROW) is an easement for a certain purpose over the land of another owner, such as a strip of land used for a road, electric transmission line, pipeline, etc.

Riparian habitat is a zone of vegetation that extends from the water's edge landward to the edge of the vegetative canopy. The term is associated with watercourses such as streams, rivers, springs, ponds, lakes, or tidewater.

Sensitive species are those plants and animals identified by the USFWS for which population viability is a concern. This classification is evidenced by significant current or predicted downward trends in populations or density and significant or predicted downward trends in habitat capability.

Silt is a designation referring to individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very fine sand (0.05 mm).

Substation is the fenced site that contains the terminal switching and transformation equipment needed at the end of a transmission line.

Threatened species are those officially designated by the USFWS as likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

Transmission line includes the structures, insulators, conductors, and other equipment used to transmit electrical power from one point to another.

Water bars are smooth, shallow ditches excavated at an angle across a road to decrease water velocity and divert water off and away from the road surface.

Wetlands are areas where the soil experiences anaerobic conditions because of inundation of water during the growing season. Indicators of a wetland include types of plants, soil characteristics, and hydrology of the area.

Acronyms and Abbreviations

ac.	acre or acres
BMPs	Best Management Practices
BPA	Bonneville Power Administration
CFR	Code of Federal Regulations
Corps	U.S. Army Corps of Engineers
CRW	Cedar River Watershed
CWA	Clean Water Act
ft.	foot or feet
Ecology	Washington Department of Ecology
EIS	environmental impact statement
EPA	Environmental Protection Agency
GIS	Geographic Information System
HCP	Habitat Conservation Plan
in.	inch or inches
kV	kilovolt
mi.	mile or miles
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NWI	National Wetland Inventory
NPDES	National Pollutant Discharge Elimination System
RCW	Revised Code of Washington
ROW	right-of-way
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDNR	Washington Department of Natural Resources
WRIA	Water Resource Inventory Area