Chapter 14 Geology and Soils

This chapter describes existing geological and soil conditions in the project area, how the project alternatives could affect soil resources, and how geologic hazards, such as landslides, seismicity and volcanic activity, could affect the project. Related information can be found in Chapter 15, Water and Appendix J, Geologic Hazard Assessment.

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

14.1 Affected Environment

14.1.1 Geology

The project area is within three physiographic regions: the Willapa Hills, South Cascades, and Portland Basin. The topography of the Willapa Hills and the South Cascades is mostly gently rolling to steep hills or relatively level terrain in the floodplains of major rivers, such as the Cowlitz River. The portion of the project area within the Portland Basin is mostly flat or nearly flat terrain. Elevation in the project area ranges from 25 feet to 3,311 feet above mean sea level (msl).

The northern portions of the action alternatives and the Casey Road, Baxter Road, and Monahan Creek substation sites are within the Willapa Hills region. Other portions of the Central, East, and Crossover alternatives and options and the West Alternative between the Cowlitz and Lewis rivers are within the South Cascades region. South of the Lewis River, most of the West Alternative and options are within the Portland Basin.

The underlying **bedrock** in the Willapa Hills and South Cascades regions is **igneous** rock, and to a lesser degree, **sedimentary** rock. In most places, the bedrock is covered by clay-rich **residual soils** weathered from the underlying bedrock. The Portland Basin is mostly filled with **sediment** (sand, clay and gravel) deposited by ice age floods (i.e., Missoula Flood deposits). In all three regions, some sediments are derived from volcanic eruptions and **lahars** (volcanic mudflows) from Mt. St. Helens and Mt. Hood. Lahar deposits are near the Cowlitz and Kalama rivers and eastern portions of the Lewis River, and at the Sundial substation site. Other geologic deposits include **glacial till**, glacial outwash, **alluvium** at river crossings, and lake and wetland deposits.

14.1.1.1 Landslide Areas

Landslides are common in hilly and steep areas and along cliffs in southwest Washington. Landslides occur on slopes as gentle as 11 percent (6 degrees) (Wegmann 2006).

The action alternatives cross known landslides and relatively steep slopes that may be susceptible to landslides (see Maps 14-1A through 14-1D and Appendix J) (DGER 2009). In general, mapped landslides and steep slopes are found in the northern (north of the Lewis River) and eastern portions of the project within the Willapa Hills and South Cascades regions. The risk of landslides is low in the relatively flat Portland Basin along the southern portion of the West Alternative.

14.1.1.2 Seismic Risks

The project is in a region where earthquakes occur from the interaction of the Juan de Fuca and North American **tectonic** plates along the offshore Cascadia **subduction** zone. Tectonic plates are pieces of the Earth's crust that move relative to each other. This movement causes earthquakes at the boundaries between the tectonic plates (i.e., at the Cascadia subduction zone), and within the plates. Based on historical and geological records, most earthquakes that generated shaking felt by residents in the project area have occurred along the Cascadia subduction zone, or deep within the subducting Juan de Fuca plate (i.e., Benioff Zone earthquakes). While quiet for centuries, scientists expect this fault could create a 9.0 magnitude or higher earthquake that would be felt by residents across the project area, and the Northwest.

About 476 earthquakes of less than magnitude 3 have occurred within 60 miles of the project area since 1973. Earthquakes measured as magnitude 3 are common in the project area and earthquakes in the 3.2 to 3.4 range are common in the Kelso area. The largest historical earthquakes within 60 miles of any part of the project were (1) a 6.9-magnitude earthquake in 1949, near Olympia, resulting in widespread damage but only minor damage in the Portland-Vancouver area, (2) the 2001 Nisqually quake north of Olympia with a 6.8 magnitude, which was strongly felt in Portland, but caused no damage, (3) the 1993 Scotts Mills Earthquake, better known as the Spring Break Quake, with a magnitude of 5.6 was located about 34 miles south of Portland in Marion County and caused limited damage, and (4) a 5.2-magnitude earthquake in 1962, located within 2 miles of Segment 25, that caused noticeable shaking in the Portland-Vancouver area but only minor damage. The 1949 and 2001 earthquakes were deep earthquakes (e.g., 32 miles deep in 2001) that occurred within the subducting Juan de Fuca plate, but the 1962 and 1993 earthquakes were relatively shallow, at about 10 and 9 miles, respectively, beneath the surface.

All earthquakes occur along **faults**; surfaces between two rock masses where one mass slides past the other. Where a fault is located at the surface, movement of the fault can damage structures built on the fault. Only one fault considered to have been active within the past 1.6 million years is crossed by the action alternatives (USGS 2006). This fault, the Lacamas Lake Fault, is crossed by the southern portion of the West Alternative. The most recent rupture of the Lacamas Lake Fault occurred sometime between 10,000 and 100,000 years ago.

During an earthquake, unconsolidated sediment (typically loose, saturated sand found in river valleys and along lakeshores) can lose strength and behave like a liquid. This is called **liquefaction**. Most of the land crossed by the action alternatives is underlain by bedrock, and would not experience liquefaction during an earthquake. Liquefaction could occur within the Cowlitz, Coweeman, Lewis, East Fork Lewis, and Columbia river valleys. These areas have a moderate to high liquefaction susceptibility (Palmer et al. 2004).

14.1.1.3 Volcanic Activity

The project area is near the volcanically active Cascade Mountains. Both the May 1980 eruption of Mt. St. Helens and previous eruptions of Mt. Hood have triggered lahars that have reached the project area. Volcanic hazards are separated into two zones (Wolfe and Pierson 1995; Scott et al. 1997). The first zone is the area close to the volcano subject to directed blasts, lava flows, **pyroclastic flows**, lahars, ash fall, earthquakes, and ground deformation. The project area does not overlap this zone. The second zone is farther from the volcanoes, and is generally subject only to lahars and ash fall. The action alternatives cross this second zone of potential lahars and

ash flow from Mt. St. Helens along the Kalama and Cowlitz rivers, and from Mt. Hood near the Columbia River and at the Sundial substation site. The entire project area is potentially subject to ash fall from a volcanic eruption.

14.1.2 Soils

Soils in the project area are generally residual, formed from igneous and sedimentary bedrock. Soil thickness varies, with thinner soils on steep slopes, and thicker soils in basins. Alluvial soils are present where the action alternatives cross the Cowlitz, Lewis, and Coweeman rivers. Other soils include glacial deposits (mostly near the Lewis and Cowlitz rivers), volcanic deposits from Mt. St. Helens near the Lewis River, and lahar deposits in Sandy and Cowlitz river floodplains (see Maps 14-2A through 14-2D and Appendix J). Soils in the area generally support agriculture, timber production, urban and rural development, and natural functions such as wetlands and aquifer recharge.

Slope and soil properties such as cohesion, drainage, and organic content are used in determining soil erosion hazard classes (NRCS 2009a). Generally, coarse-grained soils, on level to gentle slopes that are well drained have low erosion-hazard potential. Conversely, fine-grained soils on steep slopes that are poorly drained have the greatest erosion-hazard potential. There are four ratings for erosion hazard: slight, moderate, severe, or very severe (NRCS 2009a). A slight rating indicates that little or no erosion is likely; moderate indicates that some erosion is likely, that roads or trails may require occasional maintenance, and that simple erosion-control measures are needed; and severe and very severe indicate that considerable erosion could be expected from soil disturbance, that the roads or trails require frequent maintenance, and that erosion-control measures or mitigation are needed for unsurfaced roads and trails (NRCS 2009a, 2010a, 2010b). Based on NRCS' soil erosion hazard rating, most soils in the northern (north of the Lewis River) and eastern portions of the project area have a severe soil erosion potential and are susceptible to erosion (see Maps 14-2A and 14-2B and Appendix J). The portion of the West Alternative (including options) from the Lewis River to the Columbia River is on flatter terrain, with most soils rated as having low or moderate soil erosion potential. A few small areas are rated very severe south of Lake Merwin, along the East Fork Lewis River, and south of Rock Creek along the East Alternative.

Compaction susceptibility ratings for soils indicate the amount of force needed to press soil particles together, reduce pore spaces and increase soil density (NRCS 2009a). Most soils in the project area are susceptible to compaction (have low-to-moderate resistance to soil compaction). Soils with a moderate resistance to compaction have features favorable to resisting compaction. A low resistance-to-compaction rating indicates that one or more soil characteristics exist that favor the formation of a compacted layer. Areas with low resistance to compaction occur along the northern portions of the action alternatives, the middle portion of the West Alternative and the southern portions of the Central, East, and Crossover alternatives. Areas with moderate resistance occur along the Cowlitz and Lewis rivers, between Lake Merwin and Yale Dam, and south near Amboy. Less than 1 percent of the soils within the project area have a high resistance to soil compaction.

About 3 percent of the soils along the action alternatives are susceptible to **subsidence**. Subsidence is the gradual or rapid lowering of the ground surface that takes place when the soil surface is depressed or becomes dried out and can occur when the groundwater table is lowered. Soils with a high potential for subsidence are generally peat, silt, or clay and are often found in wetland areas. Within the project area, soils with a high potential for subsidence are

found along about 2 miles of the West Alternative (east end of Segment 25, east of Vancouver) and about ¼ to ½ mile near the west end of West Options 1, 2, and 3 and Crossover Option 1, east of Vancouver where segments 36, 36a, 36b, and 40 come together.

14.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

14.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Erosion occurs at road, tower, or substation construction and clearing sites on soils with severe or very severe erosion-hazard potential
- Permanent soil compaction occurs under access roads, towers, or substations

Impacts would be **moderate** where project activities would cause the following:

- Erosion occurs at road, tower, or substation construction and clearing sites on soils with a moderate erosion-hazard potential
- Temporary soil compaction occurs near or adjacent to access roads, towers, or substations

Impacts would be **low** where project activities would cause the following:

- Minor erosion occurs at road, tower, or substation construction and clearing sites on soils with a slight erosion-hazard potential
- The only disturbance created by the project would be right-of-way clearing

No impact would occur where project activities would not disturb soils.

14.2.2 Impacts Common to Action Alternatives

14.2.2.1 Construction

Geology

Permanent impacts from access road and tower construction would include some alterations to local topography. Landslides could affect the integrity of towers and road stability and other resources in the area, though towers and roads would generally be sited to avoid unstable locations. Where potentially unstable areas are unavoidable, engineers and geologists would survey locations on foot to select the best tower and road locations, use appropriate design standards for the given soils of the area, and monitor the area as part of routine maintenance. If a landslide did occur, debris could block roads; homes could be damaged or destroyed; water, sewer and power systems could be disrupted; and vegetation, wildlife habitats and other land uses could be damaged or interrupted.

Seismic issues can also affect tower construction (i.e., siting, and type of footing used). All facilities would be built to applicable seismic standards. The current tower design criteria used to account for combined wind and ice loading typically exceeds earthquake-induced loads. For towers located along the Lacamas Lake Fault or other potentially active fault zones that may be identified during the tower siting process, evidence of surface ruptures would be evaluated at the proposed tower locations before construction. Tower locations found near an identified surface rupture would be relocated away from the fault zone.

Much of the project area is underlain by bedrock or has soil with low susceptibility to liquefaction. In the few areas (about 42 to 43 acres for each alternative) where soils are moderately to highly susceptible to liquefaction, the low potential of major seismic activity reduces the likelihood of soil liquefaction. Generally, transmission towers are likely to survive settlement from liquefaction with only minor structural damage. Liquefaction hazard areas would be identified prior to construction based on anticipated soil and groundwater conditions. Several options are available to mitigate for liquefaction, such as avoiding susceptible areas, increasing soil density, and building deep foundations. Mitigation would be considered on a site-by-site basis.

Volcanic hazards such as lahars and ashfall could also affect operation of the transmission line. If possible, towers and roads would be sited to avoid potential lahars along the Kalama and Cowlitz rivers, and near the Columbia River. Because of the large area potentially covered by ashfall and lahars, not all hazards from a volcanic eruption could be avoided or mitigated.

Soils

Construction would temporarily or permanently affect soils by exposing disturbed soils to rain and wind, causing erosion; compacting soils by operating equipment; or by removing soil from use by either taking it off site or covering it with impervious surfaces.

Construction activities would involve excavation (for tower footings, substation ground mat, equipment, and counterpoise), grading and cut-and-fill for roads, tree removal, heavy equipment movement, and materials lay-down. These activities would disturb soils and remove or damage vegetative cover. The exposed soil would be vulnerable to movement off-site through water runoff, wind dispersal, or movement by gravity (soil and rocks rolling downhill). Soil erosion could increase sedimentation in streams and wetlands, which would affect surface and groundwater resources (drinking water) and aquatic habitat. Soil erosion also can create loss or degradation of topsoil, including reducing agricultural productivity. The risk for soil erosion would be greatest during and immediately after construction, when protective vegetation and topsoil have been removed and the soil is being actively disturbed and exposed. Typically, as vegetation becomes reestablished on disturbed surfaces, or the surface is covered (such as by a road, substation, or tower), the potential for erosion decreases.

Construction on steep slopes would occur in soils moderately to severely susceptible to erosion and temporary increases in soil erosion could occur. Limiting site disturbance is the single most effective method for reducing erosion (Ecology 2004). Preserving vegetative cover to the maximum extent feasible helps shield the soil from the elements, slowing runoff velocity and increasing infiltration time, and holding soils in place. Temporary erosion control measures would be maintained until vegetation is reestablished or permanent erosion control measures were in place. Control measures included as part of the project include implementing a SWPPP and designing roads to control runoff and prevent erosion (see Table 3-2). With implementation

of these **Best Management Practices** (BMPs), the impacts would be **low-to-moderate**. Additional measures such as conducting site-specific soil evaluations and performing construction during the dry season could further prevent or reduce erosion (see Section 14.2.8, Recommended Mitigation Measures).

Temporary increases in soil erosion during construction in areas where the erosion-hazard potential is moderate would be a **low-to-moderate** impact and where the erosion-hazard potential is slight, a **low** impact. Erosion would be reduced if construction occurs during the dry season.

Soil compaction would occur if soil particles are pressed together by heavy equipment, by heavy materials storage and staging areas, or repeated vehicle traffic. When soils are compacted, the pore spaces between soil particles are reduced, restricting infiltration and deep rooting, and reducing the amount of water available for plant growth. When infiltration is reduced, runoff may occur and lead to erosion, nutrient loss, and potential water quality problems (NRCS 1996, 2004). Soil water content influences compaction such that the risk is greatest when soils are moist or wet; dry soils are much more resistant to compaction than moist or wet soils (NRCS 1996, 2004). Other factors affecting compaction include the pressure exerted upon the soils (from heavy equipment or vehicles), soil characteristics (organic matter content, clay content and type, and texture), and the number of passes by equipment or vehicle traffic (NRCS 1996).

Soils in the project area generally have low to moderate resistance to soil compaction. This means that the traffic and equipment operating directly on soils would likely compact the soil, especially if the soils are moist or wet. Soil compaction would be expected where equipment operates off access roads, such as during tower and counterpoise construction, and at pulling and tensioning sites. Temporary compaction would be a **moderate** impact during construction. To limit soil compaction, heavy equipment and vehicles would only be operated on access roads and within approved construction footprints; off-road construction would be limited to dry conditions if possible. Compaction could be further prevented or reduced by recommended mitigation such as covering soils with a layer of fabric, gravel, or crushed rock and using mats under machinery during construction; tilling soils after construction; and adding features to block unauthorized use (see Section 14.2.8, Recommended Mitigation Measures). Following these methods to reduce compaction, long-term impacts on soils not under roads, towers, and substations would be **low**.

Permanent effects to soils would occur from placement of towers, access roads, and substations. Though road construction has the potential to cause mass wasting along hillsides, road grades would be varied depending on the erosion potential of the soil, and roads would be rocked where needed to stabilize them, prevent dust, increase their load-bearing capacity, or increase the seasons the roads could be used. Road design would take slopes, soil types, bedrock, and other factors into account based on site-specific information. Soil under towers, access roads, and substations also would be permanently compacted, reducing soil productivity; a long-term **high** impact.

Most soils crossed by the action alternatives are not susceptible to subsidence (NRCS 2010a, 2010b, 2010c); a small portion of the project northwest of Lacamas Lake is potentially susceptible (see Section 14.1.2, Soils). Subsidence caused by lowering groundwater tables during construction of the project, or from compaction by heavy machinery, could damage nearby utilities, roads, and foundations. Low-lying areas could subside and be underwater

permanently or seasonally. However, because the area of subsidence-prone soils is small, intersecting shallow groundwater that would cause subsidence is unlikely, and the overall impact would be **low**.

14.2.2.2 Operation and Maintenance

Operation and maintenance activities could increase erosion potential. Maintenance would involve various sized vehicles and equipment traveling on access roads. However, anticipated erosion rates would remain at or near current levels, once areas are revegetated. Operational mitigation measures, including facility maintenance and monitoring, would limit long-term soil erosion, and long-term impacts would be **low**.

14.2.2.3 Sundial Substation

No mapped landslides are documented within the Sundial site; however, the site is within a lahar deposit originating from Mt. Hood. In the event of a large earthquake, or volcanic event at Mt. Hood, mudflows could reach the site, though the probability of such an event is low. If an earthquake did occur, soils at the site are moderately to highly susceptible to liquefaction.

Substation installation would cause ground disturbance, causing soil erosion (decreasing over time during operations and maintenance, as vegetation becomes reestablished), and soil compaction (both temporary and permanent). Because the soils have a slight erosion-hazard potential (the site is very flat with little chance for sediment to move off-site), impacts to soils from erosion would be **low**.

Soils at the Sundial site have a moderate-to-low resistance to soil compaction (NRCS 2010b). Permanent compaction under the substation would be a **high** impact because soils would no longer be available for agriculture (a use that partially occur around the site), and wetlands present at the site could be filled. Temporary soil compaction in the disturbance area outside the substation footprint would be **moderate** during construction; use of measures such as avoiding work in wet soils, covering susceptible soils and supporting equipment during construction, and tilling soils after construction would reduce compaction; long-term, the project would create **low** compaction impacts.

14.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 14.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

14.2.3.1 Casey Road

The Casey Road site is underlain by igneous bedrock so the substation site is unlikely to be affected by liquefaction during an earthquake. No mapped landslides are within the site.

Similar soils impacts as those described for the Sundial site would occur at the Casey Road site. Soils at the Casey Road site have a severe erosion-hazard potential. Erosion during construction would be mitigated, and impacts would be **low-to-moderate**. During operations, impacts from erosion would be reduced to **low**. Additional measures could further reduce or prevent erosion (see Section 14.2.8, Recommended Mitigation Measures).

The Casey Road site soils also have a low resistance to soil compaction. Permanent compaction under the Casey Road Substation would be a **high** permanent impact because soils would no

longer be used for timber production. Similar to the Sundial site, temporary compaction impacts to soils in the disturbance area outside the substation footprint would be **moderate** during construction and **low** long-term after implementation of mitigation measures.

14.2.3.2 Baxter Road

The Baxter Road site is also underlain by igneous bedrock similar to the Casey Road site so the site is unlikely to be affected by liquefaction during an earthquake. No mapped landslides are within the site.

Similar soil impacts as those described for the Sundial and Casey Road sites would occur at the Baxter Road site. Soils at the site have a severe erosion hazard potential. Erosion impacts would be **low-to-moderate** with mitigation. During operations, erosion impacts would be reduced to **low**. Soil compaction under the substation would have a **high** permanent impact because soils would no longer be used for timber production. Similar to the Sundial and Casey Road sites, temporary compaction impacts in the disturbance area outside the substation footprint would be **moderate** during construction and **low** long-term after implementation of mitigation measures.

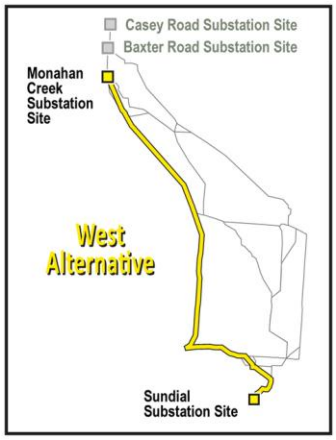
14.2.3.3 Monahan Creek

The Monahan Creek site is underlain by sedimentary bedrock overlain by alluvial deposits. The substation is unlikely to be affected by liquefaction during an earthquake. No mapped landslides are within the site.

Similar soil impacts to those described for the other substation sites would occur at this site. Soils have a moderate-to-severe erosion-hazard potential. Erosion during construction would be mitigated and impacts would be **low-to-moderate**. During operations, impacts from erosion would be reduced to **low** with implementation of mitigation and as vegetation is reestablished. Additional measures could further reduce or prevent erosion (see Section 14.2.8, Recommended Mitigation Measures).

Soils at the site have a moderate-to-low resistance to soil compaction. Permanent compaction would cause a **high** impact under the substation because soils would no longer be used for livestock grazing. Soil compaction in the adjacent disturbance area would be similar to other substation sites (temporarily **moderate** during construction and **low** in the long-term after implementation of mitigation measures).

14.2.4 West Alternative



The northern portion of the West Alternative (north of the Lewis River) is within potentially landslide-susceptible terrain and crosses mapped landslides (see Maps 14-1A through 14-1D and Appendix J). If a landslide occurred along the West Alternative near roads or urban development, debris flows could reach roads, which could cause damage or block traffic. A landslide along the Coweeman River could affect habitat and sensitive species within WDFW priority habitat, with possible sediment transport to the river or other streams in the area. To mitigate for possible

damage from landslides, towers and roads would be built to appropriate design standards, taking into account soil stability.

Similar to impacts common to action alternatives, construction of the West Alternative would create temporary and permanent soil erosion, compaction, and movement of sediment off site, and permanent effects where impervious surfaces are built. Construction activities requiring excavation would disturb soils and remove or damage vegetative cover. Temporary increases in soil erosion could occur in the northern portion of the West Alternative where soils are severely susceptible to erosion (see Maps 14-2A and 14-2B). About 211 acres of soil with a severe erosion hazard would be disturbed along the West Alternative (see Table 14-1). During construction, implementation of mitigation measures such as minimizing the disturbance area, preserving vegetative cover, limiting the amount of time soil is exposed, and installing appropriate access-road drainage would reduce potentially high impacts to **low-to-moderate** erosion impacts (see Table 3-2). Additional measures such as conducting site-specific evaluations of soil conditions and performing construction during the dry season could further prevent or reduce erosion (see Section 14.2.8, Recommended Mitigation Measures).

Table 14-1 Potential Soil Impacts[1]

Alternatives and Options	Soil Erosion-Hazard Potential (acres)			Permanent Soil Compaction (acres)[3]	Temporary Soil Compaction (acres)[4]
	Slight[2]	Moderate[2]	Severe or Very Severe[2]		
West Alternative	**131**	**141**	**211**	**238**	**163**
West Option 1	+9	-7	-5	+1	-3
West Option 2	-12	+9	+12	+8	+6
West Option 3	-11	-4	+44	+13	+13
Central Alternative	**73**	**40**	**596**	**262**	**164**
Central Option 1	N/C	-<1	+33	+3	-5
Central Option 2	-<1	+38	-38	+31	-11
Central Option 3	+1	+<1	-31	-3	-6
East Alternative	**74**	**70**	**664**	**235**	**157**
East Option 1	+5	+37	-47	+28	-9
East Option 2	N/C	-6	-60	-4	+3
East Option 3	N/C	-2	+3	-2	+3
Crossover Alternative	**72**	**85**	**478**	**253**	**157**
Crossover Option 1	+7	+25	-3	+14	+12
Crossover Option 2	-<1	-35	+67	-14	+25
Crossover Option 3	-<1	-35	+59	-19	+15

Notes:

N/C – No net change from the action alternative.

The value for each option represents the net change from the action alternative. It was calculated as the total acres of hazard potential or soil compaction added by the option minus the acres of hazard potential or soil compaction in the segments the option replaces.

Acres of new roads, towers (0.065 acre per tower), and substations within each soil erosion hazard class.

3. Compacted area under new roads, towers, and substations.

4. Temporarily compacted area from construction of towers.

Sources: Golder 2010; NRCS 2010a, 2010b, 2010c

Temporary erosion control measures would be maintained until vegetation reestablished or permanent erosion control measures were in place.

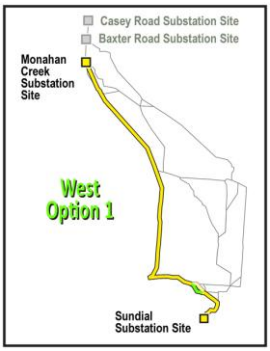
Temporary increases in soil erosion during construction in areas where the erosion-hazard potential is moderate would be a **moderate** impact, and south of the Lewis River, where the erosion-hazard potential is slight; a **low** impact. Erosion would be reduced if construction occurs during the dry season.

Erosion impacts during operation and maintenance would be **low** because temporary erosion control measures would be maintained until vegetation reestablished or permanent erosion control measures were in place.

Soils along the West Alternative generally have low-to-moderate resistance to soil compaction. Similar to impacts common to the action alternatives, though temporary soil compaction would be **moderate**, implementation of mitigation measures such as avoiding work in wet soils, covering susceptible soils and supporting equipment during construction, and tilling soils after construction would reduce compaction; **low** long-term impacts would occur on soils not under towers and roads. About 238 acres would be permanently compacted under towers and roads, reducing soil productivity; a long-term **high** impact (see Table 14-1).

A small portion of the West Alternative (about 61 acres), northwest of Lacamas Lake on the east side of Vancouver, is potentially susceptible to ground subsidence. Subsidence resulting from construction and operation of the project could damage nearby utilities, roads, and foundations.

14.2.4.1 West Option 1



West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. West Option 1 crosses soils with a slight erosion-hazard potential (see Map 14-2D and Table 14-1) and a low resistance to compaction. West Option 1 also includes about 0.7 acre of construction in areas of potentially subsidence-prone soils.

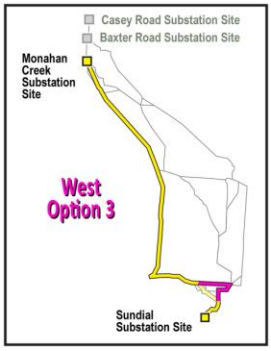
Impact levels on soils would be the same as the West Alternative.

14.2.4.2 West Option 2

West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. West Option 2 crosses soils with moderate-to-severe erosion-hazard potential on steeper slopes (see Table 14-1) and low resistance to compaction.

Impact levels on soils would be the same as the West Alternative.

14.2.4.3 West Option 3



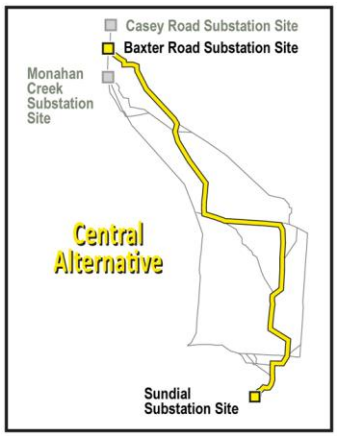
West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing the rural residential and rural areas farther east. West Option 3 crosses a mapped landslide area near Matney Creek. In this area and in other potential landslide areas (see Maps 14-1A through 14-1D), appropriate engineering designs would lessen the risk of landslide damage.

West Option 3 crosses soils with moderate-to-severe erosion-hazard potential on steeper slopes (see Table 14-1). West Option 3 crosses a higher percentage of soils with a severe erosion-hazard potential as the option moves east into the Cascade foothills. Additional measures could further reduce or prevent erosion (see Section 14.2.8, Recommended Mitigation Measures).

West Option 3 crosses soils with a low resistance to compaction.

Impact levels on soils would be the same as the West Alternative.

14.2.5 Central Alternative



Most of the Central Alternative is within potentially landslide-susceptible terrain and crosses several mapped landslides (see Maps 14-1A through Map 14-1D and Appendix J). To mitigate for possible damage from landslides, towers would be built to appropriate design standards, taking into account soil stability.

Similar to the West Alternative, construction of the Central Alternative would cause temporary and permanent changes to soils from erosion, compaction, or from creation of impervious surfaces. Temporary increases in soil erosion could occur along most of the Central Alternative, where soils are severely susceptible to erosion, similar to the northern portion of the West Alternative. About 596 acres of soil with a severe erosion hazard would be disturbed along the Central Alternative (see Table 14-1). With mitigation, construction would cause **low-to-moderate** erosion impacts. Additional mitigation measures could further prevent or reduce erosion, such as conducting site-specific evaluations of soil conditions, and performing construction during the dry season (see Section 14.2.8, Recommended Mitigation Measures).

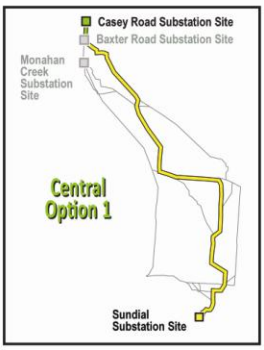
Temporary increases in soil erosion during construction in areas where the erosion-hazard potential is moderate would be a **moderate** impact and where the erosion-hazard potential is slight, a **low** impact. Erosion would be reduced if construction occurs during the dry season.

Erosion impacts during operation and maintenance would be **low** because temporary erosion control measures would be maintained until vegetation reestablished or permanent erosion control measures were in place.

Soils in the northern and southern portions of the Central Alternative generally have low resistance to soil compaction, and soils along the middle portion have moderate resistance. Similar to the other action alternatives, soil compaction would temporarily occur and would be

moderate, but with mitigation measures such as avoiding work in wet soils, covering susceptible soils and supporting equipment during construction, and tilling soils after construction would reduce compaction; long-term impacts on soils not under towers and roads would be **low**. About 262 acres would be permanently compacted under towers and roads, reducing soil productivity; a long-term **high** impact.

14.2.5.1 Central Option 1



Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated forest production and open space land. Central Option 1 crosses soils with a severe erosion-hazard potential near Castle Rock (see Table 14-1) and soils with a low resistance to compaction.

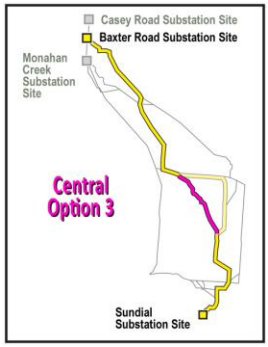
Impact levels on soils would be the same as the Central Alternative.

14.2.5.2 Central Option 2

Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. This option would add a new route running southeast from the Monahan Creek substation site through sparsely populated land, crossing the unincorporated community of West Side Highway next to SR 411, the Cowlitz River and I-5, and running through largely unpopulated land toward the east. Central Option 2 crosses a mapped landslide area near Longview (see Map 14-1A and Appendix J). In this area, and in other potential landslide areas, appropriate engineering designs would lessen the risk of landslide damage. Central Option 2 crosses soils with a severe erosion-hazard potential near Lexington, but crosses less of this soil type overall (see Table 14-1). Central Option 2 crosses soils with a low-to-moderate resistance to compaction.

Impact levels on soils would be the same as the Central Alternative.

14.2.5.3 Central Option 3



Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. Central Option 3 crosses mapped landslide areas near Amboy and the East Fork Lewis River (see Map14-1C and Appendix J). In this area, and in other potential landslide areas, appropriate engineering designs would lessen the risk of landslide damage. Central Option 3 crosses soils with a moderate-to-severe erosion-hazard potential southeast of Amboy, but crosses less of this soil type overall (see Table 14-1). Most of Central Option 3 crosses soils with a moderate resistance to compaction, with some areas south of the East Fork Lewis River rated with low resistance.

Impact levels on soils would be the same as the Central Alternative.

14.2.6 East Alternative

The East Alternative would be constructed along the most remote and rugged route of the action alternatives.

Most of the East Alternative is within potentially landslide-susceptible terrain and the East Alternative crosses several mapped landslides (see Maps 14-1A through 14-1D and Appendix J). To mitigate for possible damage from landslides, towers would be built to appropriate design standards, taking into account soil stability.

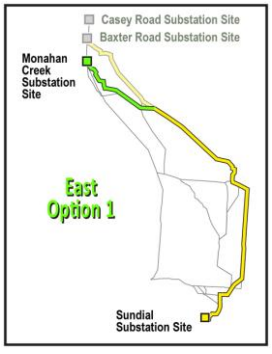
Similar to the West and Central alternatives, construction of the East Alternative would cause temporary and permanent soil erosion. Temporary increases in soil erosion could occur along most of the East Alternative, where soils are severely susceptible to erosion (see Maps 14-2A through map 14-2D). About 664 acres of soil with a severe erosion hazard would be disturbed along the East Alternative (see Table 14-1). With mitigation, construction would result in **low-to-moderate** impacts. Additional measures could further prevent or reduce erosion, such as conducting site-specific evaluations of soil conditions and performing construction during the dry season (see Section 14.2.8, Recommended Mitigation Measures).

Temporary increases in soil erosion during construction in areas where the erosion-hazard potential is moderate would be a **moderate** impact, and where the erosion-hazard potential is slight, a **low** impact. Erosion would be reduced if construction occurs during the dry season.

Erosion impacts during operation and maintenance would be **low** because temporary erosion control measures would be maintained until vegetation reestablished or permanent erosion control measures were in place.

Similar to the Central Alternative, soils in the northern and southern portions of the East Alternative generally have low resistance to soil compaction and soils along the middle portion have moderate resistance. Similar impacts would occur (**moderate** during construction but reduced by mitigation measures and low long-term impacts on soils not under towers and roads). About 235 acres of soil would be permanently compacted under towers and roads, reducing soil productivity; a long-term **high** impact.

14.2.6.1 East Option 1



East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. East Option 1 would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. East Option 1 crosses mapped landslide areas near the Cowlitz River (see Map 14-1A and Appendix J). In this area, and in other potential landslide areas, appropriate engineering designs would lessen the potential risk of landslide

damage. East Option 1 crosses soils with a severe erosion-hazard potential near Lexington, but crosses less of this soil type overall (see Table 14-1). East Option 1 crosses soils with a low resistance to compaction.

Impact levels on soils would be the same as the East Alternative.

14.2.6.2 East Option 2

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. East Option 2 crosses mapped landslide areas along Salmon Creek (see Map 14-1C and Appendix J). In this area, and in other potential landslide areas, appropriate engineering designs would lessen the risk of landslide damage.

East Option 2 crosses soils with severe erosion-hazard potential south of Yale Dam and east of Amboy, but crosses less of this soil type overall (see Table 14-1). The northern half of East Option 2 crosses soils with a moderate resistance to compaction. Most of the southern half is comprised of soils with low resistance.

Impact levels on soils would be the same as the East Alternative.

14.2.6.3 East Option 3

East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. East Option 3 crosses soils with severe erosion-hazard potential east of the upper reaches of the Washougal River (see Table 14-1). East Option 3 crosses some soils with low resistance to compaction.

Impact levels on soils would be the same as the East Alternative.

14.2.7 Crossover Alternative

Similar to the Central and East alternatives, most of the Crossover Alternative is within potentially landslide-susceptible terrain. The Crossover Alternative also crosses several mapped landslides (see Maps 14-1A through 14-1D and Appendix J). To mitigate for possible damage from landslides, towers would be built to appropriate design standards, taking into account soil stability.

Similar to the other action alternatives, the Crossover Alternative would cause temporary and permanent changes to soils. Temporary erosion along the middle and lower portions would be similar to the other action alternatives where soils are severely susceptible to erosion. About 478 acres of soil with a severe erosion hazard would be disturbed along the Crossover Alternative (see Table 14-1). Mitigation would be implemented as described for impacts common to the action alternatives, and construction would result in

low-to-moderate erosion impacts. Additional measures could further prevent or reduce erosion (see Section 14.2.8, Recommended Mitigation Measures).

Temporary increases in soil erosion during construction in areas where the erosion-hazard potential is moderate would be a **moderate** impact, and where the erosion-hazard potential is slight, a **low** impact. Erosion would be reduced if construction occurs during the dry season.

Erosion impacts during operation and maintenance would be **low** because temporary erosion control measures would be maintained until vegetation reestablished or permanent erosion control measures were in place.

Soils along the northern and southern portions of the Crossover Alternative generally have low-to-moderate resistance to soil compaction, and soils along the middle portion have moderate resistance. Similar impacts would occur (**moderate** during construction but reduced by mitigation measures and **low long-term impacts on soils not under towers and** roads). About 253 acres of soil would be permanently compacted under towers and roads, reducing soil productivity; a long-term **high** impact.

14.2.7.1 Crossover Option 1

Crossover Option 1 would remove a portion of the alternative crossing north–south through rural residential areas north of Camas between NE Zeek Road and SE 23rd Street, and replace it with a route running west along an existing right-of-way until about NE 232nd Avenue, then southeast through open fields and more rural residential areas. Crossover Option 1 crosses soils with moderate-to-severe erosion-hazard potential (see Table 14-1) and soils with a low resistance to compaction. Crossover Option 1 also crosses about 8 acres of subsidence-prone soils.

Impact levels on soils would be the same as the Crossover Alternative.

14.2.7.2 Crossover Options 2 and 3

Crossover Options 2 and 3 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land. Crossover Option 3 would require some additional new right-of-way. Crossover Options 2 and 3 cross soils with a severe erosion-hazard potential near Castle Rock (see Table 14-1).

Crossover Options 2 and 3 cross soils with a low resistance to compaction, similar to Central Option 1.

Impact levels on soils would be the same as the Crossover Alternative.

14.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional mitigation measures have been identified to further reduce or eliminate adverse soil impacts by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Consider covering soils highly susceptible to compaction with construction matter or a layer of geotextile fabric and gravel or crushed rock on top.
- Till the soils after construction is completed to reduce the degree of compaction if soils are noticeably compacted; this would need to be done carefully to avoid increasing the potential for erosion.
- Place appropriate access controls, such as berms, ditches, gates and fencing, to prevent future unauthorized use of access roads and cleared right-of-way, and to reduce the potential for soil compaction resulting from foot traffic and off-road vehicles.
- Avoid working, dewatering, or clearing areas underlain by organic or soft soil, to the extent possible.
- Use wooden or synthetic construction mats to spread loading from machinery and personnel working on the project, if necessary, for work in areas underlain by organic or soft soil.
- Conduct additional site-specific evaluations in areas of potential landslides to determine degree of recent activity, likelihood of activation or reactivation, potential setbacks, and site-specific stability as appropriate. Site towers in areas not underlain by landslides. If necessary, design site-specific mitigation measures.
- Avoid crossing identified landslide areas with new access roads.
- Conduct location-specific subsurface investigations (i.e., geotechnical drilling) at locations of substations and towers potentially underlain by liquefaction-susceptible soils to evaluate the potential of these soils to liquefy during an earthquake.
- Reduce soil liquefaction through site-specific measures, such as deep foundations (e.g., piles) or soil improvement, if substations or towers are underlain by liquefaction-susceptible soils.

14.2.9 Unavoidable Impacts

Constructing and maintaining the project, regardless of the alternative selected, would cause erosion. The amount of erosion would depend on the route selected, the inherent erodability of the soil, slope, and similar site factors. The effects from such erosion on surface waters would depend on the location of water bodies in relation to project features, such as access roads and the right-of-way. With the implementation of BMPs listed in Table 3-2 and Section 14.2.8, Recommended Mitigation Measures, and modern construction techniques, impacts from erosion would be minor and would not affect nearby water bodies. Following the completion of construction, erosion would decrease and only **low** impacts from erosion would occur from operating and maintaining the project.

Unavoidable soil compaction would result from constructing the project. Access roads and tower and substation foundations would remain compacted for the life of the line. In areas of temporary compaction, such as at construction staging areas, soil compaction would be most severe at the time of construction and would become less severe as the compacted soil is broken up by burrowing animals, plant roots, freeze-thaw, wet and dry cycles, and other natural processes that rework soil. There would be short-term loss of soil productivity in areas underlain by temporarily compacted soil, but productivity would increase with the passage of time.

The project, regardless of the action alternative selected, would have unavoidable exposure to earthquake and volcanic activity since these activities have historically occurred in the area, and are unpredictable. Transmission towers, access roads and substations are not designed to withstand the effects of major landslides, lahars, and ashfall, and impacts could not be avoided.

14.2.10 No Action Alternative

If the project were not built, existing activities within the project area would continue, such as agriculture, urban and suburban development, timber production, road construction and maintenance and recreational use, as well as maintenance activities on existing transmission lines including those owned by BPA. Existing forest roads would continue to be used and maintained. These activities could cause or increase landslides, soil erosion, soil compaction, and soil subsidence (where underlain by soft or organic soils). The degree to which these effects would occur in the future would depend on the practices used; the amount of agricultural, development, and timber production activities that occur; and the topographic, climatic, and geologic conditions where these activities take place. Other impacts described specifically from this project would not occur.

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Chapter 15 Water

This chapter describes water resources (watersheds, riparian buffers, floodplains, surface water, and groundwater) in the project area, and how the project alternatives could affect these resources. Related soils information can be found in Chapter 14, Geology and Soils. Information on water resources within wetlands can be found in Chapter 16, Wetlands. Related information about hydrologic changes, sediment delivery, and floodplain and riparian impacts can be found in Chapter 19, Fish, and Appendix K, Assessment of Relative Fish Habitat and Fish Population Impacts of I-5 Corridor Reinforcement Project Alternatives and Options.

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

15.1 Affected Environment

15.1.1 Watersheds

The action alternatives cross three major watersheds in Washington: the Cowlitz, Lewis, and Salmon/Washougal watersheds (Water Resource Inventory Areas 26, 27, and 28) (see Map 15-1). In Cowlitz County, the alternatives cross the following major sub-watersheds: the Lacamas, Delameter, Lower Cowlitz, Ostrander, Lower Coweeman, Upper Coweeman, Lower Kalama, Middle Kalama, Cathlapotle, Lake Merwin, and Cougar. In Clark County, the alternatives cross the following major sub-watersheds: the Yacolt, Cedar Creek/Chelatchie Creek, Canyon Creek/Fly Creek, Vancouver, Horseshoe Falls, Lacamas Lake, Rock Creek, Little Washougal, West Fork Washougal, and Mount Zion. In Oregon, the project crosses the Columbia River and two watersheds: the eastern end of the Columbia Slough-Frontal Columbia River watershed and the western edge of the Beaver Creek-Sandy River watershed. Both are sub-watersheds of the Lower Willamette watershed in Multnomah County.

Watershed conditions vary among and within these sub-watersheds. The action alternatives cross different precipitation zones, geology (see Chapter 14, Geology and Soils) and vegetation cover types (see Chapter 17, Vegetation). Precipitation increases water available for runoff and erosion. Underlying geology and slopes influence the susceptibility to erosion. Vegetation cover is an important factor in mitigating snow accumulation, snowmelt, runoff, and erosion. Precipitation increases west to east and occurs mostly as rain. Snow accumulation is limited and occurs at higher elevations.

For the purposes of this analysis, the Integrated Watershed Assessment (IWA) natural erodibility rating used WDNR's 1:100,000 scale 2010 Geology dataset to determine underlying geology. Most action alternatives cross underlying geology with low erodibility (massive igneous and sedimentary rocks) and gentle slopes (see Appendix K, Assessment of Relative Fish Habitat and Fish Population Impacts of I-5 Corridor Reinforcement Project Alternatives and Options). Highly erodible geology (unconsolidated sediment of alluvial, glacial or volcanic origin) is confined to several large river valleys and lowland areas. Developed and agricultural land use is also found mostly in lowland areas and along large river valleys (see Chapter 5, Land). Hardwood and conifer forest cover occurs naturally throughout the project area. The action alternatives cross large areas of forest managed for timber production.

15.1.2 Riparian Buffers

Washington and Oregon, and their counties and incorporated cities, have regulations intended to protect rivers and creeks and their tributaries. Regulating agencies establish buffers as boundaries between local waterways and existing or future development that help protect rivers and streams by filtering pollutants, providing flood control, preventing bank erosion, mitigating warming, and providing room for lateral movement of the waterway channel. These buffers also provide important habitat for wildlife. Riparian buffer widths range from 0 to 200 feet in Cowlitz County, and from 75 to 200 feet in Clark County, depending on stream flow (perennial or seasonal) and the presence or absence of fish.

The action alternatives cross non-forested and forested riparian buffers. Non-forested riparian buffers provide little to no stream shade and occur mostly in developed and agricultural land uses and in existing transmission line corridors. Riparian buffers containing conifers are common at higher elevations within the project area, especially in timber production lands. Riparian buffers containing conifers provide greater levels of stream shade. Hardwood riparian buffers are most common at lower elevations and provide less stream shade.

15.1.3 Floodplains

The Federal Emergency Management Agency (FEMA 1996) developed Flood Insurance Rate Maps as the official regulatory flood map for communities. These maps show 100-year floodplains and corresponding base flood elevations. In Washington, the action alternatives cross 15 FEMA designated 100-year floodplains of the following water bodies: Leckler Creek, Cowlitz River, Coweeman River, Kalama River, Little Kalama River, Lewis River, East Fork Lewis River, Salmon Creek, Burnt Bridge Creek, Little Washougal River, Washougal River, Lacamas Creek, Ostrander Creek, Speelyai Creek, and Canyon Creek (see Maps 15-2A through 15-2D). The project crosses the FEMA 100-year floodplain of the Columbia River in Washington and Oregon; it does not cross any other floodplains in Oregon.

Similar to riparian buffers, which are often located in floodplains, floodplains provide benefits to the human and natural environment. These areas, if undeveloped, prevent flooding to adjacent areas, filter pollutants, are typically nutrient rich, and also provide diverse wildlife habitat.

15.1.4 Surface Water

The action alternatives cross rivers and creeks mentioned in Section 15.1.3, Floodplains, and many other streams (**perennial**, **intermittent**, and **ephemeral**) (see Maps 15-2A through 15-2D). The West Alternative would have the fewest new river, stream, and creek crossings by the transmission line right-of-way and new access roads outside of the right-of-way (about 219 crossings). The Central Alternative would have about 301 crossings, the East Alternative would have about 277 crossings, and the Crossover Alternative would have about 297 crossings.

Section 303(d) of the Clean Water Act (EPA 2008a) requires states to maintain a list (commonly known as the 303(d) list) of all surface waters in the state for which beneficial uses, such as drinking, recreation, aquatic habitat, and industrial use, are impaired by pollutants. This list includes water quality limited estuaries, lakes, and streams that do not meet state surface water quality standards and are not expected to improve within 2 years.

The following 13 streams listed as impaired on Washington's 303(d) list are crossed by the action alternatives: Arkansas Creek, Monahan Creek, Delameter Creek, Ostrander Creek, South Fork of Ostrander Creek, Coweeman River, Riley Creek, Lockwood Creek, Mason Creek, East Fork of Lewis River, Salmon Creek, Dwyer Creek, and Lacamas Creek (see Maps 15-2A through 15-2D). Most of these streams are listed for elevated water temperature. Riley Creek and Lacamas Creek are listed for elevated levels of fecal coliform, and Dwyer Creek and Lacamas Creek are listed for low levels of dissolved oxygen. No streams listed as impaired on Oregon's 303(d) list are crossed by the project.

Some surface water is used as drinking water. The City of Camas supplements its drinking water from two surface water diversions dams along Jones and Boulder creeks within the Little Washougal watershed. Scoping comments indicated there are many other landowners along the action alternatives who get all or some of their drinking water from similar diversions dams or other means along streams and creeks high up in watersheds in the project area. Groundwater used for drinking water is also in direct contact with these surface waters.

15.1.5 Groundwater

Groundwater supply sources in the project area that are used for domestic, municipal, commercial, agricultural, and industrial needs come from several aquifers within unconsolidated alluvial, glacial, outburst flood, eolian (wind), and volcanic deposits, and sedimentary and igneous bedrock. These aquifers are important water sources because of their location in generally flat lowlands where human activities are concentrated. Aquifers in igneous bedrock (i.e., volcanic materials) occur mostly in the interconnected open spaces in interflow zones (between individual lava flows). These interflow zones can yield large volumes of water.

The Troutdale Aquifer in the southwestern portion of the project area is the area's only **sole source aquifer** (EPA 2008b; see Map 15-3). This sandstone and gravel dominated aquifer provides about 99 percent of available drinking water for Clark County. The Troutdale Aquifer extends into Oregon although it is not designated a sole source aquifer in Oregon and not shown or labeled as such on Map 15-3.

The Critical Aquifer Recharge Area (CARA) ordinance provides local governments with a mechanism to protect the functions and values of a community's drinking water by preventing pollution and maintaining supply. Category 1 areas are highly susceptible to groundwater contamination; Category 2 areas are moderately susceptible to groundwater contamination. Category 1 and Category 2 CARAs are present in the project area in Clark County, Washington (Clark County, Washington 2009a; see Map 15-3). No CARA data are available for Cowlitz County, Washington. In Oregon, no CARAs are present at the Sundial substation site.

Sources of water for domestic, municipal, commercial, agricultural, and industrial uses identified along the action alternatives include **water rights** (legal authorizations to use a certain amount of public water for a designated purpose), **water wells** (exempt and non-exempt wells in the Ecology Well Database), and **source wells** (Groups A and B) (see Map 15-4). Washington's specific designation for public water systems regulated by the federal Safe Drinking Water Act (SDWA) is Group A. Group B wells are public water systems in Washington smaller than the minimum cut-off defined by the SDWA (Ecology 2010a).

An approximately 0.25-mile-wide corridor along each action alternative—0.125-mile (one-eighth mile) on either side of the proposed transmission line right-of-way—was used as the study area

to identify the number of existing groundwater source wells, water wells, and water rights near the action alternatives, including near new and improved access roads (see Map 15-4). This study area was designed to capture any existing wells and water rights in the vicinity whose location may have been inaccurately recorded. For example, many wells and water rights are assigned the coordinates of the center of the quarter section in which they are located, regardless of their actual location. It is also possible that wells are present within 0.125 mile of the action alternatives that are not recorded. Water rights, water wells, and source wells outside of the 0.25-mile-wide study area are considered to have no risk of impact from the project.

In Oregon, source wells or water wells are not found within the study area, but several monitoring wells exist near the Sundial substation site. These wells were installed at the former Reynolds Metals Company aluminum reduction plant in Troutdale, Oregon (see Section 10.1.2.3, Reynolds Metals Company Site).

Wellhead protection areas are surface and subsurface zones surrounding a well or a public water system **wellfield** that are in place to reduce the risk of water source contamination from spills and contaminant discharges. Delineated wellhead protection areas are based on estimated groundwater travel times from the surrounding aquifer area to the wellhead. Emergency spill response programs are one of the key requirements for water purveyors within wellhead protection areas. Wellhead protection zones were identified in the project area for 1-year and 10-year travel times (ODEQ 2007; Washington State Department of Health 2010; see Map 15-4).

At the substation sites, the hydrogeology surrounding each site was determined using well logs within a 1-mile radius of each site:

- The Sundial site consists of interbedded sand, gravel, cemented sand and gravel, and silt (based on information from four wells). The depth to groundwater ranges from 11 to 29 feet below ground. These sedimentary deposits form a highly permeable aquifer with well yields ranging from about 20 gallons per minute (gpm) for a domestic well, to over 2,000 gpm for properly designed municipal supply wells.
- The Casey Road site consists of 10 to 70 feet of silt and clay overlying basaltic and sedimentary bedrock (siltstone, sandstone, and claystone) (based on information from 32 wells). All wells terminate in the basalt or sedimentary bedrock. The depth to groundwater ranges from 18 to 205 feet below ground. The sedimentary bedrock generally has low permeability, with well yields ranging from less than 1 gpm to 100 gpm. Most wells produced less than 20 gpm.
- The Baxter Road site consists of 15 to 60 feet of silt and clay overlying sedimentary bedrock (siltstone, sandstone, and claystone) (based on information from 16 wells). All wells terminate in the sedimentary bedrock. The depth to groundwater ranges from 4 to 170 feet below ground. The sedimentary bedrock generally has low permeability, with well yields ranging from less than 1 gpm to 20 gpm.
- The Monahan Creek site consists of 10 to 70 feet of silt and clay overlying basaltic and sedimentary bedrock (siltstone, sandstone, and claystone) (based on information from 24 wells). All wells end in the basalt or sedimentary bedrock. The depth to groundwater ranges from 3.5 to 185 feet below ground. The sedimentary bedrock generally has low permeability, with well yields ranging from about 1 gpm to 20 gpm.

15.2 Environmental Consequences

See Chapter 19, Fish and Appendix K for more information on ecological (hydrology, sediment delivery, floodplain, riparian) and fish habitat impacts.

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

15.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Long-term changes in watershed conditions that result in high impairment to hydrology or sediment functions
- Permanent changes in riparian habitat conditions that could decrease shade and lead to temperature increases that would adversely affect aquatic life
- Increased water temperature, decreased dissolved oxygen, or increased turbidity in streams listed on Washington's 303(d) list for temperature, dissolved oxygen, or turbidity (no Oregon streams are crossed)
- Increased water temperature, decreased dissolved oxygen, or increased turbidity in any streams to a level that exceeds state standards
- Altered hydraulic function or decreased hydraulic capacity of floodplains to a degree that increases the potential for flooding and damage to personal property
- Surface water contamination from oil and gas spills or herbicide use occurs at levels toxic to aquatic life and is extensive and long-term
- Groundwater contamination occurring because depth to groundwater is at or near the surface (less than 5 feet below ground surface) and surficial sediments are highly-permeable in areas surrounding the rights-of-way or substations

Impacts would be **moderate** where project activities would cause the following:

- Long-term changes in watershed conditions that result in moderate impairment to hydrology or sediment functions
- Increased water temperature, decreased dissolved oxygen, or increased turbidity in stream segments that are not themselves listed, but are immediately upstream or downstream from stream segments listed on Washington's 303(d) list for temperature, dissolved oxygen, or turbidity (no Oregon streams are crossed)
- Increased water temperature, decreased dissolved oxygen, or increased turbidity in streams listed on Washington's 303(d) list for constituents other than temperature, dissolved oxygen, or turbidity
- Groundwater contamination may occur because depth to groundwater is moderate (5 to 20 feet below ground surface) within the depth of potential excavations, and surficial sediments are moderately permeable in areas surrounding the right-of-way or substations

Impacts would be **low** where project activities would cause the following:

- Long-term changes in watershed conditions that result in minor change in existing hydrology or sediment function
- Permanent changes in riparian habitat conditions that result in the loss of stream shade along streams that already have limited shade and stream cooling
- Increased water temperature, decreased dissolved oxygen, or increased turbidity in streams that do not exceed state standards
- Altered hydraulic function or decreased hydraulic capacity of floodplains to a degree that does not increase the potential for flooding and damage to personal property
- Surface water contamination from oil and gas spills or herbicide use occurs at levels that is not toxic to aquatic life or is localized and temporary
- Groundwater contamination is less likely to occur because groundwater is relatively deep (greater than 20 feet below ground surface) compared to potential excavation depths and surficial sediments have low permeability in areas surrounding the rights-of-way or substations

No impact would occur where project activities would not disturb or alter water resources.

Impacts to wellhead protection areas and water rights, source wells, and water wells within 0.125 mile of the alternatives and options and the mitigation for each are described in Section 15.2.2, Impacts Common to Action Alternatives.

15.2.2 Impacts Common to Action Alternatives

15.2.2.1 Construction

The hardened surfaces of new roads and areas disturbed by new road construction could increase surface runoff in streams in watersheds crossed by the action alternatives. Increases could also occur through vegetation removal of hydrologically mature vegetation along rights-of-way. Opening of the tree canopy can cause greater snow accumulation, increased snowmelt in spring, accelerated melt rates, reduced rates of interception and **evapotranspiration**, and increased storm runoff volume due to increased soil moisture or snowmelt. Cutting and backfilling for new access roads, clearing and construction of the new line, and general construction traffic could expose topsoil or loose sediment. During rain events, fine sediment can be eroded from exposed surfaces and delivered to ditches and then to streams.

The action alternatives would affect soil types with different natural erodibility. Construction in more erodible terrain would cause higher sediment delivery impacts. Between about 100 acres and 1,000 acres of vegetation would be cleared (depending on the action alternative) that is currently highly effective in limiting the water available for runoff. About 70 miles of new line, and access roads and two substations would then be built potentially causing additional sediment delivery. However, these impacts would occur across watershed areas of between about 160,000 acres and 240,000 acres. The percent change in runoff and sediment delivery to streams would be less than 1 percent (see Appendix K). Long-term changes in watershed conditions would be minor; however, local **high** impacts from sediment delivery could occur. Properly implementing erosion control measures would minimize the amount of sediment

delivered to streams. Generally, impacts from long-term changes to watershed function would be **low**.

Trees and other vegetation would be removed for the transmission line right-of-way, substations, and new access roads constructed along fish-bearing streams, including trees within buffers that are normally protected under the Washington Forest Practices Act (76.09 RCW) and other land use regulations. Vegetation removal would not occur or would be minimal at many crossings that do not have trees or important buffers. At these and existing crossings where vegetation has already been removed and is not allowed to regrow, there would be **no** impact. Elsewhere, removing vegetation in riparian areas could decrease streamside shade. Reduced shade can lead to higher water temperatures. Generally, stream temperature changes would be greater where removed riparian vegetation is providing greater cover over the stream (see Appendix K). Forested vegetation would be cleared along about 2 to 3 miles of fish-bearing streams. Permanent changes to riparian function at project crossings could occur through the loss of stream shade. At the crossing scale, a range of stream shade would be lost along any action alternative; however, at the watershed scale, this loss could be buffered or moderated by stream cooling provided by shade elsewhere in the watershed (see Appendix K). Generally, crossing-scale impacts to shade from removal of riparian vegetation along fish-bearing streams would range from **low-to-high**. **Low** impacts would occur when the existing shade level is already low and provides limited stream cooling. In this instance, shade loss would cause a relatively minor stream temperature increase. **High** impacts would occur when the existing shade level does provide effective stream cooling and shade loss is more likely to result in temperature increases that adversely affect aquatic life (see Appendix K for more information on target shade levels used in the assessment).

Similarly, vegetation clearing has the potential to impact water quality (specifically turbidity and temperature/dissolved oxygen) in rivers and streams. No streams crossed are currently listed as impaired for turbidity, and with implementation of BMPs for erosion control, state standards for turbidity would continue to be met. Several streams crossed or downstream of crossings are listed on the 303(d) list as impaired due to elevated temperature (see Section 15.1.4, Surface Water). Short-term changes to temperature or dissolved oxygen from the loss of riparian vegetation would be **low-to-high** depending on the existing impairment status of the stream, the length, width, and elevation of the stream, and the shade provided by existing vegetation along the stream. Long-term changes in watershed conditions would be minor; however, local impacts could occur that result in locally high impairment. Generally, long-term changes to watershed function would create **low** impacts.

Except for one tower built on Ione Reef in the Columbia River, towers would not be built in waterways. As described in Section 3.2, Transmission Towers, this tower would be built on a small rock outcrop using coffer dams to allow dewatering of the work zone inside. Work would be conducted from barges stationed on the south side of Ione Reef, out of the navigation channel. All substrate material would be collected from within the sealed coffer dam, transferred to a spoils barge, and transported to an onshore upland area or landfill not within the floodplain. No material would be placed in the Columbia River. Tower support columns would be spaced about 50 feet apart. The open cross section (to stream flow) and round column shapes would allow large debris to pass.

In other locations where towers would be placed near streams or rivers, waterways would be spanned. Some new access roads would cross rivers or larger creeks and new access roads would invariably cross many intermittent tributaries or drainages. Where waterways, including

intermittent drainages, would be crossed, culverts or bridges would be used to ensure unobstructed water passage during flood events. With implementation of BMPs for erosion control, impacts to water quality from construction near or in waterways would be **low**.

Towers, substations, and access roads would be sited to avoid floodplains. Where unavoidable, towers constructed in a floodplain would be designed to allow water flow around the tower legs. Although soil would be more compacted around tower footings or on access roads, it is likely the soil would remain partially porous and that water could still be absorbed. The volume of the tower footings would decrease the amount of water a floodplain could store; however, the volume of the tower footings relative to the volume of floodplain storage would be small given that towers would only be placed in floodplains that are too large to span; impacts would be **low**. However, as channels naturally migrate across their floodplains, streams or overland flood flows could directly impinge on towers. If this occurs, protection measures such as riprap or sheetpile structures could be installed to protect the tower, potentially interfering with stream dynamics, increasing impacts.

Access roads constructed or improved by placing fill material in floodplains could decrease flood storage volume, obstruct flow pathways, and lead to increased flow velocities or flood surface elevations. These effects would be lessened by constructing roads to existing grade when in floodplains. Overall impacts to floodplains would be **low**.

Accidental oil or gas spills from construction equipment and vehicles could cause petroleum products to enter surface water or groundwater. Fuel storage and the refueling of equipment would only be allowed away from natural or manmade drainage conveyances including ditches, catch basins, ponds, wetlands, and pipes. All equipment fueling operations would use pumps and funnels and absorbent pads. Additional fueling and storage requirements apply in some sensitive resource areas. Temporary, localized, **no-to-low** impacts would occur.

Groundwater concerns are typically focused on changes to available water quantity and to water quality. Groundwater quality is of most concern near wellhead protection areas. Petroleum products from accidental spills are the most likely substances to degrade water quality near the action alternatives during construction. Mitigation measures would be used to prevent these substances from reaching groundwater sources (see Table 3-2 and Section 15.2.8, Recommended Mitigation Measures).

Groundwater may be encountered during tower and substation excavations. Excavations for the substations would be about 5 to 8 feet deep. Excavations for towers would be about 11 to 16 feet, depending on the tower type and subsoil conditions (see Chapter 3, Project Components). If groundwater is encountered during excavations, it would be pumped from the excavations and re-infiltrated into the soil at a nearby upland site. The necessity for and degree of dewatering would be decided on a case-by-case basis. Although temporary, direct impacts could occur during excavation work, **no** long-term impacts on groundwater would occur. Holes would be back-filled with a native-rock mixture allowing subsurface water flow. In areas where concrete is used, the tower footings would be small enough in diameter (4 to 10 feet) that groundwater flow would not be impeded. Groundwater flow can be disrupted by building new roads, which increases turbidity through soil-disturbing activities or drilling, and groundwater can be contaminated through accidental spills of hazardous materials (such as fuels, oil) or excavation of existing contaminated soils. Mitigation measures would be implemented to minimize impacts (see Section 15.2.8, Recommended Mitigation Measures, and Table 3-2).

Impacts to groundwater from substation construction are discussed in Sections 15.2.2.3, Sundial Substation, and 15.2.3, Castle Rock Substation Sites.

Some existing groundwater wells, including those identified based on water rights or as water wells or source wells (see Map 15-4), may be located in areas where new or improved roads, towers, and substation sites are proposed. Some municipal and domestic water rights and wells are likely within 0.125 mile of the action alternatives (see Table 15-1). If a decision is made to build a line, the location of all wells and water rights would be confirmed with landowners during land negotiations and during engineering field surveys along the transmission line route before construction. Wells and surface water diversions potentially disturbed by project activities would be relocated, or project activities would be adjusted to avoid them before construction. Since effects to water supply wells would be mitigated, **no** impacts on groundwater supplies would occur.

15.2.2.2 Operation and Maintenance

Operation and maintenance activities along the transmission line would include biannual inspection from helicopters and annual ground inspections from vehicles. Vehicle traffic on access roads would be infrequent, but could cause additional sediment delivery to streams. Properly implementing road drainage BMPs, regular maintenance, and placing rock on roads would reduce erosion on these roads (see Chapter 14, Geology and Soils), reducing the amount of road sediment that would reach streams. In emergencies, vehicles and equipment may need to drive across the right-of-way or other areas, which could temporarily cause erosion and deliver sediment to streams. BPA could mitigate these temporary impacts by rocking roads before and during construction and restoring riparian areas damaged by operation and maintenance activities. Sediment-related impacts to surface water quality in streams from operation and maintenance activities would be **low**.

Maintaining the transmission line right-of-way and access roads by keeping them clear of tall vegetation could reduce stream shade, potentially causing localized increases in water temperature of any adjacent streams. Long-term impacts from the loss of riparian vegetation would be **low-to-high**, depending on the impairment status of the stream, length of stream, and existing vegetation.

Overspray of herbicides used for noxious weed control within the rights-of-way and substation yards also could affect surface-water. However, if vegetation treatment is necessary, all application requirements would be followed and appropriate buffers would be established to prevent herbicides from being deposited in surface waters (BPA 2000b). Use of herbicides and pesticides could also affect groundwater quality. Minimizing use of these materials and appropriate management during use reduces the risk of such effects.

Table 15-1 Summary of Groundwater Supply Sources and Protection Areas[1]

Alternatives and Options	Water Rights				Source Wells (WA)	WA Water Wells	Wellhead Protection (WA and OR)	
	Municipal (WA and OR)	Group Domestic and Domestic Multiple (WA and OR)	All Other (WA and OR)[2]	Total Water Rights			10-yr Time of Travel (miles)[3]	1-yr Time of Travel (miles)[3]
	Number (1/8th Mile from Edge of Right-of-Way or 1/8th Mile from Edge of New or Improved Roads)							
West Alternative	**12**	**776**	**189**	**977**	**75**	**1067**	**17.1**	**3.2**
West Option 1	N/C	N/C	-1	-1	-2	+2	N/C	N/C
West Option 2	N/C	-4	+3	-1	+1	+41	N/C	N/C
West Option 3	N/C	+61	+12	+73	+2	+143	N/C	N/C
Central Alternative	**8**	**141**	**45**	**194**	**31**	**546**	**4.6**	**1.3**
Central Option 1	N/C	+1	N/C	+1	N/C	-4	N/C	N/C
Central Option 2	N/C	+22	+9	+31	-5	-50	-0.3	N/C
Central Option 3	N/C	+34	+14	+48	+12	+90	N/C	N/C
East Alternative	**8**	**121**	**48**	**177**	**23**	**453**	**4.6**	**1.3**
East Option 1	+1	-28	-6	-33	-3	-41	-0.3	N/C
East Option 2	N/C	-2	+3	+1	+3	+29	N/C	N/C
East Option 3	N/C	+2	N/C	+2	+1	-9	N/C	N/C
Crossover Alternative	**8**	**182**	**69**	**259**	**31**	**512**	**8.3**	**1.3**
Crossover Option 1	N/C	+31	+4	+35	+14	+86	N/C	N/C
Crossover Option 2	N/C	+19	+3	+22	+1	+46	N/C	N/C
Crossover Option 3	N/C	+19	+4	+23	+1	+48	N/C	N/C

Notes:

N/C – No net change from the alternative

1. The value for each option represents the net change from the action alternative. It was calculated as the total number or miles added by the option minus the total number or miles in the segments the option replaces.
2. All other water rights refer to those that are not municipal or group domestic/group multiple domestic that could include irrigation, industrial, and single residence sources.
3. Miles of right-of-way and proposed new and improved roads intersected by wellhead protections areas.

Sources: Clark County 2009a, Cowlitz County 2011, Ecology 2010a, ODEQ 2007

BPA would use a variety of vegetation control methods through its Vegetation Management Program, including manual methods (hand-pulling, clippers, chainsaws), mechanical methods (roller-choppers, brush-hogs), biological methods (insects or fungus for attacking noxious weeds), and use of EPA-approved herbicides. All herbicides sold and distributed in the U.S. must be registered with EPA. This means that EPA must conclude that they can be used without posing unreasonable risks to people or the environment, based on scientific evidence (see Chapter 10, Public Health and Safety). BPA uses herbicides as approved in its Transmission System Vegetation Management Program Record of Decision (BPA 2000b). BPA may adopt new herbicides, and if so, would review the effectiveness and the potential environmental impacts, which would include appropriate consultations with regulatory agencies. BPA bases selection of herbicides on the toxicity level, proximity to aquatic habitat, and delivery potential. BPA would use only those herbicides that are identified as "practically non-toxic" to "slightly toxic" near water environments. Any adverse changes would be temporary and localized; a **no-to-low** impact.

15.2.2.3 Sundial Substation

No impacts would occur from increased runoff and erosion, loss of riparian vegetation, or surface water contamination from oil and gas or herbicide use because the Sundial site is not near any water bodies except the Columbia River. Stormwater runoff would not be discharged into the Columbia River because an existing flood protection levee on the south side of the river separates the substation site from the river. **No** impacts to floodplains are expected because the site is outside the 100-year floodplain of the Columbia River.

Well logs show wells within a 1-mile radius of the Sundial site reach into the Troutdale Aquifer. Impacts to groundwater would be **moderate** if contamination from herbicides occurs because of the aquifer's moderate depth to water and highly permeable nature. Construction dewatering (if needed) would likely have **no** long-term impact on existing wells because the high permeability of the aquifer would cause limited drawdown away from the dewatering site, and the rapid recovery of water levels that would occur after dewatering has ended.

Because the Reynolds Metals Company Site is an active NPL or "Superfund" site, and a fluoride-contaminated groundwater plume remains at depths from 30 to 100 feet below the ground, the fluoride in the groundwater is required to be addressed by extraction wells in the intermediate- and deep-zone groundwater, and enhanced focused extraction wells in the shallow groundwater (EPA 2002, CH2MHILL 2005). No water supply wells were identified or are likely to exist in this area, given the groundwater contamination.

15.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 15.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

15.2.3.1 Casey Road

At the Casey Road site, the substation would be constructed over two intermittent, non-fishbearing streams. The streams originate within the substation site. One stream flows north to Rock Creek, about 1,800 feet north of the site; the second stream flows east to join an intermittent, non-fishbearing stream along the eastern boundary of the substation site (which then flows north to Rock Creek). Although direct impact on the intermittent streams would occur, subsurface water would likely continue to flow to nearby

streams. Other perennial and intermittent streams and wetlands south of the substation site would be avoided (see Chapter 16, Wetlands).

An existing culvert provides a crossing over the perennial stream east of the site. Using erosion control measures during construction of the substation and possible improvement of the access road would minimize the sediment transport to any of the adjacent streams and wetlands including the stream that flows to Rock Creek. Impacts on water quality during construction would be **low** if turbidity standards continue to be met.

No impacts would occur from loss of riparian vegetation because riparian vegetation has already been cleared along intermittent streams and clearing would not occur along any other streams. **No** impacts on floodplains would occur because the Casey Road site is not within the 100-year floodplain of any nearby streams.

Well logs show water wells within a 1-mile radius of the Casey Road site terminate in bedrock. The risk of groundwater contamination from herbicides would be **low** because of the moderate to deep depth to water, the low-permeability clay layer over the bedrock, and because the wells are sealed into bedrock. Construction dewatering (if needed) would have **no** long-term impact on existing wells because of the low permeability of the clay and silt materials, which would require minimal dewatering.

During substation operation, stormwater runoff from the Casey Road site would be discharged to a detention pond north of the site (see Figure 4-6, Casey Road Substation). The detention pond would be designed to control stormwater runoff during peak flows; retention times would be short and would not create appreciable increases in water temperature within the pond. Water released from an outlet at the bottom of the pond would flow overland before reaching Rock Creek. Impacts on surface water quality during operation would be **low**.

15.2.3.2 Baxter Road

At the Baxter Road site, the substation would avoid nearby streams and wetlands to the south and west (see Chapter 16, Wetlands). The new and improved access road portions also would avoid streams and wetlands. Using erosion control measures during construction would minimize impacts to water bodies including any streams that flow to Baxter Creek (just east and north of the substation site); impacts on water quality during construction would be **low** if turbidity standards continue to be met. **No** impacts would occur from loss of stream shade because riparian vegetation clearing would not occur. **No** impacts on floodplains would occur because the Baxter Road site is not within the 100-year floodplain of any nearby streams.

Well logs show water wells within a 1-mile radius of the Baxter Road site are sealed into bedrock. The risk of groundwater contamination from herbicides would be **low** because of the low permeability clay layer over the bedrock and because the wells are sealed into bedrock. Construction dewatering (if needed) would have **no** long-term impact on existing wells because of the low permeability of the surficial clay and silt materials, which would require minimal dewatering.

The substation would detain stormwater in a detention pond, then, discharge the water to Baxter Creek, which is not on the Washington State 303(d) list. Similar to the Casey Road site, the stormwater detention pond, southeast of the substation about 1,000 feet upslope from Baxter Creek, would be sized appropriately and built to control stormwater runoff during peak

flows (see Figures 4-4 and 4-5, Baxter Road Substation). Retention times in the detention pond would be short and would not cause appreciable increases in water temperature within the pond. Water released from an outlet at the bottom of the pond would flow overland before reaching Baxter Creek. Impacts to surface water quality during operation would be **low**.

15.2.3.3 Monahan Creek

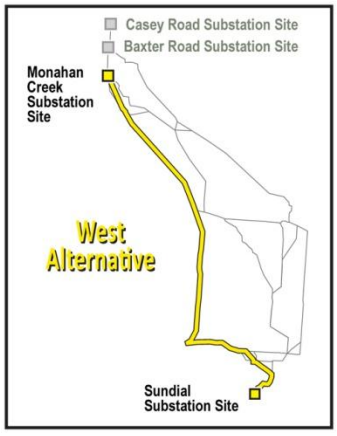
The Monahan Creek site is between Monahan and Delameter creeks about 450 to 500 feet from these streams. Both streams are listed as impaired for elevated temperature near the substation site. However, the substation would be across Delameter and Monahan roads from these streams. Access to the substation would be from Delameter Road and would not cross any streams. Impacts on water quality during construction would be **low**.

No impacts would occur from loss of riparian vegetation because riparian vegetation clearing would not occur. However, about 1,100 square feet of the Monahan Creek site is within the 100-year floodplain of Monahan Creek. The area within the floodplain would be a cutslope excavated to provide a flat area for the substation. The impact on the floodplain would be **no-to-low** because Monahan Road runs between the cutslope and Monahan Creek, decreasing the likelihood that flood flows would access this floodplain.

Well logs show water wells within a 1-mile radius of the Monahan Creek site are sealed into bedrock. The risk of groundwater contamination from herbicides is **low** because of the low permeability clay layer over the bedrock and because the wells are sealed into bedrock. Construction dewatering (if needed) would have **no** long-term impact on existing wells because of the low permeability of the surficial clay and silt materials, which would require minimal dewatering.

Similar to the Casey Road and Baxter Creek sites, a stormwater detention pond would be sized appropriately to control stormwater runoff during peak flows (see Figure 4-1, Monahan Creek Substation). The pond would be built south of the site between Delameter, Garlock, and Otter roads. Retention times in the pond would be short and would not create appreciable increases in water temperature within the pond. Water released from an outlet at the bottom of the pond would flow overland before reaching Delameter Creek. Impacts on surface water quality during operation would be **low**.

15.2.4 West Alternative



Transmission line clearing and road construction would result in about 84 miles (1,285 acres) of potential soil disturbance that could contribute sediment to streams (see Table 15-2). Because most of this alternative occupies an existing transmission line right-of-way, clearing has already occurred in some areas. Compared to the other action alternatives, this would be the least amount of construction. It would cause the least percent increase in runoff (0.09 percent), but the greatest percent increase in sediment delivery to streams (0.25 percent) because the West Alternative would cross more erodible terrain (see Appendix K). This change would occur across a large watershed area of about 161,000 acres. Isolated actions could cause **high** impacts. Generally, long-term changes in watershed conditions

would be minor, and could cause minor changes in existing watershed functions. Impacts would be **low**.

Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams (see Table 15-2). Compared to other action alternatives, this would be the least number of forested crossings. Most crossings (28) would occur where the existing shade level is already low and provides limited stream cooling; impacts would be **low**. This is the greatest number compared to other alternatives. Nineteen crossings would occur where the existing shade level does provide effective stream cooling and where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts would be **high**. This is the fewest number of high riparian impacts among the alternatives because there are relatively fewer forested crossings and because riparian vegetation at these crossings provides relatively lower shade. Compared to the other alternatives, crossings for this alternative would be at lower elevations where hardwood species composition is greater and hardwoods are not as effective as conifers in providing shade. Streams tend to be wider and forest canopies cannot fully cover the stream surface. At lower elevations, air temperatures also are higher and more shade is required to cool streams to adequate temperatures.

The West Alternative would cross five streams listed as impaired: Riley Creek, Lockwood Creek, East Fork Lewis River, Mason Creek, and Salmon Creek (see Table 15-2, Maps 15-2A through D). Riley Creek is listed for fecal coliform, and the other four are listed for elevated water temperature. Riparian vegetation has already been removed at all of these crossings and the project would cause **no** additional impacts on temperature or fecal coliform levels. However, soil disturbance that causes increased turbidity could affect these creeks. Using erosion control measures during construction would minimize the transport of sediment to streams. Properly implementing road drainage BMPs, regular maintenance, and rocking roads would reduce erosion on unpaved roads, lessening these impacts, and ensuring that turbidity standards are met. Impacts would be **low**.

Thirty-two towers would be constructed in the 100-year floodplains of the following water bodies: Lewis River (1), East Fork Lewis River (6), Curtin Creek (1), Burnt Bridge Creek (4), Lacamas Creek (8), Leckler Creek (1), Coweeman River (2), and Columbia River (9). Six miles of road would be constructed or improved within 100-year floodplains, about 5 more miles than the other action alternatives. Impacts to floodplains are similar to those common to the action alternatives (**low**). Towers and access roads would be designed to allow water flow and soil absorption.

About 20 miles of wellhead protection areas (1-year and 10-year time of travel) would be crossed by the West Alternative's rights-of-way and access roads. This is more than the other action alternatives because the West Alternative would cross more populated land. Water quality impacts in these areas would be mitigated by using BMPs and spill containment and clean-up procedures. There would be **no** long-term impacts.

Table 15-2 Potential Water-related Impacts[1]

Alternatives and Options	Right-of-Way (miles)[2]	New Road Outside Right-of-Way (miles)[2]	Percent Change in Runoff[3]	Percent Change in Sediment Delivery[4]	New Road in Riparian Zone[5] (miles)	Improved Road in Riparian Zone[5] (miles)	Right-of-Way in Riparian Zone[5] (acres)	Total Number of Forested Fish-Bearing Stream Crossings		303(d) Stream Crossings in 150-Foot-Wide Right-of-Way		303(d) Stream Crossings with New and Improved Roads		Total Number of New Towers in 100-yr Floodplain	100-yr Floodplain(s) in which New Towers would be Built (Number of Towers in the Foodplain)	Total New and Improved Roads in 100-yr Floodplain (miles)	100-yr Floodplain(s) in which New and Improved Roads would be Built (Length of Road in Miles)
								High Shade Function[6]	Low Shade Function[7]	Number (stream)	Parameters (stream)	Number (stream)	Parameters				
West Alternative	**67.5**	**16**	**0.09**	**0.25**	**1.1**	**2.2**	**83.1**	**19**	**28**	**5 (Riley Creek, East Fork Lewis River, Mason Creek, Lockwood Creek, and Salmon Creek)**	**Temperature (4-Mason Creek, East Fork Lewis River, Lockwood Creek, and Salmon Creek) Fecal Coliform (1-Riley Creek)**	**1 (East Fork Lewis River)**	**Temperature**	**32**	**Lewis River (1); East Fork Lewis River (6); Curtin Creek (1); Burnt Bridge Creek (4); Lacamas Creek (8); Leckler Creek (1); Coweeman River (2); Columbia River (9)**	**6.0**	**Lewis River (<0.1); Curtain Creek (0.03); Lacamas Creek (2.4); East Fork Lewis River (1.4); Burnt Bridge Creek (0.4); Leckler Creek (<0.1); Washougal River/Columbia River (0.8); Little Kalama River (0.1); Coweeman River (0.8)**
West Option 1	+0.1	+0.4	-0.01	N/C	+0.2	-0.1	-1.4	N/C	-1	+2 (Dwyer Creek and Lacamas Creek)	Temperature and Fecal Coliform (Lacamas Creek) Dissolved Oxygen (Dwyer Creek and Lacamas Creek)	N/C		+10	Lacamas Creek (+15, -5)[8]	+2.0	Lacamas Creek (+3.9, -2.0)[8]
West Option 2	+1.6	N/C	+0.01	N/C	-0.1	-0.2	+1.4	-1	N/C	N/C		N/C		+1	Lacamas Creek (+6, -5)[8]	-0.8	Lacamas Creek (+1.2, -2.0)[8]
West Option 3	+5.6	2.4	+0.01	-0.02	- <0.1	-0.1	+3.7	+1	+3	N/C		N/C		+2	Lacamas Creek (+7, -5)[8]	-0.7	Lacamas Creek (+1.2); Matney Creek (+ <0.1); Little Washougal River (+ <0.1); Lacamas Creek (-2.0)
Central Alternative	**77.3**	**26.8**	**0.59**	**0.15**	**0.9**	**5.6**	**73.8**	**49**	**19**	**2 (East Fork Lewis River, Coweeman River)**	**Temperature**	**0**		**11**	**Tributary to Chelatchie Creek (1); Cowlitz River (1); Columbia River (9)**	**1.1**	**Cowlitz River (0.2); Tributary to Chelatchie Creek (0.1); Little Washougal River (<0.1); Washougal River/Columbia River (0.8)**
Central Option 1	+2.5	+0.8	+0.01	-0.01	N/C	0.7	+2.8	+1	+1	N/C		N/C		N/C	N/C	N/C	
Central Option 2	-2.3	+2	-0.01	+0.01	+0.1	-0.1	-2.8	-9	+4	-1 (East Fork Lewis River)		N/C		-1	Cowlitz River (-1)	-0.1	Coweeman River (+ <0.1); Cowlitz River (-0.2)
Central Option 3	-5.8	-0.6	-0.05	N/C	-0.1	-0.5	-12.2	-2	-6	-1 (Coweeman River)		N/C		N/C	Cedar Creek (+1); Tributary to Chelatchie Creek (-1)	+0.2	Cedar Creek (+0.3); East Fork Lewis River (+ <0.1); Tributary to Chelatchie Creek (-0.1)

Alternatives and Options	Right-of-Way (miles)[2]	New Road Outside Right-of-Way (miles)[2]	Percent Change in Runoff[3]	Percent Change in Sediment Delivery[4]	New Road in Riparian Zone[5] (miles)	Improved Road in Riparian Zone[5] (miles)	Right-of-Way in Riparian Zone[5] (acres)	Total Number of Forested Fish-Bearing Stream Crossings		303(d) Stream Crossings in 150-Foot-Wide Right-of-Way		303(d) Stream Crossings with New and Improved Roads		Total Number of New Towers in 100-yr Floodplain	100-yr Floodplain(s) in which New Towers would be Built (Number of Towers in the Foodplain)	Total New and Improved Roads in 100-yr Floodplain (miles)	100-yr Floodplain(s) in which New and Improved Roads would be Built (Length of Road in Miles)
								High Shade Function[6]	Low Shade Function[7]	Number (stream)	Parameters (stream)	Number (stream)	Parameters				
East Alternative	**75.5**	**22.5**	**1.02**	**0.00**	**0.4**	**7.8**	**61.8**	**35**	**17**	**2 (East Fork Lewis River, Coweeman River)**	**Temperature**	**0**		**10**	**Cowlitz River (1); Columbia River (9)**	**1.0**	**Cowlitz River (0.2); Little Washougal River (<0.1); Washougal River/Columbia River (0.8)**
East Option 1	-1.8	+0.6	-0.05	+0.01	+0.1	-0.5	-7.2	-11	+5	+2 (South Fork Ostrander Creek, Ostrander Creek)	Temperature	+1 (South Fork Ostrander Creek)	Temperature	-1	Cowlitz River (-1)	-0.1	Ostrander Creek (+0.1); Cowlitz River (+0.1); South Fork Ostrander Creek (+ <0.1); Coweeman River (+ <0.1); Cowlitz River (-0.2)
East Option 2	+1.0	-2.2	-0.24	N/C	-0.2	-1.1	-2.2	+5	+2	N/C		N/C		N/C	N/C	N/C	
East Option 3	+1.1	-0.6	+0.03	N/C	-0.1	N/C	-1.1	+4	N/C	N/C		N/C		N/C	N/C	N/C	
Crossover Alternative	**74.0**	**21**	**0.47**	**0.17**	**0.7**	**4.1**	**83.0**	**32**	**23**	**1 (East Fork Lewis River)**	**Temperature**	**0**		**12**	**Leckler Creek (1); Coweeman River (2); Columbia River (9)**	**1.6**	**Leckler Creek (<0.1); Little Kalama River (40.1); Coweeman River (0.8); Little Washougal River (<0.1); Washougal River/Columbia River (0.8)**
Crossover Option 1	+5.2	+0.9	+0.01	N/C	N/C	+ <0.1	+2.4	+1	+2	N/C		N/C		N/C	N/C	- <0.1	Little Washougal River (- <0.1)
Crossover Option 2	+4.3	+0.2	-0.01	-0.01	+ <0.1	+0.2	+5.8	N/C	+1	+2 (Arkansas Creek, Monahan Creek)	Temperature	N/C		N/C	N/C	N/C	
Crossover Option 3	+4.2	+0.8	-0.07	-0.01	+ <0.1	+0.2	+5.3	+1	+2	+2 (Arkansas Creek, Monahan Creek)	Temperature	N/C		N/C	N/C	N/C	

Notes:
N/C – No change from the alternative
1. The value for each option represents the net change from the action alternative. It was calculated as the value added by the option minus the total value in the segments the option replaces.
2. Potential soil disturbance within a 150-foot transmission line right-of-way and a 30-foot road width outside of the transmission line right-of-way.
3. Represents the percent change in hydrologically immature vegetation in watersheds crossed by the action alternatives; hydrologically immature vegetation increases snow accumulation and snowmelt (see Appendix K).
4. Represents the percent change in sediment delivery in watersheds crossed by the action alternatives (see Appendix K).
5. Riparian zone is a 200-foot-wide buffer along perennial streams.
6. High shade function occurs at a crossing when the existing shade level provides effective stream cooling and shade loss is more likely to cause temperature increases that adversely affect aquatic life (see Appendix K).
7. Low shade function occurs when the existing shade level is already low and insufficient to provide adequate stream cooling (see Appendix K).
8. The positive value indicates towers or roads in the Lacamas Creek floodplain along the option's segments. The negative value indicates the towers or roads in the Lacamas Creek floodplain along the segments that the option replaces.

15.2.4.1 West Option 1

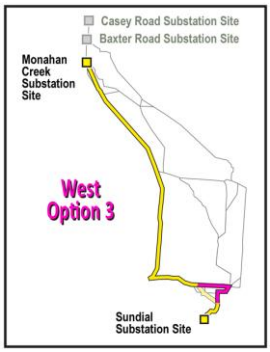
West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. This portion of the alternative includes replacing one of the existing 230-kV lines with a new double-circuit 500-kV line. The existing 230-kV line and the new line would be placed on new 500-kV towers. West Option 1 would require one fewer low shade level forested crossing of a fish-bearing stream be cleared than the portion of line this option would replace on the West Alternative.

This option would cross Dwyer Creek, a stream listed as impaired for dissolved oxygen, and Lacamas Creek, listed as impaired for fecal coliform, temperature, and dissolved oxygen. Riparian vegetation has already been removed at these crossings and the project would cause **no** additional impacts on temperature, dissolved oxygen, or fecal coliform levels. Soil disturbance that causes increased turbidity could further affect these creeks. Using erosion control measures during construction would minimize sediment transport to streams. Properly implementing road drainage BMPs, regular maintenance, and rocking roads would reduce erosion on unpaved roads, lessening these impacts, and ensuring that turbidity standards are met. Impacts would be **low**.

West Option 1 would require an additional 10 towers (15 towers added and 5 removed) and an additional 2 miles of access roads in the Lacamas Creek floodplain.

Impact levels on riparian function, watershed function, water quality, floodplains and groundwater would be the same as the West Alternative.

15.2.4.2 West Options 2 and 3

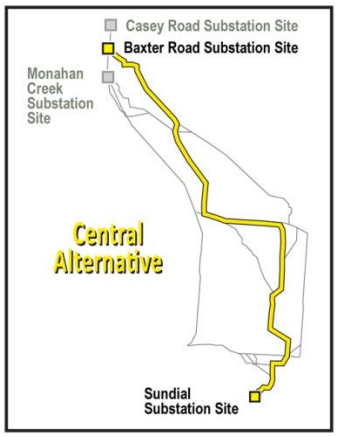


West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. West Option 2 would require one less high shade level forested crossing of a fish-bearing stream be cleared than the portion of line replaced on the West Alternative. West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing rural residential and rural areas farther east. West Option 3 would require clearing of one additional high shade level and three additional low shade level forested crossings of fish-bearing streams.

West Option 2 would require one additional tower in the Lacamas Creek floodplain (6 towers added and 5 removed) and West Option 3 would require two additional towers in the Lacamas Creek floodplain (7 towers added and 5 removed).

Impact levels on riparian function, watershed function, water quality, floodplains and groundwater would be the same as the West Alternative.

15.2.5 Central Alternative



Transmission line clearing and road construction would result in about 104 (1,503 acres) miles of potential soil disturbance that could contribute sediment to streams (see Table 15-2). Compared to the other action alternatives, this would be the greatest amount of construction. It would cause relatively moderate percent increases in runoff (0.59 percent) and sediment delivery (0.15 percent) to streams because the Central Alternative would clear moderate levels of mature conifer vegetation, but cross less erodible terrain (see Appendix K). This change would occur across a large watershed area of about 218,000 acres. Isolated actions could cause **high** impacts. Generally, long-term changes in watershed conditions would be minor, and could cause minor changes in existing watershed functions. Impacts would be **low**.

Riparian vegetation would be cleared at 68 forested crossings of fish-bearing streams (see Table 15-2). Compared to other action alternatives, this would be the greatest number of forested crossings. Nineteen crossings would occur where the existing shade level is already low and provides limited stream cooling; impacts would be **low**. Most crossings (49) would occur where the existing shade level provides effective stream cooling and where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts would be **high**. This is the greatest number of high riparian impacts among the alternatives because there would be a greater number of forested crossings and because riparian vegetation at these crossings can provide relatively greater shade function. Crossings for this alternative would tend to have greater conifer species composition, narrower streams, and be at higher elevations. Conifers are more effective than hardwoods in providing shade. Forest canopies often can fully cover the stream surface along narrower streams. At higher elevations, air temperatures are lower and it is more likely that shade cover adequately cools these streams.

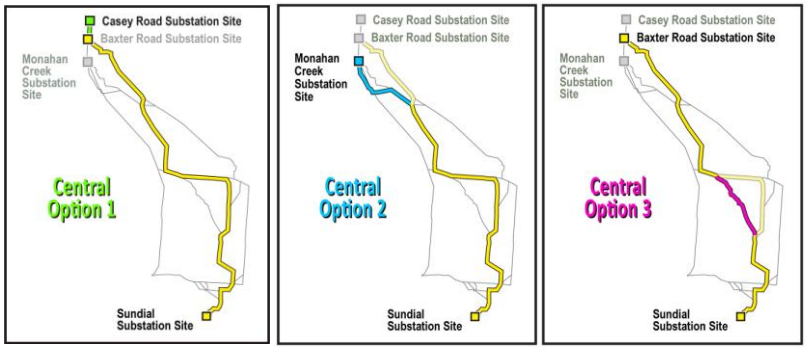
The Central Alternative would cross two rivers listed as impaired: East Fork Lewis River and Coweeman River (see Table 15-2, Map 15-1). Both streams are listed for elevated water temperature. While most of the riparian vegetation has been removed at these crossings, the project could cause additional clearing and a limited temperature increase; impacts would be **low**. Soil disturbance that causes increased turbidity could further affect these rivers. Using erosion control measures during construction would minimize the transport of sediment to streams. Properly implementing road drainage BMPs, regular maintenance, and rocking roads would reduce erosion on unpaved roads, lessening these impacts, and ensuring that turbidity standards are met. Impacts would be **low**.

Eleven towers would be built within the 100-year floodplains of the following water bodies: a tributary to Chelatchie Creek (1), Cowlitz River (1), and Columbia River (9). This alternative would also require constructing or improving about 1 mile of road in 100-year floodplains. Impacts to floodplains are similar to those common to the action alternatives (**low**). Mitigation measures, such as designing towers and access roads to allow water flow and soil absorption, would be implemented to reduce impacts.

About 6 miles of wellhead protection areas (1-year and 10-year time of travel) would overlap the Central Alternative rights-of-way and access roads, less than for the West and Crossover

alternatives. Water quality impacts in these areas would be mitigated by using BMPs and spill containment and clean-up procedures. Impacts would be similar to those common to the action alternatives (**no** long-term impacts).

15.2.5.1 Central Options 1, 2, and 3



Central Option 1 would require two more forested crossings (low and high shade levels) of fish-bearing streams be cleared than the portion of line this option would replace on the Central Alternative. Central Option 2 would require nine fewer high shade levels and four additional low shade level forested crossings of fish-bearing streams be cleared. Eight less forested crossings (two have a high shade level and six have a low shade level) of fish-bearing streams would be cleared for Central Option 3.

Central Option 2 only crosses the Coweeman River and Central Option 3 only crosses the East Fork Lewis River.

Central Option 2 would require one less tower be constructed in the Cowlitz River floodplain.

Impact levels on riparian function, watershed function, water quality floodplains, and groundwater would be the same as the Central Alternative.

15.2.6 East Alternative

Transmission line clearing and road construction would result in about 98 (1,455 acres) miles of potential soil disturbance that could contribute sediment to streams (see Table 15-2). Compared to the other action alternatives, this would be the second highest amount of construction. It would cause the most percent increase in runoff (1.02 percent) because it clears the greatest amount of mature vegetation. It would cause the least percent increase in sediment delivery (0.00 percent) to streams because the East Alternative would cross the least erodible terrain (see Appendix K). This change would occur across a large watershed area of approximately 209,000 acres. Isolated actions could cause **high** impacts. Generally, long-term changes in watershed conditions would be minor, and could cause minor changes in existing watershed functions. Impacts would be **low**.

Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams (see Table 15-2). Compared to other action alternatives, this would be the third most number of forested crossings. Seventeen crossings would occur where the existing shade level is already low and provides limited stream cooling; impacts would be **low**. Most crossings (35) for this alternative would occur where the existing shade level provides effective stream cooling and

where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts would be **high**. This is the second greatest number of high riparian impacts among the action alternatives. Similar to the Central Alternative, existing crossings along the East Alternative provide greater shade function. Crossings for this alternative tend to have greater conifer species composition, narrower streams, and be at higher elevations. The reason for relatively fewer high impacts along the East Alternative is because there are fewer streams crossed.

The East Alternative would cross the same two rivers that are listed as impaired as those crossed by the Central Alternative: East Fork Lewis River and Coweeman River (see Table 15-2, Map 15-1). Both streams are listed for elevated water temperature. Impacts to water quality would be **low** because while most of the riparian vegetation has been removed along these streams, any additional vegetation clearing from the project could cause a limited temperature increase. Use of erosion control measures during construction would minimize potential sediment transport to these rivers, also a **low** impact.

Ten towers would be built within the 100-year floodplains of the following water bodies: Cowlitz River (1) and Columbia River (9). This alternative would also require constructing or improving about 1 mile of road in 100-year floodplains. Impacts to floodplains are similar to those common to the action alternatives (**low**). Implementation of mitigation measures such as designing towers and access roads to allow water flow and soil absorption would reduce impacts.

About 6 miles of wellhead protection areas (1-year and 10-year time of travel) would overlap the East Alternative rights-of-way and access roads, less than for the West and Crossover alternatives. Water quality impacts in these areas would be mitigated by using BMPs and spill containment and clean-up procedures. Impacts would be similar to those common to the action alternatives (**no** long-term impacts).

15.2.6.1 East Option 1

East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. The option would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. East Option 1 would require 11 fewer high shade levels and five additional low shade level forested crossings of fish-bearing streams be cleared.

East Option 1 would add stream crossings at Ostrander Creek and the South Fork Ostrander Creek. Both streams are listed for elevated water temperatures. Impacts to water quality would be **high** in these streams because loss of riparian vegetation would increase water temperature. Use of erosion control measures during construction would minimize potential sediment transport to streams, a **low** impact.

East Option 1 would require one less tower constructed in the Cowlitz River floodplain.

Impact levels on riparian function, watershed function, floodplains and groundwater would be the same as the Central Alternative.

15.2.6.2 East Option 2

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. East Option 2 would require would require five more high shade level and two more low shade level forested crossings of fish-bearing streams be cleared. East Option 2 crosses the East Fork Lewis River similar to the East Alternative.

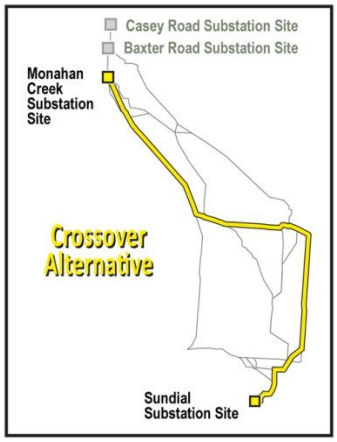
Impact levels on riparian function, watershed function, floodplains and groundwater would be the same as the East Alternative.

15.2.6.3 East Option 3

East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. East Option 3 would decrease the percent change in runoff by 0.24 percent. An additional four high shade level forested crossings of fish-bearing streams would be cleared for East Option 3.

Impact levels on riparian function, watershed function, water quality, floodplains and water quality would be the same as the East Alternative.

15.2.7 Crossover Alternative



Transmission line clearing and road construction would result in about 95 miles (1,422 acres) of potential soil disturbance that could contribute sediment to streams (see Table 15-2). Compared to the other action alternatives, this would be the third highest amount of construction. It would cause relatively moderate percent increases in runoff (0.47 percent) and sediment delivery (0.17 percent) to streams because the Crossover Alternative crosses both high levels of mature and immature land cover and both high and low erodible terrain (see Appendix K). This change would occur across a large watershed area of about 184,000 acres. Isolated actions could cause **high** impacts. Generally, long-term changes in watershed conditions would be minor, and could cause minor changes in existing watershed functions. Impacts would be **low**.

Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams (see Table 15-2). Compared to other action alternatives, this would be the second highest number of forested crossings. Twenty-three forested crossings would occur where the existing shade level is already low and provides limited stream cooling; impacts would be **low**. Most crossings (32) for this alternative would occur where the existing shade level provides effective stream cooling and where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts would be **high**. This is the third greatest number of high riparian impacts among the action alternatives. Similar to the Central Alternative, existing crossings along the Crossover Alternative provide greater shade function. Crossings for this alternative would tend to have

greater conifer species composition, narrower streams, and be at higher elevations. The reason for relatively fewer high impacts along the Crossover Alternative is because there are fewer streams crossed.

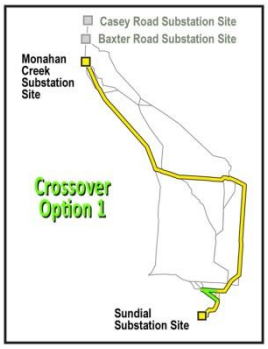
The Crossover Alternative would cross the East Fork Lewis River, listed as impaired for elevated water temperature (see Table 15-2, Map 15-1). Impacts to water quality in the East Fork Lewis River would be **low** because while most of the riparian vegetation has been removed, any additional vegetation clearing from the project could cause a limited temperature increase. Use of erosion control measures during construction would minimize potential sediment transport to the river, also a **low** impact.

Twelve towers would be built within the 100-year floodplains of the following water bodies: Leckler Creek (1), Coweeman River (2), and Columbia River (9). This alternative would also require constructing or improving about 1.5 miles of road in 100-year floodplains. Impacts to floodplains are similar to those common to the action alternatives (**low**). Mitigation measures such as designing towers and access roads to allow water flow and soil absorption would be implemented to reduce impacts.

About 10 miles of wellhead protection areas (1-year and 10-year time of travel) would overlap the Crossover Alternative rights-of-way and access roads. Water quality impacts in these areas would be mitigated by using BMPs and spill containment and clean-up procedures. Impacts would be similar to those common to the action alternatives (**no** long-term impacts).

15.2.7.1 Crossover Option 1

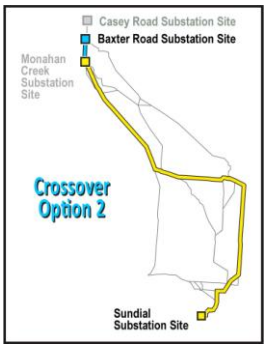
Crossover Option 1 would remove a portion of the alternative crossing north–south through rural residential areas north of Camas between NE Zeek Road and SE 23rd Street, and replace it with a route running west along an existing right-of-way until about NE 232nd Avenue, then southeast through open fields and more rural residential areas. Crossover Option 1 would clear one more high shade level and two more low shade level forested crossings of fish-bearing streams.

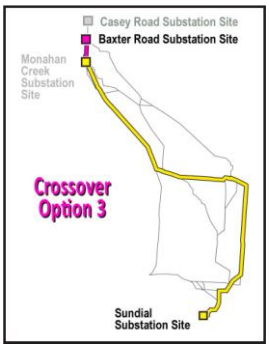


Impact levels on riparian function, watershed function, water quality, floodplains and groundwater would be the same as the Crossover Alternative.

15.2.7.2 Crossover Options 2 and 3

Crossover Option 2 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land. Crossover Option 3 would begin at the Baxter Road substation site and the new transmission line would cross sparsely populated land and require some additional new right-of-way. Crossover Option 2 would clear one more low shade level forested crossing of a fish-bearing stream. Crossover Option 3 would clear one more high shade level and two more low shade level forested crossings of fish-bearing streams.





Both Crossover Options 2 and 3 would add stream crossings at Arkansas and Monahan creeks (both listed for elevated water temperature). Impacts to water quality would be similar to those where some riparian vegetation has been removed but more vegetation removal could cause additional temperature elevation (**low**). Use of erosion control measures during construction would minimize potential sediment transport to these streams, also a **low** impact.

Impact levels on riparian function, watershed function, floodplains, and groundwater would be the same as the Crossover Alternative.

15.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional mitigation measures have been identified to further reduce or eliminate adverse water resource impacts by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Minimize the number of road-stream crossings and avoid perennial crossings where possible.
- Incorporate standard forest road drainage design BMPs into access road design to reduce erosion (road grading, ditching, drainage dips, culverts, armoring where necessary, discharging road drainage onto solid stable ground, etc.).
- Use standard erosion control measures (BMPs) during vegetation clearing in the right-of-way.
- Remove and dispose of sediment properly, away from surface waters in an upland location out of floodplains.
- Conduct construction, operation, and maintenance activities along or near streams during dry periods.
- Minimize traffic or avoid traffic on access roads during the rainy season.
- Avoid or minimize clearing riparian vegetation where possible, especially where it may affect a 303(d) listed water.
- Pursuant to Washington's Forests and Fish Law (RCW 77.85), bring all existing access roads up to new forest road standards through Road Maintenance and Abandonment Plans (RMAPs) by 2016.
- Design new access road crossings to preserve natural flow patterns, channel structure, and fish passage.
- Avoid placing towers in waterways where possible.
- Avoid placing towers and access roads in floodplains where possible.
- Design towers in floodplains to prevent potential scour and erosion.
- Minimize herbicide and pesticide application. Use physical methods of vegetation control when feasible. Use herbicides and application methods approved in the Transmission System Vegetation Management Program Record of Decision (BPA 2000b) or evaluate and consider using other herbicides or application methods at the request of property owners. Employ herbicide application BMPs in place based on the EIS and ROD

for vegetation management (BPA 2000a; BPA 2000b), including established riparian zones.

- Avoid construction immediately next to water supply wells or relocate water supply wells.

15.2.9 Unavoidable Impacts

If all erosion control mitigation measures are implemented, there would still be a small increase in sediment delivery to streams. Riparian vegetation would be removed reducing shade, which could lead to increased temperatures and possibly decreased dissolved oxygen, nutrient production, streambank stability, and habitat for aquatic and riparian dependent species. Final project design may still place some towers and access roads in larger floodplains that cannot be spanned or avoided, causing very small decreases in flood storage. Once final project design is complete, there may be some existing water wells that need to be moved to avoid towers and access roads.

15.2.10 No Action Alternative

Under the No Action Alternative, none of the action alternatives would be constructed. Existing forest production and farming practices would continue and many of the existing unpaved roads identified for use by this project would likely be improved periodically by the underlying landowner for forest production and farming purposes, which could increase sediment delivery to adjacent streams.

Riparian vegetation in forested lands that would have been cleared for the transmission line right-of-way would likely remain intact. Existing forest harvest practices require leaving a riparian buffer near streams.

No impacts to water wells or wellhead protection areas would occur. Excavations for towers and substations would not occur so no shallow groundwater would be encountered or need to be pumped. Because no additional herbicides and pesticides would be used to control vegetation, there would be no additional risk of water quality impacts from these substances.

Chapter 16 Wetlands

This chapter describes wetlands in the project area, and how the project alternatives could affect these wetlands. Related information can be found in Chapter 14, Geology and Soils; Chapter 15, Water; Chapter 17, Vegetation, Chapter 27, Consultation, Review, and Permit Requirements, and Appendix L, Wetland Modeling and Analysis.

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

16.1 Affected Environment

Wetlands are areas of transition between aquatic and terrestrial systems where water is the dominant factor that determines soil characteristics and biological communities. Wetlands can support diverse plants and animals, and help maintain or improve water quality, contribute to flood control, provide wildlife habitat, and have recreational or aesthetic value.

Several laws provide protection for wetlands and their functions. For regulatory purposes, wetlands are formally defined by local, state, and federal statutes, including the Clean Water Act. The Clean Water Act regulates discharges into waters of the United States, including wetlands. The State of Oregon regulates removal and fill of material into waters of the state through Oregon's Removal-Fill Law (see Section 27.10, Clean Water Act). The Shoreline Management Act gives the State of Washington the authority to regulate wetlands (see Section 27.24.1.2, Shoreline Management Act). Cities and counties in Washington have adopted critical areas regulations as defined by the Growth Management Act to protect critical areas including wetlands (see Section 27.24.2.1, Critical Area Ordinances). Cities and counties in Oregon do not have critical areas ordinances that would protect wetlands.

In the project area, wetlands are typical of types found in the Puget lowland and western Cascade Mountain foothills. Sources for wetland **hydrology** include precipitation, overland runoff, groundwater discharge, flows from adjacent streams, and perched water tables. Wetland soils have formed in glacial materials developing characteristics influenced by coniferous forest vegetation. Wetlands have also been created by the network of roads in agriculture and timber harvest areas.

Wetlands are found in floodplains and along rivers, streams or creeks, in depressional swales, on slopes and terraces, as part of larger complexes, or in areas of open pasture and agricultural fields. Wetlands are within rural areas, on lands managed for timber harvest and agriculture, and land within suburban and urban development primarily on the north and south sides of the Columbia River, including the cities of Longview, Vancouver, and Camas in Washington, and Portland and Troutdale in Oregon.

For the purposes of this analysis, wetlands were mapped within a study area that includes a 1,000-foot corridor (500 feet either side of the transmission line centerline) for each action alternative. This area includes the transmission line right-of-way, new and improved access roads within the right-of-way, and removed, rebuilt, and new towers on existing right-of-way. Substation areas and portions of access roads outside of the 1,000-foot corridor were also mapped. This study area was mapped using wetland delineations at the Sundial, Casey Road, and Baxter Road substation sites (DEA 2009, Herrera 2011a and 2011b), aerial imagery interpretation, and available databases (Herrera 2010 and 2012) including National Agriculture Imaging Program (NAIP) imagery (NAIP 2009), LIDAR imagery (BPA 2011), U.S. Fish and Wildlife

Service (USFWS) National Wetland Inventory (USFWS 2010a), Natural Resources Conservation Service (NRCS) **hydric soils** (NRCS 2009b), U.S. Geological Survey (USGS) topography (USGS 1995), WDNR hydrography (WDNR 2006). Wetland classification was based on the vegetation class, hydrology, position of the wetland within the landscape, and water source (Cowardin et al. 1979). The study area was extended beyond the specific proposed locations of project facilities to understand and consider potential connectivity of existing wetlands to larger wetland complexes in adjacent areas.

Both forested and non-forested wetland community types occur in the study area (see Maps 16-1A through 16-1D). Forested wetlands include **palustrine** (freshwater) forested wetlands dominated by at least 30 percent tree cover greater than 20 feet tall. Non-forested wetlands include palustrine scrub-shrub having at least 30 percent cover of woody vegetation less than 20 feet tall; and palustrine **emergent** having at least 30 percent cover of emergent herbaceous vegetation.

Forested wetlands within the study area are dominated by a mixture of deciduous and coniferous trees, including red alder (*Alnus rubra*), black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), western red cedar (*Thuja plicata*), Oregon ash (*Fraxinus latifolia*), and Sitka spruce (*Picea sitchensis*) along with western skunk cabbage (*Lysichiton americanum*) and slough sedge (*Carex obnupta*). Scrub-shrub wetland vegetation consists of small trees, shrubs, and multi-stemmed plants, such as willow (*Salix* spp.), red osier dogwood (*Cornus sericea*), Douglas spirea (*Spiraea douglasii*), wild rose (*Rosa* spp.), black hawthorn (*Crataegus douglasii*), stinging nettle (*Urtica dioica*), Pacific ninebark (*Physocarpus capitatus*), rose species (*Rosa* spp.), butterfly bush (*Buddleia davidii*), and gooseberry (*Ribes* spp.). Emergent wetlands have cattail (*Typha latifolia*), reed canarygrass (*Phalaris arundinacea*), rushes (*Juncus* spp.), bulrush (*Scirpus* spp. and *Schoenoplectus* spp.), and sedges (*Carex* spp.) as the primary vegetation. Vegetation within aquatic bed wetlands, a transition between emergent wetlands and open water, includes yellow pondlily (*Nuphar variegata*), white waterlily (*Nymphaea odorata*), milfoils (*Myriophyllum* spp.), pondweeds (*Potamogeton* spp.), and lesser duckweed (*Lemna minor*).

Wetland functions are those processes that occur within a wetland, such as water storage, nutrient cycling, and maintenance of diverse plant communities and habitat that benefits wildlife. Wetland functions can be grouped into three broad categories: habitat functions, hydrologic functions, and water quality functions. Habitat functions include providing food, water, and shelter for fish, shellfish, birds, amphibians, and mammals. Wetlands also serve as a breeding ground and nursery for many species. Hydrologic functions include reducing stormwater velocity, recharging and discharging groundwater, and providing flood storage. Water quality functions include the potential for removing sediment, nutrients, heavy metals, and toxic organic compounds.

In Washington, the Corps and Ecology recommend that wetland functions be classified according to Ecology's rating system (Hruby 2004). In Oregon, the Oregon Department of State Lands (DSL) recommends use of the Oregon Rapid Wetland Assessment Protocol (ORWAP) to assess wetland functions.

Wetlands vary in quality throughout the study area (see Maps 16-2A through 16-2D). For example, high-quality wetlands are relatively undisturbed wetlands that contain a high diversity of native plants, thereby providing greater habitat opportunities and erosion and flood control. Medium-quality wetlands are more disturbed but still provide a moderate to high level of some functions. Low-quality wetlands have the lowest level of functions because they are heavily

disturbed. In some cases, high-quality wetlands may have rare or special characteristics protected by federal, state, or local jurisdictions, or may support species protected by federal, state, and local jurisdictions (see Chapters 17, Vegetation and 18, Wildlife). In the study area, mature forested wetlands, bogs, bog-like wetlands, aspen-dominated wetlands, and camas prairie wetlands are aquatic resources that require special protection under the Seattle District Corps Clean Water Act regulatory program.

Assessing Wetland Function

Wetlands delineations were available for Baxter Road, Casey Road and Sundial substation sites. Delineations were not available for the transmission line or access roads.

For the purposes of this analysis, wetland functions (except for the Baxter Road, Casey Road, and Sundial substation sites) were assessed using a modified version of the Washington State Department of Ecology's rating system as a foundation (see Appendix L). Wetland functions (Categories I through IV) at the Baxter Road and Casey Road sites were assessed using Ecology's rating system, and at the Sundial site, the ORWAP (low to high) was used. Each state's rating system assesses wetland functions using a series of questions related to water quality, hydrology, and habitat functions, and generates a score for each function category based on the wetland's potential and opportunity for providing the function. Each question on the rating form was evaluated to determine the feasibility of answering the question using available information without conducting site visits. Several questions could not be answered without sites visits and were not included on the modified rating form developed for this project. Low, medium and high qualitative ratings were assigned to wetlands based on the wetland function score from the modified assessment (see Maps 16-2A through 16-2D). These qualitative ratings were used to help provide the basis for assigning impact levels in Section 16.2.1 below.

All wetlands in the study area are considered priority habitats by WDFW (WDFW 2010a) (see Chapter 17, Vegetation, and Chapter 18, Wildlife). Priority habitat wetlands have been identified as having unique and valuable attributes. For example, they may have comparatively high fish and wildlife density, species diversity, important breeding habitat, important fish and wildlife seasonal ranges or movement corridors, limited availability, high vulnerability to habitat alteration, or unique or dependent species (WDFW 2008). They are often part of large riparian areas along or otherwise connected to nearby rivers. Additional wetlands that could be considered priority habitats by WDFW may be present in the study area although they have not yet been documented.

Smaller, disturbed wetlands are often found in active agricultural fields and interspersed among or next to developed areas. These wetlands are frequently of lesser quality because their primary functions or values may be limited.

Wetlands have buffer areas surrounding them that provide protection of wetland functions, including providing habitat for a variety of wetland-dependent or upland wildlife and plant species. The Cowlitz County Critical Areas Ordinance and the Clark County Critical Areas Ordinance each classify wetlands based on their functions and values and specify a minimum buffer width for each classification. This width is then adjusted based on wetland function level and proposed wetland impact. Similar buffer width determinations occur in Multnomah County, Oregon. Ecology's wetland rating system also includes recommended buffer widths to protect wetlands functions, depending on the intensity of the surrounding land uses.

16.1.1 West Alternative and Options

Wetlands along the West Alternative are primarily emergent wetlands (56 percent) with scrub-shrub (23 percent) and forested (20 percent) wetlands the remaining wetland types (see Maps 16-1A through 16-1D). Within the study area (1,000 foot corridor), the West Alternative has almost three times as many wetlands compared to the other action alternatives (377 acres compared to 101 acres for the Central Alternative; 96 acres for the East Alternative; and 162 acres for the Crossover Alternative).

Low-to-medium quality wetlands were found along the Coweeman River in the northern portion of the West Alternative near the city of Longview (see Map 16-2A). Wetlands with a medium-to-high function rating or quality were mapped along Leckler Creek and near Lexington west of a residential area. Medium-to-high quality wetlands were mapped along the Lewis and East Fork Lewis rivers south to Salmon Creek (low-to-medium quality) in the middle portion of the alternative (see Maps 16-2C and 16-2D). Along Burnt Bridge Creek and Lacamas Creek, wetland functions were rated as high. Also found along the West Alternative in the Lacamas Creek area are camas prairie wetlands and special-status plants that require special protection (see Section 17.1.1.5, Herbaceous, Native Upland and Wet Prairie). Wetlands along the Columbia River, including where Lacamas Creek and the Washougal River merge and flow into the Columbia River in the southern portion of the alternative were rated as low functioning wetlands (see Map 16-2D). Several unnamed streams and drainages crossed by the West Alternative also have low-to-high functioning wetlands. In Oregon, emergent wetlands with a medium functional rating have been delineated at the Sundial substation site (see Section 16.1.5, Sundial Substation).

Many low-to-medium quality wetlands were also mapped along the West Alternative in the more developed areas of Kelso, Vancouver, Camas, Washougal, and Troutdale and along major road systems that have previously been disturbed by road construction and commercial and residential development. Wetlands have been filled and roads have created impervious surfaces and blocked water flow to wetland areas. Emergent wetlands with medium quality are found in agricultural land between the East Fork Lewis River and the city of Vancouver.

West Option 1 crosses emergent and scrub-shrub wetlands, with some forested wetlands, for almost its entire length through the Lacamas Creek floodplain northwest of Lacamas Lake where wetland functions were rated as high (see Map 16-2D). A portion of the area along West Option 1 has been designated by WDNR as a Natural Area Preserve that includes camas prairie wetland areas and special status plants and habitat (see Section 17.1.2, Special-Status Plant Habitats).

West Options 2 and 3 both cross the Lacamas Creek floodplain and wetlands with a high function rating at their western end (see Map 16-2D). West Option 2 crosses wetlands along the middle reaches of the Little Washougal River (medium-to-high quality). West Option 3 crosses small areas of forested, emergent, and scrub-shrub wetlands along Matney Creek (medium-to-high quality) and northeast of Camas along the lower and middle reaches of the Little Washougal River.

16.1.2 Central Alternative and Options

Wetlands along the Central Alternative are primarily forested and emergent wetlands (39 percent each) with some scrub-shrub wetlands (22 percent) (see Maps 16-1A through

16-1D). Within the study area, this alternative has about the same amount of wetlands as the East Alternative, about 60 acres less than the Crossover Alternative, and about a third of those mapped on the West Alternative. Emergent and forested wetlands with low-to-medium function ratings were mapped along the Cowlitz River, with high functioning wetlands along the North Fork Goble Creek and Goble Creek in the northern portion of the Central Alternative east of Longview (see Map 16-2A). Medium-to-high functioning wetlands were mapped along the Kalama, Lewis, and East Fork Lewis rivers and near Chelatchie and Big Tree creeks east of Amboy in the middle portion (see Maps 16-2B and 16-2C). Wetlands near the Little Washougal River and where Lacamas Creek and the Washougal River flow into the Columbia River in the southern portion of the alternative were rated as low-quality wetlands (see Section 16.1.1, West Alternative and Options, and Map 16-2D). Several unnamed streams and drainages crossed by the Central Alternative also have low-to-high functioning wetlands. Similar to the West Alternative, emergent wetlands with a medium functional rating have been delineated at the Sundial substation site (see Section 16.1.5, Sundial Substation).

Disturbance to low or medium functioning wetlands from previous development and roads has occurred near Camas, Washougal, and Troutdale (see Section 16.1.1, West Alternative and Options). Near Camas, Troutdale, and the Columbia River, wetlands crossed are the same as those identified for the West Alternative, since all action alternatives follow a common route to Troutdale.

Central Option 1 begins at the Casey Road substation site; there are Category I and III wetlands to the south and east of the site (see Section 16.1.6.1, Casey Road, and Map 16-2A). Medium-to-high quality wetlands were also mapped at the south end of the option just north of the Baxter Road substation site. Central Option 2 crosses low-to-high functioning forested wetlands near Lexington west of a residential area, along the Cowlitz River in the middle portion of the option, and along the Coweeman River in the southern portion of the option (see Map 16-2A). Central Option 3 crosses medium-to-high quality forested, emergent and scrub-shrub wetlands along and near Cedar Creek, Rock Creek, the East Fork Lewis River, and other streams southwest of Amboy (see Map 16-2C).

Wetland Categories I through IV

Category I wetlands are those that represent a unique or rare wetland type or are more sensitive to disturbance than most wetlands. They are also relatively undisturbed. Category II wetlands provide important functions including the potential to reduce flooding and erosion, improve water quality, and provide wildlife habitat. Category III wetlands are those with a moderate level of functions and values because they have been disturbed. They are often smaller, less diverse, or more isolated than Category I and II wetlands. Category IV wetlands have the lowest levels of functions and are often heavily disturbed wetlands.

16.1.3 East Alternative and Options

Wetlands along the East Alternative are primarily forested (43 percent) and emergent (41 percent) wetlands with some scrub-shrub wetlands (17 percent) (see Maps 16-1A through 16-1D). Within the study area, this alternative has about the same amount of wetlands as the Central Alternative, less than the Crossover Alternative, and about a third of those mapped on the West Alternative.

Low-to-medium quality emergent and forested wetlands were mapped along the Cowlitz, with low-to-high quality wetlands along and near the Coweeman River in the northern portion of the East Alternative (see Maps 16-2A and 16-2B). Medium functioning forested wetlands along the

North Fork Goble Creek, tributaries to Rock Creek, Speelyai Creek, and the Kalama and East Fork Lewis rivers were mapped on the middle portion of the East Alternative, including a concentration of forested and scrub-shrub wetlands (medium-to-high function rating) along smaller creeks west and northwest of Yale Dam (see Maps 16-2B and 16-2C). Wetlands near the Little Washougal River and where Lacamas Creek and the Washougal River flow into the Columbia River in the southern portion of the alternative were rated as low functioning wetlands (see Sections 16.1.1, West Alternative and Options, and 16.1.2, Central Alternative and Options, and Map 16-2D). Several unnamed streams and drainages crossed by the East Alternative also have low-to-high functioning wetlands. Similar to the West and Central alternatives, emergent wetlands with a medium functional rating have been delineated at the Sundial substation site (see Section 16.1.5, Sundial Substation).

Low-to-medium functioning wetlands near Camas, Washougal, and Troutdale have been previously disturbed from development and roads construction (see Section 16.1.1, West Alternative and Options).

Forested, emergent, and scrub-shrub wetlands with low-to-medium function ratings were mapped along the Cowlitz River, Ostrander Creek, and the South Fork Ostrander Creek north of Longview for East Option 1 (see Map 16-2A). Medium functioning wetlands crossed by this option were also mapped along the Coweeman River. East Option 2 crosses forested and scrub-shrub wetlands along Cedar Creek (high function rating), Big Tree Creek (low-to-high function rating), Rock Creek (high function rating), East Fork Lewis River (medium-to-high function rating), East and North Fork Lacamas creeks (medium-to-high function rating), and the Little Washougal River (medium-to-high function rating) (see Map 16-2D). East Option 3 crosses low-to-medium functioning forested and scrub-shrub wetlands along the East Fork Little Washougal River and its tributaries.

16.1.4 Crossover Alternative and Options

Wetlands along the Crossover Alternative are a combination of emergent (41 percent), scrub-shrub (30 percent) and forested (29 percent) wetlands (see Maps 16-1A through 16-1D). Within the study area, this alternative has more wetlands than the Central and East alternatives, but about a third of those mapped on the West Alternative.

Low-to-high functioning wetlands along this alternative are the same as those mapped along the northern portion of the West Alternative north of the Lewis River and southern portion of the East Alternative south of Yale Dam to the Columbia River (see Maps 16-2A to 16-2D). Where the Crossover Alternative runs west to east, medium-to-high functioning wetlands are the same as those found along the middle portion of the Central Alternative along the Lewis River between Merwin and Yale dams (see Maps 16-2B and 16-2C).

Low-to-medium functioning wetlands near Camas, Washougal, and Troutdale have been previously disturbed from development and roads construction (see Section 16.1.1, West Alternative and Options).

Forested, emergent, and scrub-shrub wetlands with medium-to-high function ratings were mapped along the Crossover Option 1 north of Lacamas Lake (see Map 16-2D). Crossover Options 2 and 3 cross scrub-shrub and forested wetland near Baxter Creek with low-to-high function ratings (see Map 16-2A).

16.1.5 Sundial Substation

Twenty-six wetlands, about 90 acres overall, were delineated at the Troutdale Reynolds Industrial Park (Port of Portland property) (DEA 2009). The Sundial substation site is on part of this property within a portion of three of the wetlands. Wetlands identified include depressional forested, scrub-shrub, and emergent and riverine wetlands; most are emergent wetland. About 11 acres of emergent wetland with a medium function rating are within the proposed substation site.

Construction and operation of the Reynolds Aluminum plant, levee construction and drainage improvements, the presence of existing transmission lines and substations, and agricultural activities have extensively disturbed portions of the industrial park (DEA 2009). These activities are no longer occurring, except for utility use, agricultural uses at the far northwest corner of the property and some new industrial development, including a Federal Express shipping facility (DEA 2009). The Port plans to continue this type of light industrial development.

16.1.6 Castle Rock Substation Sites

16.1.6.1 Casey Road

Five wetlands, about 1.4 acres overall, were delineated at the Casey Road site; none are directly within the boundary of the proposed substation facility itself (Herrera 2011a). Most wetlands are outside of the proposed facility, along a stream in the south and east portion of the site. One intermittent stream originates and flows northeast from the substation site (see Chapter 15, Water). The substation site has recently been cleared of trees.

Wetlands south and east of the site include Category I and III, forested and emergent wetlands. Category I wetlands are those that represent a unique or rare wetland type or are more sensitive to disturbance than most wetlands. They are also relatively undisturbed. Category III wetlands are those with a moderate level of functions and values because they have been disturbed. They are often smaller, less diverse, or more isolated than Category I and II wetlands.

16.1.6.2 Baxter Road

Twelve wetlands, about 5 acres overall, were delineated at the Baxter Road site including emergent and scrub-shrub wetlands (Herrera 2011b). Less than 1 acre of wetland, mostly forested, is within the boundary of the proposed substation facility. Wetlands at the site include three Category II wetlands (Hruby 2004), which provide important functions including the potential to reduce flooding and erosion, improve water quality, and provide wildlife habitat (Herrera 2011b). The other wetlands are seven Category III wetlands and two Category IV wetlands. Category IV wetlands have the lowest levels of functions and are often heavily disturbed. Eight drainages are also present south of the substation site (see Chapter 15, Water and Chapter 19, Fish).

16.1.6.3 Monahan Creek

There are no wetlands at the proposed substation site. Wetlands are found nearby in the ditch abutting Delameter Road and within the riparian zone of Monahan Creek.

16.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

16.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Permanent alteration of wetland hydrology, vegetation, and/or soils by excavation or fill of a medium- or high-quality wetland that causes destruction of water quality, hydrologic, and habitat functions.
- Permanent clearing of wetland vegetation converts high or medium-quality wetland to medium-or low-quality wetland with no opportunity for regrowth of trees or other tall-growing vegetation.
- Permanent clearing of high-quality wetland buffer areas with introduction of invasive non-native or noxious weed species or there is no opportunity for regrowth of trees or other tall-growing vegetation.
- Temporary disturbance or alteration of wetland hydrology, vegetation, and/or soils by temporary fill in wetlands requiring special protection (see Section 16.1, Affected Environment) that causes temporary alteration of water quality, hydrologic, and habitat functions.

Impacts would be **moderate** where project activities would cause the following:

- Permanent alteration of wetland hydrology, vegetation, and/or soils by excavation or fill of a low-quality wetland that causes destruction of water quality, hydrologic, and habitat functions.
- Temporary disturbance or alteration of wetland hydrology, vegetation, and/or soils by temporary fill of a medium- or high-quality wetland that causes temporary alteration of water quality, hydrologic, and habitat functions.
- Permanent clearing of medium-quality wetland buffers with introduction of invasive non-native or noxious weed species or there is no opportunity for regrowth of trees or other tall-growing vegetation.

Impacts would be **low** where project activities would cause the following:

- Temporary disturbance or alteration of wetland hydrology, vegetation, and/or soils by temporary fill of a low-quality wetland that causes temporary alteration or disruption of water quality, hydrologic, and habitat functions.

No impact would occur where project activities would not disturb or alter wetlands.

16.2.2 Impacts Common to Action Alternatives

16.2.2.1 Construction

Transmission line and access road construction would directly affect wetlands from placement of fill, vegetation removal (for the right-of-way and towers, access roads, substations, and danger trees outside of the right-of-way), soil compaction, and contamination from accidental spills or oil from construction vehicles and equipment. Long-term, indirect impacts would include habitat fragmentation and the introduction of invasive non-native or **noxious weed** species. Towers and roads would be located to avoid wetlands as much as possible. Where unavoidable, filling of medium- or high-quality wetlands for tower footings and access roads would be a **high** impact where all wetland functions such as habitat and water storage would be destroyed. Fill placed in low-quality wetlands for tower footings or access roads would be a **moderate** impact where limited wetland functions would be destroyed.

Clearing trees and shrubs from medium- or high-quality forested and scrub/shrub wetlands and wetland buffers along rights-of-way and new access roads also would be a long-term, **high** impact. Conversion of medium- or high-quality wetlands and buffers to low- or medium-quality would remove habitat, alter hydrology through a decrease in **evapotranspiration** or increase in direct precipitation onto soils, increase soil and water temperatures from lack of shading, and possibly introduce weed species. Dense vegetation common in scrub-shrub wetlands, offering cover, breeding habitat, and foraging opportunities would be lost or modified. Vegetation removal would also cause impacts to species diversity and richness and continuity with adjacent habitat.

Temporary soil disturbance and compaction from construction activities could modify hydrology, and disturb vegetation or change species richness and diversity in emergent wetlands, especially if noxious weeds are introduced. Impacts to medium- or high-quality wetlands would be **moderate-to-high** depending on landscape position and opportunity for the wetland to provide flood storage, water quality improvement, habitat, or if they are wetlands requiring special protection. Similarly, temporary impacts to low-quality wetlands would be **low** depending on the same factors. Short-term habitat fragmentation would occur to all wetland types found within and next to the transmission line and access roads during project construction.

Danger trees that pose a potential hazard to the transmission line also would be removed from areas next to rights-of-way, creating a **moderate-to-high** impact depending on the number removed at a specific wetland site and the quality of the wetland.

16.2.2.2 Operation and Maintenance

Operation and maintenance of the transmission line and access roads would create direct and indirect impacts to wetlands. Direct impacts would occur from vegetation maintenance activities such as vegetation clearing or herbicide application for noxious weed control. If herbicide application is required, appropriate buffers would be used to keep herbicides out of wetlands (BPA 2000a, Table III-I). Use of access roads during wet periods for structure maintenance would indirectly affect wetlands by introducing sediment into wetlands through vehicular traffic mud splash, potentially affecting water quality in the short-term. Best management practices would be used to reduce the potential for sediment to enter wetlands; impacts from maintenance activities would be **low-to-moderate**.

Wetlands or wetland buffers adjacent to or near substations could receive dust or sediment and contaminants in surface runoff from substation yard and roads. Exposure to these contaminants would be infrequent, temporary, and a **low** impact.

16.2.2.3 Sundial Substation

About 11 acres of emergent wetland could be filled at the Sundial site regardless of the action alternative selected. Although wetlands at the Sundial site are within an industrial setting and are of medium-quality, functions such as water quality improvement, decreasing overland runoff from precipitation, and bird, amphibian, reptile, and aquatic invertebrate habitat would be lost; impacts would be **high**.

16.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 16.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

16.2.3.1 Casey Road

No-to-low impacts to wetlands would occur at the Casey Road site because wetlands are outside the substation disturbance area. A stormwater detention pond constructed north of the substation site would be about 100 to 200 feet south of a possible wetland and stream area. However, there is the potential for operation and maintenance activities to encroach into wetland buffers. If dust, sediment, or contaminants reach adjacent buffers, this would be a short-term, **low** impact.

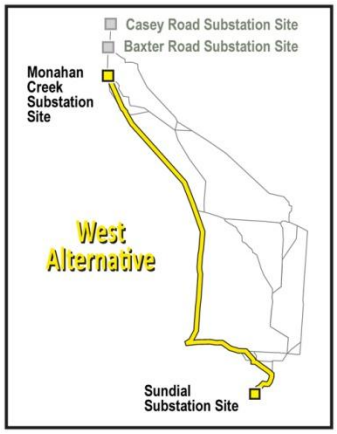
16.2.3.2 Baxter Road

About 0.6 acre of medium-quality wetland, mostly forested, could be filled at the Baxter Road site causing a **high** impact. The functions provided by the wetlands and their buffers that could be filled, such as reducing overland flows and delivery of storm runoff to streams, would be lost. A stormwater detention pond constructed southeast of the substation site would be about 300 feet northeast of these wetlands.

16.2.3.3 Monahan Creek

No impacts to wetlands would occur at the Monahan Creek site because the substation would avoid wetlands including the ditch along Delameter Road and the riparian zone along Monahan Creek.

16.2.4 West Alternative



All forested wetlands within new and existing transmission line right-of-way and where crossed by access roads would be cleared. About 54 acres of forested wetland would be cleared within new and existing right-of-way (see Table 16-1). Most cleared forested wetland would be converted to low-growing scrub-shrub wetland. While these medium-to-high quality wetlands would continue to function as wetlands, a **high** impact would occur because habitat would be removed and hydrology could be altered similar to impacts described in impacts common to action alternatives.

Table 16-1 Potential Impacts to Wetlands[1,2]

Alternatives and Options	Clearing (acres)			Fill (acres)								
	Right-of-Way[3]		Total Approximate Wetland Clearing	Towers[4]		New Access Roads[5]		Improved Access Roads[5]		Substations		Total Approximate Wetland Fill
	Forested	Scrub-Shrub		Forested	Non-Forested[6]	Forested	Non-Forested[6]	Forested	Non-Forested[6]	Forested	Non-Forested[6]	
West Alternative	**54**	**62**	**116**	**0.6**	**3**	**2**	**11**	**1**	**7**	**2**	**11**	**38**
West Option 1	+5	+2	+7	+0.1	+0.3	+0.3	+3	+0.6	+0.4	N/C	N/C	+5
West Option 2	-8	-3	-11	-0.1	-0.3	-0.5	-1	-0.2	-2	N/C	N/C	-4
West Option 3	-5	-2	-7	-<0.1	-0.3	-0.4	-1	-0.1	-2	N/C	N/C	-4
Central Alternative	**69**	**16**	**85**	**0.4**	**1**	**2**	**3**	**1**	**0.5**	**0.6**	**11**	**20**
Central Option 1	+1	+0.5	+1.5	N/C	-<0.1	N/C	+<0.1	+<0.1	+0.2	-0.5	-<0.1	-0.3
Central Option 2	+5	-0.7	+4.3	-<0.1	-<0.1	+1	+0.4	-0.1	-<0.1	+2	-<0.1	+3
Central Option 3	-2	-0.5	-2.5	-0.1	+0.1	+0.9	+0.5	-<0.1	-<0.1	N/C	N/C	+1
East Alternative	**61**	**23**	**84**	**0.7**	**1**	**3**	**3**	**2**	**1**	**0.6**	**11**	**22**
East Option 1	+2	+8	+10	+0.1	+0.5	+0.3	+2	-<0.1	-<0.1	+1	-<0.1	+4
East Option 2	+4	-7	-3	-0.3	-0.1	-0.9	-0.5	-0.7	-0.5	N/C	N/C	-3
East Option 3	+1	-1	N/C	-<0.1	-<0.1	-0.3	-0.4	-0.2	N/C	N/C	N/C	-1

Alternatives and Options	Clearing (acres)			Fill (acres)								
	Right-of-Way[3]		Total Approximate Wetland Clearing	Towers[4]		New Access Roads[5]		Improved Access Roads[5]		Substations		Total Approximate Wetland Fill
	Forested	Scrub-Shrub		Forested	Non-Forested[6]	Forested	Non-Forested[6]	Forested	Non-Forested[6]	Forested	Non-Forested[6]	
Crossover Alternative	**53**	**35**	**88**	**0.7**	**1**	**3**	**4**	**2**	**3**	**2**	**11**	**26**
Crossover Option 1	+8	+1	+9	+0.1	+0.2	+0.5	-0.3	N/C	+1	N/C	N/C	+2
Crossover Option 2	+1	+3	+4	N/C	+<0.1	N/C	+<0.1	+<0.1	+<0.1	-1	+<0.1	-1
Crossover Option 3	+3	+2	+5	N/C	+<0.1	N/C	N/C	+<0.1	N/C	-1	+<0.1	-1

Notes:
N/C – No net change from the action alternative.
1. The value for each option represents the net change from the action alternative. It was calculated as the acres added by the option minus the acres in the segments the option replaces.
2. All acreages are based on wetlands mapped from available data.
3. Cleared wetland within the right-of-way (does not include clearing for towers/roads because those acreages are included in the fill numbers).
4. Tower fill includes new, rebuilt, and removal based on 0.065 acre per tower.
5. Includes all road impacts inside and outside the transmission line right-of-way and assumes a 30-foot disturbance area for new roads and 20-foot disturbance area for improved roads.
6. Non-forested wetland includes emergent, scrub-shrub, and aquatic bed.
Sources: DEA 2009; Herrera 2011a, 2011b, 2012

Vegetation removal in scrub-shrub wetlands (about 62 acres) also would occur causing a **high** impact. Likely, some low-growing scrub-shrub habitat would remain, causing some functions such as water quality improvement to continue, but overall, habitat would be degraded.

Fill for tower footings and access roads also would be placed in 25 acres of forested and non-forested wetlands from tower footings and access roads, including along the Coweeman, Lewis, and East Fork Lewis rivers, and Salmon and Lacamas creeks. Two towers with access roads would be constructed in non-forested wetlands along the Coweeman River. About 20 towers would be constructed in the area starting just north of the East Fork Lewis River south to the Salmon Creek area. Fill in these wetlands would cause a **high** impact because they are primarily medium-to-high quality wetlands. As discussed in impacts common to action alternatives, compaction and fill would destroy wetland functions, fragment habitat, and possibly alter hydrology. About 26 towers with access roads would be constructed in medium-to-high quality scrub-shrub, forested, and emergent wetlands along Lacamas Creek and north of Lacamas; this would be a **high** impact because there is no opportunity for regrowth, even of low-growing species, and continuity may be disturbed with adjacent wetland habitat. In these wetlands, the potential for construction activities to introduce noxious, non-native weeds would cause a **moderate** impact because weed species could displace native wetland species. Almost twice as much fill would be required for the West Alternative as the other action alternatives (see Table 16-1).

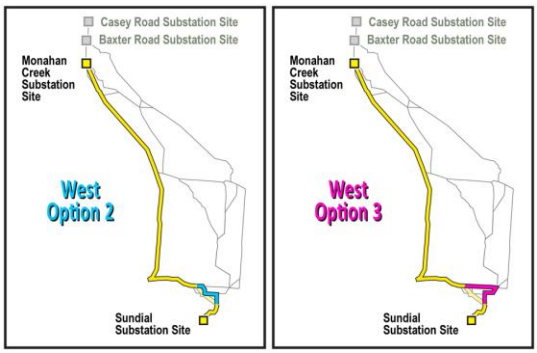
About 14 towers with access roads would be constructed near Camas where the line would cross the Columbia River and south of the Columbia River. The impact on wetlands in this area would be **low-to-high** where temporary or permanent fill would be placed at towers and roads constructed in disturbed wetlands with low-to-medium function ratings. Wetland impacts at Sundial Substation would be high (see Section 16.2.2.3, Sundial Substation).

16.2.4.1 West Option 1

West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. This portion of the alternative includes replacing one of the existing 230-kV lines with a new double-circuit 500-kV line. The existing230-kV line and the new line would be placed on new 500-kV towers.

Clearing in scrub-shrub and forested wetlands and fill of emergent and scrub-shrub wetlands along West Option 1 would occur within the Lacamas Creek floodplain northwest of Lacamas Lake (see Table 16-1). About 14 towers with access roads would be constructed in this area. Most of this option would be located in wetlands. Because this area has wetlands with a high function rating (the southern portion has been designated by WDNR as a Natural Area Preserve), impacts from clearing and fill would be **high**. Additionally, West Option 1 would impact more wetlands (12 acres) than the portion of line this option would replace on the West Alternative.

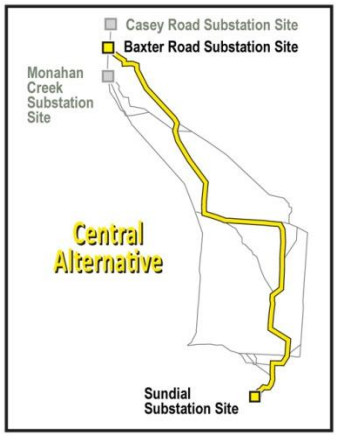
16.2.4.2 West Options 2 and 3



West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing rural residential and rural areas farther east.

Clearing in scrub-shrub wetlands and fill of emergent and scrub-shrub wetlands also would occur within the Lacamas Creek floodplain for both West Options 2 and 3 causing a **high** impact (the first five towers of both options would be constructed in the same high functioning emergent and scrub-shrub wetlands as West Option 1). While the wetlands are part of the larger wetland complex along Lacamas Creek, this northern portion has more agriculturally disturbed wetlands where functions are rated as low-to-medium. Farther to the east, clearing of forested and scrub-shrub wetlands with no opportunity for regrowth northeast of Camas and along the Little Washougal River for both options and Matney Creek for West Option 3 would create a **moderate-to-high** impact. Similar to the West Alternative, wetland functions would continue, but habitat would be removed and hydrology could be altered. However, West Options 2 and 3 would require between 11 and 7 fewer acres to be cleared in forested and scrub-shrub wetlands within the right-of-way than the portions of line these options would replace on the West Alternative.

16.2.5 Central Alternative

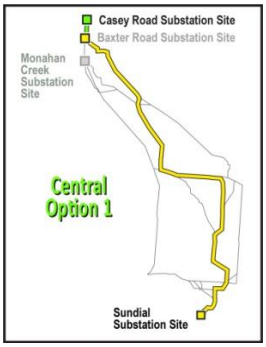


Similar to the West Alternative, all forested wetlands within new and existing transmission line right-of-way and where crossed by access roads would be cleared for the Central Alternative, a **high** impact. Together, about 85 acres of forested and scrub-shrub wetland would be cleared within the right-of-way, with most of these medium-to-high quality wetlands converted to lower quality and low-growing scrub-shrub or other types of wetland (see Table 16-1). Similar to the West Alternative, while these wetlands would most likely continue to offer some wetland functions, impacts would occur from habitat removal and possible changes to wetland hydrology and water quality improvement.

Fill would be placed in 8 acres of forested and non-forested wetlands primarily for construction and improvement of access roads near the Cowlitz River (two towers would be constructed in the floodplain) and east of Amboy along Chelatchie Creek (two towers with roads), near Big Tree Creek (two towers with roads) and northeast of Camas. Fill placed in these wetlands would destroy wetland functions, fragment habitat, and possibly alter hydrology causing a **high** impact.

As for the West Alternative, about 14 towers with access roads would be constructed near Camas where the transmission line would cross the Columbia River and south of the river. Wetland impacts in this area would be **low-to-high** where temporary or permanent fill for towers and roads would be placed in disturbed wetlands with low-to-medium function ratings (see Section 16.2.4, West Alternative).

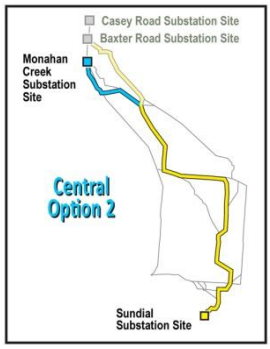
16.2.5.1 Central Option 1



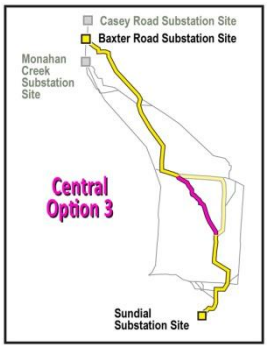
Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated forest production and open space land. Central Option 1 would require a small amount (about 2 acre) of clearing within medium-to-high quality scrub-shrub and forested wetlands near the southern end of the option, a **moderate-to-high** impact. No fill would be placed at tower sites or for roads and existing scrub-shrub or emergent wetland functions would continue even if some degradation occurs.

16.2.5.2 Central Option 2

Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. Clearing of forested wetland would occur as Central Option 2 crosses into Lexington near the Cowlitz River (about 5 acres). Fill and disturbance for construction of four towers in this wetland also would occur. Similar to impacts described in impacts common to action alternatives, a **high** impact would occur because habitat would be removed and hydrology could be altered. Compaction and fill at towers sites would also destroy wetlands functions and values.



16.2.5.3 Central Option 3

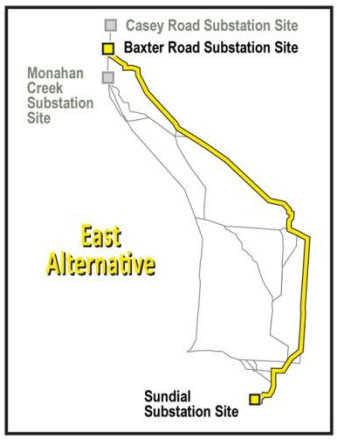


Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. Impacts would be similar to those from Central Option 2 (**high**), although this option would require about 3 acres less clearing than the portion of line this option would replace on the Central Alternative. Clearing of forested wetland and construction of two towers would occur along Cedar Creek within high-quality forested and emergent wetlands. Fill for access roads and towers would be placed in smaller scrub-shrub wetlands along drainages west and south of Amboy. Wetlands along the East Fork Lewis River would most likely be avoided by placing towers outside the wetland and buffer although clearing would occur. Clearing and tower placement with access road construction also would occur in a forested wetland along the south end of Central Option 3.

16.2.6 East Alternative

Similar to the West and Central alternatives, all forested wetlands within new and existing transmission line right-of-way and where crossed by access roads would be cleared for the East Alternative, a **high** impact. Together, about 84 acres of forested and scrub-shrub wetland would be cleared within the transmission right-of-way, with most of the medium-to-high quality wetlands converted to low-growing scrub-shrub or other types of wetland for the East

Alternative (see Table 16-1). Similar to other action alternatives, though wetlands would most likely continue to offer some wetland functions, a **high** impact would occur from habitat removal and possible changes to wetland hydrology and water quality improvement.



Fill for towers and roads also would be placed in 10 acres of forested and non-forested wetlands (**high** impact) near the Cowlitz River (two towers and roads in forested wetlands), east of Amboy (seven towers and roads in forested and scrub-shrub wetlands), and northeast of Camas along and north of the Little Washougal River (five towers and roads in mostly scrub-shrub and emergent wetlands). Similar to the West and Central alternatives, temporary or permanent fill placed in agricultural fields or more developed areas where functions and quality are lower would cause **low-to-high** impacts depending on wetland quality. Fill placed in wetlands that provide benefits in the less developed areas along much of the East Alternative would affect water quality improvement and habitat, causing a **high** impact. The East Alternative would take the same route near Camas as the other action alternatives; about 14 towers with access roads would be constructed where the line would cross the Columbia River and south of the river. These are generally low-to-medium quality wetlands; impacts would be **low-to-high** (see Section 16.2.4, West Alternative).

16.2.6.1 East Option 1

East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. The option would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. About eight towers with roads would be constructed within emergent, scrub-shrub, and forested wetlands in the Cowlitz River floodplain for East Option 1. Similar to impacts described in impacts common to action alternatives, a **high** impact would occur where forested wetlands are cleared and fill is placed because habitat would be removed and hydrology could be altered. Compaction and fill at towers sites would also destroy wetlands functions and values. Additionally, East Option 1 would clear more wetlands (10 acres) than the portion of line this option would replace on the East Alternative.

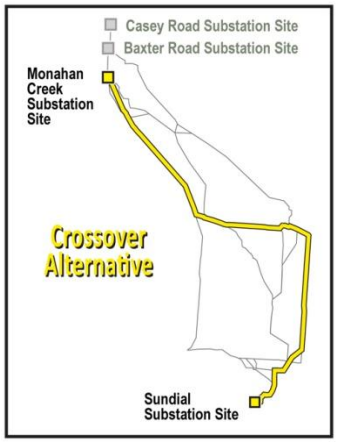
16.2.6.2 East Options 2 and 3

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. While many small wetlands are present along East Option 2, most would be spanned or avoided. About two towers with roads would be constructed near Cedar Creek in forested and scrub-shrub wetlands. Clearing and fill in these primarily medium-to-high quality scrub-shrub and forested wetlands would be a **high**

impact. Similar to the other options and action alternatives, though wetland functions would continue, habitat would be removed and hydrology could be altered. About three towers with roads would be constructed near the Little Washougal River. Similar to impacts for West Option 3, impacts to wetlands cleared and filled along the Little Washougal River would be **high**.

East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. One forested wetland is present along East Option 3 south of the East Fork Little Washougal River. About two towers with roads would be constructed within this wetland. Clearing and fill in the forested wetland would be a **high** impact.

16.2.7 Crossover Alternative



Similar to the other action alternatives, all forested wetlands within new and existing transmission line right-of-way and where crossed by access roads would be cleared for the Crossover Alternative, a **high** impact. Together, about 88 acres of forested and scrub-shrub wetland would be cleared within the transmission right-of-way, with most of the wetlands converted to low-growing scrub-shrub or other types of wetland (see Table 16-1). Similar to other action alternatives, though wetlands would most likely continue to offer some wetland functions, a **high** impact would occur from habitat removal and possible changes to wetland hydrology and water quality improvement.

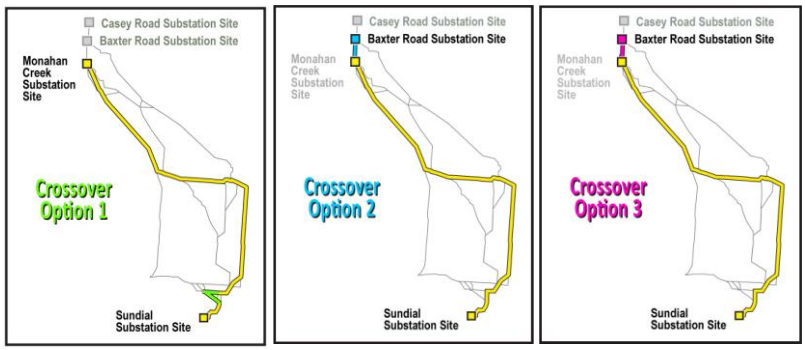
Fill for towers and access roads would be placed in 13 acres of forested and non-forested wetlands from towers and access roads along the Coweeman and Cowlitz rivers, east of Amboy (seven towers and roads in forested and scrub-shrub wetlands), and northeast of Camas along and north of the Little Washougal River (five towers and roads in mostly scrub-shrub and emergent wetlands). Fill in these wetlands would cause a **high** impact. As discussed in impacts common to action alternatives, compaction and fill would destroy wetland functions, fragment habitat, and possibly alter hydrology. Similar to the other action alternatives, temporary or permanent fill placed in disturbed areas where functions and quality are lower along the northern portion of the Crossover Alternative, would create **low-to-high** impacts depending on wetland quality. Fill placed in wetlands that provide benefits in the less developed areas along the southern portion of the Crossover Alternative would affect water quality improvement and habitat, causing a **high** impact.

The Crossover Alternative would take the same route as the East and Central alternatives near Camas; about 14 towers with access roads would be constructed where the line would cross the Columbia River and south of the river. Impacts would be **low-to-high** (see Section 16.2.4, West Alternative).

16.2.7.1 Crossover Options 1, 2, and 3

Crossover Option 1 would require clearing and construction in the same forested, emergent, and scrub-shrub wetlands as described for West Option 3; impacts would be **high**. This option would clear more forested wetlands (8 acres) than the portion of line this option would replace on the Crossover Alternative.

About two to three towers with roads would be constructed in or near wetlands along Crossover Options 2 and 3 between the Baxter Road and Monahan Creek substation sites. Fill and clearing would occur in areas of scrub-shrub and forested wetland near Baxter Creek; this would be a **high** impact.



16.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2 and will be used to avoid and minimize impacts to wetlands to the maximum extent possible. The following additional mitigation measures have been identified to further reduce or eliminate adverse wetland impacts by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Obtain all required permits with approved wetland delineations and compensatory mitigation plans prior to construction, and implement required wetland compensation in accordance with these plans and permits.
- Stockpile wetland topsoil when excavating in wetlands and redeposit soil in place for restoration following construction.
- Avoid placing new access roads through wetlands and around surface waters to minimize the potential for altering surface water patterns and isolating connected wetlands.

16.2.9 Unavoidable Impacts

Unavoidable impacts to wetlands from all action alternatives include permanent fill of wetlands. As described above, depending on the action alternative, unavoidable impacts from fill would range from 19 to 43 acres of direct wetland loss. Unavoidable impacts also would occur from permanent removal of trees, shrubs, and other vegetation in wetlands within the transmission line right-of-way; and where tower footings, access roads, and substations would be sited. Depending on the action alternative, about 83 to 123 acres would be cleared. Within certain wetlands outside of the transmission line right-of-way, select trees that would present a current or future hazard to the transmission line (i.e., danger trees) also would be removed. This removal would result in unavoidable destruction or degradation of wetland functions. In all areas where trees are removed from forested wetlands and wetland fill is not required, wetlands would be converted to scrub-shrub or emergent wetlands. Maintenance of vegetation height within the right-of-way would prevent these converted wetlands from redeveloping the functions and values previously provided as forested wetland (e.g., forested wildlife habitat, stream shading, species diversity, overland flow and flood storage moderation, water quality functions). Tower footings, access roads, and substations can fragment wetlands, altering

hydrology and drainage patterns, plant species and vegetation structure, and wildlife use and distribution.

16.2.10 No Action Alternative

The No Action Alternative would have no project-related impact on wetlands because no new transmission lines, towers, or substations would be constructed. Impacts from ongoing commercial practices or other future development could impact wetlands, either directly or indirectly, through population growth, land management, climate change, or development affecting water quality. Potential future impacts to wetlands include those from ongoing commercial timber harvest on lands managed for timber production in both Cowlitz and Clark counties and from urban development in the greater Portland-Vancouver metro area.

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Chapter 17 Vegetation

This chapter describes existing vegetation resources in the project area, and how the project alternatives could affect these vegetation resources. Related vegetation information can be found in Chapter 16, Wetlands; Chapter 18, Wildlife; and Chapter 19, Fish.

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

17.1 Affected Environment

Most of the project area is in the Western Hemlock Forest Vegetation Zone, which was historically dominated by western hemlock, Douglas fir, and western red cedar (Franklin and Dyrness 1988). The southwest portion of the project area transitions into the Interior (Willamette) Valley Vegetation Zone. Within these zones, other plant community types occur, including remnant patches of wet and dry prairie, Oregon white oak (*Quercus garryana*) woodlands, and riparian woodlands dominated by black cottonwood and willow. **Wetland plant communities** are common, especially near rivers and streams and where **hydric soils** occur in lowland and floodplain areas, including the Cowlitz River valley lowlands and the Columbia River floodplain (see Chapter 16, Wetlands).

In general, vegetation within the project area is determined by a combination of factors, including climate, topography, soils, hydrology, and land use practices. Much of the vegetation has been disturbed and altered by urbanization, forestry, and agriculture. Major urban and suburban influences on vegetation occur near larger rivers and include the cities of Kelso, Longview, Castle Rock, Vancouver, and Camas in Washington, and Troutdale and Fairview in Oregon. Agriculture and production forests are common in rural areas east of the Longview-Kelso area and north of Vancouver.

The effects of extensive development on natural vegetation include **habitat fragmentation**, the conversion and loss of native habitats, and the introduction and spread of weedy species. In the project area, many native species and plant communities have become scarce, such as Bradshaw's lomatium (*Lomatium bradshawii*) and Oregon ash/common snowberry forested wetlands (see Section 17.1.2, Special-Status Plant Habitats, and Section 17.1.3, Special-Status Species). Despite the large extent of human development in the project area, however, some high-quality native plant communities persist, including stands of old-growth and mature forest, Oregon white-oak woodlands, an extensive network of streams and riparian areas, wetlands, and small areas of native prairie. This is particularly the case in the northern and eastern portions of the project area.

17.1.1 General Vegetation Types

Land cover and vegetative cover were used to categorize the land within the project area into seven general vegetation types: mature forest, forest, production forest, shrubland, herbaceous (non-woody), rural landscaped, and urban/suburban landscaped (see Maps 17-1A through 17-1D).

Although these maps show the vegetation types throughout the project area, for this analysis, a study area for vegetation types was identified to include a 3,000-foot corridor, 1,500 feet either side of the transmission line centerline. This area includes the transmission line right-of-way,

new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way.

Wetlands may occur in all general vegetation types and include forested wetlands, scrub-shrub wetlands, emergent wetlands, aquatic bed wetlands, and open water. The vegetation characteristic of each of these wetland types is described under the general vegetation types in this section, but information on existing wetland locations and acreages in the project area is in Chapter 16, Wetlands.

17.1.1.1 Mature Forest

Mature forest includes older forested areas typically dominated by coniferous trees over 80-years old with a diameter at breast height (dbh) over 21 inches. This vegetation type also includes old-growth forest, which is forest with at least eight trees per acre that either have a dbh greater than 32 inches, or are more than 200-years old, and form a multi-layered canopy with occasional small openings.

The most common tree species in mature forest is Douglas fir, but mature forest may also include Sitka spruce, noble fir (*Abies procera*), western hemlock, western red cedar, and Pacific silver fir (*Abies amabilis*). Understory species vary, but may include vine maple (*Acer circinatum*), salal (*Gaultheria shallon*), bunchberry dogwood (*Cornus Canadensis*), beaked hazelnut (*Corylus cornuta*), red huckleberry (*Vaccinium parvifolium*), oval-leaf blueberry (*V. ovalifolium*), thinleaf huckleberry (*V. membranaceum*), and sword fern (*Polystichum munitum*).

Some mature forests include areas dominated by Oregon white oak, particularly in areas with well-drained sandy and gravely soils. Oregon white oak woodlands are a priority for conservation and management by the state of Washington (see Section 17.1.2, Special-Status Plant Habitats).

Mature forest also includes some areas with mature forested wetlands, which have at least 30 percent areal cover by mature tree species (over 80-years old) (see Chapter 16, Wetlands). Tree species commonly found in mature forested wetlands include red alder, black cottonwood, western red cedar, Sitka spruce, and Oregon ash. Shrub and herbaceous layers in mature forested wetlands include black hawthorn, red-osier dogwood, stinging nettle, western skunk cabbage, slough sedge, and various fern species.

Mature forest is uncommon in the study area, but can be found in riparian areas where timber harvest has been limited, and near Yale Lake and Lake Merwin (see Maps 17-1A, 17-1C, and 17-1D). Mature forest only covers about 3 percent of the study area along the Crossover Alternative, 2 percent along the West Alternative, and 1 percent along the Central and East alternatives.

Mature forests are considered high-quality native plant habitats.

17.1.1.2 Forest

The forest vegetation type includes forests with at least 30 percent areal cover by trees younger than 80-years old, or with a dbh less than 21 inches. Forest has a greater diversity of shrubby and herbaceous species in the understory than in the mature forest and production forest

vegetation types. Forests in the project area may be dominated by conifers or by a combination of conifers and hardwoods. They include small stands in some urban and suburban settings and expansive stands in more remote areas. The forest vegetation type likely includes some small tracts of privately owned forests managed for production.

Common coniferous tree species in the forest vegetation type include Douglas fir, grand fir (*Abies grandis*), noble fir, and western hemlock in uplands, and western red cedar in wetlands. Common hardwood tree species include big leaf maple (*Acer macrophyllum*) in uplands, and Oregon ash, black cottonwood, and red alder in forested wetlands. Common shrub understory species include Oregon grape (*Mahonia nervosa*), beaked hazelnut, salmonberry (*Rubus spectabilis)*, oceanspray (*Holodiscus discolor*), vine maple, Indian plum (*Oemleria cerasiformis*), and salal.

The forest vegetation type also includes some forested wetlands (see Chapter 16, Wetlands). These forested wetlands are similar to mature forested wetlands, but with trees generally less than 80-years old. Because of more recent or frequent disturbances and more open canopy, less mature forested wetlands may have more non-native species in the understory, including various shrubs and dense areas of reed canarygrass.

The forest vegetation type can be found throughout the study area, although it is more prevalent on either side of the Cowlitz River in the northern portion of the study area and southwest of Lake Merwin in the central portion (see Maps 17-1A through 17-1D). This vegetation type covers about 31 percent of the study area along the West Alternative, 24 percent along the Central Alternative, 27 percent along the Crossover Alternative, and 16 percent along the East Alternative.

Forest is considered a native plant habitat of moderate quality, and forested wetlands a high-quality native plant habitat.

17.1.1.3 Production Forest

Cowlitz and Clark counties are dominated by the production forest vegetation type, which are forests routinely harvested to produce wood products, although some production forest is also managed for habitat. Production forest was identified by the locations of large timber company landholdings in the project area. It is likely that some smaller areas of privately-owned production forest also occur in the project area, but information about these smaller areas is not readily available, so these areas have been categorized as forest for the purposes of this analysis. In 2009, private timberland owners harvested about 114 million board feet of timber from about 4,500 acres in Cowlitz, Clark, and Multnomah counties (WDNR 2009b, Oregon Department of Forestry 2009). About 86 percent of this timber was harvested in Cowlitz County.

The production forest vegetation type is dominated by Douglas fir and western hemlock (WDNR 2009c). Although plant species in production forest areas are similar to species found in the other two forest vegetation types, tree species diversity is lower. A recurring cycle of tree growth and harvest strongly influence the structural characteristics, age, and composition of these forests. Frequent disturbance from tree harvests can also create opportunities for weedy species to invade the understory.

Production forest is most concentrated in the central portion of the study area, both north and southeast of Lake Merwin and Yale Dam (see Map 17-1B and Map 17-1C). It is the most common vegetation type along three of the action alternatives. In the study area, it covers 73 percent of the East Alternative, 63 percent of the Central Alternative, and 50 percent of the Crossover Alternative (Herrera 2010). It covers only 10 percent of the West Alternative. The Casey Road and Baxter Road substation sites and about one third of the Monahan Creek substation site occur in production forest.

Production forest is considered a low-quality native plant habitat.

17.1.1.4 Shrubland

Shrubland includes areas with at least 30 percent areal cover by shrubs and tree saplings. In the project area, shrubland occurs in existing transmission line rights-of-way where vegetation management requires the regular removal of tall-growing vegetation, in recently harvested production forest, and in fallow fields. Because shrublands develop following a disturbance, they are susceptible to invasion by non-native plants from infested areas. Because of this, and given the prevalence of non-native plants in the region, shrublands are likely to have low native plant diversity in the project area.

Common native shrub species within upland shrubland include vine maple, oceanspray, and snowberry (*Symphoricarpos albus*), and common non-native species include Himalayan blackberry (*Rubus armeniacus*) and Scotch broom (*Cytisus scoparius*). Non-native pasture grasses and **forbs** commonly occur in the understory within upland shrubland.

Wetlands within shrubland are known as scrub-shrub wetlands (see Chapter 16, Wetlands). Scrub-shrub wetlands are dominated by shrubs adapted to areas that are partially inundated during the growing season. Scrub-shrub wetlands occur in depressions; along streams, rivers, and ditches; and in forested wetlands that have been cleared. Common native shrub species include a variety of willows, salmonberry, red-osier dogwood, Douglas' spiraea, Pacific ninebark, and rose species. Non-native shrub species may include butterfly bush. Common herbaceous species include native sedges, rushes, and ferns, and native and non-native grasses and forbs.

Shrublands are scattered throughout the production forest and forest habitats in the study area and are often connected to herbaceous habitat. They are more common along the West and Crossover alternatives than the Central and East alternatives (see Maps 17-1A through 17-1D). Shrubland covers about 7 percent of the study area along the West Alternative and 4 percent along the Crossover Alternative. The Central and East alternatives only have about 2 percent of the study area in shrublands.

Shrubland is considered a low-quality native plant habitat; scrub-shrub wetlands are considered a high-quality native plant habitat.

17.1.1.5 Herbaceous

The herbaceous vegetation type includes pasture and cropland, and native upland and wetland prairie. Although more than 99 percent of the prairies of southwestern Washington have been converted to pasture, cropland, or other uses, areas of remnant native prairie and wetland vegetation remain (Caplow and Miller 2004). In 1988, the USFWS estimated that between

20 and 39 percent of Washington's wetlands had been lost, with estimates of continuing wetland removal ranging from 700 to 2,000 acres per year (Lane and Taylor 1997).

The herbaceous vegetation type, like shrublands, frequently occurs scattered throughout forest and production forest. It is more concentrated along the Cowlitz River and mixed with forest in the area southwest of Lake Merwin. This vegetation type is more common along the West Alternative, providing about 21 percent cover of the study area (see Maps 17-1A through 17-1D). The remaining action alternatives have little herbaceous vegetation within the study area: about 5 percent in the Crossover Alternative, 4 percent cover in the Central Alternative, and 3 percent in the East Alternative.

The herbaceous vegetation type is generally considered a low-quality native plant habitat, with the exception of native prairie and herbaceous wetlands.

Pasture and Cropland

The pasture and cropland vegetation types include large tracts of pastures, hayfields, and row crops interspersed with orchards, Christmas tree farms, and vineyards. Common pasture species include orchard grass (*Dactylis glomerata*), sweet vernal grass (*Anthoxanthum odoratum*), timothy (*Phleum pratense*), and non-native forbs such as clovers (*Trifolium spp.*), oxeye daisy (*Leucanthemum vulgare*), and hairy cat's ear (*Hypochaeris radicata*). A variety of crops are grown including vegetables, mints, grapes, nursery stock, sod, berries (e.g., strawberries, blueberries, and caneberries), tree fruits, and nuts.

Areas within pasture and cropland often include drainage ditches and depressions, which may support emergent and scrub-shrub wetland communities. Pasture and cropland can also include natural or human-made open water areas and streams, which often support riparian habitat.

Native Upland and Wet Prairie

Native prairie is a rare vegetation type. Native prairie predominantly consists of native herbaceous species and is classified as either wetland (wet) or upland prairie. For this analysis, native prairie is considered a high-quality native plant habitat. Wet prairie has wetland hydrology, hydric soils, and plant species adapted to grow in wet conditions. Although the project area historically contained many native prairies, most have been converted for agriculture or developed for other uses. Only small remnant patches remain along fencerows and field margins (WDNR 2008, 2009c; Caplow and Miller 2004).

The Lacamas Prairie Natural Area is in the project area and contains the only remaining intact wet prairie in Washington (see Section 17.1.2.1, WDNR Protected Areas). The Lacamas Prairie Natural Area also includes extensive Oregon white oak woodland habitats. Plant species include native grasses such as tufted hairgrass (*Deschampsia cespitosa*) and California oatgrass (*Danthonia californica*), native sedges and rushes, and a variety of native forbs, including blue camas (*Camassia quamash*). Special-status plant species include the federally endangered Bradshaw's lomatium, state-endangered hairy-stemmed checker-mallow (*Sidalcea hirtipes*), and state-threatened Oregon coyote-thistle (*Eryngium petiolatum*) (see Section 17.1.3, Special-Status Plant Species). Most remnant wetland native prairies in the project area have been extensively altered and invaded by non-native species such as common velvetgrass (*Holcus*

lanatus), and various native trees and shrubs, including Oregon ash, red alder, black hawthorn, and various rose species.

Plant species found in intact upland native prairies include native bunchgrasses such as Roemer's bunchgrass (*Festuca idahoensis* ssp. *roemeri*), California oatgrass, blue wildrye (*Elymus glaucus*), Lemmon's needlegrass (*Achnatherum lemmonii*), and junegrass (*Koeleria macrantha*) (Chappell and Kagan 2001). The spaces between the bunchgrasses are typically covered by mosses, fruticose lichens, or native forbs (Altman et al. 2001). Showy, slow-growing, perennial forbs include common woolly sunflower (*Eriophyllum lanatum*), slender cinquefoil (*Potentilla gracilis*), wild strawberry (*Fragaria virginiana*), rose checker-mallow (*Sidalcea malviflora* ssp. *virgata*), Hall's aster (*Symphotrichum hallii)*, and Tolmie's mariposa lily (*Calochortus tolmiei*). Most remnant upland native prairies in the project area have been extensively altered and invaded by non-native species such as Kentucky bluegrass (*Poa pratensis*), sweet vernal grass, and scotch broom, and by various native shrubs and trees.

Wetlands

Herbaceous wetlands include palustrine emergent wetlands, aquatic bed wetlands, and open water. Vegetation consists of erect, rooted, herbaceous **hydrophytes** with at least 30 percent areal coverage (Cowardin et al. 1979). Emergent wetlands are common along the margins of aquatic beds and open water areas and in cleared forested wetlands. Common native herbaceous plant species in emergent wetlands include sedges, rushes, bulrushes, and cattail. They can also contain a wide range of non-native species such as reed canarygrass. Emergent wetlands may also provide habitat for special-status native plant species, including those that historically occurred in wet prairies.

Aquatic bed wetland vegetation is dominated by plants that grow on or below the surface of the water for most of the growing season (Cowardin et al. 1979). The areal coverage of submerged or floating aquatic vegetation is at least 30 percent. Aquatic beds represent a diverse group of plant communities that require surface water for optimum growth; they are best developed in permanent water or under conditions of repeated flooding. The plants attach to the substrate or float freely in the water above or below the surface. Plant species include milfoils, pondweeds, water lilies, and lesser duckweed. Aquatic bed habitats within the project area are scarce, widely scattered, and least common in foothills areas (such as those crossed by the East Alternative). They occur in open water and next to emergent habitats. Depending on water depth and turbidity, open water may contain non-emergent hydrophytic plant species.

17.1.1.6 Rural Landscaped

The rural landscaped vegetation type includes the vegetation in farmyards, small pastures or cultivated areas a few acres in size, and low-density residential development.

The landscape is highly fragmented and may include vegetation from the other general vegetation types. Examples are small pastures or cultivated fields surrounding farmyards, and forested areas intermixed with single-family homes. The quality and amount of natural plant habitats are highly variable.

The rural landscaped vegetation type is located primarily along the Cowlitz River, mixed with forest in the area southwest of Lake Merwin, and in and around Castle Rock, Longview-Kelso, and Vancouver (see Maps 17-1A, 17-1C, and 17-1D). This vegetation type covers about

12 percent of the study area along the West Alternative, 7 percent along the Crossover Alternative, 4 percent along the Central Alternative, and 3 percent along the East Alternative.

Rural landscaped vegetation is considered a low-quality native plant habitat due to high levels of disturbance and a small distribution of native plant communities.

17.1.1.7 Urban/Suburban Landscaped

The urban/suburban landscaped vegetation type includes the vegetation in mid-to-high–density development, including commercial, residential, and industrial areas. Vegetation primarily occurs in highly fragmented patches of non-native street trees, lawns, and ornamental landscaping, although some native plant communities may occur in parks or other public spaces.

Urban and suburban landscaped vegetation occurs primarily in the north and south portions of the study area. They include Castle Rock and the Longview-Kelso metro area in the north, and Vancouver in the south (see Maps 17-1A and 17-1D). This vegetation type covers about 18 percent of the study area along the West Alternative, 4 percent along the Crossover Alternative, and 3 percent along the Central and East alternatives.

The rural landscaped vegetation type is considered a low-quality native plant habitat due to high levels of disturbance and a small distribution of native plant communities.

17.1.2 Special-Status Plant Habitats

Special-status plant habitats are native plant communities that are rare or have very limited distribution. In Washington, they are recognized as high quality or rare plant communities (priority ecosystems) that contain a unique, mature, or high-diversity assemblage of native plant species (WNHP 2011b). They are a priority for preservation and the lands on which they occur may be purchased by WDNR and designated as **Natural Area Preserves** (NAPs) or **Natural Resource Conservation Areas** (NRCAs). In addition, WDNR owns forest riparian conservation easements, research plots, and genetic reserves important for conservation and research. **Priority habitats** are similar to priority ecosystems, but are identified by the Washington Department of Fish and Wildlife (WDFW) as having unique vegetation types, dominant plant species, successional stages, or specific habitat features that are important to wildlife and considered a priority for conservation and management by the state (WDFW 2008) (see Chapter 18, Wildlife).

The Oregon Biodiversity Information Center (ORBIC) identifies high-quality native plant communities that represent the full range of Oregon's natural heritage resources, and are priorities for preservation (Oregon Natural Heritage Advisory Council 2010). Natural heritage (vegetation) resources are identified as ecosystem elements, which can be high-quality plant communities, ecosystems, or special-status species.

For this analysis, the study area for special status plant habitats and species was a 2-mile corridor (1 mile either side of the transmission line centerline). This area includes the transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way. This study area is larger than the study area for general vegetation types. A broader area allows a more accurate assessment of their likelihood to occur in the affected environment, and a better description of the extent of impacts to these important resources.

A number of special-status plant habitats have been identified within the study area in Washington, although none have been found within this area in Oregon.

17.1.2.1 WDNR Protected Areas

WDNR protected areas include a proposed combined NAP and NRCA, and forest riparian conservation easements, research plots, and genetic reserves.

Natural Area Preserves are important natural areas owned and managed by WDNR. They protect some of the best remaining examples of natural ecosystems that occur in the state. They include rare plant and animal habitat, and often have features unique to the region. The overarching purpose of the NAP program is to protect these areas as a legacy for future generations.

The project area in Washington includes the Lacamas Prairie Natural Area, as designated by the Washington State Commissioner of Public Lands (see Figure 17-1). The Lacamas Prairie Natural Area is east of Vancouver and northwest of Washougal. It contains federally and state-listed plant species, WNHP priority ecosystems (see Section 17.1.2.2, WNHP Priority Ecosystems) and other high quality plant communities, including wet prairie and mature forest. WDNR has proposed that the entire Natural Area be purchased by WDNR for a NAP and NRCA, and WDNR is currently pursuing the purchase of a portion of the proposed NAP.

The following alternatives and options have the Lacamas Prairie Natural Area within their study areas: West Alternative (1,603 acres), West Option 1 (46 additional acres), West Option 2 (259 fewer acres), West Option 3 (524 fewer acres), and Crossover Option 1 (371 acres). Specific segments crossing Lacamas Prairie include 36, 36A, 36B, 40, 41, 45, 46 and 50 (see Figure 17-1).

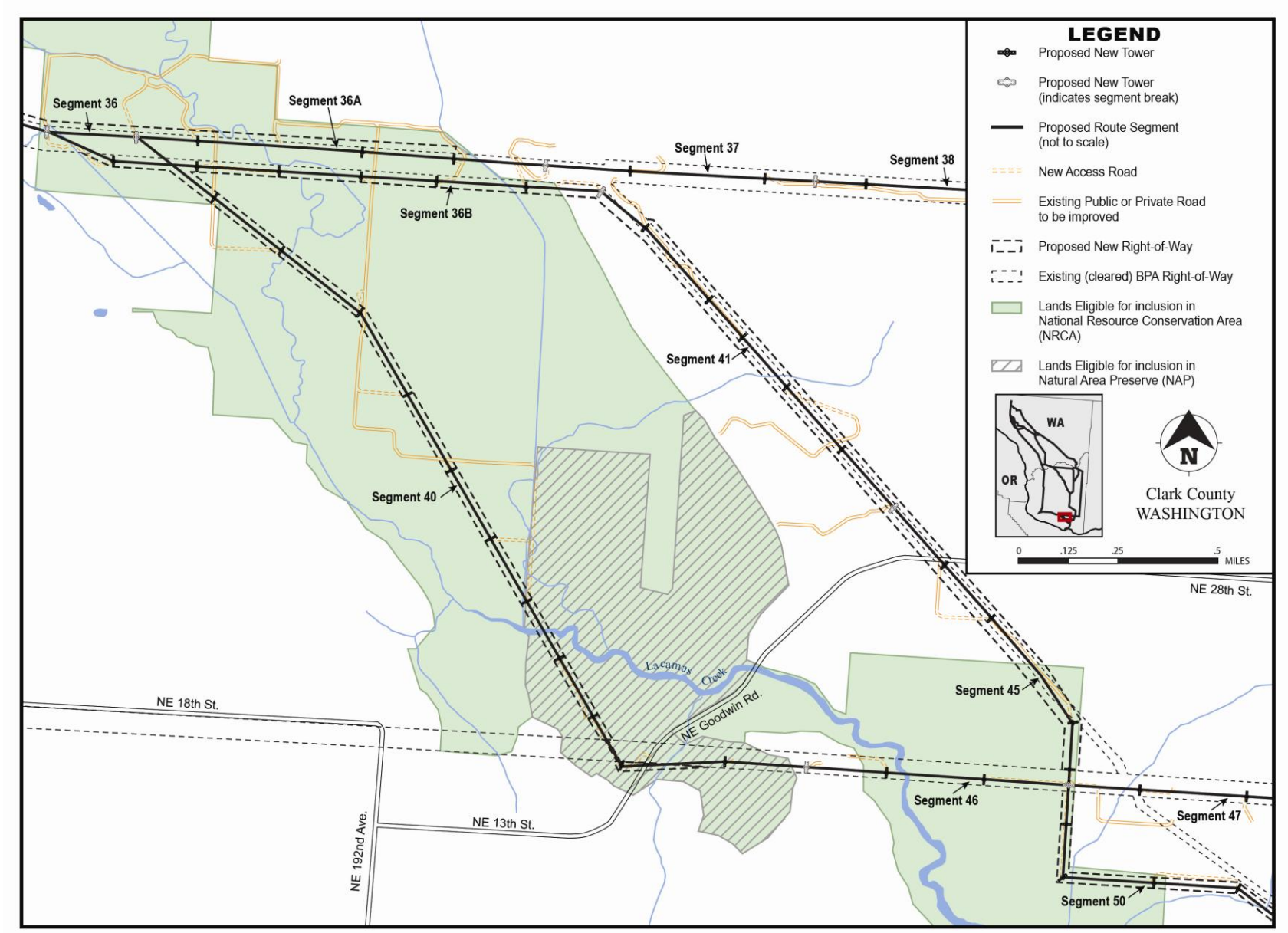
WDNR holds a forest riparian conservation easement through its Riparian Open Space Program within the right-of-way along Segment 9 of the West and Crossover alternatives. WDNR also maintains permanent research plots for varying purposes and has reserves for research on tree species genetics. One of these areas is partially within new right-of-way and the proposed routes for new and improved access roads along Segment 30 of Central Option 3.

17.1.2.2 WNHP Priority Ecosystems

The Washington Natural Heritage Program establishes native plant and ecological conservation priorities for Washington by identifying priority ecosystems. Prioritization is based on ecosystem rarity; the degree of threat to the persistence of an ecosystem; whether an ecosystem is habitat for endangered, threatened, and sensitive plants and animals; and whether the ecosystem is an important scenic landscape (WNHP 2007). Prioritization of these ecosystems is meant to guide the selection of areas to be designated officially as NAPs and NRCAs by WDNR, and to help guide other entities in land use planning and environmental decision-making (WNHP 2011b).

WNHP maintains a database of high-quality or rare ecological communities known to occur in each county of Washington (WNHP 2010). These priority ecosystems are areas designated by WNHP that contain unique mature or highly diverse native plant communities. Priority ecosystems are identified by indicator plant species, such as Oregon white oak/Pacific poison-oak (*Toxicondendron diversilobum*)/blue wildrye.

Figure 17-1 Proposed and Existing Rights-of-Way through the Lacamas Prairie Natural Area



The action alternatives have documented occurrences of the following priority ecosystems in the study area (WDNR 2008, 2010c):

- Oregon white oak woodlands
    - Oregon ash/common snowberry (in forested wetlands)
    - Oregon white oak/Pacific poison-oak/blue wildrye (in forest)
- Tufted hairgrass–California oatgrass (in emergent and scrub-shrub wetlands)
- North Pacific **herbaceous bald** and bluff (in forest openings)

Oregon white oak woodland priority ecosystems have been documented along parts of the southern portion of the study areas for all action alternatives, primarily in or near the Lacamas Prairie Natural Area. However, they are only found in the study areas of the West Alternative (including the West Options) and Crossover Option 1, which is where they are also most abundant.

One tufted hairgrass-California oatgrass priority ecosystem occurs in the study areas of the West Alternative (including the West Options) and Crossover Option 1 in the Lacamas Prairie Natural Area, though it is not crossed by the alternatives.

There is one documented North Pacific herbaceous bald and bluff WNHP priority ecosystem within the study area of the West Alternative, West Option 1, and Crossover Option 1, but it is not crossed by the proposed right-of-way or access roads. Six other herbaceous balds that have not been documented as WNHP priority ecosystems have been identified by WDFW: Larch Mountain (East and Crossover alternatives and East Option 2), Bald Mountain (Central Alternative), Davis Peak (Central Alternative), Lacamas Lake (Central, Crossover, East, and West alternatives, all West Options, and Crossover Option 1), Little Baldy Mountain (West Option 3), and Wilkinson Saddle (East Alternative) (see Chapter 18, Wildlife). Only the herbaceous bald on Larch Mountain is crossed by the project, although the herbaceous bald on Bald Mountain is within a few feet of an access road.

Several other priority ecosystems considered by WNHP as high quality or rare have not been documented in the study area, but have the potential to occur because they are known to occur in Cowlitz or Clark counties:

- Oregon ash/slough sedge forest (in forested wetlands)
- Douglas-fir–Oregon white oak/snowberry woodland (in forest and production forest areas)
- A variety of remnant native prairie associations, such as the Roemer's fescue (*Festuca idahoensis*, var. *roemerii*)–great camas (*Camassia leichtlinii*) association (in herbaceous areas)
- Douglas fir/beaked hazelnut/sword fern forest (in forest, production forest, and mature forest)
- Noble fir forest (in forest and production forest areas)
- Douglas fir–western hemlock/sword fern forest (in forest and production forest)
- Sitka willow (*Salix sitchensis*) shrubland (in scrub-shrub wetlands)
- Western hemlock/sword fern forest (in forest and production forest)

The ORBIC database maintains Oregon's database of natural vegetation, with descriptions and information on occurrences of rare, threatened, or endangered species; however, it does not map native plant communities, ecosystems, or associations (ORBIC 2010).

17.1.3 Special-Status Species

17.1.3.1 Definitions

Special-status species include those native species identified by federal and/or state authorities as having low or declining populations that could put the species at risk at state, national, and/or global levels.

Federally listed threatened and endangered plant species are protected under the federal Endangered Species Act (ESA) and regulated by the USFWS. Federal special-status species also include those categorized by USFWS as proposed for listing, candidates for listing, or as species of concern. Fourteen federal special-status plant species potentially occur in the project area; two species have current documented occurrences in the study area (see Table 17-1 and Section 17.1.2, Special-Status Plant Habitats for a definition of the study area) (USFWS 2010a, 2010b, 2010c, 2011; WNHP 2010).

State special-status species are those identified by the states of Washington (WDNR) and/or Oregon (Oregon Department of Agriculture [ODA]) as having populations at risk within the state (see Table 17-1). In Washington, special-status species in the project area include those identified as endangered, threatened, sensitive, or candidates for listing (WDNR 2010e). In Oregon, they include those identified as endangered, threatened, sensitive vulnerable, sensitive critical, or as candidates for listing (ORBIC 2010). Twenty-eight state special-status plant species have the potential to occur in the project area; 13 are also federal special-status species. Eleven species have current documented occurrences in the study area.

Table 17-1 Special-Status Plant Species with the Potential to Occur in the Study Area[1]

Species	Status	Potential Habitat in Project Area	Documented Occurrences by Action Alternative		
			In Access Roads or at Tower Sites[2]	In the Right-of-Way	Outside of the Right-of-Way
Barrett's penstemon (*Penstemon barrettiae*)	Federal (SOC) WA (T)	Herbaceous (herbaceous bald and bluff)	–	–	–
Bolandra (*Bolandra oregano*)	WA (S)	Mature Forest, Forest, Production Forest (riparian, moist rocky outcrops)	–	–	West, Central, and East alternatives and options (h); Crossover Alternative and Options (c)
Bradshaw's lomatium (*Lomatium bradshawii*)	**Federal (E)** WA (E) OR (E)	Herbaceous (wet prairies)	West Alternative and Options (c)	West Option 1 (c)	West Alternative and Options (c) Crossover Option 1 (c)
Branching montia (*Montia diffusa*)	WA (S)	Forest, Production Forest	–	–	West Alternative and Options (h)
Clackamas corydalis (*Corydalis aquae-gelidae*)	Federal (SOC) WA (S)	Forest, Production Forest (elev. 2,500 to 3,800 feet, forested wetland, forested riparian)	–	–	–
Dense sedge (*Carex densa*)	WA (T)	Herbaceous (wet prairie, riparian areas)	–	–	West Alternative West Option 1 Crossover Option 1 (c)
Golden paintbrush (*Castilleja levisecta*)	**Federal (T)** WA (E) OR (E)	Herbaceous (wet and upland prairie)	–	–	All Action Alternatives (h)
Great polemonium (*Polemonium carneum*)	WA (T)	Forest, Production Forest, Herbaceous, Rural Landscaped	–	–	West Alternative and Options (h)
Hairy-stemmed checkermallow (*Sidalcea hirtipes*)	WA (E)	Herbaceous (prairie, herbaceous balds)	–	–	West (h), Central (c/h) (Central Option 3 = h), and Crossover alternative and options (h)
Hall's aster (*Symphyotrichum hallii*)	WA (T)	Herbaceous (prairie)	West Option 1 (c)	West Option 1 (c)	West Alternative, West Option 1, Crossover Option 1 (c)

Species	Status	Potential Habitat in Project Area	Documented Occurrences by Action Alternative		
			In Access Roads or at Tower Sites[2]	In the Right-of-Way	Outside of the Right-of-Way
Howell's bentgrass (Agrostis howellii)	Federal (SOC)	Forest, Production Forest (shady woodlands, cliff bases)[f]	–	–	–
Howell's daisy (*Erigeron howellii*)	Federal (SOC) WA (T)	Herbaceous (1,600–3,400', herbaceous balds)[e]	–	–	–
Idaho gooseberry (*Ribes oxyacanthoides* ssp. *Irriguum*)	WA (T)	Forest and Production Forest (3,000 to 5,000 feet, stream-sides, canyon slopes)	–	–	West Alternative and Options (h)
Kincaid's lupine (*Lupinus sulphureus* ssp. *kincaidii*)	**Federal (T)** WA (E) OR (T)	Herbaceous and Forest (upland prairie and open oak woodlands)	–	–	–
Narrowleaf wyethia (*Wyethia angustifolia*)	WA (S)	Herbaceous (upland prairie)	–	–	Central Alternative and Options (h)
Nelson's checker-mallow (*Sidalcea nelsoniana*)	**Federal (T)** WA (E) OR (T)	Herbaceous (wet prairie, open riparian)	–	–	–
Nuttall's quillwort (*Isoetes nuttallii*)	WA (S)	Herbaceous (wet prairie)	West Alternative and Options (c)	West Option 1 (c)	West Alternative and Options Crossover Option 1 (c)
Oregon coyote-thistle (*Eryngium petiolatum*)	WA (T)	Herbaceous (wet prairie)	West Option 1 (c)	West Option 1 (c)	West Alternative and Options Crossover Option 1 (c)
Pale (white rock) larkspur (*Delphinium leucophaeum*)	Federal (SOC) WA (E) OR (E)	Herbaceous (herbaceous bald and bluff, upland prairie, wet prairie)	–	–	–
Small-flowered trillium (*Trillium parviflorum*)	WA (S)	Mature forest, Forest (including Oregon white oak woodlands and riparian areas), Production Forest, Shrubland	All Action Alternatives (c)	All Action Alternatives (c)	All Action Alternatives (c)
Smooth goldfields (*Lasthenia glaberrima*)	WA (E)	Herbaceous (emergent wetlands, riparian areas)	–	–	All Action Alternatives (h)

Species	Status	Potential Habitat in Project Area	Documented Occurrences by Action Alternative		
			In Access Roads or at Tower Sites[2]	In the Right-of-Way	Outside of the Right-of-Way
Soft-leaved willow (*Salix sessilifolia*)	WA (S)	Mature Forest, Forest, Production Forest (forested riparian)	–	–	Central Alternative, Central Options 1 and 3, East Alternative, East Options 2 and 3 (c)
Tall bugbane (*Cimicifuga elata*)	Federal (SOC) WA (S) OR (C)	Mature Forest, Forest, Production Forest (forested riparian)	–	–	West Alternative and Options (c/h); Central, East, and Crossover alternatives and options (c)
Torrey's peavine (*Lathyrus torreyi*)	Federal (SOC) WA (T)	Forest, Production Forest	–	–	West Alternative and Options (h)
Water howellia (*Howellia aquatilis*)	**Federal (T)** WA (T)	Herbaceous (emergent wetlands)	–	–	–
Western wahoo (*Euonymus occidentalis* var. *occidentalis*)	WA (T)	Mature Forest, Forest, Production Forest	–	–	West Alternative and Options (c/h), Central Alternative and Options 1 and 2 (h), Central Option 3 (c/h), and East Alternatives and Options (h)
Western yellow oxalis (*Oxalis suksdorfii*)	WA (T)	Herbaceous, Forest, Production Forest	–	–	West Alternative and Options (h)
Whitetop aster (*Sericocarpus rigidus*)	Federal (SOC) OR (S)	Herbaceous (upland prairie)	–	–	–
Willamette Valley daisy (*Erigeron decumbens* var. *decumbens*)	**Federal (E)** OR (E)	Herbaceous (upland prairie, Oregon white oak savanna)	–	–	–

Notes:
C – candidate, T – threatened, E – endangered, S – sensitive, SOC – species of concern, c = current documented occurrences (recently verified as still existing), h = historic documented occurrences (not recently verified)

1. Documented occurrences are within a 2-mile-wide corridor (1 mile on each side of the action alternatives).
2. Documented occurrences of species that occur in access roads or at tower sites are not repeated in the two right-of-way columns.

Sources: Center for Plant Conservation 2011, eFloras.org 2011, ORBIC 2010, OSU 2010, USFWS 2010b, USFWS 2011a, WDNR 2010d, WDNR 2010e, WNHP 2010

17.1.3.2 Documented Occurrences of Special-Status Species

In Washington, federally listed species and federal species of concern with historic or current documented occurrences in the study area include Bradshaw's lomatium (federally endangered, Oregon and Washington state endangered); golden paintbrush (*Castilleja levisecta*; federally endangered); tall bugbane (*Cimicifuga elata*; federal species of concern, Washington sensitive, Oregon candidate), and Torrey's peavine (federal species of concern, Washington threatened) (see Table 17-1). Of these, only Bradshaw's lomatium and tall bugbane have been recently verified (current occurrences). Fifteen additional state special-status species have been documented within the study area; nine of these have been verified recently along at least one action alternative (see Table 17-1).

In Oregon, no special-status species are documented in the study area (OSU 2010). However, there are documented occurrences of special-status species in the larger project area in Oregon, and suitable habitat for these species may be present in the study area in Oregon (Herrera 2010).

Federally listed species may have **critical habitats**—areas that are determined to be "essential for the conservation of the species" (USFWS 2011c). These areas are determined and designated by USFWS. No critical habitat is currently designated in the study area for any federally listed plant species (USFWS 2011b).

17.1.4 Weeds

"Noxious weeds" are specifically defined in the Federal Plant Protection Act as those plant species that can damage cultivated or natural vegetation, livestock, and other resources. The Federal Noxious Weed Act directs federal agencies to manage noxious weeds—as identified by state or federal law—on federal land where county or private management plans are in place. Weeds can reduce crop yields and forage production, injure livestock, alter habitats, and displace native plant species. State and county noxious weed lists classify weeds according to the threats they pose, their distribution, and their potential for eradication or control. Generally, those species posing a higher risk and having a lower distribution are rated higher, meaning more intensive control is required or recommended.

In Washington, noxious weeds are regulated at the state level by the Washington State Noxious Weed Control Board (WSNWCB), which identifies three classes of noxious weeds (WSNWCB 2010). **Class A** weeds require eradication according to state law; **Class B** weeds require control in areas of the state where they are not yet widespread; and for **Class C** weeds, local jurisdictions can dictate whether control is required.

In Oregon, noxious weeds are regulated at the state level by the ODA, which also identifies three classes of noxious weeds (ODA 2011a). **List A** weeds are recommended for eradication or intensive control when and where found; **List B** weeds are recommended for intensive control on a site-specific, case-by-case basis at the state, county, or regional levels; and **List T** weeds are recognized as priority species for prevention and control that ODA targets for developing and implementing statewide management plans (ODA 2011a).

Cowlitz County's Noxious Weed Control Board and Clark County's Department of Environmental Services Vegetation Management track weed distribution and manage control operations. Each county keeps a complete noxious weed species list (see Appendix M).

In Cowlitz County, Class A weeds with a high priority for control include false brome (*Brachypodium sylvaticum*), buffalobur (*Solanum rostratum*), bighead knapweed (*Centaurea macrocephala*), milk thistle (*Silybum marianum*), and slenderflower thistle (*Carduus tenuiflorus*). Scotch broom is a Class B weed, but is listed as a priority for control, with control being required along transportation rights-of-way, near residential communities where plants create a high fire danger for residents, and near areas where plants substantially degrade the quality of pastures and farmland (Cowlitz County 2010c).

In Clark County, Class A weeds with a high priority for control include garlic mustard (*Alliaria petiolata*), giant hogweed (*Heracleum mantegazzianum*), buffalobur, bighead knapweed, Vochin knapweed (*Centaurea nigrescens*), European hawkweed (*Hieracium sabaudum*), yellow devil hawkweed (*Hieracium floribundum*), and shiny geranium (*Geranium lucidum*) (Lebsack September 2010).

In Multnomah County, ODA and the Multnomah County Weed Control Program track weed distribution and manage control operations. Weeds with a high priority for control include yellow starthistle (*Centaurea solstitialis*), rush skeletonweed (*Chondrilla juncea*), giant hogweed, orange hawkweed (*Hieracium aurantiacum*), pepperweed (*Lepidium latifolium*), Dalmatian toadflax (*Linaria dalmatica* ssp. *almatica*), kudzu (*Pueraria Montana* var. *lobata*), and tansy ragwort (*Senecio jacobaea*).

Noxious weed species are most common along roadsides, within existing utility corridors, and in other disturbed areas. Reed canarygrass and knotweeds are particularly abundant in disturbed areas in emergent wetland habitats and along ditches and streams. Himalayan blackberry is common along the fringes of wetlands and non-forested upland habitats along existing utility corridors and other disturbed areas. Thistles and scotch broom are common in disturbed, drier areas, such as along roadsides, abandoned pastures, and unmanaged agricultural areas. Butterfly bush is common in drier areas along roadsides and on vacant lots. Giant hogweed can occur along roadsides, other rights-of-way, vacant lots, and disturbed streambanks and wetland habitats.

17.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

17.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Disturbance to a federally listed plant species that adversely affects population recovery
- Permanent removal or alteration of special-status plant habitats or other high quality native plant habitats (e.g., mature forest) such that most or all of the relevant attributes of the original habitat are lost
- Disturbance to a special-status plant species that contributes to the need for federal listing of the species
- One or more Washington Class A or Oregon "T-list" noxious weeds to become established, more abundant, or more widespread

Impacts would be **moderate** where project activities would cause the following:

- Disturbance to a federally listed plant species does not adversely affect population recovery
- Disturbance of special-status plant habitats or other high quality native plant habitats (e.g., mature forest) such that all or most of the relevant attributes of the original habitat are altered but will be restored
- Disturbance to a special-status plant species that does not contribute to the need for federal listing of the species
- Permanent removal or alteration of native plant habitats of moderate quality (e.g., non-production forest) such that all or most of the relevant attributes of the original habitat are lost
- One or more Class B noxious weeds to become established, more abundant, or more widespread

Impacts would be **low** where project activities would cause the following:

- Minimal disturbance to special-status plant habitats or other high quality native plant habitats such that all or most of the relevant attributes of the original habitat are maintained
- Permanent removal or alteration of low quality native plant habitats with low native species diversity (e.g., production forest)
- One or more Class C noxious weeds to become established, more abundant, or more widespread

There would be **no** impact when vegetation would remain undisturbed, and no weeds would be spread or introduced.

17.2.2 Impacts Common to Action Alternatives

17.2.2.1 Construction

Vegetation Removal

Vegetation with a mature height greater than 4 feet would be cleared from the right-of-way to ensure safe operation of the transmission line. Vegetation within at least a 6-foot buffer around the perimeter of a substation yard would also be removed (see Section 3.11, Vegetation Clearing), and danger trees next to the right-of-way would be removed if they could fall on any part of the transmission line or grow close enough to the conductors to cause a flashover.

Removal of tall-growing vegetation in forested areas would permanently alter the remaining understory plant communities because shade-tolerant species would either not persist with exposure to full sun or would likely be outcompeted by species with a higher light requirement. The right-of-way would be converted to vegetation types dominated by low-growing species. Right-of-way clearing would permanently remove all forest vegetation types (including Oregon white oak woodlands and forested wetlands) from within and immediately adjacent to the

right-of-way. Riparian areas would lose trees and tall-growing shrubs and would be extensively altered.

The loss of trees and tall shrubs would also create habitat fragmentation in forested and riparian areas. Habitat fragmentation can occur when a habitat is divided into smaller areas, hindering the spread or movement of plants and animals from one area to another. Plant populations that become fragmented have greater edge exposure and reduced genetic diversity. These conditions can negatively affect the ability of plant communities to recover from disturbance and increase their vulnerability to weed invasion, disease, and other external threats.

Removal or alteration of special-status plant habitats and high-quality native plant habitats (mature forest, riparian areas, and forested wetlands) would be a **high** impact; clearing in forested areas with documented occurrences of special-status species a **moderate-to-high** impact; removal of forest a **moderate** impact; and removal of production forest a **low** impact. Shrublands containing species with a mature height greater than 4 feet would be altered by right-of-way clearing, but would persist as shrublands, which would cause a **low** impact. The herbaceous, rural landscaped, and urban/suburban landscaped vegetation types would generally experience **no-to-low** impacts from right-of-way clearing since low-growing vegetation would not need to be removed, and removing isolated trees, woodlands, tall shrubs, or orchard and landscape trees would not alter the surrounding vegetation type.

Some trees within and next to the transmission line right-of-way might not need to be removed if the trees pose no danger to the safe operation of the transmission line. BPA foresters would conduct a survey to determine if mature trees would be far enough below the conductors, such as in low-lying stream or river channels, to avoid removal.

All proposed locations for towers, new access roads, and substations would be permanently cleared of existing vegetation. New access roads would also create habitat fragmentation in all vegetation types since no vegetation would exist within the roadbed. Permanent vegetation removal would also occur on existing access roads that have become overgrown with vegetation or where roads would be widened.

Impacts from vegetation removal for towers, access roads, and substations would be **high** for special-status habitats and high quality native habitats (i.e., mature forest, riparian areas, wet prairie, and forested wetlands); **moderate-to-high** in areas with documented occurrences of special-status species; **moderate** for forest, and **low** for all other habitats. Towers, access roads, and substations would be sited to avoid important vegetation resources, including special-status species, as much as possible.

Construction Activities

Construction activities would cause temporary impacts along the right-of-way and at tower sites, substations, counterpoise sites, pulling and tensioning sites, and staging areas. These impacts would include damage to vegetation from clearing, cutting, or crushing; loss of soil structure from digging and other activities; and soil compaction from vehicles and construction equipment (see Chapter 14, Geology and Soils). Exposed soil at a construction site could be eroded by stormwater runoff, causing sedimentation and changes in the hydrology of the site. However, standard mitigation measures would prevent or minimize erosion; **no-to-low** impacts would occur.

Construction areas are also vulnerable to weed invasion—particularly in areas close to existing weed populations—from inadvertent transportation of weed seeds or plant parts on vehicles and equipment that could regenerate on exposed, bare soil. Where weeds become established, plant diversity is reduced and native species may be replaced. Mitigation measures such as wash stations for vehicles and equipment, eradication of noxious weeds before construction begins, and reseeding disturbed areas would reduce this potential. Pre-construction and post-construction weed surveys would be done to identify and map noxious weeds and identify newly established noxious weeds in or near construction areas. BPA would address control or eradication of these weeds during construction or afterwards during maintenance of the project. Because vegetation management occurs more frequently around substations (annual herbicide applications, etc.), noxious weeds are more likely to be detected and eradicated in these areas. However, non-native, invasive plants not on the county or state noxious weed lists would not be actively managed along the right-of-way, access roads, or substations, and could still present a threat to native ecosystems.

In areas disturbed by construction, where soils and hydrology could be adequately restored and low-growing disturbed vegetation reestablished, temporary, **low** impacts would occur. With mitigation measures, including reseeding with appropriate seed mixes and possible soil cultivation to reduce soil compaction, vegetation in the construction area would be expected to reestablish within a few growing seasons, particularly if weed spread can be prevented or suppressed. If weeds become established in spite of control efforts, or if the soil structure and hydrology are too damaged, preconstruction plant communities could become permanently altered. In these cases, the vegetation community would be degraded and experience **low-to-high** impacts, depending on the quality and protected status of the preconstruction community, and extent of the alteration. WNHP priority ecosystems and WDNR Protected Areas, for instance, would experience **moderate-to-high** impacts. Tall-growing vegetation would not be allowed to remain, causing these communities to be permanently altered. Spread of noxious weeds would cause **low-to-high** impacts, depending on the status of the weed species.

Indirect effects from construction could include damage to vegetation next to construction areas from the effects of soil erosion and the potential spread of weeds to the wider landscape, which would cause **low-to-high** impacts depending on the quality of the surrounding plant communities and the status of the weed species. Again, standard mitigation measures would help prevent or minimize soil erosion and the spread of noxious weeds.

Material staging areas could cause some soil compaction, erosion, and vegetation removal, but these areas would most likely be located on currently developed areas or highly disturbed paved or cleared and graded areas. Staging areas would be between 5 and 15 acres and locations would be identified before construction. Vegetation would likely be weedy, non-native species, and impacts would be limited to mowing or trampling. Preconstruction vegetation would be allowed to reestablish or be reseeded following construction. **No-to-low** impacts would occur.

17.2.2.2 Operation and Maintenance

Vegetation Management

BPA conducts ongoing vegetation management under its Vegetation Management Program (BPA 2000a). Manual, mechanical (including brushing, cutting, and trimming), chemical, and biological methods of vegetation management are used to control noxious weeds and foster

low-growing plant communities to keep tall shrubs and trees from interfering with transmission lines. Along the right-of-way, woody vegetation would be cut every 2 to 8 years, and herbicides applied for noxious weed control every 3 to 10 years, where appropriate. Vegetation management activities prevent forest development within the right-of-way and sometimes outside of the right-of-way (danger trees), and create a corridor with native and non-native herbaceous plants and shrubs. Crops, pasture, and residential and urban landscaping can generally occur, although tall-growing vegetation may need to be removed or trimmed. All vegetation is removed in substation yards and 6 feet beyond the substation fence. Brushing and cutting are used to maintain the edges of access roads.

Typical vegetation management in transmission line rights-of-way and along access roads would generally have **low** impacts on vegetation because there would be little to no ground disturbance or soil exposed. Trampled vegetation and soil compaction from vehicles and crews during vegetation maintenance would be temporary, infrequent, and, minor; and, although forest vegetation types would not be allowed to reestablish, other vegetation types would persist (except within a substation yard). Impacts would be greater if vegetation maintenance such as brushing or mowing inadvertently harmed special-status species (causing **moderate-to-high** impacts, depending on the extent of the damage), spread weeds (**low-to-high** impacts depending on weed status), or introduced weeds to or otherwise damaged special-status plant habitats (**high impacts**). Any herbicide use would increase the risk of herbicide drift or leaching that could damage non-target plants, including special-status species, both within and outside the right-of-way**.** However, BPA would reduce this risk by hiring qualified contractors and requiring them to properly handle and apply herbicides. With appropriate methods, some vegetation management activities would help maintain herbaceous vegetation communities such as emergent wetlands and native prairies.

Maintenance

Transmission line maintenance could crush vegetation and compact soils in work areas around towers, but these disturbances would be infrequent and minor with no permanent damage, causing **low** impacts. During some maintenance activities such as emergency repair work, heavy equipment and vehicles could travel off designated access roads, which could damage vegetation and compact soils. Impacts would likely be greater than typical maintenance work, creating **low-to-high** impacts depending on the quality of the surrounding plant community. Site restoration may be attempted if the degree of damage is high, if special-status species or WNHP priority ecosystems are affected, or if noxious weed species are present.

Access road maintenance could include grading and culvert replacement. These activities are similar to construction activities and could cause soil disturbance, vegetation removal or damage, erosion, and changes in hydrology that could damage plants and alter plant communities. Soil disturbed by these activities could also provide a place for weeds to become established. These disturbances would create **low-to-high** impacts, depending on the quality of the surrounding plant community. Standard mitigation measures would help minimize the area disturbed, prevent or minimize erosion, re-establish vegetation, and prevent or minimize the spread of noxious weeds.

Maintenance vehicles driven over grassy areas during the dry season could start fires. However, because fire prevention and control measures would be used, the project would cause **no-to-low** impacts from fire (see Chapter 10, Public Health and Safety).

17.2.2.3 Sundial Substation

The Sundial site is covered with herbaceous vegetation. Construction would permanently remove 40 acres of herbaceous vegetation. This includes about 11 acres of moderately functioning herbaceous emergent wetlands (see Section 16.1.5, Sundial Substation). Although low-quality wetlands sometimes support special-status species, there are no documented occurrences in the area. Because the wetlands are already disturbed, impacts to vegetation would be **low-to-moderate** (see Chapter 16, Wetlands).

17.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 17.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

17.2.3.1 Casey Road

The Casey Road site is in production forest and shrubland vegetation types that include recently harvested areas and young forest. No special-status species or habitats are documented to occur in this area. Weedy species could occur at this site due to frequent disturbance from timber production.

Construction would permanently remove about 63 acres of vegetation. This would include about 38 acres of production forest, 24 acres of shrubland, and 1 acre of rural landscaped. Because the vegetation has little native diversity, impacts from plant removal and crushed vegetation would be **low**.

17.2.3.2 Baxter Road

The Baxter Road site is in the production forest vegetation type and supports young to middle-aged trees. Some forest and wetland areas are within the riparian zone of Baxter Creek. Because this is a disturbed production forest area, WNHP priority ecosystems would not likely occur. The wetland and riparian areas could provide suitable habitat for special-status species (see Table 17-1), although no special-status species or habitats are documented to occur in the area. Noxious weeds that grow in wetlands or aquatic environments could occur at this site due to frequent disturbance from timber production.

Construction would permanently remove about 47 acres of production forest vegetation. This includes a small area of forested (less than 0.6 acre of forested wetland; see Chapter 16, Wetlands) that could be high-quality native plant habitat. Since most impacts would be to previously harvested production forest, impacts to vegetation would be **low**.

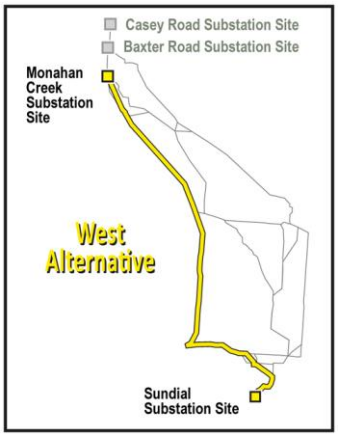
17.2.3.3 Monahan Creek

The Monahan Creek site includes the rural landscaped vegetation type composed primarily of pasture, with some mature forest, forest vegetation, and shrubland. The northern portion of the site supports a stand of mixed coniferous and deciduous forest, particularly in areas near Monahan Creek. Western wahoo (*Euonymus occidentalis var. occidentalis*) (a state-listed species) is within 1 mile of the site, making it the only substation site with a documented special-status plant occurrence in the vicinity. There are no documented occurrences of this species on-site, but suitable habitat could be present in the forested areas. Also, the potential

for noxious weeds at this site is great due to the high level of previous disturbance to vegetation from agricultural activities.

Construction would permanently remove about 67 acres of vegetation. The vegetation types include about 2 acres of mature forest, 18 acres of forest, 1 acre of shrubland, and 46 acres of rural landscaped vegetation. Losses of rural landscaped vegetation, production forest, and shrubland would be **low** impacts. The removal of mature forest would be a **high** impact. The proximity of western wahoo increases the possibility that it could be present at the Monahan Creek site and could experience **moderate-to-high** impacts depending on whether impacts would contribute to the need for federal listing. It is considered secure globally, but critically imperiled at the state level (with five or fewer known occurrences) (WNHP 2011a).

17.2.4 West Alternative



17.2.4.1 General Vegetation Types

The general vegetation types with the most acreage affected by the West Alternative would be shrubland and forest, although all general vegetation types would be affected (see Tables 17-2 and 17-3). Of the total 366 acres of shrubland affected by this alternative, right-of-way clearing would affect 307 acres, and towers, access roads, and substations would permanently remove 59 acres, all **low** impacts. The West Alternative would also clear 372 acres of the forest vegetation type for right-of-way, towers, access roads, and substations, a **moderate** impact. About 27 acres of mature forest would be cleared under this alternative, a **high** impact (see Tables 17-2 and 17-3). About 13 acres of production forest would be cleared for access roads, a **low** impact.

Towers, access roads, and substations would permanently remove 106 acres of the herbaceous vegetation type, which would generally be a **low** impact except where special-status plant habitats or species would be affected in the Lacamas Prairie Natural Area (see Section 17.2.4.2, Special-Status Plant Habitats), or wherever prairie or wetlands could occur. Right-of-way would cross an additional 342 acres of herbaceous vegetation, which would have **no** impact since vegetation is low-growing and clearing would not be required for safe operation of the line.

About 241 acres of rural landscaped and urban/suburban landscaped vegetation types together would experience **no-to-low** impacts from right-of-way clearing, towers, access roads, and substations.

17.2.4.2 Special-Status Plant Habitats

High impacts would result from removal and alteration of special-status plant habitats and high-quality plant communities, including those within the Lacamas Prairie Natural Area and the WDNR Forest Riparian Conservation Easement. Through the Lacamas Prairie Natural Area, portions of the new line and access roads could be in new right-of-way, existing cleared right-of-way, and/or expanded existing right-of-way. Thirty-three acres of the Lacamas Prairie Natural Area (within the proposed WDNR Natural Resource Conservation Area) would be crossed by the right-of-way. This would create a **high** impact on less than 1 acre of Oregon white oak woodlands, and **no** impact where the right-of-way would cross wet prairie (where no clearing

would be needed). In addition, 11 acres of the Lacamas Prairie Natural Area would be lost to towers (1 acre), new access roads (6 acres), and improved access roads (4 acres), a **high** impact.

A portion of the WDNR Forest Riparian Conservation Easement would also be within the right-of-way; vegetation removal in this easement would be a **high** impact since tree removal would be necessary (impacted acreage is unknown at this time) (see Section 5.2.4.2, Land Use, Open Space).

A tufted hairgrass-California oatgrass priority ecosystem is located in the proposed Natural Area Preserve; however, it would not likely be affected unless project activities spread weeds.

17.2.4.3 Special-Status Species

Special-Status Species State and Global Conservation Rankings

- **Critically Imperiled:** 5 or fewer known occurrences
- **Imperiled:** 6–20 known occurrences
- **Rare:** 21–100 known occurrences

Source: WNHP 2011a

Based on the location of current documented occurrences in the impacted area and habitat requirements, habitat and plant losses could occur for four special-status species: Bradshaw's lomatium (0.08 acre), small-flowered trillium (4.3 acres), dense sedge (1 acre), and Nutall's quillwort (0.5 acre). Small-flowered trillium would primarily be affected by right-of-way clearing (4 acres) (it needs forest canopy and shade cover to survive), but also new and improved access roads and a tower (0.3 acre). Bradshaw's lomatium, Nutall's quillwort, and dense sedge would be affected by an improved access road. The impact to Bradshaw's lomatium would be **high.** Losses could affect species recovery since it is critically imperiled at the state level and imperiled at the global level, according to conservation rankings by the state of Washington and the conservation organization NatureServe, which provide an additional measure of population status for special-status species (WNHP 2011a). Impacts to small-flowered trillium, dense sedge, and Nuttall's quillwort would be **moderate-to-high** depending on whether impacts would contribute to the need for federal listing. Small-flowered trillium is imperiled/rare at both the state and global levels; dense sedge and Nuttall's quillwort are critically imperiled within the state of Washington, but globally secure (WNHP 2011a).

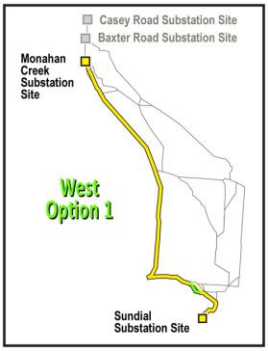
In addition, four other special-status species have current documented occurrences in the study area, indicating an increased likelihood that they could be present and affected by project activities, although they are not crossed by the project. They include Hall's aster, Oregon coyote-thistle, tall bugbane, and western wahoo (see Table 17-1). If affected, impacts to Oregon coyote-thistle would be **high;** impacts to the other three species would be **moderate-to-high**. All are secure globally with the exception of tall bugbane, which is considered rare (WNHP 2011a). At the state level, the only known population of Oregon coyote-thistle in Washington is the one identified in this analysis, with Oregon being the only other state where it is known to occur. Western wahoo and Hall's aster are critically impaired at the state level.

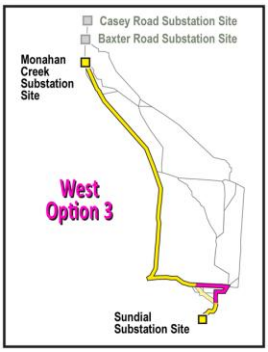
17.2.4.4 West Option 1, 2, and 3

Impact Option Discussion

Impacts to higher quality vegetation types, special-status plant habitats, and special-status species are discussed for each option. See Maps 17-1A through 17-1D and Tables 17-2 and 17-3 for all impacts.

West Option 1 would clear 15 fewer acres of forest. The proposed right-of-way would cross an additional 28 acres of the Lacamas Prairie Natural Area. New access roads would remove an additional 4 acres, and towers and improved access roads would remove an additional 2 acres of this special-status plant habitat. These impacts affect the proposed WDNR NAP and an additional acre of a WNHP Oregon white oak woodland priority ecosystem. Clearing for right-of-way (19 additional acres), and a new access road (1 additional acre) would remove or degrade 20 acres of habitat with documented occurrences of small-flowered trillium. In addition, 4 additional acres of Bradshaw's lomatium would be removed by towers (0.6 acre), a new access road (3.3 acres), and an improved access road (0.1 acre). These project activities would also remove Oregon coyote-thistle (0.4 additional acre), and a tower and new road would remove an area with Hall's aster (0.2 additional acre), and Nuttall's quillwort (3.3 additional acres). (Although the latter four species are also in the right-of-way [see Table 17-1], they require herbaceous habitat, which would not be affected by right-of-way clearing).





West Options 2 and 3 would have 14 fewer acres of right-of-way and 4 fewer acres of towers and new and improved access roads (4 fewer acres) through the Lacamas Prairie Natural Area than the West Alternative. They would also avoid the WDNR Forest Riparian Conservation Easement and WNHP Oregon white oak woodland priority ecosystems, and the documented populations of dense sedge. West Options 2 and 3 would, however, clear more mature forest vegetation for new right-of-way (West Option 2, 5 acres; West Option 3, 3 acres). West Option 2 would remove 9 fewer acres of forest (see Tables 17-2 and 17-3). West Option 3 would remove 31 more acres of forest (see Tables 17-2 and 17-3).

Impact levels on vegetation would be the same as the West Alternative.

Table 17-2 General Vegetation Types Impacted by Right-of-Way Clearing (Acres)[1,2,3,4]

Alternatives and Options	Mature Forest	Forest	Production Forest	Shrubland	Rural Landscaped[5]	Urban/ Suburban Landscaped[5]
West Alternative	**23**	**285**	**0**	**307**	**79**	**87**
West Option 1	N/C	-14	N/C	+3	-2	N/C
West Option 2	+5	-10	+9	+2	+7	N/C
West Option 3	+3	+27	+21	+22	+31	N/C
Central Alternative	**12**	**228**	**910**	**42**	**26**	**20**
Central Option 1	N/C	+1	+39	+2	N/C	N/C
Central Option 2	+5	+35	-76	+4	-1	-6
Central Option 3	+3	+53	-175	-3	+10	-1
East Alternative	**10**	**163**	**961**	**34**	**28**	**19**
East Option 1	+5	+13	-56	+3	+8	-8
East Option 2	-6	+21	N/C	+1	N/C	N/C
East Option 3	N/C	-6	+22	+3	N/C	N/C
Crossover Alternative	**37**	**239**	**588**	**208**	**59**	**21**
Crossover Option 1	-1	+16	N/C	+16	-6	+1
Crossover Option 2	+1	+2	N/C	+54	+14	N/C
Crossover Option 3	+1	+28	+16	+6	+14	N/C

Notes:

N/C – No net change from the action alternative.

1. To avoid double counting impacts, the acreages for substations, and access roads and towers that occur within the right of way, were subtracted from right-of-way acreages. These acreages are in Table 17-3.

2. 150-foot wide right-of-way

3. The value for each option represents the net change from the action alternative. It was calculated as the acres added by the option minus the acres in the segments the option replaces.

4. Clearing for danger trees outside the right-of-way is unknown at this time and not included in these calculations.

5. Right-of-way clearing would only affect portions of the acreages given for these general vegetation types; i.e., where trees and tall shrubs are present. Herbaceous vegetation is below clearing requirements and not included in this table.

Sources: Herrera 2010, USGS 2011

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Table 17-3 General Vegetation Types Converted to Towers, Access Roads, and Substations (Acres)[1]

	Mature Forest					Forest					Production Forest					Shrubland					Herbaceous					Rural Landscaped					Urban/Suburban				
Alternatives and Options	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Totals**	Towers	New Access Roads	Improved Access Roads	Substations	**Totals**	Towers	New Access Roads	Improved Access Roads	Substations	**Totals**	Towers	New Access Roads	Improved Access Roads	Substations	**Totals**	Towers	New Access Roads	Improved Access Roads[3]	Substations	**Totals**	Towers	New Access Roads	Improved Access Roads	Substations	**Totals**	Towers	New Access Roads	Improved Access Roads	Substations	**Totals**
West Alternative	**<1**	**0**	**1**	**2**	**4**	**6**	**20**	**16**	**18**	**60**	**0**	**5**	**8**	**0**	**13**	**7**	**29**	**22**	**1**	**59**	**11**	**37**	**18**	**40**	**106**	**2**	**5**	**12**	**46**	**65**	**3**	**4**	**3**	**0**	**10**
West Option 1	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	-1	N/C	**-1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	+2	N/C	N/C	**+2**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
West Option 2	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	+1	N/C	**+1**	N/C	+1	+<1	N/C	**+2**	N/C	+2	-<1	N/C	**+1**	N/C	+3	-5	N/C	**-2**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
West Option 3	N/C	N/C	N/C	N/C	**N/C**	+1	+1	+2	N/C	**+4**	+<1	+7	+4	N/C	**+12**	N/C	+4	+2	N/C	**+6**	N/C	-2	-4	N/C	**-6**	+<1	N/C	N/C	N/C	**+1**	N/C	N/C	N/C	N/C	**N/C**
Central Alternative	**0**	**<1**	**0**	**0**	**<1**	**5**	**25**	**45**	**0**	**75**	**19**	**100**	**185**	**47**	**351**	**2**	**7**	**23**	**0**	**32**	**3**	**10**	**7**	**40**	**60**	**<1**	**2**	**19**	**0**	**22**	**0**	**<1**	**2**	**0**	**3**
Central Option 1	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	-1	N/C	**-1**	+<1	+2	+9	-9	**+3**	-<1	+<1	+2	+24	**+26**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	+8	+1	**+9**	N/C	N/C	N/C	N/C	**N/C**
Central Option 2	N/C	N/C	N/C	+2	**+2**	+1	+11	-5	+18	**+25**	-2	+1	-12	-47	**-60**	-<1	N/C	-3	+1	**-3**	N/C	-<1	-2	N/C	**-3**	N/C	N/C	+<1	+46	**+47**	N/C	N/C	N/C	N/C	**N/C**
Central Option 3	N/C	N/C	N/C	N/C	**N/C**	+2	+6	-4	N/C	**+4**	-4	-11	-18	N/C	**-33**	N/C	-1	-2	N/C	**-3**	N/C	+1	N/C	N/C	**+1**	N/C	+2	+4	N/C	**+6**	N/C	N/C	N/C	N/C	**N/C**
East Alternative	**0**	**<1**	**2**	**0**	**3**	**3**	**16**	**32**	**0**	**51**	**19**	**84**	**275**	**47**	**425**	**2**	**5**	**48**	**0**	**55**	**3**	**10**	**12**	**40**	**65**	**1**	**3**	**45**	**0**	**49**	**0**	**<1**	**2**	**0**	**3**
East Option 1	N/C	N/C	N/C	+2	**+2**	N/C	+6	-3	+18	**+21**	-1	+<1	-11	-47	**-58**	N/C	+<1	-7	+1	**-5**	N/C	N/C	-2	N/C	**-2**	+<1	+1	-<1	+46	**+47**	N/C	N/C	-<1	N/C	**-1**
East Option 2	N/C	N/C	-2	N/C	**-2**	+<1	+<1	-<1	N/C	**+1**	N/C	-5	-45	N/C	**-50**	N/C	N/C	-15	N/C	**-15**	N/C	N/C	-2	N/C	**-2**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
East Option 3	N/C	N/C	N/C	N/C	**N/C**	N/C	-3	N/C	N/C	**-3**	+<1	N/C	N/C	N/C	**+1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
Crossover Alternative	**<1**	**2**	**3**	**2**	**8**	**5**	**21**	**32**	**18**	**76**	**12**	**65**	**122**	**0**	**199**	**5**	**16**	**44**	**1**	**66**	**3**	**11**	**9**	**40**	**63**	**2**	**3**	**12**	**46**	**63**	**<1**	**1**	**2**	**0**	**4**
Crossover Option 1	N/C	N/C	N/C	N/C	**N/C**	N/C	+2	-<1	N/C	**+1**	N/C	N/C	N/C	N/C	**N/C**	+<1	+2	N/C	N/C	**+3**	+2	+7	+3	N/C	**+12**	N/C	N/C	+<1	N/C	**+1**	N/C	N/C	N/C	N/C	**N/C**
Crossover Option 2	N/C	N/C	N/C	-2	**-2**	N/C	N/C	+3	-18	**-15**	N/C	N/C	+5	+47	**+52**	+3	+2	+9	-1	**+13**	N/C	N/C	N/C	N/C	**N/C**	N/C	+1	+4	-46	**-41**	N/C	N/C	N/C	N/C	**N/C**
Crossover Option 3	N/C	N/C	N/C	-2	**-2**	N/C	+<1	+3	-18	**-14**	+<1	+<1	+4	+47	**+53**	+<1	+2	+10	-1	**+12**	N/C	N/C	N/C	N/C	**N/C**	N/C	+1	+4	-46	**-41**	N/C	N/C	N/C	N/C	**N/C**

Notes:

N/C – No net change from the action alternative.

1. The value for each option represents the net change from the action alternative. It was calculated as the acres added by the option minus the acres in the segments the option replaces.
2. Many improved access roads could be overgrown or would need to be widened; vegetation would need to be removed.

Sources: Herrera 2010, USGS 2011

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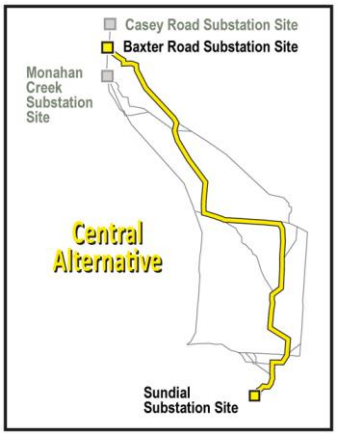
17.2.5 Central Alternative



17.2.5.1 General Vegetation Types

The general vegetation type with the most acreage affected by the Central Alternative would be production forest. About 1,261 acres of this vegetation type would be cleared for right-of-way, towers, access roads, and substations, which would be a **low** impact (see Tables 17-2 and 17-3). The same disturbances would affect the other forested vegetation types; 303 acres of forest would be cleared under this alternative, a **moderate** impact, and 13 acres of mature forest would be cleared under this alternative, a **high** impact.

About 74 acres of shrubland would be affected by this alternative. Right-of-way clearing could affect 42 acres of shrubland, while towers and access roads would permanently remove 32 acres of shrubland, both **low** impacts (see Tables 17-2 and 17-3). A similar amount of herbaceous vegetation would be affected; 60 acres would be removed by towers, access roads, and substations, a **low** impact. The right-of-way would cross an additional 55 acres of herbaceous vegetation, which would have **no** impact since clearing would not be required. Rural landscaped and urban/suburban vegetation types together would have **no-to-low** impacts on 71 acres from right-of-way clearing, towers, and access roads.

17.2.5.2 Special-Status Plant Habitats

No known special-status plant habitats identified by the WNHP, ORBIC, or WDNR (see Section 17.1.2, Special-Status Plant Habitats) would be affected by the Central Alternative.

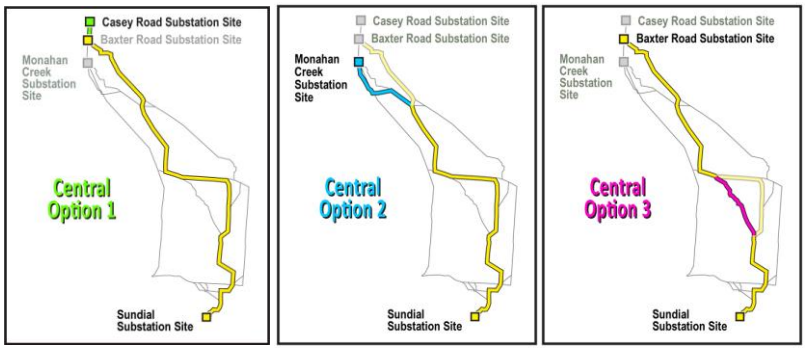
17.2.5.3 Special-Status Species

Two special-status species could be affected by the Central Alternative. Based on the location of current documented occurrences in the impacted area and habitat requirements, right-of-way clearing, towers, and access roads would remove plants and habitat of small-flowered trillium (4.3 acres) (it needs forest canopy and shade cover to survive), while a tower and a new access road would remove plants and habitat for hairy-stemmed checker-mallow (0.8 acre). Impacts to hairy-stemmed checker-mallow would be **high** since it is critically imperiled at the state level and imperiled at the global level, and impacts could contribute to the need for federal listing. (While hairy-stemmed checker-mallow does occur within the right-of-way of the Central Alternative, it occurs in herbaceous habitat [see Table 17-1] and would not be affected by right-of-way clearing). Impacts to small-flowered trillium would be **moderate-to-high**, since it is imperiled/rare at both the state and global levels (WNHP 2011a). (The same small-flowered trillium population would experience the same impacts by all action alternatives because it is on Segment 52).

Two additional special-status species—soft-leaved willow and tall bugbane—have current documented occurrences in the study area, indicating an increased likelihood that they could be present and affected by project activities, although they are not crossed by the project. If affected, impacts would be **moderate**. Both are globally secure, with soft-leaved willow imperiled at the state level and tall bugbane rare (WNHP 2011a).

17.2.5.4 Central Options 1, 2, and 3

Central Option 1 crosses similar types of vegetation as the Central Alternative and would create similar impacts (see Tables 17-2 and 17-3).

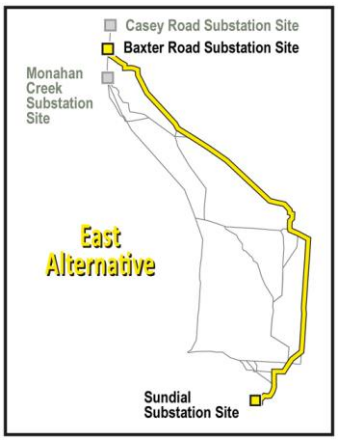


Central Option 2 would remove 7 more acres of mature forest, and 60 more acres of forest (see Tables 17-2 and 17-3).

Central Option 3 would remove 3 more acres of mature forest, and 57 more acres of forest. Central Option 3 could also impact a WDNR Permanent Research Plot and Genetic Reserve, a special-status plant habitat (exact acreages are unknown at this time, but impacts would be **moderate-to-high** depending on whether the site could continue to be used for research). Conversely, it would avoid the population of hairy-stemmed checker-mallow.

Impact levels on vegetation would be the same as the Central Alternative.

17.2.6 East Alternative



17.2.6.1 General Vegetation Types

The most common vegetation type affected by the East Alternative would be production forest. About 1,386 acres of this vegetation type would be cleared for right-of-way, towers, access roads, and substations, which would be a **low** impact (see Tables 17-2 and 17-3). Of the other forested vegetation types, 214 acres of forest would be cleared, a **moderate** impact; and 13 acres of mature forest would be cleared, a **high** impact.

The remaining vegetation types would experience fewer or lower-level impacts (see Tables 17-2 and 17-3). About 89 acres of shrubland would be affected. Right-of-way clearing could affect 34 acres of shrubland, and towers and access roads would remove 55 acres of shrubland, both **low** impacts. About 65 acres of herbaceous vegetation type would be cleared for towers, access roads, and substations, a **low** impact except where special-status plant habitats would be affected (see Section 17.2.6.2 Special-Status Plant Habitats). The right-of-way would cross 54 acres of herbaceous vegetation, which would have **no** impact since clearing would not be required. About 99 acres of rural landscaped and urban/suburban landscaped vegetation types together would have **no-to-low** impacts from right-of-way clearing and **low** impacts from towers and access roads.

17.2.6.2 Special-Status Plant Habitats

One special-status plant habitat could be affected by the East Alternative. About 0.5 acre of an existing access road to be improved crosses the southern edge of the herbaceous bald along

Segment O. Although species composition is unknown at this time, it could qualify as a WNHP North Pacific herbaceous bald and bluff priority ecosystem (it is not currently documented as such by WNHP), or as a high quality plant community. If so, disturbance to this plant community and the possible spread of weedy species would cause **moderate-to-high** impacts. Since disturbance would likely be located along the edge of the potential priority ecosystem, disturbance or damage could be minimized, decreasing impacts to **low**.

17.2.6.3 Special-Status Species

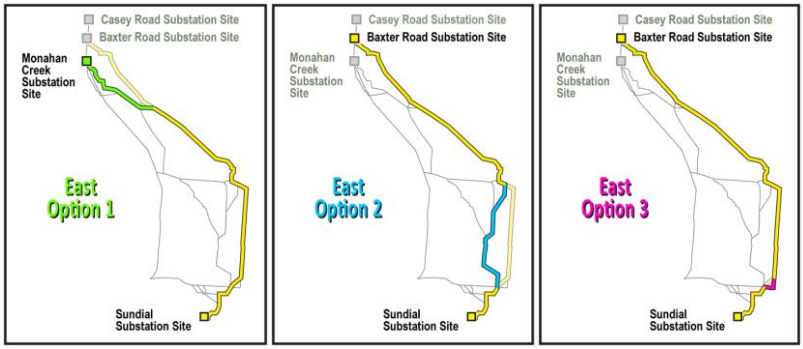
Based on the location of current documented occurrences in the impacted area and habitat requirements, right-of-way clearing and towers and access roads would remove or alter habitat of only one special-status species: small-flowered trillium (4.3 acres [it needs forest canopy and shade cover to survive]). These losses would be **moderate-to-high** depending on whether the impacts would contribute to the need for federal listing, given that it is imperiled/rare at the state and global levels (WNHP 2011a). (The same small-flowered trillium population would experience the same impacts by all action alternatives).

Two additional special-status species—soft-leaved willow and tall bugbane—have current documented occurrences in the study area, indicating an increased likelihood that they could be present and affected by project activities, although they are not crossed by the project. If affected, impacts would be **moderate**. Both are globally secure, with soft-leaved willow imperiled at the state level and tall bugbane rare (WNHP 2011a).

17.2.6.4 East Options 1, 2, and 3

East Option 1 would remove 7 additional acres of mature forest, and 34 additional acres of forest (see Table 17-2 with Table 17-3).

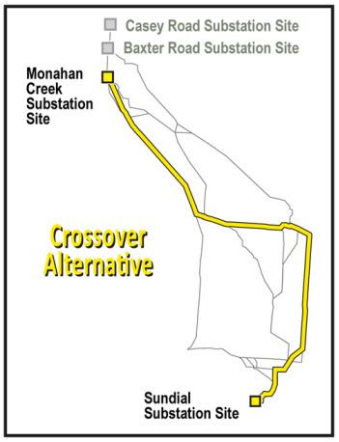
East Option 2 would remove less mature forest (8 fewer acres), but more forest (22 additional acres).



East Option 3 would remove 9 fewer acres of forest.

Impact levels on vegetation would be the same as the East Alternative.

17.2.7 Crossover Alternative



17.2.7.1 General Vegetation Types

The most common vegetation type that would be affected by the Crossover Alternative would be production forest. About 787 acres of this vegetation type would be cleared for right-of-way, towers, and access roads, which would be a **low** impact (see Tables 17-2 and 17-3). Of the other forested vegetation types, about 315 acres of forest would be cleared, a **moderate** impact, and about 44 acres of mature forest would be cleared, a **high** impact.

The remaining general vegetation types would have either fewer or lower impacts (see Tables 17-2 and 17-3). About 274 acres of shrubland would be affected. Right-of-way clearing could alter 208 acres of shrubland, and towers, access roads, and substations would remove an additional 66 acres of shrubland, both **low** impacts. About 63 acres of herbaceous vegetation type would be cleared for towers, access roads, and substations, a **low** impact except where special-status plant habitats could be affected (see Section 17.2.6.2 Special-Status Plant Habitats). Right-of-way would cross over an additional 88 acres of herbaceous vegetation, which would have **no** impact since clearing would not be required. Depending on the need for tree removal, about 147 acres of rural landscaped and urban/suburban landscaped vegetation types together would experience **no-to-low** impacts from right-of-way clearing, towers, access roads, and substations.

17.2.7.2 Special-Status Plant Habitats

Two special-status plant habitats or high quality plant communities could be affected. Similar to the East Alternative, about 0.5 acre of an existing access road to be improved crosses the southern edge of an herbaceous bald along Segment O. Although species composition is unknown at this time, it could qualify as a WNHP North Pacific herbaceous bald and bluff priority ecosystem (it is not currently documented as such by WNHP), or as a high quality plant community. If so, disturbance to this plant community and the possible spread of weedy species would cause **moderate-to-high** impacts. Since disturbance would likely be located along the edge of the potential priority ecosystem, disturbance or damage could be minimized, decreasing impacts to **low**. The second habitat is the WDNR Forest Riparian Conservation Easement. Vegetation removal in this easement would be a **high** impact since a portion would be within the right-of-way, and tree removal would be necessary (impacted acreage is unknown at this time) (see 5.2.4.2, Land Use, Open Space).

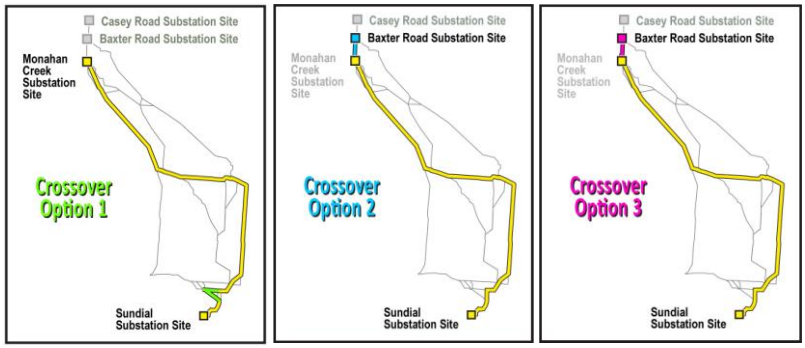
17.2.7.3 Special-Status Species

Based on the location of current documented occurrences in the impacted area, right-of-way clearing and towers and access roads could remove or alter habitat of only one special-status species: small-flowered trillium (4.3 acres) (it needs forest canopy and shade cover to survive). These losses would be **moderate-to-high** depending on whether the impacts could contribute to the need for federal listing, given that it is imperiled/rare at the state and global levels (WNHP 2011a). (The same small-flowered trillium population would experience the same impacts by all action alternatives).

Two additional special-status species— bolandra (*Bolandra oregano*) and tall bugbane—have current documented occurrences in the study area, indicating an increased likelihood that they could be present and affected by project activities, although they are not crossed by the project. If affected, impacts would be **moderate** for tall bugbane, which is globally secure and rare at the state level, and **moderate-to-high** for bolandra, which is globally rare and imperiled at the state level (WNHP 2011a).

17.2.7.4 Crossover Options 1, 2, and 3

Crossover Option 1 would pass through the Lacamas Prairie Natural Area and potentially disturb 8 acres of this special-status plant habitat from new right-of-way (8 acres) and a tower and new access road (less than 1 acre). These disturbances would increase impacts, depending on the need for tree removal, but would not affect any known WNHP priority ecosystems in the Lacamas Prairie Natural Area. Crossover Option 1 would also remove an additional 16 acres of forest (see Tables 17-2 and 17-3).



Crossover Option 2 would reduce impacts by removing 14 fewer acres of forest.

Crossover Option 3 would increase impacts by removing 13 more acres of forest.

Impact levels on vegetation would be the same as the Crossover Alternative.

17.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2 of Chapter 3, Project Components. The following additional mitigation measures have been identified to avoid, minimize, or eliminate adverse vegetation impacts (especially special-status species and habitats) by the action alternatives. Chapter 16, Wetlands, and Chapter 19, Fish, recommend mitigation measures for vegetation clearing in wetlands and riparian areas. All mitigation measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Prior to construction, perform surveys to confirm the presence or absence of special-status species and habitats where they have the potential to occur in areas potentially affected by the proposed project.
- Identify known special-status plant populations and habitats, including an appropriate buffer, as sensitive areas in construction documents and maps used by construction contractors, maintenance contractors, and BPA personnel.
- Mark and sign (as sensitive areas) the boundaries of special-status plant populations and habitats located near or adjacent to construction sites where work is prohibited, and install protective fencing as needed, including an appropriate buffer, to ensure they are not disturbed during construction.

- Explain all vegetation-related mitigation measures and permit conditions to construction contractors and BPA personnel during a preconstruction meeting detailing environmental requirements.
- Restrict construction activities, including vehicle access and equipment storage, to the smallest area necessary to work effectively and safely while limiting removal and disturbance to vegetation, special-status species and habitats, and other sensitive plant communities; and to help prevent weed introduction or spread.
- Where possible, in areas not already infested with high concentrations of weeds and particularly where ground disturbance affects special-status species or habitats, stockpile excavated topsoil during construction and use it to restore excavated areas to former grades to help retain the native seed bank present in the soils.
- Reseed disturbed areas after construction and regrading are complete, as soon as possible and at the appropriate time for germination, with a seed mix identified in the Stormwater Management Manual for Western Washington (Ecology 2005a), with an appropriate native seed mix in sensitive vegetation areas, with one most appropriate for establishment in a weed-infested area, or with a seed mix agreed upon with landowners for use on their property.
- Monitor seed germination of seeded areas with at least three field visits per year until site stabilization (defined as at least 70 percent cover by native or acceptable non-native species) is achieved; if vegetative cover is inadequate, implement contingency measures and reseed to ensure adequate revegetation of disturbed soils.
- Clean construction vehicles and other equipment at established wash stations before entering construction work areas.
- Conduct the following: (1) a preconstruction weed survey of areas that would be disturbed by construction activities to document weed distribution present at that time; and (2) a post-construction weed survey of all areas disturbed by construction activities to determine if noxious weeds were introduced or spread.
- Implement appropriate control measures of weed infestations caused by construction activities.
- Use noxious weed control practices that minimize harm to special-status species and their habitats.
- Obtain rock and other fill materials from weed-free quarries.
- Use certified weed-free straw for use in erosion control, if available in the project area.
- Use the procedures outlined in BPA's Transmission System Vegetation Management Program (BPA 2000a) to address and minimize noxious weed problems during construction and subsequent management activities.

17.2.9 Unavoidable Impacts

Unavoidable impacts on vegetation common to all action alternatives include temporary removal or disturbance of vegetation during construction, and permanent vegetation loss to tower footings, access roads, and substation facilities. Permanent loss of forest and conversion of forest to low-growing vegetation types within the 150-foot-wide right-of-way and outside of the right-of-way for removal of danger trees also would occur. Noxious weed introduction likely

would occur to some degree, even with implementation of identified weed control measures. This unavoidable weed introduction or spread could impact native plant communities depending on their status and ability to recover.

17.2.10 No Action Alternative

The No Action Alternative would avoid impacts on vegetation from the project because no new transmission lines, access roads, or substations would be constructed. Current and future actions in the project area by others, besides BPA, could affect plant communities, reduce species diversity, and affect special-status plant habitats or special-status species and their habitat, through removal or degradation of existing plant communities, and conversion to non-native plant communities. Actions that would affect vegetation include ongoing commercial practices, maintenance of existing rights-of-way, road maintenance and development, residential and commercial development ongoing commercial timber harvest, and effects from climate change.

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Chapter 18 Wildlife

This chapter describes existing wildlife resources in the project area, and how the project alternatives could affect these resources. Related wetland and vegetation information are in Chapter 16, Wetlands, and Chapter 17, Vegetation.

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

18.1 Affected Environment

Wildlife species that would be affected by the project include those that occur in forest, production forest, shrubland, open, and urban/suburban habitats. These categories correspond with the general vegetation types discussed in Chapter 17, Vegetation, and shown on Maps 17-1A through 17-1D, with some minor differences (see Table 18-1).

Table 18-1 Wildlife Habitats[1] and Corresponding Vegetation Types[2]

Wildlife Habitat	Vegetation Types
forest	forest; mature forest
production forest	production forest
shrubland	shrubland
open	herbaceous; rural landscaped
urban/suburban	urban/suburban landscaped

Notes:
1. WDFW priority habitats are treated as a subset of general wildlife habitats. See Section 18.1.1, Wildlife Habitats and Species.
2. See Chapter 17, Vegetation, and Maps 17-1A through 17-1D.

In addition, wildlife in the WDFW priority habitats (see Section 18.1.2, WDFW Priority Habitats) of Oregon white oak woodlands, herbaceous balds, westside prairie, old-growth/mature forest, freshwater wetlands and fresh deepwater, riparian areas, caves, cliffs, talus, and snags and logs would also be affected. These habitats are discussed in the general wildlife habitats (see Section 18.1.1, Wildlife Habitats and Species) where they are typically found. For example, westside prairie is a type of open habitat.

General wildlife habitats were identified within a 3,000-foot corridor (1,500 feet either side of the transmission line centerline). This area includes the transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way. For WDFW Priority Habitats, the study area covers a 2-mile corridor (1 mile either side of the transmission line centerline). This area includes the transmission line right-of-way, new and improved access roads, substation areas, and removed, rebuilt, and new towers on existing right-of-way. This study area is larger than the study area for general habitats because a broader area allows a more accurate assessment of their likelihood to occur in the affected environment, and a better description of the extent of impacts to these high-value wildlife habitats.

18.1.1 Wildlife Habitats and Species

18.1.1.1 Wildlife in Forest and Production Forest Habitats

Forest Wildlife

In the study area, forest habitat is generally about 60 years old and contains a mix of conifers and hardwoods, with conifers generally dominating. Old-growth/mature forest, Oregon white oak woodlands, forested freshwater wetlands, riparian areas, herbaceous balds, and caves are considered WDFW priority habitats and may occur within this general wildlife habitat (see Section 18.1.2, WDFW Priority Habitats).

Forest habitat occurs throughout the study area but is concentrated on either side of the Cowlitz River in the northern portion of the study area, and southwest of Lake Merwin in the central portion (see Maps 17-1A and 1C). It covers about 33 percent of the study area along the West Alternative, 25 percent along the Central Alternative, 17 percent along the East Alternative, and 30 percent along the Crossover Alternative. The Monahan Creek substation site contains some forest.

The habitat features used by forest-dependent wildlife include surface rock, logs, duff/litter, **snags**, live trees, moss, cavities, and shrubs (Johnson and O'Neil 2001). Common wildlife species include mammals such as coyotes (*Canis latrans*), black bear (*Ursus americanus*), rabbits, squirrels, chipmunks, and Columbian black-tailed deer (*Odocoileus hemionus* ssp. *columbianus*). Many game birds such as ruffed grouse (*Bonasa umbellus*) and pheasants (*Phasianus* spp.) are found in young conifer stands, along with other common year-round resident bird species such as Steller's jay (*Cyanocitta stelleri*), winter wren (*Troglodytes hyemalis*), and golden-crowned kinglet (*Regulus satrapa*). Some of the most broadly distributed migratory species include Swainson's thrush (*Catharus ustulatus*), Pacific-slope flycatcher (*Empidonax difficilis*), and Townsend's warbler (*Dendroica townsendii*) (Johnson and O'Neil 2001).

Thirteen special-status species could be found in forest habitat in the study area (see Section 18.1.4, Special-Status Wildlife). However, only 4 of the 13 special-status species have documented occurrences in the study area: bald eagle (*Haliaeetus leucocephalus*), elk (*Cervus elephus*), Townsend's big-eared bat (*Corynorhinus townsendii*), and wood duck (*Aix sponsa*). At least two of these—bald eagle and wood duck—are associated with forested WDFW riparian priority areas. Additional special-status species could be found in old-growth/mature forests (see Section 18.1.2.5, Old-Growth/Mature Forest).

Production Forest Wildlife

Production forest habitat is similar to forest habitat, but can have lower species diversity due to the recurring cycle of selective tree growth and harvest—which strongly influences the structural characteristics, age, and composition of this habitat—and frequent disturbance—which creates openings for weedy species. Production forest is routinely harvested for wood products, but may also be managed for habitat. In the study area, it is dominated by Douglas fir and western hemlock (WDNR 2009c). The age and quality of production forest in the study area can vary widely, ranging from newly replanted production forest to old-growth/mature forest (a WDFW priority habitat).

Production forest also occurs frequently throughout the study area (see Maps 17-1A through 1D), being somewhat less concentrated to the south and southwest of Lake Merwin (see Map 17-1C). It is the most common general wildlife habitat in the study area along three of the action alternatives: 63 percent along the Central Alternative, 73 percent along the East Alternative, and 50 percent along the Crossover Alternative. It only makes up 10 percent of the habitat along the West Alternative. The Casey Road and Baxter Road substation sites are in production forest.

The same special-status species and habitats that can occur in forest can occur in production forest, particularly in areas that have not been logged recently or frequently (see Section 18.1.4, Special-Status Wildlife). Indeed, a similar number of old-growth/mature forests in the study area occur in both forest and production forest where logging has not yet occurred (or last occurred over 80 years ago), and 11 special-status species have been documented in production forest in the study area, including elk, bald eagle, Cascade torrent salamander (*Rhyacotriton cascadae*), Cope's giant salamander (*Dicamptodon copei*), Dunn's salamander (*Plethodon dunni*), Larch Mountain salamander (*Plethodon larselli*), Rocky Mountain tailed frog (*Ascaphus montanus*), western toad (*Anaxyrus boreas*), Columbian black-tailed deer, peregrine falcon (*Falco peregrinus*), and northern goshawk (*Accipiter gentilis*) (most of these were associated with WDFW priority habitats contained within production forest, including forested riparian areas, cliffs, and talus slopes or caves).

18.1.1.2 Wildlife in Shrubland Habitats

Shrubland includes areas dominated by shrubs or tree saplings, and typically occur in existing rights-of-way, on recently harvested production forest, and in fallow fields (see Chapter 17, Vegetation). It may include or encompass WDFW priority habitats, including scrub-shrub freshwater wetlands, riparian areas, herbaceous balds, and caves (see Section 18.1.2, WDFW Priority Habitats).

Shrubland is mixed with production forest and forest habitats in the study area and is often connected to open habitat (see Maps 17-1A through 1D). It is somewhat less concentrated in the Vancouver area (see Map 17-1D). It makes up about 7 percent of the West Alternative, 4 percent of the Crossover Alternative, and 2 percent of the Central and East alternatives. One acre of the Monahan Creek substation site is in shrubland.

Native shrubland can attract large numbers of wildlife. However, in the study area, shrubland is often highly disturbed and consequently dominated by weedy plant species, which can reduce wildlife habitat diversity. Common wildlife include birds such as willow flycatcher (*Empidonax traillii*) and bushtit (*Psaltriparus minimus*); and mammals such as coyotes, squirrels, chipmunks, and white- and black-tailed deer. Several species of neotropical migratory birds (those that breed in North America and winter in Central and South America), such as Swainson's thrush, typically nest in thickets of deciduous shrubs (Johnson and O'Neil 2001).

Five special-status species may be found in shrubland (see Section 18.1.4, Special-Status Wildlife). All five species are habitat generalists, in that they can be found in a variety of habitats, including both forested habitats and shrubland. Of these, only elk and Columbian black-tailed deer are documented in the study area.

18.1.1.3 Wildlife in Open Habitats

Open habitat includes non-forested areas dominated by herbaceous plants. It may include WDFW priority habitats including westside prairie, riparian areas, and freshwater wetlands (see Section 18.1.2, WDFW Priority Habitats). Open habitat has diverse land uses and features that distinguish it from other habitat types, including frequent disturbance from cultivation, mowing, and harvesting; monotypic landscapes from farming and grazing practices; and low-density residential and farm-related development. As such, it is generally highly disturbed and consequently dominated by weedy plant species, which can reduce wildlife habitat diversity. Similar to production forest, the quality of open habitats can vary widely across the study area.

Open habitat, like shrubland habitat, is scattered throughout forest and production forest, and in and around urban/suburban habitat (see Maps 17-1A through 1D). It is somewhat more concentrated along the Cowlitz River, in the area southwest of Lake Merwin, and in Castle Rock, Longview-Kelso, and Vancouver. Open habitat is more common along the West Alternative than the more forested Central, East, and Crossover alternatives. About 33 percent of the West Alternative crosses open habitat, compared to 12 percent of the Crossover Alternative, 8 percent of the Central Alternative, and 6 percent of the East Alternative. Open habitat makes up a majority of the habitat at the Monahan Creek substation site.

Much of the wildlife that use open habitat are habitat generalists, and have adapted to using several habitat types for feeding and breeding, including birds such as American robin (*Turdus migratorius*), wrens, jays, crows, and vultures; and mammals such as coyotes, squirrels, chipmunks, and white-tailed deer. Important habitat elements include wetlands, wells and water developments, deserted dwellings, shelterbelts (rows of trees and shrubs along the edges of agricultural fields), hedgerows, roadsides, and field borders (a band or strip of perennial vegetation established on the edge of cropland to reduce erosion). Shelterbelts and field borders are important as stopover and breeding habitats for neotropical migratory birds (Johnson and O'Neil 2001). Farm buildings and trees in farmsteads and pastures and along field edges provide potential nesting and roosting sites for common species such as owls, hawks, and bats, and many small prey mammals such as Townsend's vole (*Microtus townsendii*) and vagrant shrew (*Sorex vagrans*).

Ten special-status species can be found in open habitat in the project area (see Section 18.1.4, Special-Status Wildlife). Six have been documented within the study area, including elk, sandhill crane (*Grus canadensis*), tundra swan (*Cygnus columbianus*), Townsend's big-eared bat, Dunn's salamander, and western pond turtle (*Actinemys marmorata*). Two of these—Dunn's salamander and western pond turtle—are associated with WDFW priority habitats contained within open habitat, including riparian areas and wetlands.

18.1.1.4 Wildlife in Urban/Suburban Habitat

Urban/suburban habitat is a mix of natural and developed environments that support a relatively low diversity and density of wildlife species. However, it may include small areas of WDFW priority habitats including westside prairie, riparian areas, freshwater wetlands, and Oregon white oak woodlands (see Section 18.1.2, WDFW Priority Habitats).

Urban/suburban habitat occurs primarily in the northern and southern portions of the study area (see Maps 17-1A and 1D). It includes Castle Rock and the Longview-Kelso metro area in the north and Vancouver in the south. More urban/suburban habitat occurs along the West

Alternative than the other action alternatives (18 percent compared to 3 to 4 percent for the other three alternatives) because they cross the Longview-Kelso and Vancouver metro areas. The Sundial substation site is in an urban/suburban habitat (which includes a disturbed wetland).

Many wildlife species thrive in high density inner city areas such as Vancouver and Longview-Kelso and have a high tolerance for human activity. Habitat features in the built environment—such as rooftops, antennae, vent holes, and decorative boxes—provide holes, crevices, and ledges used by birds and mammals. Wildlife species are habitat generalists, and frequently are non-natives, such as opossum (*Didelphis virginiana*) and European starling (*Sturnus vulgaris*). Other common species could include American robin, wrens, jays, and crows. Available woody vegetation is the most important factor to support native birds (Johnson and O'Neil 2001). The proportion of native songbird species tends to decline as urban development intensifies. Some native perching birds and wildlife species that use remnant patches of forest, parks, and green belts could occur in this habitat, including four federal species of concern or state-listed species (see Section 18.1.4, Special-Status Wildlife).

In suburban areas with more vegetation, wildlife diversity increases, although most species are still typically generalists adapted to a wide range of food sources. Remnant patches of habitat left undeveloped such as riparian areas, canyons or ravines, rock outcrops, and lakes provide habitat for generalist species such as coyotes, osprey (*Pandion haliaetus*), belted kingfisher (*Megaceryle alcyon*), and occasionally cougars (*Puma concolor*) (Johnson and O'Neil 2001), and species more specialized to those habitats. Undeveloped areas in suburban areas next to rural areas may serve as wildlife corridors. Where remnant patches of habitat occur, special-status species appropriate to the type of habitat present also have the potential to occur. For example, one special-status species—purple martin (*Progne subis*)—has been documented along the West Alternative in urban/suburban habitat, likely in or near a riparian area.

18.1.2 WDFW Priority Habitats

WDFW priority habitats are those habitats "with unique or significant value to a diverse assemblage of species" (WDFW 2008) considered a conservation and management priority by the state. The WDFW priority habitats include those documented in the WDFW database (WDFW 2010b) and those that might qualify as WDFW priority habitats based on a GIS database analysis or field surveys (see Maps 18-1A through 18-1D). They include Oregon white oak woodlands, herbaceous balds, westside prairie, biodiversity areas and corridors, old-growth/mature forest, freshwater wetlands and fresh deepwater, riparian areas, caves, cliffs, talus, and snags and logs (snag-rich areas).

18.1.2.1 Oregon White Oak Woodlands

Oregon white oak woodlands are stands of Oregon white oak or oak/conifer associations where oak accounts for at least 25 percent of the canopy (WDFW 2008). Only Oregon white oak woodlands equal to or greater than 1 acre are considered priority habitat in non-urbanized areas, but even a single Oregon white oak tree can be considered priority habitat in an urbanized area if particularly valuable to wildlife (WDFW 2008).

There are two documented areas of Oregon white oak woodlands within 1 mile of the action alternatives. Both are in the southern part of the study area (see Map 18-1D). One occurrence is the Sifton/Lacamas Oregon White Oak Woodland in the Lacamas Prairie Natural Area, which is

crossed by the West Alternative (segments 25, 36, 41, 43, 40, and 48) (WNHP 2010). The other is in the Washougal Oaks woodland, which is along Segment 52 (crossed by all action alternatives) next to the Washougal River and Shepard Hill (WDFW 2012). (The Washougal Oaks Woodland is different from the Washougal Oaks NAP, which is about 5 miles to the east and not crossed by the action alternatives).

Oregon white oak woodlands provide an abundance of food and important habitat for wildlife. Species such as deer and squirrels feed on the acorns, cavity nesters and some bats nest in oak cavities, and mammals such as red fox (*Vulpes vulpes*) use cavities created by decaying root systems for denning (WFF 1997). Four special-status species could be found in this habitat (see Section 18.1.4, Special-Status Wildlife). Of these, three have been documented in the study area, including wood duck, pileated woodpecker, and Townsend's big-eared bat. A WDFW wood duck priority area encompasses much of an Oregon white oak woodland in the Lacamas Prairie Natural Area. Slender-billed white-breasted nuthatches (*Sitta carolinensis aculeata*) occur in the nearby Washougal Oaks NAP (WWRC 2010), but there are no documented occurrences of this species within the study area.

18.1.2.2 Herbaceous Balds

Herbaceous balds are areas of herbaceous vegetation growing in shallow soils over bedrock, often occurring within forested habitats or woodlands. Both WDFW and WNHP have special designations for herbaceous balds: WNHP herbaceous bald priority ecosystems consist of specific plant species associations (see Chapter 17, Vegetation); WDFW priority habitats are more general. There is no size limit for an herbaceous bald to be considered a WDFW priority habitat.

Three herbaceous balds are documented by WDFW within 1 mile of the action alternatives. They include the herbaceous bald south of Rock Creek on Larch Mountain (Segment O of the East and Crossover alternatives, see Map 18-1D); on Baldy (or Bald) Mountain south of Goble Creek (Segment 10 of the Central Alternative, see Map 18-1B); and on Little Baldy Mountain southeast of Lacamas Creek (Segment 39 of West Option 3, see Map 18-1D). Only the herbaceous bald on Larch Mountain is crossed by the project, although a new access road crosses within a few feet of the herbaceous bald on Baldy (or Bald) Mountain. The WNHP has also documented an additional herbaceous bald within the study area that is not documented by WDFW. This additional herbaceous bald has been documented as a North Pacific herbaceous bald and bluff priority ecosystem (West Alternative, West Option 1, and Crossover Alternative) (see Chapter 17, Vegetation).

Herbaceous balds provide habitat to many rare butterfly species, such as Fender's blue butterfly (*Icaricia icarioides* ssp. *fenderi*) and several others (see Section 18.1.4, Special-Status Wildlife). However, none of these species have been documented in the study area.

18.1.2.3 Westside Prairie

Westside prairie is an increasingly rare type of habitat. This vegetation community is dominated by native herbaceous species and is classified as wet prairie or dry prairie based on hydrologic conditions and plant species present. Although the project area (including portions of the study area) historically contained many westside prairies, most have been converted to agriculture or developed for other uses. Consequently, westside prairie is primarily found in small remnant patches along fencerows and field margins (Caplow and Miller 2004; WDNR 2008, 2009c). An

exception is the Lacamas Prairie in Clark County, which was recently designated as a Natural Area by the Washington State Commissioner of Public Lands. WDNR has plans to purchase this Natural Area for a NAP and NRCA since it is the only remaining example of an intact remnant wet prairie in Washington (see Section 17.1.2.1, WDNR Protected Areas).

Only the West Alternative, West Options, and Crossover Option 1 cross westside prairie habitat (see Map 18-1D). The affected areas include two portions of the Lacamas Prairie Natural Area, including part of the proposed NAP (crossed by West Option 1—segments 40 and 46), and part of the proposed NRCA (crossed by the West Alternative, West Options, and Crossover Option 1—segments 36, 36A, 36B, 40, 41, 45, 46, and 50).

Eleven special-status species could be found in westside prairie; five have been found in the study area: tundra swan, sandhill crane, Columbian black-tailed deer, elk, and Townsend's big-eared bat (see Section 18.1.4, Special-Status Wildlife).

18.1.2.4 Biodiversity Areas and Corridors

Biodiversity areas include habitats identified by WDFW as being important for their biological diversity. Corridors include the relatively undisturbed, unbroken tracts of vegetation that connect these areas (WDFW 2008). There are seven documented WDFW biodiversity areas and corridors in the southern half of the study area: the Upper Salmon Creek Riparian Corridor, the Burnt Bridge Creek Biodiversity Area, the Cougar Creek Riparian Corridor, the Green Mountain Biodiversity Area, the East Fork Lewis River Riparian Corridor, the Camas Biodiversity Area, and the Lady and Akerman Islands Biodiversity Area and Corridor. All are crossed by the West Alternative, while the latter three are crossed by all action alternatives (see Maps 18-1C and 18-1D). All but one are in riparian areas in either open or forested habitat (including two in old-growth/mature forest); the other—the Green Mountain Biodiversity Area—is in forest next to the Lacamas Prairie Natural Area.

Wildlife includes those species listed for forest (see Section 18.1.1.1, Wildlife in Forest and Production Forest Habitats), open habitats (see Section 18.1.1.3, Wildlife in Open Habitats), old-growth/mature forest (see Section 18.1.2.5, Old-Growth/Mature Forest), and/or riparian areas (see Section 18.1.2.8, Riparian).

18.1.2.5 Old-Growth/Mature Forest

Old-growth/mature forests in Washington have declined over the past century from timber harvest activities, but patches of these forests remain throughout the state. About 22.8 million acres of old-growth forests remain in Washington, which is about 6 percent of Washington's forests (USFS 1993). To be considered WDFW priority habitat, old growth/mature forest stands need to be at least 7.5 acres, although stands less than 7.5 acres could still be considered a biodiversity area and corridor priority area (WDFW 2008).

There are about 27 stands of old-growth/mature forests crossed by or immediately adjacent to the action alternatives, although they occur most frequently along the West Alternative, particularly Segment 9 (see Maps 18-1A and 18-11B) (Herrera 2010; WDFW 2010b). About half of the stands identified are along rivers and streams. Some larger stands occur along Monahan Creek north of the Monahan Creek substation site (Segment E), the Coweeman River (Segment 9), the Kalama River (Segment 9), the Lewis River near Lake Merwin (Segment 23), Pup Creek (just south of Segment 18), King Creek (Segment O), Lacamas Lake (Segment 40), the

Little Washougal River (Segment 51), and the Columbia River on Lady Island (Segment 52) (see Maps 18-1A through 18-1D).

Wildlife species found in old-growth/mature forests can vary from those found in forests, and generally have more specific habitat requirements. Common species in old-growth/mature forest include varied thrush (*Ixoreus naevius*) and bark-foraging birds such as brown creeper (*Certhia americana*), chestnut-backed chickadee (*Poecile rufescens*), red-breasted nuthatch (*Sitta canadensis*), and hairy woodpecker (*Picoides villosus*) (Johnson and O'Neil 2001). At least nine special-status species may be found in old-growth/mature forest, including two federally listed species—marbled murrelet (*Brachyramphus marmoratus*) and northern spotted owl (*Strix occidentalis*) (see Section 18.1.4, Special-Status Wildlife). Of the nine species, five have been documented in the study area: northern spotted owl, bald eagle, northern goshawk, pileated woodpecker, and Vaux's swift.

18.1.2.6 Snags and Logs (Snag-Rich Areas)

Snags and logs can occur within any forest or woodland habitat, although they tend to be less frequent in managed forests. They support similar wildlife as the other forest and woodland habitats, but increase habitat structural diversity. Snag-rich areas occur infrequently in the project area, partly due to the large amount of managed (production) forest. They are only found in the study areas of the East, Central, and Crossover alternatives. WDFW-documented snag-rich areas occurring within the study area include the Rock Creek Snag-Rich Area, crossed by Segment K (East Alternative, see Map 18-1B); the North Fork Lacamas Snags crossed by Segment P (Central Alternative and East Option 2, see Map 18-1D); and an unnamed snag-rich area in the Rock Creek Watershed near Segment O (East and Crossover alternatives, see Map 18-1D).

18.1.2.7 Freshwater Wetlands and Fresh Deepwater

Freshwater wetlands include the transitional areas between aquatic and terrestrial habitats where the water table is at or near the soil surface, or where the land is covered by shallow water (WDFW 2008). They include emergent, scrub-shrub, and forested wetlands.

Wetland habitat occurs frequently along all action alternatives, although most frequently along the West Alternative (see Maps 18-1A, 1C, and 1D). Many wetlands found along the action alternatives are associated with the floodplains of large river systems, including the Cowlitz, Coweeman, Lewis, Kalama, and Columbia rivers. Wetland habitats are also found within smaller stream corridors, such as Salmon Creek. Although they can vary in their value to wildlife based on various attributes—such as size, structural complexity, connectivity, etc.—WDFW considers all wetlands to be priority habitat (WDFW 2010a). However, only three have been documented by WDFW in the study area to date. These include the Coweeman Wetland along the Coweeman River (Segment 9 of the West and Crossover alternatives), the Fraser Creek Wetland north of Yale Lake (Segment K of the East Alternative), and the Mill Creek Wetland south of the East Fork Lewis River (Segment 9 of the West Alternative,). These wetlands are valuable to wildlife for various reasons, as noted by WDFW (WDFW 2012).

Birds, including species such as Bullock's oriole (*Icterus bullockii*), red-tailed hawk (*Buteo jamaicensis*), Virginia rail (*Rallus limicola*), belted kingfisher, red-winged blackbird (*Agelaius phoeniceus*), cavity nesting ducks, and breeding and wintering concentrations of waterfowl, typically use low-elevation herbaceous wetlands for foraging and refuge more than any other

wetland type (WDFW 2010b). Mink (*Mustela vison*) and beaver (*Castor canadensis*) are common in wetlands. Emergent and scrub-shrub wetlands are used for breeding by most semi-aquatic amphibian species; even very small wetlands can be important habitat for amphibians (Johnson and O'Neil 2001). Nineteen special-status species can be supported by freshwater wetlands (see Section 18.1.4, Special-Status Wildlife). At least 7 of these have been documented in either wetland, riparian, or fresh deepwater habitat in the study area, including great blue heron (*Ardea herodias*), tundra swan, elk, Cope's giant salamander, Dunn's salamander, western toad, and western pond turtle.

Fresh deepwater includes the deep water habitat beyond the emergent wetland boundary in permanently flooded lands such as rivers and lakes (WDFW 2008). They support non-emergent **hydrophytic** plant species and fish and serve as foraging habitat for waterfowl, waterbirds, raptors, and bats. A similar number of fresh deepwater habitats are crossed by the action alternatives and include the Coweeman and Cowlitz rivers in the northern portion of the study area (see Maps 18-1A and 1B), the Kalama, Lewis, and East Fork Lewis rivers in the central portion (see Maps 18-1B and 1C), and the Columbia and Washougal rivers in the southern portion (see Map 18-1D).

Eleven special-status species could be found in fresh deepwater (see Section 18.1.4, Special-Status Wildlife). Of these, the California floater mussels (*Anodonta californiensis*), tundra swan, and western pond turtle are documented as occurring either in open water or wetlands in the study area.

18.1.2.8 Riparian

Riparian habitats occur in the lower-lying areas extending from the streamside vegetation along rivers and streams out to the edge of the floodplain (see also Chapter 15, Water and Chapter 19, Fish). Wetlands are commonly found within riparian zones. Riparian woodlands dominated by deciduous tree species are common, as are riparian areas in early- to late-successional coniferous forest.

Streams and rivers occur frequently throughout the study area (see Maps 18-1A through 18-1D). Riparian habitat would be cleared for the transmission line corridor at 46 to 70 fish-bearing stream crossings, depending on the action alternative (see Tables 15-2 and 19-2). This would likely include habitat along seven to nine larger rivers and streams. All action alternatives would cross the Cowlitz, Coweeman, Kalama, Lewis, East Fork Lewis, Washougal, and Columbia rivers; while the West Alternative would also cross Salmon Creek (also part of the Clark County Regional Conservation and Greenway System) and Lacamas Creek.

Riparian zones generally contain more mammal, bird, and amphibian species than surrounding uplands. Mammals may include such habitat generalists as coyotes, squirrels, chipmunks, and white-tailed deer. Riparian habitats also provide abundant high-quality food for neotropical migratory birds, which use riparian areas for breeding and as stopovers during migration. Other bird species that use these areas include osprey, red-winged blackbird, red-tailed hawk, American kestrel (*Falco sparverius*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), and song sparrow (*Melospiza melodia*). Amphibians such as Pacific giant salamanders (*Dicamptodon* spp.) and western redback salamander (*Plethodon vehiculum*) use riparian zones for foraging, and most amphibian species require an aquatic habitat for part of their life cycle.

In the study area, riparian areas are important habitats to special-status species. Fifteen special-status species with potential to occur in the study area are those that use riparian habitats (see Section 18.1.4, Special-Status Wildlife). Thirteen of these have been documented as occurring in riparian or wetland habitat: Barrow's goldeneye (*Bucephala islandica*), Tundra swan, wood duck, great blue heron, bald eagle, pileated woodpecker, purple martin, elk, Cascade torrent salamander, Cope's giant salamander, Dunn's salamander, Rocky Mountain tailed frog, and western toad.

18.1.2.9 Caves

Caves are naturally occurring cavities, recesses, voids, or systems of interconnected passages that are large enough for a person and that occur under or into the earth in soils, rock, ice, or other geological formations. Mine shafts may mimic caves and provide similar wildlife habitat (WDFW 2008).

Several WDFW cave-rich priority areas occur near Yale Lake (see Map 18-1C). They include a WDFW cave-rich priority area crossed by the East and Crossover alternatives in the portion of Segment O nearest to Yale Lake. Two others occur near Yale Lake within 1 mile of an action alternative: one near Segment K of the East Alternative, and one near Segment U of East Option 2. In addition, a cave occurs between segments 41 and 38 near the West Alternative and West Options 2 and 3 (see Map 18-1D).

Caves could provide habitat for seven special-status species (see Section 18.1.4, Special-Status Wildlife). Three have been documented in the study area: Townsend's big-eared bat, peregrine falcon, and Larch Mountain salamander.

18.1.2.10 Talus

Talus is a homogenous area of rock rubble, including riprap slides and mine tailings. Talus may be associated with cliff habitat, a WDFW priority habitat that has not been documented or quantified by WDFW (WDFW 2008).

Talus occurs where the East and Crossover alternatives cross Larch Mountain on Segment O (see Map 18-1D), which may also cross cliff habitat (also not yet documented by WDFW).

Common species such as red-legged frog (*Rana aurora*), Pacific tree frog (*Pseudacris regilla*), northwestern salamander (*Ambystoma gracile*), and long-toed salamander (*Ambystoma macrodactylum*) sometimes use talus slopes for winter hibernation. Cliffs provide vantage points and unique nesting and roosting habitat for birds, and roosting habitat for bats. Mammals such as fishers use cliffs for denning.

Talus slopes may provide habitat for two special-status species: Larch Mountain salamander and Van Dyke's salamander (*P. vandykei*) (see Section 18.1.4, Special-Status Wildlife). Cliffs may support three special-status species: peregrine falcons, long-eared myotis, and long-legged myotis. Only Larch Mountain salamander and peregrine falcon have been documented to occur in the study area.

18.1.3 ODFW Strategy Habitats

In Oregon, strategy habitats are native habitats considered to be conservation priorities due to high losses over the last century and the risk of future losses (ODFW 2006). ODFW guides habitat mitigation by rating and categorizing strategy habitats based on quality and importance to wildlife. These habitat categories are designated as categories 1 through 6, with 1 being the highest quality (OAR 635-415-0025). Oregon strategy habitats in the study area (defined the same as WDFW priority habitats) include wetland and riparian habitats. These habitats have been highly disturbed and would likely be considered ODFW habitat categories 5 and 6, including the herbaceous emergent wetlands surrounding the Sundial substation site. The ODFW Sandy River Conservation Opportunity Area (COA) may contain higher quality habitat, but is 0.25 mile east of the proposed right-of-way for all action alternatives and 0.5 mile east of the Sundial substation site (see Map 18-1D), and would not be affected.

18.1.4 Special-Status Wildlife

Special-status wildlife include those species protected under the federal Endangered Species Act as threatened, endangered, or proposed species; those listed by the USFWS as candidate species or species of concern; and those listed for protection by the states of Oregon and Washington. Special-status species also include WDFW priority (non-listed) species and specific wildlife groups, such as waterfowl. These are species identified as conservation priorities due to their dependency on specific habitats for important aggregations (e.g., heron rookeries), or based on their recreational, commercial, and/or tribal importance coupled with various vulnerabilities to decline (WDFW 2008). Special status wildlife species with documented occurrences and/or potential suitable habitat within the study area (defined the same as WDFW priority habitats and ODFW strategy habitats) are identified in Table 18-2. The following discussion describes federally listed wildlife species with the potential to occur in the study area, and other special-status wildlife species.

18.1.4.1 Federally Listed Wildlife Species

The potential for a certain federally-listed wildlife species to occur in the study area is determined by documented occurrences and suitable habitat. Suitable habitat occurs for one federally endangered species (Columbian white-tailed deer) and two federally threatened species (northern spotted owl and marbled murrelet) along all action alternatives.

Columbian White-Tailed Deer

Suitable habitat for Columbian white-tailed deer includes a mix of open habitat and forest or woodland habitat (see Section 18.1.2, WDFW Priority Habitats). Although suitable habitat exists along all action alternatives for Columbian white-tailed deer, they are not likely found in the study area. There are only two known populations of this species: one in Washington along the Columbia River west of the project area, and one in Roseburg, Oregon (USFWS 1983). The eastern extent of the Columbia River population is about 5 miles west of the study area (WDFW 2009c). There is no federally designated critical habitat for Columbian white-tailed deer in the study area (USFWS 2010b, 2010c).

Table 18-2 Special-Status Wildlife Species with the Potential to Occur in the Study Area[1]

Species (*Scientific Name*)	Status	Potential Habitat in Study Area	Documented Occurrences by Action Alternative
Birds			
Bald eagle (*Haliaeetus leucocephalus)*	Federal (SOC) WA (S)	Open water; Riparian; Forest; Production forest; Old-growth/mature forest	All Action Alternatives
Band-tailed pigeon (*Columba fasciata*)	WA (Priority)	Forest; Production forest	–
Barrow's goldeneye (*Bucephala islandica*)[2]	WA (Priority)	Wetlands; Riparian	West, West Options 1–3, Crossover, Crossover Options 1–3
Bufflehead (*Bucephala albeola*)[2]	WA (Priority)	Wetlands; Riparian; Oregon white oak woodlands; Open water	–
Cavity-nesting ducks	WA (Priority Areas)	Riparian	West Alternative and Options Central Option 3
Common Goldeneye (*Bucephala clangula*)[2]	WA (Priority)	Wetlands; Riparian; Oregon white oak woodlands; Open water	–
Golden eagle (*Aquila chrysaetos*)	WA (C)	Open habitat; Prairie	–
Great blue heron (*Ardea herodias*)	WA (Priority)	Wetlands; Riparian	West Alternative and Options Crossover Alternative and Options
Harlequin duck (*Histrionicus histrionicus*)	WA (Priority)	Wetlands	–
Hooded Merganser (*Lophodytes cucullatus*)[2]	WA (Priority)	Wetlands; Riparian; Oregon white oak woodlands; Open water	–
Marbled murrelet (*Brachyramphus marmoratus*)	**Federal (T)** OR (T) WA (T)	Old-growth/ mature forest	–
Northern goshawk (*Accipiter gentilis*)	Federal (SOC) OR (S-V) WA (C)	Old-growth/mature forest	West Alternative and Options Central Alternative and Options Crossover Alternative and Options
Northern spotted owl (*Strix occidentalis*)	**Federal (T)** OR (T) WA (E)	Old-growth/mature forest	All Action Alternatives
Olive-sided flycatcher (*Contopus cooperi*)	Federal (SOC) OR (S-V)	Shrubland; Forest; Production Forest; Open water	–
Peregrine falcon (*Falco peregrinus*)	Federal (SOC) OR (S-V) WA (S)	Urban/suburban; Caves; Cliffs	East Alternative and Options Crossover Alternative and Options
Pileated woodpecker (*Dryocopus pileatus*)	OR (S-V) WA (C)	Old-growth/mature forest; Riparian; Oregon white oak woodlands	West Alternative and Options Crossover Alternative and Options
Purple martin (*Progne subis*)	Federal (SOC) OR (S-CR) WA (C)	Riparian	All Action Alternatives
Sandhill crane (*Grus canadensis*)	OR (S-V) WA (E)	Open habitat; Open water; Wetlands	West Alternative and Options
Slender-billed white-breasted nuthatch (*Sitta carolinensis aculeata*)	Federal (SOC) OR (S-V) WA (C)	Old-growth/mature forest; Oregon white oak woodlands	–

Species (*Scientific Name*)	Status	Potential Habitat in Study Area	Documented Occurrences by Action Alternative
Sooty grouse (formerly blue grouse) (*Dendragapus fuliginosus*)	WA (Priority)	Forest; Production forest	–
Streaked horned lark (*Eremophila alpestris strigata*)	Federal (C) OR (S-CR) WA (C)	Riparian; Open Habitat; Prairie	–
Trumpeter swan (*Cygnus bucinator*)	WA (Priority)	Open water; Wetlands	–
Tundra swan (*Cygnus columbianus*)	WA (Priority)	Open habitats; Open water; Riparian	West Alternative and Options
Vaux's swift (*Chaetura vauxi*)	WA (C)	Old-growth/mature forest	All Action Alternatives except Central Option 3
Waterfowl Concentrations (Ducks, Geese, and Swans)	WA (Priority Areas)	Wetlands; Riparian; Oregon white oak woodlands; Open water	West Alternative and Options East Alternative, East Options 2 and 3
Western grebe (*Aechmophorus occidentalis*)	WA (C)	Open water; Wetlands	–
Wood duck (*Aix sponsa*)[2]	WA (Priority)	Wetlands; Riparian; Oregon white oak woodlands	West Alternative and Options Crossover Option 1
Yellow-billed cuckoo (*Coccyzus americanus*)	Federal (C) OR (S-CR) WA (C)	Forest; Production forest; Riparian	–
Mammals			
Big brown bat (*Eptesicus fuscus*)	WA (Priority)	Urban/suburban; Forest; Production forest	–
Brush prairie pocket gopher (*Thomomys mazama spp. Oregonus*)	Federal (C) WA (T)	Open habitat; Prairie	–
Columbian black-tailed deer (*Odocoileus hemionus* ssp. *columbianus*)	WA (Priority)	Open habitat; Shrubland; Forest; Production forest	West Alternative and Options East Alternative and Options Crossover Alternative and Options
Columbian white-tailed deer (*Odocoileus virginianus* ssp. *leucurus*)	**Federal (E)** OR (S-V) WA (E)	Open habitat; Shrubland; Forest; Production forest; Wetlands; Riparian; Prairie	–
Elk: Rocky Mountain Elk (*Cervus elephus nelsoni*) and Roosevelt Elk (*Cervus elephus roosevelti*)	WA (Priority)	Open habitat; Shrubland; Forest; Production forest; Wetlands	All Action Alternatives
Fisher (*Martes pennanti*)	Federal (C) OR (S-CR) WA (E)	Forest; Production forest; Cliffs	–
Fringed myotis (*Myotis thysanodes*)	Federal (SOC) OR (S-V) WA (Monitor)	Forest; Production forest; Caves	–
Gray-tailed vole (*Microtus canicaudus*)	WA (C)	Open habitat	–
Keen's myotis (*Myotis keenii*)	WA (C)	Urban/suburban; Old-growth/mature forest	–
Long-eared myotis (*Myotis evotis*)	Federal (SOC) WA (Monitor)	Shrubland; Forest; Production forest; Open water; Riparian; Caves; Cliffs	–

Species (*Scientific Name*)	Status	Potential Habitat in Study Area	Documented Occurrences by Action Alternative
Long-legged myotis (*Myotis volans*)	Federal (SOC) OR (S-V) WA (Monitor)	Urban/suburban; Forest; Production forest; Caves; Cliffs	–
Marten (*Martes americana*)	OR (S-V) WA (Priority)	Old-growth/mature forest; Wetlands	–
Townsend's big-eared bat (*Corynorhinus townsendii*)	Federal (SOC) OR (S-CR) WA (C)	Caves; Forest; Production forest; Oregon white-oak woodland; Open habitat; Riparian	West Alternative and Options
Amphibians			
Cascade torrent salamander (*Rhyacotriton cascadae*)	Federal (SOC) OR (S-V) WA (C)	Wetlands; Riparian	All Action Alternatives
Cope's giant salamander (*Dicamptodon copei*)	OR (S-V) WA (Monitor)	Wetlands; Riparian	West Alternative and Options Central Alternative and Options Crossover Alternative and Options
Dunn's salamander (*Plethodon dunni*)	WA (C)	Wetlands; Riparian	Central Option 1
Larch Mountain salamander (*Plethodon larselli*)	Federal (SOC) OR (S-V) WA (S)	Caves; Talus	–
Northern red-legged frog (*Rana aurora*)	OR (S-V)	Open water; Wetlands; Riparian	–
Oregon spotted frog (*Rana pretiosa*)	Federal (C) OR (S-CR) WA (E)	Open water; Wetlands; Riparian	–
Rocky Mountain tailed frog (*Ascaphus montanus*)	OR (S-V) WA (C)	Riparian	East Alternative and Options Crossover Alternative and Options
Van Dyke's salamander (*Plethodon vandykei*)	Federal (SOC) WA (S)	Wetlands; Riparian; Caves; Talus	–
Western toad (*Anaxyrus boreas*)	Federal (SOC) OR (S-V) WA (C)	Open water; Wetlands; Riparian; Open Habitat; Forest	Central Alternative and Options
Reptiles			
Western pond turtle (*Actinemys marmorata*)	Federal (SOC) OR (S-CR) WA (E)	Open water; Wetlands; Riparian; Open habitat; Forest	All Action Alternatives
Invertebrates			
Blue-gray taildropper (snail) (*Prophysaon coeruleum*)	WA (C)	Old-growth/mature forest	–
California floater (mussel) (*Anodonta californiensis*)	Federal (SOC) WA (C)	Open water; Wetlands	All Action Alternatives
Valley silverspot (butterfly) (*Speyeria zerene bremnerii*)	Federal (SOC) WA (C)	Open habitats; Prairie	–

Notes:

C = Candidate; E = Endangered; T = Threatened; S = Sensitive; S-CR = Sensitive, Critical; S-V = Sensitive, Vulnerable; SOC = Species of Concern.

1. Documented occurrences are within a 2-mile-wide corridor (1 mile on each side of the action alternatives).

2. These five species make up the WDFW priority species group "Cavity-Nesting Ducks."

Sources: ORBIC 2010; USFWS 2010b, 2011; WDFW 2008, 2010b

Northern Spotted Owl

Suitable habitat for northern spotted owl is multi-layered, species diverse old-growth forest dominated by large overstory trees. Old-growth/mature forest stands of varying condition occur in the study area along all action alternatives (see Map 18-1A through 18-1D). In addition, northern spotted owls and their foraging territory (referred to as **northern spotted owl circles**, and including all territorial owls) are known to occur throughout the project area, with northern spotted owl circles crossed by or occurring within 1 mile of the Central, East, and Crossover alternatives. There is no federally designated critical habitat for northern spotted owl in the study area (USFWS 2010b, 2010c).

Marbled Murrelet

Suitable habitat for marbled murrelet is old-growth/mature forest within about 50 miles of the coast that contains trees with large branches capable of providing nesting platforms (USFWS 1997). Since the western-most portions of the action alternatives are over 50 miles from the coast, they are at the furthest edge of the region expected to support marbled murrelet. Because of the distance from the coast and the small amount of mature forest (see Map 17-1A), it is unlikely that marbled murrelet would nest in the study area. However, there is a documented occurrence about 3 miles northeast of the Casey Road substation site, so it is possible that marbled murrelet could be found in the small patches of mature forest that occur in the northwest portion of the project area. In addition, the eastern extent of the Western Washington Coast Range Conservation Zone, or Conservation Zone 2, for marbled murrelet (marbled murrelet conservation zone) is crossed by all action alternatives and the three Castle Rock substation sites. As stated in the Marbled Murrelet Recovery Plan, maintaining suitable habitat within each of the six marbled murrelet conservation zones is important for the recovery of the species (USFWS 1997). There is no federally designated critical habitat for marbled murrelet in the study area (USFWS 2010b, 2010c).

18.1.4.2 Other Special-Status Wildlife Species

In addition to the 3 federally listed species, 46 other special-status species have the potential to occur in the study area (see Table 18-2). Twenty-one have documented occurrences in the study area and are discussed in Appendix N.

Birds

Bald Eagle. All action alternatives have areas of suitable bald eagle habitat. They include large trees in riparian areas (or within 0.5 mile of water) for nesting and foraging habitat, and mature conifer stands for shelter at night (Stinson, et. al 2007; USFWS 2012). Throughout the study area, there are 12 documented occurrences of bald eagle nests and 3 WDFW bald eagle priority areas in riparian habitats: the Cowlitz Bald Eagle Feeding Habitat, (see Map 18-1A), the Lewis River Winter Eagle Habitat, and the Yale Tailrace Foraging Area by Lake Merwin (see Map 18-1C). Each action alternative crosses within 1 mile of at least one WDFW bald eagle priority area (the Crossover Alternative crosses two), and all cross within 1 mile of at least three nests. The West and Crossover alternatives cross by the most nests.

Cavity-Nesting Ducks. Cavity-nesting ducks is a WDFW priority species group including wood duck, Barrow's goldeneye, common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), and hooded merganser (*Lophodytes cucullatus*). Priority areas are areas that provide

high-quality breeding habitat (WDFW 2008). There are two WDFW cavity-nesting duck priority areas in the study area: one is within 1 mile of Central Option 3 along Segment M (specific name unknown); and the other is the Woodland Cavity Nesting Habitat Priority Breeding Area within 1 mile of the West Alternative along Segment 25 (see Map 18-1C). In addition, there are priority areas specific to two of these species in the study area:

- **Barrow's Goldeneye.** There is one documented occurrence of Barrow's goldeneye within 1 mile of both the West and Crossover alternatives in high-value wetland habitat, which is also a WDFW waterfowl concentration priority area (see Waterfowl Concentrations, this section).
- **Wood Duck**. There are two WDFW wood duck priority areas in the study area in riparian areas crossed by the West Alternative, one of which also comes within 1 mile of Crossover Option 1.

Great Blue Heron. Potential habitat for great blue heron includes emergent and forested wetlands, open habitats, riparian areas, and shallow water along ponds and lakes (NatureServe 2012). Great blue herons are colonial breeders that nest in a variety of tall deciduous and evergreen trees in forested wetlands, establishing rookeries that usually exist in the same location for many years. Foraging habitat includes fields, meadows, and shallow water (NatureServe 2012). There are three documented occurrences of great blue heron in the study area. They are located within 1 mile of the West Alternative in three distinct areas, one of which is also within 1 mile of the Crossover Alternative.

Northern Goshawk. This species requires mature/old-growth forest habitat. Individuals typically nest in the largest trees in dense forests with sparse groundcover (NatureServe 2012). There is one documented occurrence of an immature northern goshawk in the study area, located in production forest within 1 mile of where the West, Central, and Crossover alternatives also cross production forest.

Peregrine Falcon. Potential habitat for peregrine falcon includes urban and suburban areas, caves, and cliffs. Peregrine falcons often nest on ledges or holes in rocky cliffs, riverbanks, large stick nests of other species, tree hollows, and man-made structures. Ideal locations include undisturbed areas with a wide view, near water, and close to an abundant food source (NatureServe 2012). There is one documented occurrence of peregrine falcon in the study area, located in WDFW cliffs/bluffs priority habitat within 1 mile of both the East and Crossover alternatives.

Pileated Woodpecker. Potential habitat for pileated woodpecker primarily includes old-growth/mature forest (including forested freshwater wetlands and forested riparian areas), although it may also include younger forests and Oregon white oak woodlands for foraging habitat if snags are present. There is one documented occurrence of pileated woodpecker in the study area within 1 mile of the West and Crossover alternatives where they cross forested freshwater wetlands.

Purple Martin. Purple martin nest in tree cavities in riparian areas and require open habitats (fields, marshes, or open water) to forage for insects (NatureServe 2012). There is one documented occurrence in the study area, located in riparian habitat within 1 mile of where all action alternatives cross the Columbia River.

Sandhill Crane. Potential habitat for sandhill crane includes open habitats such as agricultural areas, prairie habitat, emergent wetlands, and shallow ponds. Nesting habitat includes wet meadows and the edges of wetlands, while during the non-breeding season, sandhill cranes roost at night in shallow water (NatureServe 2012). Open habitats provide forage. There is one documented occurrence of sandhill crane in open habitat within 1 mile of the West Alternative.

Vaux's Swift. Potential habitat for Vaux's swift includes old-growth/mature forests, where they nest in hollow and broken-top trees and snags, although they sometimes use chimneys for nesting (NatureServe 2012). They generally use the same nest site each year. Vaux's swifts also need open habitats nearby, where they feed on insects (NatureServe 2012). There is one documented occurrence of Vaux's swift in the study area: a nesting Vaux's swift found in a chimney in urban-suburban habitat about 0.5 mile away from the Central Alternative. Vaux's swift has also been reported in a WDFW biodiversity area and corridor priority habitat (WDFW 2012) within 1 mile of all action alternatives.

Waterfowl Concentrations (Ducks, Geese, and Swans). WDFW waterfowl concentration priority areas are those known to support large numbers of ducks, geese, and swans, including those that are significant breeding areas or support regular concentrations of these birds in winter. There are five WDFW waterfowl concentration priority areas in the study area. Two are crossed by the West Alternative on Segment 25 along and just south of the East Fork Lewis River, one is within 1 mile of the West Alternative on Segment 25 along Mill Creek (see Map 18-1C), and one is within 1 mile of the East Alternative near the Cowlitz River on Segment F (see Map 18-1A). In addition, at least two WDFW priority (waterfowl) species are documented to occur in these areas:

- **Barrow's Goldeneye** (see Cavity-Nesting Ducks).
- **Tundra Swan**. This species only occurs in the study area during the winter (non-breeding) season (NatureServe 2012). Open habitats, including shallow lakes and ponds, slow-moving rivers, flooded fields, prairies, and agricultural fields provide foraging and roosting habitat for tundra swan (NatureServe 2012; Seattle Audubon Society 2012). There are two documented occurrences of tundra swan in the study area. They are at two separate locations in riparian/wetland habitats within 1 mile of the West Alternative. One occurrence is in a WDFW Waterfowl Concentration Priority Area.

Mammals

Columbian Black-Tailed Deer. Columbian black-tailed deer is a subspecies of mule deer, and is classified as a state game species. Their preferred habitat includes a mix of shrubland and coniferous forest; as such, they are an "edge" species, finding food in forest openings and shelter in the forest. There are two known concentrations of this species in the study area. The Crossover and East alternatives cross a WDFW Columbian black-tailed deer winter range priority area, and there is a small concentration of this species in a WDFW biodiversity area and corridor—known as the Green Mountain Urban Natural Open Space (WDFW 2012), that is crossed by the West Alternative (including West Options 2 and 3).

Elk. There are two subspecies of elk in the project area: Roosevelt elk, indigenous to Washington, and Rocky Mountain elk, introduced from the Rocky Mountain region (WDFW 2006). Both are game species in Washington. Elk are also considered an edge species because ideal habitat for elk consists of open habitat interspersed with closed-canopy forest (WDFW

2005). There are 10 to 11 recognized elk herds in Washington (WDFW 2006, 2012), three have known ranges and WDFW winter range priority areas crossed by all action alternatives: the Willapa Herd (WDFW Roosevelt Elk Winter Range Priority Area) and the Mt. St. Helen's and Mt. Rainier herds (WDFW Rocky Mountain and Roosevelt Elk Winter Range Priority Area). The range of the Willapa Herd extends to the northwest portion of the study area. The Mt. St. Helen's/Mt. Rainier's herds range extends to the east and southern portions of the study area. WDFW priority areas for both herds occur only in the northern portion of the study area.

Townsend's Big-Eared Bat. Townsend's big-eared bats may be found in forest habitats or in areas with a mosaic of forest, open, and/or shrubland habitats (NatureServe 2010). They establish maternity and hibernation colonies in caves and mine tunnels, roost in trees, and feed on insects near the foliage of trees and shrubs. There is one documented occurrence of Townsend's big-eared bat in the study area in a cave within about 0.15 mile of the West Alternative (including the West Options) (WDFW 2010b).

Amphibians

Cascade Torrent Salamander. Suitable habitat for Cascade Torrent Salamander includes riparian areas in moist coniferous forests, primarily in and around streams (NatureServe 2012). There are 12 documented occurrences of Cascade torrent salamander in the study area, primarily along the Central, East, and Crossover alternatives, but also one along the West Alternative (WDFW 2010b).

Cope's Giant Salamander. Suitable habitat for Cope's giant salamander includes riparian areas, moist coniferous forests, and in and around streams, rivers, and ponds (NatureServe 2012). There are two documented occurrences of Cope's giant salamander in the study area. One occurs in the study areas of both the Crossover and West alternatives, while the other only occurs in the study area of the Crossover Alternative.

Dunn's Salamander. Suitable habitat for Dunn's salamander would be riparian areas along shady streams or stream seepages in wet rocky areas, talus slopes, moss-covered outcrops, and under rocks, logs, and leaf litter (NatureServe 2012). Dunn's salamanders have been documented twice in the study area, both occurrences are near access roads of Central Option 1 near the Casey Road substation site.

Larch Mountain Salamander. The range of Larch Mountain salamanders extends from the Columbia River Gorge northward in the Cascades to central Washington. Potential habitat for Larch Mountain salamander includes steep slopes (usually north-facing, mossy slopes) associated with talus, gravelly soils, or other types of rocky substrate. There is one documented occurrence in the study areas of the East and Crossover alternatives.

Rocky Mountain Tailed Frog. Rocky Mountain tailed frogs require clear, cold, swift-moving mountain streams with a coarse substrate—most commonly found in forested riparian areas (NatureServe 2012). Rocky Mountain tailed frogs have moderate mobility and may be found in forest or open habitat away from streams in wet weather. There are five documented occurrences of this species in the study area. Two are located exclusively along the East Alternative; three others are along both the East and Crossover alternatives.

Western Toad. The western toad migrates seasonally between aquatic breeding and terrestrial non-breeding habitat. Potential breeding habitat for the western toad includes emergent

wetlands, ponds and lakes, or pools of slow-moving streams (NatureServe 2012). Non-breeding habitat occurs in a variety of disturbed and undisturbed open and forest habitats. There is one documented occurrence of this species in the study area along the Central Alternative.

Reptiles

Western Pond Turtle. Potential habitat for the western pond turtle includes riparian areas, emergent wetlands, ponds and small lakes, and adjacent upland habitat for nesting and hibernation (NatureServe 2012). There are three documented occurrences of this species in the study area. One is in Washington along the Central Alternative. Two are along all action alternatives in Oregon, including one occurrence near the Sundial substation site. The population in Washington is a captive population (WDFW 2010b); its potential range is therefore limited to that specific site, which is about 0.25 mile away from the proposed right-of-way and access road.

Invertebrates

California Floater. Potential habitat along the action alternatives for this freshwater mussel includes shallow water in primarily silty or sandy substrates of various aquatic habitats, although they have also been found in gravelly substrates (Xerces 2012). There is one documented occurrence of California floater in the Columbia River within 1 mile of the action alternatives.

18.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

18.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Mortality, a temporary decline in reproduction, or habitat loss of known occurrences of a federally listed species under the ESA that adversely affects population recovery
- Mortality, a temporary decline in reproduction, or habitat loss of known occurrences of a non-federally listed species with an at-risk population that contributes to the need for federal listing
- Permanent removal or alteration of WDFW priority habitats of high value to wildlife such that most or all relevant attributes of the original habitat are lost

Impacts would be **moderate** where project activities would cause the following:

- Mortality, a temporary decline in reproduction, or habitat loss of known occurrences of a federally listed species under the ESA that does not adversely affect population recovery
- Mortality, a temporary decline in reproduction, or habitat loss of known occurrences of a non-federally listed special-status species with an at-risk population that does not contribute to the need for federal listing
- Mortality of common wildlife species

- Disturbance of federally designated critical habitat under the ESA or high value WDFW priority habitats such that all or most of the relevant attributes of the original habitat are altered but will be restored
- Permanent removal or alteration of WDFW priority habitats of moderate value to wildlife such that most or all relevant attributes of the original habitat are lost
- Long-term or continued intermittent reduction of local food sources including prey species

Impacts would be **low** where project activities would cause the following:

- Minimal disturbance of federally designated critical habitat under the ESA or high value WDFW priority habitat such that all or most of the relevant attributes of the original habitat are maintained
- Permanent removal or alteration of WDFW priority habitats or ODFW strategy habitats of low value to wildlife such that most or all relevant attributes of the original habitat are lost
- Permanent removal or alteration of common wildlife habitats
- Loss of potential habitat of a federally listed species under the ESA where there is a greater likelihood that individuals could be present, but where none have been documented to occur.
- Habitat loss or temporary decline in reproduction of known occurrences of WDFW priority species with stable populations and of common species
- Temporary and minor disturbance of special-status species with at-risk populations that does not affect reproduction or cause injury or mortality
- Temporary disturbance of common wildlife species that does not cause mortality
- Short-term reduction to local food sources including prey species

No impact would occur when there is no degradation of habitat, or any mortality, injury, or reduced reproductive capacity of any wildlife species.

18.2.2 Impacts Common to Action Alternatives

18.2.2.1 Construction

Habitat Removal and Alteration

Project construction would remove or alter forest, forest production, shrubland, open, and urban/suburban habitats, and certain WDFW priority habitats.

Wildlife forested habitats—including Oregon white oak woodlands, old-growth/mature forests, and some urban/suburban habitats with trees—would be lost by clearing the right-of-way of vegetation for the new line. Most trees and shrubs taller than 4 feet would be removed. These impacts

Habitat removal includes the loss of habitats due to towers, access roads, and substations; or where right-of-way clearing removes forested habitats.

Habitat alteration includes areas where right-of-way clearing removes taller vegetation, but does not eliminate the main attribute of the habitat: e.g., in riparian and shrubland habitats.

would be permanent since the right-of-way would need to remain clear of tall-growing vegetation for the life of the line to maintain operational safety. The loss of wildlife breeding, roosting, nesting, and foraging sites characteristic of forested habitats would change the composition of the wildlife community within and at the edge of the right-of-way, substation, and access roads. Typically, the forested habitats would be converted to shrubland, and Oregon white oak woodlands to prairie. This change in habitat within the right-of-way would also create habitat fragmentation that could reduce and isolate wildlife populations, such as Cope's giant salamander and Dunn's salamander. Fragmentation can negatively affect a species' ability to access seasonal habitats and interbreed.

Habitat loss of forest and production forest from right-of-way clearing would generally have **low** impacts on wildlife because impacts would be spread out along a relatively narrow corridor, and affected habitats are fairly common in the project area, with the exception of WDFW priority habitats (see further discussion, this section). Where special-status species, such as northern spotted owl, are known to be present and would lose habitat, impacts would be **moderate**. Impacts would not be higher since habitat loss would be distributed along the corridor and not greatly affect any single wildlife population. Also, right-of-way clearing would not affect the listing status of any special-status species based on the documented occurrences in the study area and their conservation status (see Special-Status Species, this section). For wildlife species that are habitat generalists (including one federally listed species [Columbian white-tailed deer] and two WDFW priority species [elk and Columbian black-tailed deer]), there would be **no** permanent adverse impacts from right-of-way clearing since they could still use shrubland or prairie habitat as foraging habitat.

Forested riparian areas and forested freshwater wetlands would be extensively altered although they would persist as scrub-shrub riparian areas or scrub-shrub freshwater wetlands (also see WDFW Priority Habitats, this section). This alteration would have a **low-to-high** impact to these WDFW priority habitats depending on the condition of the affected areas and the proportion of shrubs and trees removed.

Shrublands (including scrub-shrub wetlands) would also be altered by right-of-way clearing since they would lose taller vegetation, which could reduce nesting habitat for some bird species. However, these areas would persist as shrubland habitats. In addition, new shrubland would be created through right-of-way clearing of forest and production forest. Therefore, right-of-way clearing would either have beneficial impacts to shrubland wildlife, or **low** adverse impacts to wildlife in existing shrubland.

Other habitats less affected by right-of-way clearing include caves, open habitat, talus fields, and cliff habitat (also see WDFW Priority Habitats, this section). Caves in forested areas would lose adjacent forest habitat, but many wildlife species that rely on caves—such as bats—are habitat generalists that could use the resulting shrublands as foraging habitat. Adverse impacts would include the loss of small amounts of roosting habitat. Right-of-way clearing would therefore be beneficial or have **low** adverse impacts to both wildlife and habitat. Wildlife in open habitat, talus fields, and cliff habitat would experience **no** impacts from right-of-way clearing.

All types of wildlife habitat would be reduced by towers, access roads, and substations. Tree, shrub, groundcover, woody debris, and soil or rock removal would create habitat losses for mammals, reptiles, birds, and invertebrates in all wildlife habitat types. The loss of these resources could also decrease prey populations and other food such as acorns and seeds. Conversely, habitat could be enhanced for raptors since towers could provide new or additional

perches, roosts, and nest sites. This could benefit raptor populations, but may adversely affect their prey, which would experience **moderate** impacts from mortality (e.g., small mammals, lizards, and snakes).

Habitat loss would generally have a **low** impact on wildlife given that impacts would be spread out along a relatively narrow corridor, and affected habitats are fairly common in the project area, with the exception of WDFW priority habitats (see WDFW Priority Habitats, this section). Where special-status species, such as western pond turtle, could be present and lose habitat, impacts would range from **low-to-high** depending on the value of the affected area**,** the extent of the disturbance, and the potential to affect a species' listing status based on documented occurrences and conservation status.

Not all impacts from right-of-way clearing would be negative, however. Species such as Columbian white-tailed deer, elk, black bear , beaver, rabbits, hares, mice, a variety of songbirds, migratory birds, and raptors frequent transmission line corridors and would be positively affected by right-of-way clearing of forested habitats (Harriman and Baker 2003). Shrubs can provide nesting habitat for some bird species (Bramble, et al. 1994), and the shrubs and herbaceous plants that grow in the cleared right-of-way are desirable for deer, elk, and other species (Loft and Menke 1984).

Construction Activities

In addition to habitat modification and loss that would take place during construction, construction activities themselves could temporarily affect wildlife habitat and species. These activities involve clearing for the right-of-way, installing towers, constructing or improving access roads, and building substations. Resulting disturbances would include noise and physical hazards from heavy equipment, helicopters, blasting, vehicles, chainsaws, falling trees, and general human activity.

Construction disturbances could harm individual animals and temporarily displace or elevate stress levels for many wildlife species in or near construction areas. Increased stress from noise and construction activities could temporarily disrupt foraging, breeding, and other normal activities, generally a **low** impact. Most invertebrates, reptiles, and amphibians living in wetlands, riparian areas, woodlands, and open habitats are not highly mobile and would be less able to flee construction disturbance. Because of this, these species would experience increased stress during construction and disproportionate impacts from decreased reproduction, injury, and mortality—**low-to-high** impacts depending on a species' status, although mortality of most wildlife, including special-status species would result in **moderate** impacts. For more mobile species such as birds and mammals, displacement within and near construction sites would occur; however, their mobility would decrease the likelihood that they would be harmed, and impacts would be **low**. For example, potential habitat for Columbian white-tailed deer occurs along all action alternatives (see Table 18-2), but because these deer are highly mobile and are habitat generalists, they would mostly be displaced by construction with no mortality or injury (a **low** impact).

Impacts would increase for special-status species if project-related stress or displacement should occur during the breeding season and cause decreased reproduction or the abandonment and loss of a nest or young, which would have **moderate** impacts to the affected wildlife. Where needed, construction would be limited during the breeding or nesting season to

avoid mortality or nest abandonment for federally listed species and migratory birds (see Section 18.2.8, Recommended Mitigation Measures).

Construction activities along access roads and around substations and towers could also have temporary or permanent impacts on wildlife habitat by crushing, removing, or trampling vegetation, spreading weeds, and compacting soils (see Chapter 17, Vegetation and Chapter 14, Geology and Soils). BPA would attempt to restore the vegetation, soils, and hydrology in these areas as needed to mitigate impacts. In some cases, complete restoration may not be possible, and impacts to wildlife from habitat loss would range from **low-to-moderate** depending on the extent of the impacts, the listing and conservation status of the affected species, and the condition of the preconstruction habitat.

WDFW Priority Habitats

Impacts to WDFW priority habitats are assessed in terms of their effect on the habitats because of their importance to a rich diversity and number of wildlife. All action alternatives would impact at least three types of WDFW priority habitats: riparian areas, wetlands, and old growth/mature forest. These habitats would also have the most acreage impacted of all WDFW Priority Habitats affected by the project. The project, regardless of the action alternative, would cause impacts to at least seven major riparian areas (the West Alternative would cross an additional two: Salmon Creek and Lacamas Creek riparian areas) (see Section 18.1.2.8, Riparian). Impacts to special-status habitats would range from **low-to-high** depending on their value as wildlife habitat and the extent of the disturbance.

ODFW Strategy Habitats and COA

The project is outside of the ODFW Sandy River Conservation Opportunity Area and would create **no** impacts to the COA. The only Oregon strategy habitats affected by the project would be the disturbed wetland at the Sundial substation site (see Section 18.2.2.3, Sundial Substation). No other habitats in Oregon designated as conservation priorities would be impacted by the project.

Special-Status Species

Disturbances have the potential to affect two federally listed species: northern spotted owl and marbled murrelet. Impacts to northern spotted owl would range between **low** and **moderate** depending on the action alternative. Impacts to marbled murrelet would be **low** for all action alternatives. All action alternatives also come within 1 mile of documented occurrences of 10 to 16 other special-status species (see Table 18-2), which indicates an increased likelihood that they could be affected by the project. Four of these species are found along all action alternatives and would experience similar types and levels of impacts, though documented occurrences may vary: bald eagle, Cascade torrent salamander, Vaux's swift, and elk. Three other species—California floater, purple martin, and western pond turtle—have the same documented occurrences and would experience the same impacts along all action alternatives:

California Floater (Federal SOC, WA Candidate, OR Sensitive). Since there is a documented occurrence of California floater in the Columbia River within 1 mile of all action alternatives, and towers would be installed on a reef in the Columbia River, there is some potential for impacts to this species from temporary increased turbidity during construction. Direct impacts to individual mussels would not be as likely since this species most frequently occurs in shallow

water in silty or sandy substrates, whereas the towers would be installed in the hard surface of the basalt reef adjacent to the deep channel of the river (see Section 3.2.4, Tower Construction in the Columbia River). If construction occurs in the finer substrates of the river, direct mortality could occur. Although its conservation status is imperiled in Oregon and Washington and vulnerable at the national level (NatureServe 2012), impacts would range from **low-to-moderate** given the factors listed above.

Purple Martin (Federal SOC, WA Candidate). Since there is a documented occurrence of purple martin within 1 mile of all action alternatives, there is a greater chance that individuals could be present and affected by the project. Impacts could include loss of riparian habitat caused by tree removal for right-of-way clearing and towers and access roads. BPA would use mitigation measures to avoid harm to a nest or young during the breeding season, if necessary. Since purple martin rely on trees in riparian areas, tree removal from right-of-way clearing in an urban/suburban area would remove valuable habitat in an area where such habitats are scarce. Conversely, because of this scarcity, any impacts would likely be isolated, potentially affecting only a small number of purple martin. Loss of individuals or habitat in this area would not likely affect its overall conservation status, which is listed as vulnerable in Washington but secure nationally (NatureServe 2012); impacts would be **moderate**.

Western Pond Turtle (Federal SOC, OR Sensitive-Critical). All action alternatives cross wetland habitat within 1 mile of two documented occurrences of western pond turtle in Oregon (both near the Sundial substation site [see Section 18.2.2.4, Sundial Substation]). Given this proximity, there is an increased chance that this species would be affected by the project. (The Central Alternative also crosses wetland/riparian habitat within 1 mile of a third [captive] population, which would not be impacted since it is a captive population about 0.25 mile away from the construction area). Impacts could include temporary construction disturbance, construction mortality, and loss of a nest or young if construction takes place during the breeding/nesting season, and degradation or loss of wetland habitat from the placement of towers or an access road. Because western pond turtle is rated as imperiled in Oregon and vulnerable-to-apparently secure federally (NatureServe 2012), and since its population is in decline in Oregon (ODFW 2011), mortality or loss of breeding habitat potentially affecting two populations could contribute to a need for federal listing, which would be a **moderate-to-high** impact.

18.2.2.2 Operation and Maintenance

Operation

Transmission lines can be obstacles to bird flight. Bird fatalities along the right-of-way could occur from collisions with the 500-kV transmission line conductors or ground wires. The frequency of collisions typically depends on line placement and configuration, and the numbers and species of birds present (Hunting 2002). The proximity of lines to areas of high bird use or migration is the biggest factor in avian collisions. Waterfowl, shorebirds, and other water birds such as egrets and cranes appear to be more susceptible to collision where lines span open water, wetlands, and riparian areas, or where lines are between waterfowl feeding and roosting areas (McNeil et al. 1985). The risk of collisions with power lines also increases when birds are migrating in groups at night or in low-visibility conditions such as fog. Other important factors in determining the risk of collisions for a bird species include body size, maneuverability, age of the birds, and the height at which the birds fly (Crowder and Rhodes 1999). Mountain quail, pheasant, and other low-flying birds do not typically fly high enough to collide with conductors. Raptors and passerines appear to be most susceptible in upland habitats (Hunting 2002).

Because the project would be within the Pacific Flyway, migrating birds could also collide with the lines. Bats do not tend to collide with transmission lines because they can easily echolocate the conductors.

Transmission lines with a flat configuration (where the conductors are on the same horizontal plane) are easier for birds to avoid. Lines that have the conductors stacked (the same vertical plane), or that parallel other transmission lines strung at a different height, can create a fence effect and are harder for birds to avoid (these conditions exist for this project along existing right-of-way). Typically, the conductors of 500-kV transmission lines are relatively large and more visible to birds and they fly higher to avoid them. Birds flying into transmission lines often collide with the smaller ground wire that is sometimes strung at the top of the towers.

The areas of primary concern for potential bird collisions with the proposed transmission line are riparian areas where the action alternatives would cross over the Cowlitz, Coweeman, Kalama, Lewis, East Fork Lewis, and the Columbia rivers, and in larger wetland areas, though collisions could occur in all habitats. Migratory, raptor, and federally-listed birds could experience mortality from collision with the transmission line. Historically, raptors—including eagles, hawks, owls, etc.—were known to have a high incidence of mortality from power lines, primarily from electrocution; however, current design standards have greatly reduced the probability of this occurring (APLIC 2006). Most transmission line collisions involve waterfowl, pelicans, and cranes, while raptor collisions are relatively rare (APLIC 2012; Kochert and Olendorff 1999; Oldendorff and Lehman 1986). To avert possible collisions, bird diverters (devices placed on transmission lines to make the lines more visible to birds) could be installed on overhead ground wires spanning the open water in these areas, or in other areas of high bird use. In most habitats under most conditions, and with the use of bird diverters, collisions would be infrequent and impacts to birds **low**. Impacts would be more frequent and **low-to-moderate** where transmission lines are near water bodies or other areas of high bird use, or where the new line would parallel existing lines of a different height. Where the latter two situations occur together, impacts would be **moderate** due to the increased number of collisions that could occur.

Electrocution of birds is not an issue with high-voltage transmission lines, even for birds with large wingspans, because electrocution is considered in the line design and the conductors are spaced far enough apart that birds cannot touch two conductors at the same time to complete an electric circuit.

Previous studies have found that EMF from transmission lines generally does not affect the health, behavior, or productivity of large animals, including wildlife and livestock (Exponent 2011). However, some limited research has suggested possible effects of low frequency EMF on the navigation abilities of honeybees, birds, and bats. For example, some studies report that honeybees and some bird species use magnetic navigation and can detect EMF. Some recent experiments suggest magnetic field exposure might affect these magnetic navigation systems in birds and bees (Fernie and Reynolds 2005; Hsu et al. 2007). However, there is no conclusive evidence that quantifies these effects or determines if such effects are found in high-voltage transmission line environments.

Maintenance

Typical operation and maintenance activities would have **low** temporary impacts on most wildlife for all action alternatives, except where there is mortality, in which case the impact

would be **moderate** (if mortality would contribute to a need for federal listing, the impact would be **high**). Tower, line, and substation maintenance activities would impact wildlife from noise (see Chapter 9, Noise), the presence of workers and vehicles, and habitat damage. Vehicle noise would create a low, infrequent, and brief disturbance along the right-of-way during annual ground inspections with one or two maintenance vehicles and during bi-annual aerial inspections with a helicopter. Maintenance vehicles would typically use established access roads; if off-road work should be required, habitat in these areas could be damaged, particularly with the use of large equipment. BPA would revegetate these areas as needed to mitigate impacts.

Vegetation management, which can require mechanical and chemical controls, could take place in the right-of-way as often as every 2 years in areas with fast-growing vegetation. Mowing along roadsides could take place more regularly. Impacts to wildlife would be temporary and primarily include disturbance from the noise from spraying, mowing, or cutting.

18.2.2.3 Sundial Substation

Construction activities would affect wildlife dependent on wetlands and open habitat by permanently filling 40 acres of open habitat that includes 11 acres of freshwater wetland habitat. The site is within an industrial park, and the wildlife habitat on site has been degraded by construction and operation of the Reynolds Aluminum plant, levee construction, drainage improvements, and agricultural activities (DEA 2009). Because of these disturbances, both habitats are low-value habitats for wildlife. Although wetlands are ODFW strategy habitats, the wetlands at the site would likely only be rated as a category 5 or 6 habitat given their condition. Impacts to wildlife would include displacement, habitat loss, and temporary construction disturbance to wildlife in the surrounding open and wetland habitats. Because of the condition of the affected habitat, the project would likely not affect a large diversity or number of wildlife species, so impacts would be **low**. In the wetland areas, impacts could also include injury or mortality of less mobile species, which would have **low** or **moderate** impacts.

There are two documented occurrences of western pond turtle within 1 mile of the site, indicating an increased likelihood that it could be present and affected by substation construction (these are the same occurrences as those listed for all action alternatives: see Sections 18.2.4.3, 18.2.5.3, 18.2.6.3, and 18.2.7.3, Special-Status Species). However, the high degree of disturbance already at the site makes this area poor nesting habitat for western pond turtle (ODFW 2011), and its presence is unlikely. If present, loss of suitable habitat or harm to individuals in a population at the Sundial site, with potential additional impacts from new towers and new access roads along the right-of-way approaching the substation, would have a **moderate-to-high** impact on the turtle given its declining population and its conservation status of imperiled in Oregon and vulnerable-to-apparently secure status in the United States (ODFW 2011; NatureServe 2012).

18.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 18.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

All three Castle Rock substation sites are in the northern portion of the project area (see Maps 17-1A and 18-1A), which is within the marbled murrelet conservation zone (USFWS 1997). However, only one site has the potential to affect marbled murrelets (see Section 18.2.3.3, Monahan Creek). The three sites are also within the WDFW winter range priority area of the Willapa Roosevelt elk herd.

Impacts to elk from habitat loss in this WDFW priority area would be **low** for all substation sites based on their secure conservation status (NatureServe 2012) and the relatively small portion of the total WDFW priority area that would be affected (the relative acreages affected are given below). No special-status species have been documented within 1 mile of the Castle Rock substation sites.

18.2.3.1 Casey Road

The substation and substation access road would permanently displace forest and shrubland wildlife by removing and permanently occupying 38 acres of production forest, 24 acres of shrubland, and 1 acre of open habitat. Displacement, habitat loss, and temporary construction disturbance to wildlife in surrounding production forest and shrubland would generally have **low** impacts on wildlife because the amount of habitat affected is small relative to the total amount present in the project area. Also, though the area is documented by USFWS as potentially having old-growth forest habitat suitable for northern spotted owl, recent high resolution imagery shows no old-growth forest currently present in the affected area (BPA 2011). Construction would have **no** impact on marbled murrelet or northern spotted owl.

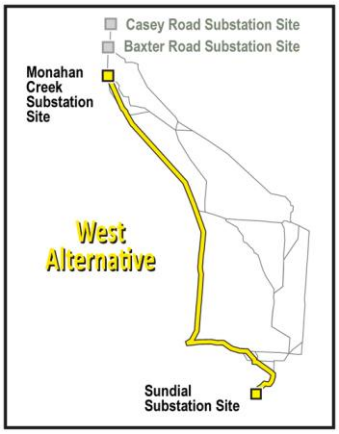
18.2.3.2 Baxter Road

The substation and substation access road would permanently displace production forest wildlife by removing and permanently occupying 47 acres of production forest with a small amount of shrubland. This would less than 1 acre of mostly forested wetland. Impacts on wildlife in production forest would essentially be the same as those described for the Casey Road site, although different types and numbers of wildlife would be affected (see Section 18.2.3.1, Casey Road). Impacts to the scrub-shrub wetland as a WDFW priority habitat could be **low-to-high** depending on the value of the wetland as wildlife habitat. Construction would have **no** impact on marbled murrelet or northern spotted owl because there is no suitable old-growth forest habitat currently present within the affected area (BPA 2011).

18.2.3.3 Monahan Creek

The substation and substation access road would permanently displace wildlife typically found in open habitat, production forest, old-growth/mature forest, and shrubland. The Monahan site would remove and permanently occupy 46 acres of open habitat, 18 acres of production forest, 2 acres of old-growth/mature forest, and 1 acre of shrubland. Impacts to wildlife in open habitat, production forest, and shrubland would essentially be the same as those described for the Casey Road site, although different types and numbers of wildlife would be affected (see Section 18.2.3.1, Casey Road). The loss of old-growth/mature forest would be a **high** impact due to its importance as a WDFW priority habitat. Also, it could provide suitable nesting habitat for marbled murrelet or northern spotted owl, although there are no documented occurrences nearby, and the large amount of open habitat and immature production forest surrounding the site reduce the quality of the habitat, particularly for northern spotted owl (BPA 2011). Potential impacts to marbled murrelet and northern spotted owl would include a small amount of potential habitat loss. This would be a **low** impact due to the small amount of habitat removed, the poor quality of the surrounding habitat, the lack of documented occurrences, and, for marbled murrelet, the low likelihood for nesting at the site due to the distance from the coast.

18.2.4 West Alternative



Because 65 miles of the West Alternative parallels an existing transmission line(s) on existing right-of-way, the new line would not create new fragmentation although it could expand existing fragmentation where the right-of-way would need to be widened, primarily in forested habitats (see Chapter 4, Proposed Action and Alternatives). In addition, since the new line would be taller than the parallel existing line(s), the higher conductors would increase the fence effect to bird flight paths and increase the risk of collision in many areas.

18.2.4.1 Wildlife Habitats and Species—West Alternative

The following discussion describes the impact levels for wildlife in habitats that are not considered to be WDFW priority habitats; impact levels generally could be higher where WDFW priority habitats or special-status species would be affected (see Section 18.2.4.2, WDFW Priority Habitats—West Alternative, and Section 18.2.4.3, Special-Status Species—West Alternative).

Discussing Impacts in Sections 18.2.4–18.2.7

Sections 18.2.4, 18.2.5, 18.2.6, and 18.2.7 provide the amount of wildlife habitat (in acres) that would be altered or removed by each action alternative. They also give the length (in miles) of the transmission line in each habitat. The amount of habitat altered or removed by right-of-way clearing is in Table 18-3 exclusive of the footprints of access roads, towers, and substations, which are in Table 18-4.

Where right-of-way clearing and access road, tower, and substation footprints have similar effects on the resource (i.e., for woodland and forest habitats), acreages from the two tables are added together in the discussion.

Wildlife in Open Habitat

The proposed transmission line would cross 25 miles of open habitat—more than any other habitat (see Table 18-3). Towers, access roads, and substations would cause a permanent loss of 171 acres (see Table 18-4), although 3 acres of open habitat would also be created by clearing Oregon white oak woodlands (see Table 18-5). The wildlife most affected by the project in open habitat would likely be ground-dwelling animals. They would experience both a decrease in available habitat and an increase in mortality from the increased number of perches available to predatory raptors (raptors, conversely, would experience mostly positive effects, with some potential for mortality from transmission line collisions). Impacts to wider-ranging wildlife would include a small reduction in breeding or grazing habitat. Wildlife mortality from construction and transmission-line bird collisions would also occur. Because the project would be long and narrow, any single population of animals would lose very little habitat and experience a small increase in mortality. These would cause **low** impacts from habitat loss and construction disturbance, and **moderate** impacts from mortality, since mortality of individual animals would not affect the conservation status of most species.

Table 18-3 General Wildlife Habitats Impacted by Right-of-Way Clearing (Acres) and Transmission Line Crossing (Miles)[1,2,3,4]

Alternatives and Options	Forest		Production Forest		Shrubland[5]		Urban/ Suburban[5]		Open	
	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles
West Alternative	**308**	**17**	**0**	**0**	**307**	**18**	**87**	**5**	**0**	**25**
West Option 1	-14	-1	N/C	N/C	+3	+<1	N/C	-<1	N/C	+1
West Option 2	-5	-1	+9	+1	+2	+<1	N/C	+<1	N/C	+1
West Option 3	+30	+2	+21	+1	+22	+1	N/C	-<1	N/C	+2
Central Alternative	**240**	**13**	**910**	**54**	**42**	**3**	**20**	**1**	**0**	**5**
Central Option 1	+1	+<1	+39	+3	+2	+<1	N/C	N/C	N/C	+<1
Central Option 2	+40	+2	-76	-5	+4	+<1	-6	-<1	N/C	-<1
Central Option 3	+56	+3	-175	-10	-3	-<1	-1	-<1	N/C	+1
East Alternative	**173**	**10**	**961**	**56**	**34**	**2**	**19**	**1**	**0**	**5**
East Option 1	+18	+1	-56	-3	+3	+<1	-8	-1	N/C	+1
East Option 2	+15	+1	N/C	+<1	+1	+<1	N/C	N/C	N/C	+<1
East Option 3	-6	-1	+22	+2	+3	+<1	N/C	N/C	N/C	N/C
Crossover Alternative	**276**	**14**	**588**	**35**	**208**	**12**	**21**	**1**	**0**	**9**
Crossover Option 1	+15	+1	N/C	N/C	+16	+1	+1	+<1	N/C	+3
Crossover Option 2	+3	+<1	N/C	N/C	+54	+3	N/C	N/C	N/C	+1
Crossover Option 3	+29	+1	+16	+2	+6	+<1	N/C	N/C	N/C	+1

Notes:

N/C – No net change from the action alternative.

1. To avoid double counting impacts, the acreages for access roads, towers, and substations that occur within the right of way were subtracted from right-of-way acreages. These acreages are in Table 18-4.

2. 150-foot wide right-of-way

3. The value for each option represents the net change from the action alternative. It was calculated as the acres added by the option minus the acres in the segments the option replaces.

4. Clearing for danger trees outside the right-of-way is unknown at this time and not included in these calculations.

5. Right of way clearing would only affect portions of the acreages given for these general vegetation types; i.e., where trees and tall shrubs are present.

Sources: Herrera 2010, USGS 2011

Table 18-4 General Wildlife Habitat Converted to Towers, Access Roads, and Substations (Acres)[1]

	Forest					Production Forest					Shrubland					Open					Urban/Suburban				
Alternatives and Options	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**
West Alternative	**7**	**20**	**17**	**20**	**64**	**0**	**5**	**8**	**0**	**13**	**7**	**29**	**22**	**1**	**59**	**13**	**42**	**30**	**86**	**171**	**3**	**4**	**3**	**0**	**10**
West Option 1	N/C	N/C	-1	N/C	**-1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	+2	-<1	N/C	**+1**	N/C	N/C	N/C	N/C	**N/C**
West Option 2	N/C	N/C	+1	N/C	**+1**	N/C	+1	+<1	N/C	**+2**	N/C	+2	-<1	N/C	**+1**	+<1	+3	-6	N/C	**-1**	N/C	N/C	N/C	N/C	**N/C**
West Option 3	+<1	+1	+2	N/C	**+4**	+<1	+7	+4	N/C	**+12**	N/C	+4	+2	N/C	**+6**	+<1	-2	-4	N/C	**-5**	N/C	N/C	N/C	N/C	**N/C**
Central Alternative	**5**	**26**	**45**	**0**	**76**	**19**	**100**	**185**	**47**	**351**	**2**	**7**	**23**	**0**	**32**	**4**	**12**	**26**	**40**	**82**	**0**	**<1**	**2**	**0**	**3**
Central Option 1	N/C	N/C	-<1	N/C	**-<1**	+<1	+2	+9	-9	**+3**	-<1	+<1	+2	+24	**+26**	N/C	N/C	+8	+1	**+9**	N/C	N/C	N/C	N/C	**N/C**
Central Option 2	+<1	+12	-5	+20	**+28**	-2	+1	-12	-47	**-60**	-<1	N/C	-3	+1	**-3**	N/C	-<1	-<1	+46	**+44**	N/C	N/C	N/C	N/C	**N/C**
Central Option 3	+2	+6	-4	N/C	**+4**	-4	-11	-18	N/C	**-33**	N/C	-1	-2	N/C	**-3**	N/C	+3	+4	N/C	**+7**	N/C	N/C	N/C	N/C	**N/C**
East Alternative	**3**	**17**	**34**	**0**	**54**	**19**	**84**	**275**	**47**	**425**	**2**	**5**	**48**	**0**	**55**	**4**	**13**	**57**	**40**	**114**	**0**	**<1**	**2**	**0**	**3**
East Option 1	+<1	+6	-3	+20	**+24**	-1	+<1	-11	-47	**-58**	N/C	+<1	-7	+1	**-5**	N/C	+1	-3	+46	**+44**	N/C	N/C	-<1	N/C	**-1**
East Option 2	+<1	N/C	-3	N/C	**-2**	N/C	-5	-45	N/C	**-50**	N/C	N/C	-15	N/C	**-15**	N/C	N/C	-2	N/C	**-2**	N/C	N/C	N/C	N/C	**N/C**
East Option 3	N/C	-3	N/C	N/C	**-3**	+<1	N/C	N/C	N/C	**+<1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**

	Forest					Production Forest					Shrubland					Open					Urban/Suburban				
Alternatives and Options	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**	Towers	New Access Roads	Improved Access Roads[2]	Substations	**Total**
Crossover Alternative	**6**	**23**	**35**	**20**	**84**	**12**	**65**	**122**	**0**	**199**	**5**	**16**	**44**	**1**	**66**	**5**	**14**	**21**	**86**	**126**	**<1**	**1**	**2**	**0**	**4**
Crossover Option 1	N/C	+2	-<1	N/C	**+1**	N/C	N/C	N/C	N/C	**N/C**	+<1	+2	N/C	N/C	**+3**	+1	+7	+3	N/C	**+12**	N/C	N/C	N/C	N/C	**N/C**
Crossover Option 2	N/C	N/C	+3	-20	**-17**	N/C	N/C	+5	+47	**+52**	+3	+2	+9	-1	**+13**	N/C	+1	+4	-46	**-41**	N/C	N/C	N/C	N/C	**N/C**
Crossover Option 3	N/C	+<1	+3	-20	**-16**	+<1	+<1	+4	+47	**+53**	+<1	+2	+10	-1	**+12**	N/C	+1	+4	-46	**-41**	N/C	N/C	N/C	N/C	**N/C**

Notes:
N/C – No net change from the action alternative.
1. The value for each option represents the net change from the action alternative. It was calculated as the acres added by the option minus the acres in the segments the option replaces.
2. Many improved access roads could be overgrown or would need to be widened; habitat would need to be removed.
Sources: Herrera 2010, USGS 2011

Wildlife in Forest and Production Forest Habitats

Although fewer miles of transmission line would cross forest habitat than open habitat (see Table 18-3), forest wildlife would experience more extensive impacts from clearing. Construction would clear 372 acres of forest for right-of-way, towers, substations, and access roads, and 13 acres of production forest for towers and access roads (see Tables 18-3 and 18-4). Forest-dependent wildlife would be most affected by habitat loss. Habitat generalists would be less affected since they would be able to use the altered "edge" habitat within the cleared right-of-way for foraging or hunting (shrubland and open habitat species could experience positive impacts by an increase in habitat) (see Section 18.2.2, Impacts Common to Action Alternatives). Because forest and production forest are common in the project area, and since impacts would be spread out along the corridor, most forest wildlife species would experience **low** impacts from habitat loss and construction disturbance. Wildlife mortality from construction and transmission-line bird collisions would occur but would be **moderate**, since mortality of individual animals would not affect the conservation status of most species (see Section 18.2.4.2, WDFW Priority Habitats−West Alternative, and Section 18.2.4.3, Special-Status Species—West Alternative, for potentially higher impacts).

Wildlife in Shrubland Habitat

Although total affected acreage is similar to the affected acreage in forest habitat, shrubland wildlife would experience fewer adverse effects, partly since more shrubland would be created than lost. Only 59 acres of existing shrubland would be removed for towers, access roads, and substations, with 307 acres of existing tall shrubland habitat altered by right-of-way clearing (see Tables 18-3 and 18-4). Conversely, they could benefit from the creation of 308 acres of shrubland habitat from right-of-way clearing in forest habitat (see Table 18-3). Also, raptors would experience a positive effect from the increase in available perches. Nonetheless, adverse impacts would occur, particularly to those animals in existing shrubland, including temporary construction disturbance; the loss of existing habitat; the loss of some tall shrub nesting habitat for birds; potential construction mortality for less mobile species; and a possible increase in mortality caused by an increase in predation by raptors using the transmission lines and towers as perches, and by bird/transmission line collisions. Since impacts would be spread out along the corridor and affect a relatively small amount of habitat, the levels of adverse impacts would be similar to those for open habitat, including **low** impacts from loss of existing habitat and construction disturbance, and **moderate** impacts from mortality.

Wildlife in Urban/Suburban Habitat

Wildlife found in urban/suburban habitat would experience some of the least amount of disturbance in both miles of transmission line and lost or altered habitat. The West Alternative would alter 87 acres of habitat by right-of-way clearing (see Table 18-3) and remove 10 acres of habitat for towers and access roads (see Table 18-4). Impacts to wildlife would range among those impacts listed for open, shrubland, forest, and production forest habitats, depending on which habitats might be present in any given urban/suburban area. Given the small amounts of habitat lost and the general tolerance of urban/suburban wildlife to human disturbance, impacts related to construction and habitat loss or alteration would be **low**, while those related to an increase in mortality (such as for prey species of raptors and bird/transmission line collisions) would be **moderate**.

18.2.4.2 WDFW Priority Habitats—West Alternative

This section provides the amount of WDFW priority habitats altered or removed by the West Alternative, and the length in miles of the transmission line crossing in each habitat.

Riparian Areas. Along the West Alternative, more habitat loss or alteration would occur in riparian areas than any other WDFW priority habitat: 135 acres would be altered by right-of-way clearing (see Table 18-5) and 25 acres would be lost to towers, access roads, and substations (see Table 18-6). Habitat loss would be a **low-to-high** impact to these WDFW priority habitats, depending on their condition. In addition, transmission line bird collisions could increase across 8 miles of riparian habitat, particularly with the increased fence effect caused by parallel lines. This would also be a **low-to-high** impact depending on bird use and the effectiveness of mitigation measures, since it could reduce the ability of these habitats to safely support waterfowl, waterbirds, and raptors: an essential attribute for these habitats.

Riparian areas also encompass other priority habitats affected by the project, including biodiversity areas and corridors, wetlands, and old-growth/mature forest.

Biodiversity Areas and Corridors. Seven documented WDFW biodiversity area and corridor priority habitats would be affected by the West Alternative. They include the East Fork Lewis River Riparian Corridor, the Upper Salmon Creek Riparian Corridor, the Burnt Bridge Creek Biodiversity Area, the Cougar Creek Riparian Corridor, the Green Mountain Biodiversity Area, the Camas Biodiversity Area, and the Lady and Akerman Islands Biodiversity Area and Corridor (WDFW 2012). Fragmentation of these habitats from right-of-way clearing could adversely affect the movement of many wildlife species across a biologically diverse and relatively undisturbed area. A total of 3 miles of these habitats would be crossed at approximately 10 locations by new transmission line, with 53 acres altered from right-of-way clearing, and 8 acres lost to transmission towers and access roads (see Tables 18-5 and 18-6). Impacts to these WDFW priority habitats would be **high** since fragmentation would diminish one of their main attributes, which is to be a "relatively undisturbed and unbroken tract of vegetation" that connects high-value habitats (WDFW 2008).

Freshwater Wetlands and Fresh Deepwater. About 113 acres of forested, scrub-shrub, and emergent freshwater wetlands would be lost to right-of-way clearing (forested wetland) and/or towers, access roads, and substations (see Tables 18-5 and 18-6). Sixty-two acres of scrub-shrub wetland would be altered by right-of-way clearing (see Table 18-5). Impacts to wildlife from the alteration and loss of wetland habitat would range from **low-to-high**, depending on the condition of each wetland. Habitat alteration and removal could occur at the Coweeman Wetlands, and would likely be **moderate-to-high** impacts given the description of their value to wildlife by WDFW (WDFW 2012). In addition, transmission line bird collisions may become more frequent over 16 total miles of all three types of freshwater wetlands (see Table 18-6); similar to riparian areas, an increase in transmission line collisions could reduce the value of these areas for wildlife habitat, a **low-to-high** impact.

The only impacts to fresh deepwater would be from transmission line bird collisions, which may increase across 1 mile of this habitat (see Table 18-5). As for freshwater wetlands and riparian areas, impacts to this WDFW priority habitat would be **low-to-high**.

Old-Growth/Mature Forest. Twenty-seven acres of old-growth/mature forest would be removed by right-of-way clearing, towers, substations, and existing access roads (see

Tables 18-5 and 18-6). Impacts to these WDFW priority habitats would be **high** since tree clearing would remove the main attributes of this habitat: long-lived trees and the associated understory vegetation, which have become uncommon in the Pacific Northwest and could not be easily or quickly replaced.

Westside Prairie. Six acres of westside prairie in the Lacamas Prairie Natural Area would be removed by towers and access roads, a **high** impact due to the rarity of this habitat in Washington (see Table 18-6). In addition, the transmission line would cross 2 miles of westside prairie parallel to the existing line, which together may increase transmission line bird collisions (see Table 18-5). Impacts to this habitat would be **low-to-moderate** depending on bird use and mitigation. This is higher than in other types of open areas, since Lacamas Prairie Natural Area is a wet prairie and could have a higher level of waterbirds and waterfowl than dry prairies (see Section 18.2.4.3, Special-Status Species—West Alternative, for a discussion of WDFW wood duck priority area in the Lacamas Prairie Natural Area).

Oregon White Oak Woodlands. Three acres total from the Sifton/Lacamas Oregon White Oak and Washougal Oak woodlands would be removed by right-of-way clearing (see Table 18-5). Impacts to these WDFW priority habitats would be **high** since tree clearing would remove the main attributes of this habitat: Oregon white oak trees and the associated understory vegetation, which are becoming less common in the Pacific Northwest.

Table 18-5 WDFW Priority Habitats Impacted by Right-of-Way Clearing (Acres) and Transmission Line Crossing (Miles)[1,2,3]

Alternatives and Options	Oregon White Oak Woodlands		Snag-Rich Area		Old-Growth/ Mature Forest		Riparian		Forested Freshwater Wetlands		Scrub-Shrub Freshwater Wetlands		Emergent Freshwater Wetlands		Fresh Deepwater		Westside Prairie		Biodiversity Areas and Corridors		Talus		Caves or Cave-Rich Habitat	
	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles	Acres	Miles
West Alternative	**3**	**<1**	**0**	**0**	**23**	**1**	**135**	**8**	**54**	**3**	**62**	**4**	**0**	**9**	**0**	**1**	**0**	**2**	**53**	**3**	**0**	**0**	**0**	**0**
West Option 1	N/C	+<1	N/C	N/C	N/C	N/C	+<1	-<1	+5	+<1	+2	+<1	**0**	+1	0	N/C	0	+1.6	-11	N/C	0	N/C	0	N/C
West Option 2	-1	-<1	N/C	N/C	+5	+<1	N/C	-<1	-8	-1	-3	-<1	**0**	-<1	0	N/C	0	-1	+12	+2	0	N/C	0	N/C
West Option 3	-1	-<1	N/C	N/C	+3	+<1	+12	+<1	-5	-1	-2	-<1	**0**	-<1	0	N/C	0	-1	+11	+1	0	N/C	0	N/C
Central Alternative	**2**	**<1**	**2**	**<1**	**12**	**1**	**105**	**6**	**69**	**4**	**16**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**10**	**1**	**0**	**0**	**0**	**0**
Central Option 1	N/C	N/C	N/C	N/C	N/C	N/C	+4	+<1	+1	+<1	+0.5	+<1	**0**	+<1	0	N/C	0	N/C	N/C	N/C	0	N/C	0	N/C
Central Option 2	N/C	N/C	N/C	N/C	+5	+<1	-2	+<1	+5	+<1	-0.7	-<1	**0**	+<1	0	+<1	0	N/C	N/C	N/C	0	N/C	0	N/C
Central Option 3	N/C	N/C	N/C	N/C	+3	+<1	-10	-1	-2	-1	-0.5	-<1	**0**	+<1	0	+<1	0	N/C	-2	+<1	0	N/C	0	N/C
East Alternative	**2**	**<1**	**31**	**2**	**10**	**1**	**94**	**5**	**61**	**3**	**23**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**9**	**1**	**0**	**<1**	**0.05**	**0**
East Option 1	N/C	N/C	N/A	N/A	+5	+<1	-3	-<1	+2	+<1	+8	+<1	**0**	+1	0	+<1	0	N/C	N/C	N/C	0	N/C	0	N/C
East Option 2	N/C	N/C	+2	+<1	-6	-<1	+2	+<1	+4	+<1	-7	-<1	**0**	N/C	0	+<1	0	N/C	+1	+<1	0	-<1	0	N/C
East Option 3	N/C	N/C	N/A	N/A	N/C	N/C	N/C	+<1	+1	+<1	-<1	-<1	**0**	N/C	0	N/C	0	N/C	N/C	N/C	0	N/C	0	N/C
Crossover Alternative	**2**	**<1**	**0**	**0**	**37**	**2**	**125**	**7**	**53**	**3**	**35**	**2**	**0**	**2**	**0**	**1**	**0**	**0**	**9**	**1**	**0**	**<1**	**0.05**	**<1**
Crossover Option 1	N/C	N/C	N/C	N/C	-<1	-<1	+8	+1	+8	+1	+1	+<1	**0**	+<1	0	N/C	0	+1	N/C	N/C	0	N/C	0	N/C
Crossover Option 2	N/C	N/C	N/C	N/C	+1	+1	+9	+1	+1	+<1	+3	+<1	**0**	N/C	0	N/C	0	N/C	N/C	N/C	0	N/C	0	N/C
Crossover Option 3	N/C	N/C	N/C	N/C	+1	+1	+7	+<1	+3	+<1	+2	+<1	**0**	N/C	0	N/C	0	N/C	N/C	N/C	0	N/C	0	N/C

Notes:
N/C – No net change from the action alternative.
1. To avoid double counting impacts, the acreages for access roads, towers, and substations that occur within the right of way were subtracted from right-of-way acreages. See Table 18-8 for impacts from access roads, towers, and substations.
2. 150-foot wide right-of-way
3. The value for each option represents the net change from the action alternative. It was calculated as the acres added by the option minus the acres in the segments the option replaces.
Sources: Herrera 2010, WDFW 2010b

Table 18-6 WDFW Priority Habitat Converted to Towers, Access Roads, and Substations (Acres)[1,2]

	Old-Growth/Mature Forest					Snag-Rich Areas					Riparian					Forested, Scrub-Shrub, and Emergent Freshwater Wetlands[3]					Westside Prairie					Biodiversity Areas and Corridors					Talus					Herbaceous Balds				
Alternatives and Options	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**	Tower	New Access Roads	Improved Access Roads[4]	Substations	**Total**
West Alternative	**<1**	**0**	**<1**	**2**	**4**	**0**	**0**	**0**	**0**	**0**	**2**	**6**	**8**	**9**	**25**	**7**	**23**	**18**	**11**	**59**	**1**	**3**	**2**	**0**	**6**	**1**	**6**	**1**	**0**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
West Option 1	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	+1	+<1	N/C	**+2**	N/C	+3	<1	N/C	**+4**	N/C	+3	+3	N/C	**+6**	-<1	-<1	-1	N/C	-2	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
West Option 2	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	-<1	+2	N/C	**+1**	-<1	-3	-3	N/C	**-7**	-<1	-2	+2	N/C	**-<1**	+<1	+2	+1	N/C	+4	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
West Option 3	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	+2	N/C	**+2**	N/C	-3	-3	N/C	**-6**	-<1	-2	+2	N/C	**-<1**	+<1	+1	+1	N/C	+3	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
Central Alternative	**0**	**<1**	**0**	**0**	**<1**	**<1**	**<1**	**<1**	**0**	**1**	**1**	**3**	**7**	**0**	**11**	**2**	**6**	**7**	**12**	**27**	**0**	**0**	**0**	**0**	**0**	<1	<1	0	0	<1	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Central Option 1	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	+<1	N/C	**+<1**	N/C	N/C	N/C	-<1	**-<1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
Central Option 2	N/C	N/C	N/C	+2	**+2**	N/C	N/C	N/C	N/C	N/C	N/C	+<1	N/C	+9	**+10**	N/C	+2	-2	-<1	**-<1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
Central Option 3	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	+1	N/C	N/C	**+1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
East Alternative	**0**	**<1**	**2**	**0**	**3**	**1**	**2**	**11**	**0**	**14**	**1**	**3**	**9**	**0**	**13**	**2**	**5**	**10**	**12**	**29**	**0**	**0**	**0**	**0**	**0**	<1	<1	0	0	<1	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0.5**	**0**	**0.5**
East Option 1	N/C	N/C	N/C	+2	**+2**	**N/C**	**N/C**	**N/C**	**N/C**	**N/C**	N/C	N/C	-<1	+9	**+8**	N/C	+3	N/C	-<1	**+2**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
East Option 2	N/C	N/C	-2	N/C	**-2**	**+<1**	**+<1**	**+<1**	**0**	**+1**	N/C	-<1	-2	N/C	**-3**	N/C	N/C	-3	N/C	**-3**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	-1	N/C	N/C	**-1**	N/C	N/C	**-0.5**	N/C	**-0.5**
East Option 3	N/C	N/C	N/C	N/C	**N/C**	**N/C**	**N/C**	**N/C**	**N/C**	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	+<1	N/C	+<1	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
Crossover Alternative	**<1**	**2**	**3**	**2**	**8**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**11**	**9**	**24**	**3**	**7**	**13**	**11**	**34**	**0**	**0**	**0**	**0**	**0**	<1	<1	0	0	10	**0**	**1**	**0**	**0**	**1**	**0**	**0**	**0.5**	**0**	**0.5**
Crossover Option 1	N/C	N/C	N/C	N/C	**N/C**	**N/C**	**N/C**	**N/C**	**N/C**	**N/C**	N/C	N/C	N/C	N/C	**N/C**	N/C	+1	+<1	N/C	**+2**	N/C	+<1	N/C	N/C	**+<1**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
Crossover Option 2	N/C	N/C	N/C	-2	**-2**	**N/C**	**N/C**	**N/C**	**N/C**	**N/C**	N/C	N/C	-<1	-9	**-10**	N/C	N/C	N/C	-<1	**-<1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**
Crossover Option 3	N/C	N/C	N/C	-2	**-2**	**N/C**	**N/C**	**N/C**	**N/C**	**N/C**	N/C	N/C	N/C	-9	**-9**	N/C	N/C	N/C	-<1	**-<1**	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C	**N/C**	N/C	N/C	N/C	N/C	**N/C**

Notes:
N/C – No net change from the action alternative.
1. The value for each option represents the net change from the action alternative. It was calculated as the acres added by the option minus the acres in the segments the option replaces.
2. Oregon white oak woodlands are not included in this table as they would not be affected by towers, access roads, or substations.
3. Freshwater wetlands are part of the WDFW priority habitat "freshwater wetlands and fresh deepwater". Fresh deepwater areas are not included in this table as they would not be affected by towers, access roads, or substations.
4. Many improved access roads could be overgrown or would need to be widened; habitat would need to be removed.
Sources: Herrera 2010, WDFW 2010b

18.2.4.3 Special-Status Species—West Alternative

Two federally listed species and 19 other special-status species or species groups could be affected by the West Alternative. All documented occurrences of these species are found in Washington with the exception of California floater mussel—found in the Columbia River—and western pond turtle—found in Oregon.

Federally Listed Species

Special-Status Species State and Global Conservation Rankings

- **Critically Imperiled:** 5 or fewer known occurrences
- **Imperiled:** 6–20 known occurrences
- **Vulnerable:** 21–100 known occurrences

Source: WNHP 2011a

Marbled Murrelet (Threatened). Although there are no documented occurrences of marbled murrelet within 1 mile of the West Alternative, right-of-way clearing and towers, substations, and access roads would remove 377 acres of habitat within the marbled murrelet conservation zone. Therefore, impacts to the species would include loss of potential habitat. However, at most only 27 acres of this conservation zone is suitable old-growth/mature forest habitat (see Tables 18-5 and 18-6) and they are outside the general range of marbled murrelet from the coast, so the available habitat would not likely be used for nesting. In addition, the old-growth/mature forest within this area primarily occurs in small patches, so any potential habitat loss would be minor in any particular area. Given the small amount of potential habitat affected, the distance from the coast, and the lack of any documented occurrences, potential habitat loss would be a **low** impact.

Northern Spotted Owl (Threatened). The West Alternative route comes within 0.4 mile of a northern spotted owl circle (WDFW 2010b). The adjacent habitat that would be removed for the right-of-way includes a mix of old-growth/mature forest, forest, and production forest. In addition, the loss of 27 acres of old-growth/mature forest along the entire action alternative would remove potential nesting habitat for this species, although recent high resolution imagery shows most of the area is marginal habitat for the owl (BPA 2011). Impacts to the species would include the loss of potential habitat. Given that potential habitat is generally low quality; there is only one documented northern spotted owl circle within 1 mile; and a relatively small amount of potential habitat would be removed, with impacts spread out along the corridor, **low** impacts on this species would occur.

Other Special-Status Wildlife Species—Birds

Bald Eagle (Federal SOC, WA Sensitive) and WDFW Bald Eagle Priority Area. Bald eagles would be impacted by the project because there are eight documented occurrences of bald eagles, and two WDFW bald eagle priority areas—the Cowlitz Bald Eagle Feeding Habitat and Lewis River Winter Eagle Habitat—within 1 mile of the West Alternative. New transmission line would cross a little less than 1 mile of a WDFW bald eagle priority area, and right-of-way clearing, towers, and access roads would remove tree habitat from a total of 13 acres. Impacts would include temporary construction disturbance and loss of potential nesting and roosting habitat through tree removal in riparian areas along the West Alternative (see 18.2.4.3, Special-Status Habitats), particularly where it occurs in a WDFW priority area. As for other raptors, transmission line collisions are typically uncommon, but could occur. Mitigation measures would be used to ensure individual nests and young are not harmed or disrupted during the

breeding season, and to reduce the risks of transmission line collisions throughout the year. Impacts to this species would be **moderate** since the species is still listed as sensitive by WDFW, is monitored by USFWS following its delisting in 2010, and impacts would not be expected to contribute to a need for federal relisting of this species based on a conservation status of secure at both the state and federal levels (NatureServe 2012).

Cavity-Nesting Ducks (also see Waterfowl, this section). The West Alternative could affect cavity-nesting ducks since it crosses within 1 mile of the WDFW Woodland Cavity Nesting Habitat Priority Breeding Area along the Lewis River. Impacts could include habitat removal, increased transmission line collisions, and temporary construction disturbance. Mitigation measures would be used to avoid harm to a nest or young during the breeding season, if necessary. These areas are important to a wide diversity and number of cavity-nesting ducks, but because mortalities would not contribute to a need for federal listing for any of the associated species (see further discussion of specific species that follows), and since the WDFW priority area itself would not be crossed, impacts to cavity-nesting ducks would be **low-to-moderate**.

- **Barrow's Goldeneye (WDFW Priority).** Given that the West Alternative crosses wetland habitat within 1 mile of a documented occurrence of Barrow's goldeneye, there is a greater chance that individuals could be present and affected by the project (this is the same occurrence listed for the Crossover Alternative). Impacts would be the same as those listed for the WDFW cavity-nesting duck priority area. Since the conservation status is vulnerable (breeding) to secure (non-breeding) at the state level and secure at the federal level (NatureServe 2012), and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.
- **Wood Duck (WDFW Priority).** It is highly likely that wood duck would be adversely impacted by the West Alternative since it crosses two WDFW wood duck priority areas: the WDFW Lacamas Lake Bottoms Priority Breeding Area, and the Mill Creek Tributary Priority Breeding Area. Impacts would be the same as those listed for the WDFW cavity-nesting duck priority area. A little less than 1 mile of the WDFW wood duck priority area would be crossed by the West Alternative transmission line at Lacamas Lake Bottoms, with 14 acres lost to right-of-way tree removal, towers, and access roads (WDFW 2009). These losses would be in addition to any occurring in other riparian or wetland areas where wood duck could occur, particularly near the one documented occurrence. These would likely cause just **moderate** impacts to the species, however, since the impacts would not contribute to a need for federal listing given the relatively small area affected and the relatively stable conservation status of the species (ranges between vulnerable [non-breeding] to apparently secure [breeding] at the state level, and secure at the federal level [NatureServe 2012]).

Great Blue Heron (WA Priority). Since the West Alternative crosses either wetlands or riparian habitats within 1 mile of three documented occurrences of great blue heron, there is a greater chance that individuals could be present and affected by the project. Impacts would include mortality from transmission line collisions over open habitats and open water, and lost habitat due to towers and access roads placed in riparian areas and open habitat. Since the conservation status is apparently secure to secure at the state level and secure at the federal level (NatureServe 2012), impacts would not contribute to a need for federal listing and would be **moderate**.

Northern Goshawk (Federal SOC, WA Candidate). Because the West Alternative crosses production forest within 1 mile of a documented occurrence of northern goshawk (also in production forest), there is a greater chance the project could affect this species (this is the same documented occurrence as the one along the Central and Crossover alternatives). Impacts would include loss of old-growth/mature forest habitat and temporary construction disturbance, although mitigation measures would be used to avoid mortality of young or loss of nests during the breeding season, if necessary. Although the conservation status of this species is imperiled-to-vulnerable in Washington (NatureServe 2012), it is listed as apparently secure at the federal level, and so the small amount of suitable mature/old-growth forest habitat affected (see Section 18.2.4.2, WDFW Priority Habitats—West Alternative) would be a **moderate** impact to the species. As for other raptors, transmission line collisions are typically uncommon, the rare occurrence of mortality of an individual would not affect the overall conservation status, and impacts would be **moderate**.

Pileated Woodpecker (WA Candidate). Since the West Alternative crosses high-value riparian habitat within 1 mile of a documented occurrence of pileated woodpecker (the same occurrence listed for the Crossover Alternative), there is a greater chance that individuals of this species could be present and affected by the project. Impacts could include habitat loss through right-of-way tree clearing, towers, and access roads, mortality through collisions with transmission lines, and temporary construction disturbance. Mitigation measures would be used to avoid harm to a nest or young during the breeding season, if necessary. Since the conservation status is apparently secure at the state level and secure at the federal level (NatureServe 2012), and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.

Purple Martin (Federal SOC, WA Candidate). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

Sandhill Crane (WA Endangered). Since the West Alternative crosses either wetlands, open water, or open habitats within 1 mile of one documented occurrence of sandhill crane, there is a greater chance that individuals could be present and affected by the project. Impacts would include mortality from transmission line collisions over open habitats and open water, and lost habitat due to towers and access roads placed in riparian areas and open habitat. Since the conservation status is vulnerable to critically imperiled at the state level but secure at the federal level (NatureServe 2012), and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.

Tundra Swan (WDFW Priority). Since the West Alternative crosses either riparian, open water, or open habitats within 1 mile of two documented occurrences of tundra swan, there is a greater chance that individuals could be present and affected by the project. Impacts would include mortality from transmission line collisions over open habitats and open water, and lost habitat due to towers and access roads placed in riparian areas and open habitat. Since the conservation status is apparently secure at the state level and secure at the federal level (NatureServe 2012), and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.

Vaux's Swift (WA Candidate). The mention of Vaux's swift in the description of a WDFW biodiversity area and corridor priority habitat that is crossed by the West Alternative indicates

an increased likelihood for impacts to this species (see Section 18.1.4.2, Other Special-Status Wildlife Species). Impacts could include habitat loss through tree removal, temporary construction disturbance, and transmission line collisions, although collisions are not very likely for this species (see Section 18.2.2, Impacts Common to Action Alternatives). Mitigation measures would be used to avoid mortality of young or loss of nests during the breeding season, if nests occur near the construction area. Since the conservation status of this species is vulnerable-to-apparently secure at the state level and secure at the federal level (NatureServe 2012), mortality or loss of habitat would not likely contribute to a need for federal listing and **moderate** impacts could occur.

Waterfowl Concentrations (WDFW Priority). A little more than 1 mile of new transmission line would cross over two WDFW waterfowl concentration priority areas: the East Fork Lewis Wintering Waterfowl Area and the Pioneer Wetlands Waterfowl Concentration Area (WDFW 2012). The right-of-way would also come within 1 mile of the Kennedy Dairy WDFW Waterfowl Concentration Priority Area. Impacts could include habitat removal, increased transmission line collisions, and temporary construction disturbance. Right-of-way tree removal, towers, and access roads would remove 30 acres of habitat from these important habitats. WDFW priority waterfowl concentration areas could support five special-status species: wood duck, Barrow's goldeneye, harlequin duck, tundra swan, and trumpeter swan, although only tundra swan has been documented in a WDFW waterfowl concentration priority area within 1 mile of the West Alternative (see Tundra Swan, this section). These areas are important to a wide diversity and number of waterfowl, but because mortalities would not contribute to a need for federal listing for any of the associated species, impacts would be **moderate**.

Mammals

Columbian Black-Tailed Deer (WA Priority). The population in a WDFW biodiversity area and corridor priority habitat would experience both positive and adverse effects from the West Alternative. These would include adverse effects from the loss of habitat to towers and access roads, and positive effects from right-of-way clearing, which could help diversify the habitats available to this population. Impacts would be **low** since a relatively small portion of the habitat occupied by this population would be affected, and since the species has a secure conservation status at both state and federal levels (NatureServe 2012).

Elk (WDFW Priority Species) and WDFW Elk Priority Area. Adverse effects to elk would include temporary construction disturbance and habitat loss within the two WDFW elk winter range priority areas. Towers, substations, and access roads would remove about 147 acres of habitat. This would have a **low** impact on elk since a relatively small portion of the total WDFW elk winter range priority area would be affected, impacts would be spread out along the corridor, and the species has a secure conservation status at both state and federal levels (NatureServe 2012). Impacts from 382 acres of right-of-way clearing could be beneficial to elk since it would create a corridor of shrubland or open habitat adjacent to forested habitat.

Townsend's Big-Eared Bat (Federal SOC, WA Candidate). Since the West Alternative crosses forest within about 0.15 mile of a documented occurrence of this species, there is a greater chance that individuals could be present and affected by the project. Adverse impacts would include temporary construction disturbance and loss of forest habitat due to towers and access roads. Right-of-way clearing could benefit this species since it can use open and shrubland habitats for foraging. Although the species is listed as imperiled to vulnerable at the state level

(NatureServe 2012), impacts would be **low** because of the small area impacted, potential benefits, and the species is apparently secure at the federal level (NatureServe 2012).

Amphibians

Cascade Torrent Salamander (Federal SOC, WA Candidate). Since the West Alternative crosses riparian habitat within 1 mile of a documented occurrence of Cascade torrent salamander, there is a greater chance that individuals could be present and affected by the project. Impacts could include temporary construction disturbance, construction mortality or stress from both physical injury and increased water turbidity from in-water work, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Since its conservation status is only listed as vulnerable at both the state and federal levels (NatureServe 2012), and since only one documented occurrence of this species occurs near the affected environment, habitat loss coupled with increased mortality would not be likely to adversely affect many individuals or lead to a need for federal listing; impacts would be **moderate**.

Cope's Giant Salamander (WA Monitor Species). Since the West Alternative crosses riparian habitat within 1 mile of a documented occurrence of Cope's giant salamander, there is an increased likelihood that individuals could be present and affected by the project (this is one of the same occurrences as along the Crossover Alternative). Impacts to a population of this species could include temporary construction disturbance, construction mortality or stress from physical injury and increased water turbidity, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Since the conservation status is vulnerable-to-apparently secure at both the state and federal levels (NatureServe 2012,) and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.

Reptiles

Western Pond Turtle (Federal SOC, OR Sensitive-Critical). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

Invertebrates

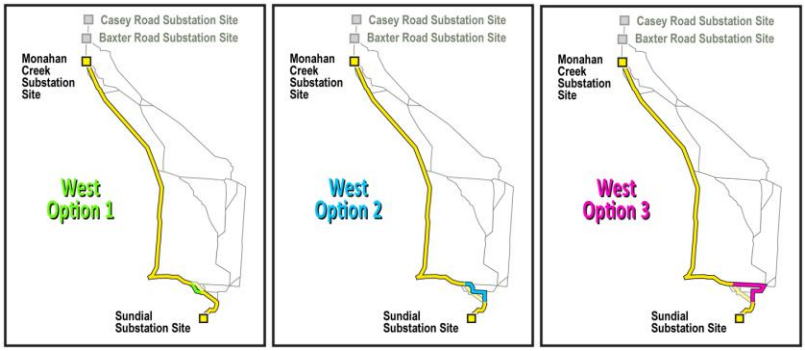
California Floater (Federal SOC, WA Candidate, OR Sensitive). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

18.2.4.4 West Options 1, 2, and 3

Impacts to WDFW priority habitats and special-status species are discussed for each option. See Maps 18-1A through 18-1D and Tables 18-3 through 18-6 for all impacts.

The levels of the impacts to wildlife and WDFW priority habitats would be the same as for the West Alternative, except where stated otherwise.

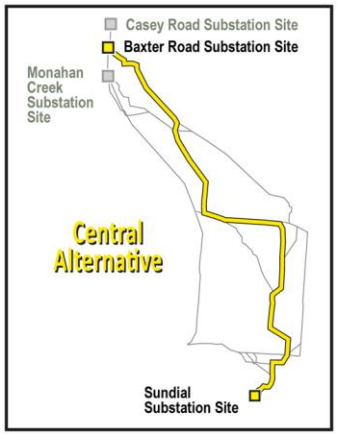
Impacts to wildlife from the West Options occur near the Lacamas Prairie Natural Area (see Map 18-1D and Tables 18-3 through 18-6). West Option 1 would remove or alter 11 additional acres of the three freshwater wetland habitat types, 2 additional acres of riparian habitat, and would double the westside prairie removed (from 6 to 12 acres) (see Tables 18-5 and 18-6). However, it would



also remove or alter 13 fewer acres of biodiversity areas and corridors. For special-status species, the option would cross an additional 3 miles of one of the two WDFW wood duck priority areas, removing 7 acres of habitat from this important area, a **moderate** impact. However, it would also avoid the Columbian black-tailed deer population in the WDFW biodiversity area and corridor priority habitat crossed by the West Alternative.

West Options 2 and 3 would have similar effects, with West Option 2 affecting slightly more acreages in each case. They would remove or alter fewer acres of freshwater wetlands (18 and 13 acres), but remove more acres of old-growth/mature forest (5 and 3 acres) and a WDFW biodiversity area and corridor that supports a population of Columbian black-tailed deer (12 and 11 acres). West Option 3 would also remove or alter 14 more acres of riparian habitat and remove 34 more acres of forest (see Tables 18-3 through 18-6).

18.2.5 Central Alternative



The Central Alternative would require mostly new right-of-way (see Chapter 4, Proposed Action and Alternatives), which would increase habitat fragmentation primarily in forested habitats. However, since most of the new line would not parallel existing lines, there would be less of a fence effect to increase the collision risk for birds.

18.2.5.1 Wildlife Habitats and Species—Central Alternative

Impacts would be higher where WDFW priority habitats or special-status species would be affected (see Section 18.2.5.2, WDFW Priority Habitats—Central Alternative, and Section 18.2.5.3, Special-Status Species—Central Alternative).

Wildlife in Open Habitat

Wildlife in open habitat would be less affected by the Central Alternative than wildlife in forest habitat. The proposed transmission line would cross 5 miles of open habitat—much less than in forest habitat, but similar to shrubland and urban/suburban habitats (see Table 18-3). Towers, access roads, and substations would cause the permanent loss of 82 acres of open habitat (see Table 18-4), although 2 acres of open habitat would also be created through the clearing of Oregon white oak woodlands (see Table 18-5). The wildlife most affected by the project in open habitat would likely be ground-dwelling animals. They would experience both a decrease in available habitat and an increase in mortality from the increased number of perches available to predatory raptors (raptors, conversely, would experience mostly positive effects, with some potential for mortality from transmission line collisions). Impacts to wider-ranging wildlife would include a small reduction in breeding or grazing habitat. Wildlife mortality from

construction and transmission-line bird collisions would also occur. Because the project would be long and narrow, any single population of animals would lose very little habitat and experience a small increase in mortality. These would cause **low** impacts from habitat loss and construction disturbance, and **moderate** impacts from mortality, since mortality of individual animals would not affect the conservation status of most species.

Wildlife in Forest and Production Forest Habitats

Forest-dependent wildlife would be more affected than other wildlife by the Central Alternative since these species would lose the most habitat. The proposed transmission line would cross 54 miles of production forest, and 13 miles of forest (see Table 18-3). Production forest habitat would be reduced by 1,261 acres from right-of-way clearing, towers, access roads, and substations, and forest would be reduced by 316 acres from the same disturbances (see Tables 18-3 and 18-4). Forest-dependent wildlife would be most affected by habitat loss. Habitat generalists would be less affected since they would be able to use the altered "edge" habitat within the cleared right-of-way for foraging or hunting (shrubland and open habitat species could experience positive impacts by an increase in habitat) (see Section 18.2.2, Impacts Common to Action Alternatives). Because forest and production forest are common in the project area, and since impacts would be spread out along the corridor, most forest wildlife species would experience **low** impacts from habitat loss and construction disturbance (see Section 18.2.4.2, WDFW Priority Habitats—West Alternative, for a discussion of potentially higher impacts in old-growth/mature forests). Wildlife mortality from construction and transmission-line bird collisions would occur, but would be **moderate**, since mortality of individual animals would not affect the conservation status of most species.

Wildlife in Shrubland Habitat

Wildlife that use shrubland habitat could benefit from the creation of 1,150 acres of shrubland habitat from right-of-way clearing in forest and production forest, and raptors would experience a positive effect from the increase in available perches (see Table 18-3). Conversely, with 3 miles of new transmission line crossing existing shrubland habitat, wildlife would also experience some adverse effects from the project, including the alteration of 42 acres of tall shrubland, and the loss of 32 acres of habitat to towers, access roads, and substations (see Tables 18-3 and 18-4). Adverse effects would include temporary construction disturbance; the loss of existing habitat; the loss of some tall shrub nesting habitat for birds; potential construction mortality for less mobile species; and a possible increase in mortality caused by an increase in predation by raptors using the transmission lines and towers as perches, and by bird/transmission line collisions. Since impacts would be spread out along the corridor and affect a relatively small amount of habitat, the levels of adverse impacts would be similar to those for open habitat, including **low** impacts from loss of existing habitat and construction disturbance, and **moderate** impacts from mortality.

Wildlife in Urban/Suburban Habitat

Wildlife found in urban/suburban habitat would be the least affected, with just 1 mile of new transmission line crossing this habitat. The Central Alternative would clear 20 acres of urban/suburban habitat for the right-of-way and remove 3 acres of habitat for access roads (see Tables 18-3 and 18-4). Impacts to wildlife would range among those impacts listed for open, shrubland, forest, and production forest habitats, depending on which habitats might be present in any given urban/suburban area. Given the small amounts of habitat lost and the general

tolerance of urban/suburban wildlife to human disturbance, impacts related to construction and habitat loss or alteration would be **low**, while those related to an increase in mortality (such as for prey species of raptors and bird/transmission line collisions) would be **moderate**.

18.2.5.2 WDFW Priority Habitats—Central Alternative

This section provides the amount of WDFW priority habitats altered or removed by the Central Alternative, and the length in miles of the transmission line located in each habitat.

Riparian Areas. Along the Central Alternative, most impacts from habitat alteration or removal would occur in riparian habitats with 105 acres altered by right-of-way clearing (see Table 18-5) and 11 acres lost to towers, access roads, and substations (see Table 18-6.). Habitat loss would be a **low-to-high** impact to these WDFW priority habitats, depending on their condition. In addition, transmission line bird collisions would increase across 6 miles of riparian areas. This would also be a **low-to-moderate** impact depending on bird use and the effectiveness of mitigation measures, since it could reduce the ability of these habitats to safely support waterfowl, waterbirds, and raptors: an essential attribute for these habitats.

Riparian areas also encompass other priority habitats affected by the project, including biodiversity areas and corridors, wetlands, and old-growth/mature forest.

Biodiversity Areas and Corridors. Three documented WDFW biodiversity area and corridor priority habitats would be affected by the Central Alternative: the East Fork Lewis River Riparian Corridor (crossed in three places at Big Tree Creek, the East Fork Lewis River, and Rock Creek); the Camas Biodiversity Area; and the Lady and Akerman Islands Biodiversity Area and Corridor (WDFW 2012). Fragmentation of these habitats from right-of-way clearing could adversely affect the movement of many wildlife species across a biologically diverse and relatively undisturbed area. One mile of these habitats would be crossed in three places by new transmission line, with 10 acres altered due to right-of-way clearing, and less than 1 acre lost to a transmission tower and new access road (see Tables 18-5 and 18-6). Impacts to these WDFW priority habitats would be **high** since fragmentation would diminish one of their main attributes, which is to be a "relatively undisturbed and unbroken tract of vegetation" that connects high-value habitats (WDFW 2008).

Freshwater Wetlands and Fresh Deepwater. Altogether, 96 acres of forested, scrub-shrub, and emergent freshwater wetlands would be lost to right-of-way clearing (forested wetland) and/or towers, access roads, and substations (see Table 18-5 and 18-6). Sixteen acres of scrub-shrub wetlands would be altered by right-of-way clearing (see Table 18-5). Impacts to wildlife from the alteration and loss of wetland habitat would range from **low-to-high**, depending on the condition of each wetland. In addition, transmission line bird collisions would become more frequent over 6 total miles of all three types of freshwater wetlands (see Table 18-5). Similar to riparian areas, an increase in transmission line collisions could reduce the value of these areas for wildlife habitat, a **low-to-moderate** impact.

The only impacts to fresh deepwater would be from transmission line bird collisions, which would increase across 1 mile of fresh deepwater (see Table 18-5). As for freshwater wetlands and riparian areas, impacts would be **low-to-moderate**.

Old-Growth/Mature Forest. A little over 12 acres of old-growth/mature forest would be removed by right-of-way clearing and a new access road (see Tables 18-5 and 18-6). Impacts to

these WDFW priority habitats would be **high** since tree clearing would remove the main attributes of this habitat: long-lived trees and the associated understory vegetation, which have become uncommon in the Pacific Northwest and could not be easily or quickly replaced.

Oregon White Oak Woodlands. Two acres of the Washougal Oaks Woodland would be removed by right-of-way clearing (see Table 18-5). Impacts to these WDFW priority habitats would be **high** since tree clearing would remove the main attributes of this habitat: Oregon white oak trees and the associated understory vegetation, which are becoming less common in the Pacific Northwest.

Snag-Rich Areas. Three acres of the WDFW North Fork Lacamas Snags priority habitat would be removed by right-of-way clearing, towers, and new and improved access roads along the Central Alternative (see Tables 18-5 and 18-6). Impacts would include the permanent loss and fragmentation of snag tree habitat. Because of the scarcity of this habitat in the project area, impacts would be **high**.

18.2.5.3 Special-Status Species—Central Alternative

There are 2 federally listed species and 10 other special-status species potentially affected by the Central Alternative. All documented occurrences are found in Washington with the exception of California floater mussel—found in the Columbia River—and western pond turtle—found in Oregon and Washington.

Federally Listed Species

Marbled Murrelet (Threatened). Although there are no documented occurrences of marbled murrelet within 1 mile of the Central Alternative, right-of-way clearing and towers, access roads, and substations would affect 458 acres of habitat within the marbled murrelet conservation zone. However, at most only 13 acres of this is suitable old-growth/mature forest habitat (see Table 18-5 and Table 18-6), and is outside the general range of marbled murrelet from the coast, so the available habitat would not likely be used for nesting. In addition, the old-growth/mature forest within this area primarily occurs in small patches, so any potential habitat loss would be minor in any particular area. Given the small amount of potential habitat affected, the distance from the coast, and the lack of any documented occurrences, potential habitat loss would be a **low** impact.

Northern Spotted Owl (Threatened). An improved access road for the Central Alternative would remove 4 acres of production forest habitat from one northern spotted owl circle, and the right-of-way would pass through production forest within 1 mile of another circle. In addition, the loss of 13 acres of old-growth/mature forest along the entire action alternative would remove potential nesting habitat for this species, although recent high resolution imagery shows most of the area along the Central Alternative to be of marginal habitat (BPA 2011). Impacts would include temporary construction disturbance and the loss of known and potential habitat. Mitigation measures would be used to prevent loss of a nest or mortality of young. Given that the overall potential habitat is generally low quality for northern spotted owl; there is a low number of documented occurrences in the study area; a relatively small amount of known and potential habitat would be removed, with impacts spread out along the corridor; and mitigation measures would reduce construction disturbance, impacts on this species would not affect species recovery, and would therefore be **moderate**.

Other Special-Status Wildlife Species — Birds

Bald Eagle (Federal SOC, WA Sensitive) and WDFW Bald Eagle Priority Areas. Three documented occurrences of bald eagle nests and one WDFW bald eagle priority area—the Lewis River Winter Eagle Habitat—are within 1 mile of the Central Alternative. New transmission line would cross less than 1 mile of these priority areas, and right-of-way clearing would remove tree habitat from 5 acres. Impacts would include temporary construction disturbance and loss of potential nesting and roosting habitat through tree removal in riparian areas along the Central Alternative (see 18.2.5.3, Special-Status Habitats), particularly where it occurs in a WDFW priority area. As for other raptors, transmission line collisions are typically uncommon, but could occur. Mitigation measures would be used to ensure individual nests and young are not harmed or disrupted during the breeding season, and to reduce the risks of transmission line collisions throughout the year. Impacts to this species would be **moderate** since the species is still listed as sensitive by WDFW, is monitored by USFWS following its delisting in 2010, and impacts would not be expected to contribute to a need for federal relisting of this species based on a conservation status of secure at both the state and federal levels (NatureServe 2012).

Northern Goshawk (Federal SOC, WA Candidate). Because the Central Alternative crosses production forest within 1 mile of a documented occurrence of northern goshawk (also in production forest), there is a greater chance the project could affect this species. Impacts would include loss of old-growth/mature forest habitat and temporary construction disturbance, although mitigation measures would be used to avoid mortality of young or loss of nests during the breeding season, if necessary. Although the conservation status of this species is imperiled-to-vulnerable in Washington (NatureServe 2012), it is listed as apparently secure at the federal level, and so the small amount of suitable mature/old-growth forest habitat affected (see Section 18.2.5.2, WDFW Priority Habitats—Central Alternative) would be a **moderate** impact to the species. As for other raptors, transmission line collisions are typically uncommon, the rare occurrence of mortality of an individual would not affect the overall conservation status, and impacts would be **moderate**.

Purple Martin (Federal SOC, WA Candidate). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

Vaux's Swift (WA Candidate). The Vaux's swift nest documented within 1 mile of the Central Alternative in a chimney in urban-suburban habitat indicates an increased chance that individuals could be present and affected by the project. However, the Central Alternative does not cross any known suitable nesting habitat within 1 mile of the occurrence, reducing the chance that Vaux's swift habitat would be affected in this area. Observations of Vaux's swift in a WDFW biodiversity area and corridor priority habitat that is crossed by the Central Alternative indicates an increased likelihood for impacts. Impacts in this area could include habitat loss through tree removal, temporary construction disturbance, and transmission line collisions, although collisions are not very likely for this species (see Section 18.2.2, Impacts Common to Action Alternatives). Mitigation measures would be used to avoid mortality of young or loss of nests during the breeding season, if nests occur near the construction area. Since the conservation status of this species is vulnerable-to-apparently secure at the state level and secure at the federal level (NatureServe 2012), mortality or loss of habitat would not likely contribute to a need for federal listing and **moderate** impacts could occur.

Mammals

Elk (WA Priority Species) and WDFW Elk Priority Area. Adverse effects to elk would include temporary construction disturbance and habitat loss within the two WDFW elk winter range priority areas. Towers, substations, and access roads would remove 274 acres of habitat within the two WDFW elk priority area. This would have a **low** impact on elk since a relatively small portion of the total WDFW elk winter range priority area would be affected, impacts would be spread out along the corridor, and the species has a secure conservation status at both state and federal levels (NatureServe 2012). Impacts from 519 acres of right-of-way clearing could be beneficial to elk since it would create a corridor of shrubland or open habitat adjacent to forested habitat.

Amphibians

Cascade Torrent Salamander (Federal SOC, WA Candidate). Given that the Central Alternative crosses riparian habitat within 1 mile of five documented occurrences of Cascade torrent salamander, there is a high likelihood that this species could be affected by the project. Impacts could include temporary construction disturbance, construction mortality or stress from both physical injury and increased water turbidity from in-water work, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Although there are a high number of occurrences near the affected area, they mainly occur along two main streams/rivers. Also, the conservation status of the species is listed as vulnerable at the state and federal levels (NatureServe 2012). Given the limited distribution and conservation status, habitat loss coupled with increased mortality would not likely contribute to a need for federal listing; impacts to this species would be **moderate.**

Cope's Giant Salamander (WA Monitor Species). Since the Central Alternative crosses riparian habitat within 1 mile of a documented occurrence of Cope's giant salamander, there is a greater chance that individuals could be present and affected by the project. (This is the same occurrence identified for the Crossover Alternative [see Section 18.2.7.3, Special-Status Species—Crossover Alternative]). Impacts to a population of this species could include temporary construction disturbance, construction mortality or stress from physical injury and increased water turbidity, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Since the conservation status is vulnerable-to-apparently secure at both the state and federal levels (NatureServe 2012,) and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.

Western Toad (Federal SOC, WA Candidate). The Central Alternative crosses riparian habitat within 1 mile of a documented occurrence of western toad, increasing the chance that individuals could be affected by the project (this is the same occurrence identified for the Crossover Alternative, see Section 18.2.7.3, Special-Status Species—Crossover Alternative). Impacts could include temporary construction disturbance, construction mortality, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from towers and access roads. Right-of-way clearing would convert forested riparian and wetland habitats to scrub-shrub riparian and wetland habitat, which would still be suitable habitat for this species.

Although this species is rated as vulnerable at both the state and federal levels, not many individuals would likely be affected based on just one documented occurrence. Impacts would not likely contribute to a need for federal listing and would be **moderate**.

Reptiles

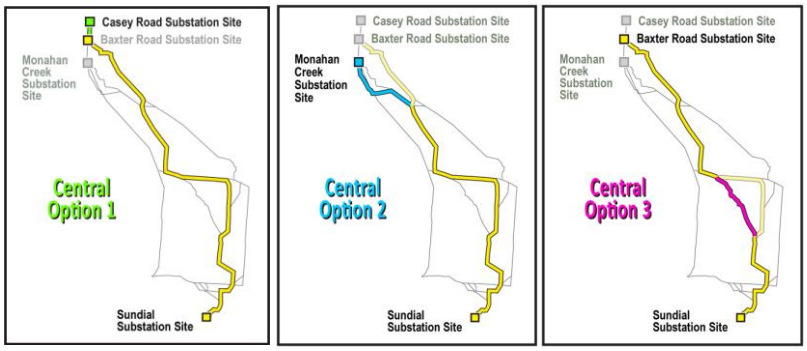
Western Pond Turtle (Federal SOC, WA Endangered, OR Sensitive-Critical). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

Invertebrates

California Floater Mussel (Federal SOC, WA Candidate, OR Sensitive). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

18.2.5.4 Central Options 1, 2, and 3

The levels of the impacts to wildlife and WDFW priority habitats would be the same as for the Central Alternative, except where stated otherwise.



Central Option 1 would alter or remove a little over 4 additional acres of riparian habitat (see Tables 18-5 and 18-6), and 78 additional acres of the WDFW Roosevelt Elk Winter Range Priority Area. An access road would also cross riparian habitat within 1 mile of two documented occurrences of Dunn's salamander, the only occurrence of this species among all action alternatives. With a conservation status of vulnerable at the state level and apparently secure at the federal level (NatureServe 2012), potential impacts would be **moderate**.

Central Option 2 would remove 7 additional acres of old-growth/mature forest, 10 additional acres of riparian habitat, and 68 additional acres of forest.

Central Option 3 would remove 3 additional acres of old-growth/mature forest and 60 additional acres of forest, but would alter 10 fewer acres of riparian habitat. It would also cross a forested riparian area within 1 mile of a WDFW cavity-nesting duck priority area. Impacts would be the same as those given for the West Alternative (**moderate**) (see Section 18.2.4.3, Special-Status Species—West Alternative). Central Option 3 would avoid two of the five documented occurrences of Cascade torrent salamander, one of three documented occurrence of western pond turtle (the one occurrence in Washington), and the one documented occurrence of Vaux's swift.

18.2.6 East Alternative

The East Alternative would require mostly new right-of-way (see Chapter 4, Proposed Action and Alternatives), which would increase habitat fragmentation primarily in the forested

habitats. However, since most of the new line would not parallel existing lines, there would be less of a fence effect to increase the collision risk for birds.

18.2.6.1 Wildlife Habitats and Species—East Alternative

Impacts could be higher where WDFW priority habitat or special-status species would be affected (see Section 18.2.6.2, WDFW Priority Habitats—East Alternative and Section 18.2.6.3 Special-Status Species—East Alternative).

Wildlife in Open Habitat

Wildlife in open habitat would be less affected by the East Alternative than wildlife in forest habitat. The proposed transmission line would cross 5 miles of open habitat—much less than in forest habitat, but similar to shrubland and urban/suburban habitats (see Table 18-3). Towers, access roads, and substations would cause the permanent loss of 114 acres of open habitat (see Table 18-4). The wildlife most affected by the project in open habitat would likely be ground-dwelling animals. They would experience both a decrease in available habitat and an increase in mortality from the increased number of perches available to predatory raptors (raptors, conversely, would experience mostly positive effects, with some potential for mortality from transmission line collisions). Impacts to wider-ranging wildlife would include a small reduction in breeding or grazing habitat. Wildlife mortality from construction and transmission-line bird collisions would also occur. Because the project would be long and narrow, any single population of animals would lose very little habitat and experience a small increase in mortality. These would cause **low** impacts from habitat loss and construction disturbance, and **moderate** impacts from mortality, since mortality of individual animals would not affect the conservation status of most species.

Wildlife in Forest and Production Forest Habitats

Forest-dependent wildlife would be more affected than other wildlife by the East Alternative since they would lose the most habitat. The proposed transmission line would cross 56 miles of production forest, and 10 miles of forest (see Table 18-3). Production forest habitat would be reduced by 1,386 acres from right-of-way clearing, towers, access roads, and substations, and forest would be reduced by 227 acres from the same disturbances (see Tables 18-3 and Table 18-4). Forest-dependent wildlife would be most affected by habitat loss. Habitat generalists would be less affected since they would be able to use the altered "edge" habitat within the cleared right-of-way for foraging or hunting (shrubland and open habitat species could experience positive impacts by an increase in habitat) (see Section 18.2.2, Impacts Common to Action Alternatives). Because forest and production forest are common in the project area, and since impacts would be spread out along the corridor, most forest wildlife species would experience **low** impacts from habitat loss and construction disturbance. Wildlife mortality from construction and transmission-line bird collisions would occur but would be **moderate**, since mortality of individual animals would not affect the conservation status of most species.

Wildlife in Shrubland Habitats

Wildlife that use shrubland habitat could benefit from the creation of 1,134 acres of shrubland habitat through right-of-way clearing in forest and production forest, and raptors would experience a positive effect from the increase in available perches (see Table 18-3). Conversely, with 2 miles of new transmission line crossing existing shrubland habitat, wildlife would also experience some adverse effects from the project, including the alteration of 34 acres of tall shrubland, and the loss of 55 acres of existing habitat to towers and access roads (see Tables 18-3 and 18-4). Adverse effects would include temporary construction disturbance; the loss of existing habitat; the loss of some tall shrub nesting habitat for birds; potential construction mortality for less mobile species; and a possible increase in mortality caused by an increase in predation by raptors using the transmission lines and towers as perches, and by bird/transmission line collisions. Since impacts would be spread out along the corridor and affect a relatively small amount of habitat, the levels of adverse impacts would be similar to those for open habitat, including **low** impacts from loss of existing habitat and construction disturbance, and **moderate** impacts from mortality.

Wildlife in Urban/Suburban habitat

Wildlife found in urban/suburban habitat would be the least affected, with just 1 mile of new transmission line crossing this habitat (see Table 18-3). The East Alternative would alter 19 acres of urban/suburban habitat by right-of-way clearing and remove 3 acres of habitat for access roads (see Tables 18-3 and 18-4). Impacts to wildlife would range among those impacts listed for open, shrubland, forest, and production forest habitats, depending on which habitats might be present in any given urban/suburban area. Given the small amounts of habitat lost and the general tolerance of urban/suburban wildlife to human disturbance, impacts related to construction and habitat loss or alteration would be **low**, while those related to an increase in mortality (such as for prey species of raptors and bird/transmission line collisions) would be **moderate**.

18.2.6.2 WDFW Priority Habitats—East Alternative

This section provides the amount of WDFW priority habitats altered or removed by the East Alternative, and the length in miles of the transmission line in each habitat.

Riparian Areas. Along the East Alternative, riparian areas would have more impacts than other WDFW priority habitats, with 94 acres of habitat altered by right-of-way clearing and 13 acres lost to towers, access roads, and substations (see Tables 18-5 and 18-6). Habitat loss would be a **low-to-high** impact to these WDFW priority habitats, depending on their condition. In addition, transmission line bird collisions would increase across 5 miles of riparian areas. This would also be a **low-to-moderate** impact depending on bird use and the effectiveness of mitigation measures, since it could reduce the ability of these habitats to safely support waterfowl, waterbirds, and raptors: an essential attribute for these habitats.

Riparian areas may encompass other priority habitats affected by the project, including biodiversity areas and corridors, wetlands, and old-growth/mature forest.

Biodiversity Areas and Corridors. Three documented WDFW biodiversity area and corridor priority habitats would be affected by the East Alternative: the East Fork Lewis River Riparian Corridor (crossed in two places at the East Fork Lewis River and a tributary to King Creek); the

Camas Biodiversity Area; and the Lady and Akerman Islands Biodiversity Area and Corridor (WDFW 2012). (These are the same as those affected by the Crossover Alternative). Fragmentation of these habitats from right-of-way clearing could adversely affect the movement of a diversity of wildlife across a biological diverse and relatively undisturbed area. A little less than 1 mile of this habitat would be crossed in four places by new transmission line, with 9 acres altered due to right-of-way clearing, and about 1 acre lost to a transmission tower and new access road (see Tables 18-5 and 18-6). Impacts to these WDFW priority habitats would be **high** since fragmentation would diminish one of their main attributes, which is to be a "relatively undisturbed and unbroken tract of vegetation" that connects high-value habitats (WDFW 2008).

Freshwater Wetlands and Fresh Deepwater. In total, 90 acres of forested, scrub-shrub, and emergent freshwater wetlands would be removed by right-of-way clearing (forested wetlands) and/or towers, access roads, and substations (see Tables 18-5 and 18-6). Twenty-three acres of scrub-shrub wetlands would be altered by right-of-way clearing (see Table 18-5). Habitat alteration and removal at the Fraser Creek Wetland would be a **high** impact, since it is known to be of high value to wildlife (WDFW 2012). Impacts to wildlife from the alteration and loss of other wetlands would range from **low-to-high**, depending on the condition of each wetland. In addition, transmission line bird collisions would become more frequent over 5 miles of freshwater wetlands (see Table 18-5). Similar to riparian areas, an increase in transmission line collisions could reduce the value of these areas for wildlife habitat, a **low-to-moderate** impact.

The only impacts to fresh deepwater would be from transmission line bird collisions, which would increase across 1 mile of fresh deepwater (see Table 18-5). As for freshwater wetlands and riparian areas, impacts would be **low-to-moderate**.

Caves or Cave-Rich Areas. The right-of-way would cross through about 0.05 acre along the edge of a WDFW cave-rich priority area in production forest (see Table 18-5) (the same area that would be impacted by the Crossover Alternative). Impacts could include permanent removal of production forest habitat surrounding a cave—which could remove some roosting habitat; the presence of a tower, transmission line, or access road; and temporary construction disturbance. These disturbances would generally have **low** impacts to this habitat given the small area of disturbance and the likelihood that actual cave habitat would not be permanently altered. Also, the effects on wildlife (such as Townsend's big-eared bat) that rely on caves would not likely prevent them from using this cave habitat, while the addition of shrubland from right-of-way clearing could be beneficial for foraging purposes. Also, the placement of the disturbance along the edge of the cave-rich area would mean that the area would not be fragmented.

Herbaceous Bald. About 0.5 acre of an improved access road would cross the southern edge of the Larch Mountain WDFW herbaceous bald priority habitat (see Table 18-6). Impacts could include permanent vegetation removal from possible widening of the access road, and temporary construction disturbance such as soil compaction. These disturbances would have **low** impacts to this WDFW priority habitat given the small areas of disturbance, the placement of the disturbance along the edge of the habitats—meaning the habitat would not be fragmented—and the existing disturbed conditions from the existing access road.

Old-Growth/Mature Forest. Thirteen acres of old-growth/mature forest would be removed by right-of-way clearing and new and improved access roads (see Tables 18-5 and 18-6). Impacts to these WDFW priority habitats would be **high** since tree clearing would remove the main

attributes of this habitat: long-lived trees and the associated understory vegetation, which have become uncommon in the Pacific Northwest and could not be easily or quickly replaced.

Oregon White Oak Woodlands. Two acres of the Washougal Oaks Woodland would be removed by right-of-way clearing (see Table 18-5). Impacts to this WDFW priority habitat would be **high** since tree clearing would remove the main attributes of this habitat: Oregon white oak trees and the associated understory vegetation, which are becoming less common in the Pacific Northwest.

Snag-Rich Areas. The East Alternative would remove 45 acres from the WDFW Rock Creek Snag-Rich Area priority habitat (see Tables 18-5 and 18-6). Habitat loss would be caused by right-of-way clearing, towers, and access roads. Impacts would include the permanent loss and fragmentation of snag tree habitat. Because of the scarcity of this habitat in the project area, impacts would be **high**.

Talus. One acre of a talus field would be permanently removed by a new access road (see Table 18-6), and less than 1 mile would be crossed by the new transmission line (see Table 18-5). Impacts would include permanent loss of habitat, potential transmission-line collisions by raptors, and temporary construction disturbance. Impacts would be **high** due to the scarcity of this wildlife habitat, and since these areas are relatively inaccessible and more likely to be in pristine (undisturbed) condition prior to construction.

18.2.6.3 Special-Status Species—East Alternative

There are 2 federally listed species and 12 other special-status species or species groups potentially affected by the East Alternative. All documented occurrences are found in Washington with the exception of California floater mussel—found in the Columbia River—and western pond turtle—found in Oregon.

Federally Listed Species

Marbled Murrelet (Threatened). Although there are no documented occurrences of marbled murrelet within 1 mile of the East Alternative, it would remove 424 acres of marginal habitat within the marbled murrelet conservation zone, although at most only 13 acres of this is suitable old-growth/mature forest habitat (see Table 18-5 and Table 18-6), and they are outside the general range of marbled murrelet from the coast, so the available habitat would not likely be used for nesting. In addition, the old-growth/mature forest within this area primarily occurs in small patches, so any potential habitat loss would be minor in any particular area. Given the small amount of potential habitat affected, the distance from the coast, and the lack of any documented occurrences, potential habitat loss would be a **low** impact.

Northern Spotted Owl (Threatened). Right-of-way clearing, towers, substations, and access roads would remove 220 acres of mostly production forest from within four northern spotted owl circles, and the right-of-way would pass within a mile of three others. In addition, about 13 acres of potentially suitable old-growth/mature forest habitat would be removed by the project. This includes habitat from the WDFW Rock Creek Snag-Rich Area priority habitat near Yale Dam (also see Section 18.2.6.2, WDFW Priority Habitats—East Alternative). This area contains potential high-quality habitat for northern spotted owl and occurs near the western edge of a northern spotted owl Conservation Support Area (CSA) designated by the USFWS (2008a). Otherwise, recent high resolution imagery shows most of the area along the East

Alternative to be of marginal habitat (BPA 2011). Impacts to individuals of this species would include temporary construction disturbance and loss of known and high-quality potential habitat. Mitigation measures would be used to prevent loss of a nest or mortality of young. Although there are a relatively high number of documented occurrences in the affected environment and both known and potential high-quality habitat would be lost, since the amount of habitat lost is relatively small and of generally poor quality, with impacts spread out among a number of northern spotted owl circles and along the corridor; and since mitigation measures would reduce construction disturbance, impacts on this species would not affect species recovery and would therefore be **moderate**.

Other Special-Status Wildlife Species — Birds

Bald Eagle (Federal SOC, WA Sensitive) and WDFW Bald Eagle Priority Areas. Bald eagle would be impacted by the project given that within 1 mile of the East Alternative, there are three documented occurrences of bald eagle nests and one WDFW bald eagle priority area—the Yale Tailrace Foraging Area. New transmission line would cross about 1 mile of the WDFW bald eagle priority area, and right-of-way clearing, towers, and access roads would remove tree habitat from 37 acres of this area. Impacts would include temporary construction disturbance and loss of potential nesting and roosting habitat through tree removal in riparian areas along the East Alternative (see 18.2.6.3, Special-Status Habitats), particularly where it occurs in a WDFW priority area. As for other raptors, transmission line collisions are typically uncommon, but could occur. Mitigation measures would be used to ensure individual nests and young are not harmed or disrupted during the breeding season, and to reduce the risks of transmission line collisions throughout the year. Impacts to this species would be **moderate** since the species is still listed as sensitive by WDFW, is monitored by USFWS following its delisting in 2010, and impacts would not be expected to contribute to a need for federal relisting of this species based on a conservation status of secure at both the state and federal levels (NatureServe 2012).

Peregrine Falcon (Federal SOC, WA Sensitive). Although there is one documented occurrence of peregrine falcon in WDFW cliffs/bluffs priority habitat within 1 mile of the East Alternative, the East Alternative does not cross any known suitable habitat (cliffs/bluffs or caves) within 1 mile of the occurrence, indicating a decreased likelihood that peregrine falcon habitat would be affected (this is the same occurrence as along the Crossover Alternative). However, the presence of a new transmission line in the area could increase the chance for mortality through transmission line collisions. If suitable habitat does occur along the right-of-way or access roads, additional impacts could include habitat loss from towers and access roads and temporary construction disturbance. Mitigation measures would be used to ensure individual birds are not harmed or disrupted during the breeding season, if necessary. Positive impacts could also result from the addition of new perch sites on towers and lines from which individual birds could hunt prey. Since the conservation status of this species is imperiled (breeding) to vulnerable (non-breeding) at the state level, and apparently secure at the federal level (NatureServe 2012), mortality or loss of habitat in one location would not likely contribute to a need for federal listing, and impacts would be **moderate**.

Purple Martin (Federal SOC, WA Candidate). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

Vaux's Swift (WA Candidate). Observations of Vaux's swift in a WDFW biodiversity area and corridor priority habitat that is crossed by the East Alternative indicates an increased likelihood of impacts. Impacts could include habitat loss through tree removal, temporary construction

disturbance, and transmission line collisions, although collisions are not very likely for this species (see Section 18.2.2, Impacts Common to Action Alternatives). Mitigation measures would be used to avoid mortality of young or loss of nests during the breeding season, if nests occur near the construction area. Since the conservation status of this species is vulnerable-to-apparently secure at the state level and secure at the federal level (NatureServe 2012), mortality or loss of habitat would not likely contribute to a need for federal listing and **moderate** impacts could occur.

Waterfowl Concentrations. Because there is a WDFW waterfowl concentration priority area (at the Whittle Creek Wetlands) within 1 mile of the East Alternative, and since the right-of-way would cross between the waterfowl concentration area and the Cowlitz River, there is a chance that waterfowl would be impacted by an increase in transmission line collisions. Because of the importance of these areas to a wide diversity and number of waterfowl, but because mortalities would not contribute to a need for federal listing for any of the associated species, impacts would be **moderate**.

Mammals

Columbian Black-Tailed Deer (WA Priority) and WDFW Columbian Black-Tailed Deer Priority Habitat. Impacts to this species would be similar to those for elk, including negative impacts from loss of 6 acres of habitat in a WDFW Columbian black-tailed deer wintering and migration priority area, and positive impacts from right-of-way clearing across 15 acres of this priority area. As for elk, impacts would be **low** since a relatively small portion of the total WDFW Columbian black-tailed deer wintering and migration priority area would be affected and the species has a secure conservation status at both state and federal levels (NatureServe 2012).

Elk (WA Priority) and WDFW Elk Priority Area. Adverse effects to elk would include temporary construction disturbance and habitat loss within the two WDFW elk winter range priority areas. Towers, substations, and access roads would remove 357 acres of habitat from within the two WDFW elk winter habitat priority areas. This would have a **low** impact on elk since a relatively small portion of the total WDFW elk winter range priority area would be affected, impacts would be spread out along the corridor, and the species has a secure conservation status at both state and federal levels (NatureServe 2012). Impacts from 655 acres of right-of-way clearing could be beneficial to elk since it would create a corridor of shrubland or open habitat adjacent to forested habitat.

Amphibians

Cascade Torrent Salamander (Federal SOC, WA Candidate). Given that the East Alternative crosses riparian habitat within 1 mile of six documented occurrences of Cascade torrent salamander, there is a high likelihood that this species could be affected by the project. Impacts could include temporary construction disturbance, construction mortality or stress from both physical injury and increased water turbidity from in-water work, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Although there are a high number of occurrences near the affected area, they mainly occur in two areas. Also, the conservation status of the species is listed as vulnerable at the state and federal levels (NatureServe 2012). Given the limited distribution and conservation status, habitat loss coupled with increased mortality would not likely contribute to a need for federal listing; impacts to this species would be **moderate.**

Larch Mountain Salamander. There is one documented occurrence of this species within 1 mile of the East Alternative. However, the East Alternative does not cross any known suitable habitat (talus or caves) within 1 mile of the occurrence, indicating a decreased likelihood that individuals would be affected. If a population of Larch Mountain salamander does occur near the project near unmapped talus or caves, impacts could include temporary construction disturbance, construction mortality, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of talus habitat from towers and access roads. Since the conservation status of this species is vulnerable at the state and federal levels (NatureServe 2012), mortality or loss of habitat would not likely contribute to a need for federal listing. This, along with the low likelihood for adverse effects, indicates that impacts to this species would be **low-to-moderate**.

Rocky Mountain Tailed Frog (WA Candidate). Given that the East Alternative crosses riparian habitat within 1 mile of five documented occurrences of this species, all occurring along three main streams/rivers, there is a high likelihood that it could be affected by the project (three of these are also along the Crossover Alternative). Impacts to a population of this species could include temporary construction disturbance, construction mortality, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Although its conservation status is imperiled in the state of Washington (NatureServe 2012) and there are a relatively high number of occurrences near the affected environment, its federal conservation status is apparently secure, and so impacts would not likely contribute to a need for federal listing and would be **moderate**.

Reptiles

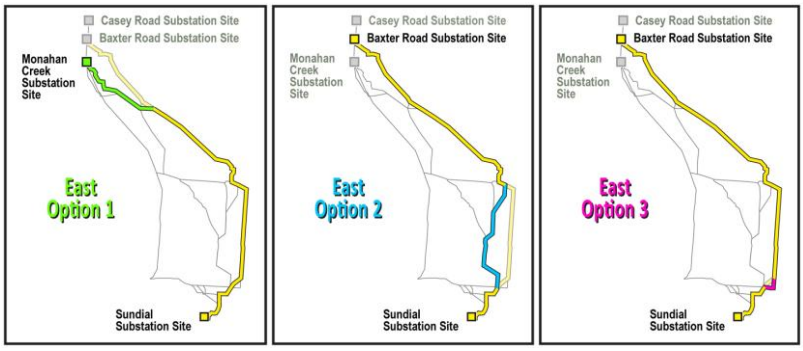
Western Pond Turtle (Federal SOC, OR Sensitive-Critical). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

Invertebrates

California Floater (Federal SOC, WA Candidate). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

18.2.6.4 East Options 1, 2, and 3

The levels of the impacts to wildlife and WDFW priority habitats would be the same as for the East Alternative, except where stated otherwise.



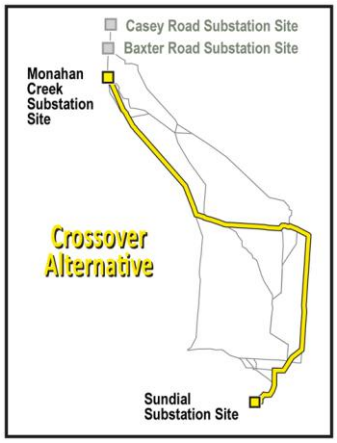
East Option 1 would remove an additional 4 acres of the three freshwater wetland types, 7 acres of old-growth/mature forest, 8 acres of riparian habitat, and 42 acres of forest habitat; and alter 3 fewer acres of riparian habitat (see Tables 18-5 and 18-6). Regarding special-status species, it would avoid the WDFW waterfowl concentration priority area. However, it would

remove 3 acres from an additional WDFW bald eagle priority area—the Cowlitz Bald Eagle Feeding Habitat—and cross within the buffers of two additional bald eagle nests (though another nest would be avoided).

East Option 2 would alter 7 fewer acres of scrub-shrub wetlands, remove 8 fewer acres of old-growth/mature forest (see Tables 18-5 and 18-6), and remove 75 fewer acres from northern spotted owl circles. It would also avoid affecting the talus slope, the Larch Mountain herbaceous bald, and the cave-rich area that are all affected by the East Alternative, although it would remove 3 acres from a second snag-rich area—the North Fork Lacamas Snags. It would also avoid crossing within 1 mile of a number of special-status species occurrences that are all near the East Alternative, including three of the five occurrences of Rocky Mountain tailed frog, and three of the six occurrences of Cascade torrent salamander. It would remove about half the amount (12 of 24 acres) of WDFW Columbian black-tailed deer priority area.

East Option 3 would be similar to the East Alternative.

18.2.7 Crossover Alternative



The Crossover Alternative would require new right-of-way along much of its southern half (see Chapter 4, Proposed Action and Alternatives), which would cause increased habitat fragmentation primarily in the forested habitats. In much of its northern half, it would parallel existing transmission lines, which would not create new fragmentation, although it could expand existing fragmentation where the right-of-way would need to be widened. In addition, since the new lines would be higher than the existing lines, the parallel right-of-way would create an increased fence effect to bird flight paths and increase the risk of bird collisions in many areas.

18.2.7.1 Wildlife Habitats and Species—Crossover Alternative

Impacts would be higher where WDFW priority habitats or special-status species would be affected (see Section 18.2.7.2, WDFW Priority Habitats—Crossover Alternative, and Section 18.2.7.3, Special-Status Species—Crossover Alternative).

Wildlife in Open Habitat

Wildlife in open habitat would be less affected by the Crossover Alternative than wildlife in forest habitat. The proposed transmission line would cross 9 miles of open habitat—much less than in forest habitat, but similar to shrubland (see Table 18-3). Towers, access roads, and substations would cause the permanent loss of 126 acres of open habitat (see Table 18-4), although 2 acres of open habitat would also be created through the clearing of Oregon white oak woodlands (see Table 18-5). The wildlife most affected by the project in open habitat would likely be ground-dwelling animals. They would primarily experience both a decrease in available habitat and an increase in mortality from the increased number of perches available to predatory raptors (raptors, conversely, would experience mostly positive effects, with some potential for mortality from transmission line collisions). Impacts to wider-ranging wildlife would include a small reduction in breeding or grazing habitat. Wildlife mortality from

construction and transmission-line bird collisions would also occur. Because the project would be long and narrow, any single population of animals would lose very little habitat and experience a small increase in mortality. These would cause **low** impacts from habitat loss and construction disturbance, and **moderate** impacts from mortality, since mortality of individual animals would not affect the conservation status of most species.

Wildlife in Forest and Production Forest Habitats

Forest-dependent wildlife would be more affected than other wildlife by the Crossover Alternative since they would lose the most habitat. The proposed transmission line would cross 35 miles of production forest, and 14 miles of forest (see Table 18-3). Production forest habitat would be reduced by 787 acres from right-of-way clearing, towers, access roads, and substations, and forest would be reduced by 360 acres from the same disturbances (see Tables 18-3 and 18-4). Forest-dependent wildlife would be most affected by habitat loss. Habitat generalists would be less affected since they would be able to use the altered "edge" habitat within the cleared right-of-way for foraging or hunting (shrubland and open habitat species could experience positive impacts by an increase in habitat) (see Section 18.2.2, Impacts Common to Action Alternatives). Because forest and production forest are common in the project area, and since impacts would be spread out along the corridor, most forest wildlife species would experience **low** impacts from habitat loss and construction disturbance. Wildlife mortality from construction and transmission-line bird collisions would occur but would be **moderate**, since mortality of individual animals would not affect the conservation status of most species.

Wildlife in Shrubland Habitats

Wildlife that use shrubland habitat could benefit from the creation of 864 acres of shrubland habitat through right-of-way clearing in forest and production forest, and raptors would experience a positive effect from the increase in available perches (see Table 18-3). Conversely, with 12 miles of new transmission line crossing existing shrubland habitat, wildlife would also experience some adverse effects from the project, including the alteration of 208 acres of tall shrubland, and the loss of 66 acres of existing habitat to towers, access roads, and substations (see Tables 18-3 and 18-4). Adverse effects would include temporary construction disturbance; the loss of existing habitat; the loss of some tall shrub nesting habitat for birds; potential construction mortality for less mobile species; and a possible increase in mortality caused by an increase in predation by raptors using the transmission lines and towers as perches, and by bird/transmission line collisions. Since impacts would be spread out along the corridor and affect a relatively small amount of habitat, the levels of adverse impacts would be similar to those for open habitat, including **low** impacts from loss of existing habitat and construction disturbance, and **moderate** impacts from mortality.

Wildlife in Urban/suburban habitat

Wildlife found in urban/suburban habitat would be the least affected, with just 1 mile of new transmission line crossing this habitat. The Crossover Alternative would alter 21 acres of urban/suburban habitat by right-of-way clearing and remove 4 acres of habitat for access roads (see Tables 18-3 and 18-4). Impacts to wildlife would range among those impacts listed for open, shrubland, forest, and production forest habitats, depending on which habitats might be present in any given urban/suburban area. Given the small amounts of habitat lost and the general tolerance of urban/suburban wildlife to human disturbance, impacts related to

construction and habitat loss or alteration would be **low**, while those related to an increase in mortality (such as for prey species of raptors and bird/transmission line collisions) would be **moderate**.

18.2.7.2 WDFW Priority Habitat—Crossover Alternative

This section provides the amount of WDFW priority habitats that would be altered or removed by the Crossover Alternative, and the length in miles of the transmission line in each habitat.

Riparian Areas. Along the Crossover Alternative, most impacts to WDFW priority habitat from habitat alteration or removal would be in riparian areas, with 125 acres of habitat altered by right-of-way clearing and 24 acres lost to towers, access roads, and substations (see Tables 18-5 and 18-6). Habitat loss would be a **low-to-high** impact to these WDFW priority habitats, depending on their condition. In addition, transmission line bird collisions would increase across 7 miles of riparian habitat, particularly in the northern portion of the alternative, where the transmission line would parallel an existing line (see Table 18-5). This would also be a **low-to-high** impact depending on bird use and the effectiveness of mitigation measures, since it could reduce the ability of these habitats to safely support waterfowl, waterbirds, and raptors: an essential attribute for these habitats (In the southern portion of the alternative where there would be no parallel existing line, impacts would be **low-to-moderate**).

Riparian areas may encompass other priority habitats affected by the project, including biodiversity areas and corridors, wetlands, and old-growth/mature forest.

Biodiversity Areas and Corridors. Three documented WDFW biodiversity area and corridor priority habitats would be affected by the Crossover Alternative: the East Fork Lewis River Riparian Corridor (crossed in two places at the East Fork Lewis River and a tributary to King Creek); the Camas Biodiversity Area; and the Lady and Akerman Islands Biodiversity Area and Corridor (WDFW 2012). A little less than 1 mile of this habitat would be crossed in four places by new transmission line, with 9 acres altered due to right-of-way clearing, and about 1 acre lost to a transmission tower and new access road (see Tables 18-5 and 18-6). (These are the same areas as those affected by the East Alternative) Impacts would be **high** since fragmentation would diminish one of the main attributes of these priority habitats, which is to be a "relatively undisturbed and unbroken tract of vegetation" that connects high-value habitats (WDFW 2008).

Freshwater Wetlands and Fresh Deepwater. In total, 87 acres of forested, scrub-shrub, and emergent freshwater wetlands would be removed by right-of-way clearing (forested wetlands) and/or towers, access roads, and substations (see Table 18-5 and 18-6). Thirty-five acres of scrub-shrub wetland would be altered by right-of-way clearing (see Table 18-5). Impacts to wildlife from the alteration and loss of wetlands would range from **low-to-high**, depending on the condition of each wetland. In addition, transmission line bird collisions would become more frequent over 5 total miles of all three types of freshwater wetlands (see Table 18-5). Similar to riparian areas, impacts to these WDFW priority habitats from transmission line collisions would be **low-to-high** where there would be a parallel existing line, and mostly **low-to-moderate** where there would be no parallel line.

The only impacts to fresh deepwater would be from transmission line bird collisions, which would increase across 1 mile of fresh deepwater (see Table 18-5). As for freshwater wetlands and riparian areas, impacts would be **low-to-high** where there would be a parallel line and **low-to-moderate** where there would be no parallel line.

Caves or Cave-Rich Areas. The right-of-way would pass through the edge of about 0.05 acre of a WDFW cave-rich area priority habitat in production forest (see Table 18-5). (This is the same cave-rich area affected by the East Alternative). Impacts could include permanent removal of production forest habitat surrounding a cave—which could remove some roosting habitat; the presence of a tower, transmission line, or access road; and temporary construction disturbance. These disturbances would generally have **low** impacts to this habitat given the small area of disturbance and the likelihood that actual cave habitat would not be permanently altered. Also, the effects on wildlife (such as Townsend's big-eared bat) that rely on caves would not likely prevent them from using this cave habitat, while the addition of shrubland from right-of-way clearing could be beneficial for foraging purposes. Also, the placement of the disturbance along the edge of the cave-rich area would mean that the area would not be fragmented.

Herbaceous Bald. About 0.5 acre of an improved access road would cross the southern edge of the Larch Mountain WDFW herbaceous bald priority habitat (see Table 18-6). (This is the same herbaceous bald affected by the East Alternative). Impacts could include permanent vegetation removal from possible widening of the access road, and temporary construction disturbance such as soil compaction. These disturbances would have **low** impacts to this WDFW priority habitat given the small areas of disturbance, the placement of the disturbance along the edge of the habitats—meaning the habitat would not be fragmented—and the existing disturbed conditions from the existing access road.

Old-Growth/Mature Forest. Forty-five acres of old-growth/mature forest would be removed by right-of-way clearing and new and improved access roads (see Tables 18-5 and 18-6). Impacts to these WDFW priority habitats would be **high** since tree clearing would remove the main attributes of this habitat: long-lived trees and the associated understory vegetation, which have become uncommon in the Pacific Northwest and could not be easily or quickly replaced.

Oregon White Oak Woodlands. Two acres of the Washougal Oaks Woodland would be removed by right-of-way clearing (see Table 18-5). (This is the same Oregon white oak woodlands area affected by the East Alternative). Impacts to this WDFW priority habitat would be **high** since tree clearing would remove the main attributes of this habitat: Oregon white oak trees and the associated understory vegetation, which are becoming less common in the Pacific Northwest.

Talus. One acre of a talus field would be permanently removed by a new access road (see Table 18-6), less than 1 mile of which would be crossed by new transmission line (see Table 18-5). (This is the same talus field affected by the East Alternative). Impacts would include permanent loss of habitat, potential transmission-line collisions by raptors, and temporary construction disturbance. Impacts would be **high** due to the scarcity of this wildlife habitat, and since these areas are relatively inaccessible and more likely to be in pristine (undisturbed) condition prior to construction.

18.2.7.3 Special-Status Species—Crossover Alternative

There are 2 federally listed species and 15 other special-status species potentially affected by the Crossover Alternative. All documented occurrences are found in Washington with the exception of California floater mussel—found in the Columbia River—and western pond turtle—found in Oregon.

Federally Listed Species

Marbled Murrelet (Threatened). Although there are no documented occurrences of marbled murrelet within 1 mile of the Crossover Alternative, it would remove 377 acres of marginal habitat within the marbled murrelet conservation zone. At most only 45 acres are suitable old-growth/mature forest habitat (see Table 18-5 and 18-6), and they are outside the general range of marbled murrelet from the coast, so the available habitat would not likely be used for nesting. In addition, the old-growth/mature forest within this area primarily occurs in small patches, so any potential habitat loss would be minor in any particular area. Given the small amount of potential habitat affected, the distance from the coast, and the lack of any documented occurrences, potential habitat loss would be a **low** impact.

Northern Spotted Owl (Threatened). Right-of-way clearing, towers, substations, and access roads would remove 70 acres from a documented northern spotted owl circle. The right-of-way would also come within 1 mile of three other northern spotted owl circles that occur in mostly production forest. In addition, about 45 acres of potentially suitable old-growth/mature forest habitat would be removed by the project, although recent high resolution imagery shows most of the area along the Crossover Alternative to be of marginal habitat (BPA 2011). Impacts would include temporary construction disturbance and the loss of known and potential habitat. Mitigation measures would be used to prevent loss of a nest or mortality of young. Given that the overall potential habitat is generally low quality for northern spotted owl; a relatively small amount of known and potential habitat would be removed, with impacts spread out along the corridor; and mitigation measures would reduce construction disturbance; impacts on this species would not affect species recovery and would therefore be **moderate**.

Other Special-Status Wildlife Species — Birds

Bald Eagle (Federal SOC, WA Sensitive) and WDFW Bald Eagle Priority Areas. Bald eagle would be impacted by the project given that within 1 mile of the Crossover Alternative there are five documented occurrences of bald eagle nests and three WDFW bald eagle priority areas—the Cowlitz Bald Eagle Feeding Habitat, the Lewis River Winter Eagle Habitat, and the Yale Tailrace Foraging Area. In total, new transmission line would cross 2 miles of WDFW bald eagle priority areas, and right-of-way clearing, towers, and access roads would remove tree habitat from 31 acres. Impacts would include temporary construction disturbance and loss of potential nesting and roosting habitat through tree removal in riparian areas along the East Alternative (see 18.2.6.3, Special-Status Habitats), particularly where it occurs in a WDFW priority area. As for other raptors, transmission line collisions are typically uncommon, but could occur. Mitigation measures would be used to ensure individual nests and young are not harmed or disrupted during the breeding season, and to reduce the risks of transmission line collisions throughout the year. Impacts to this species would be **moderate** since the species is still listed as sensitive by WDFW, is monitored by USFWS following its delisting in 2010, and impacts would not be expected to contribute to a need for federal relisting of this species based on a conservation status of secure at both the state and federal levels (NatureServe 2012).

Barrow's Goldeneye (WDFW Priority). Given that the Crossover Alternative crosses wetland habitat within 1 mile of a documented occurrence of Barrow's goldeneye, there is a greater chance that individuals could be present and affected by the project (this is the same occurrence as that listed for the West Alternative). Impacts could include habitat removal, increased transmission line collisions, and temporary construction disturbance. Mitigation measures would be used to avoid harm to a nest or young during the breeding season, if necessary. Since

the conservation status is vulnerable (breeding) to secure (non-breeding) at the state level and secure at the federal level (NatureServe 2012), and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.

Great Blue Heron (WA Priority). Since the Crossover Alternative crosses either wetlands or riparian habitats within 1 mile of one documented occurrence of great blue heron, there is a greater chance that individuals could be present and affected by the project. Impacts would include mortality from transmission line collisions over open habitats and open water, and lost habitat due to towers and access roads placed in riparian areas and open habitat. Since the conservation status is apparently secure to secure at the state level and secure at the federal level (NatureServe 2012), impacts would not contribute to a need for federal listing and would be **moderate**.

Northern Goshawk (Federal SOC, WA Candidate). Because the Crossover Alternative crosses production forest within 1 mile of a documented occurrence of northern goshawk (also in production forest), there is a greater chance the project could affect this species. Impacts would include loss of old-growth/mature forest habitat and temporary construction disturbance, although mitigation measures would be used to avoid mortality of young or loss of nests during the breeding season, if necessary. Although the conservation status of this species is imperiled-to-vulnerable in Washington (NatureServe 2012), it is listed as apparently secure at the federal level, and so the small amount of suitable mature/old-growth forest habitat affected (see Section 18.2.7.2, WDFW Priority Habitats—Crossover Alternative) would be a **moderate** impact to the species. As for other raptors, transmission line collisions are typically uncommon, the rare occurrence of mortality of an individual would not affect the overall conservation status, and impacts would be **moderate**.

Peregrine Falcon (Federal SOC, WA Sensitive). Although there is one documented occurrence of peregrine falcon in WDFW cliffs/bluffs priority habitat within 1 mile of the Crossover Alternative, the Crossover Alternative does not cross any known suitable habitat (cliffs/bluffs or caves) within 1 mile of the occurrence, indicating a decreased likelihood that peregrine falcon habitat would be affected (this is the same occurrence as along the East Alternative). However, the presence of a new transmission line in the area could increase the chance for mortality through transmission line collisions. If suitable habitat does occur along the right-of-way or access roads, additional impacts could include habitat loss from towers and access roads and temporary construction disturbance. Mitigation measures would be used to ensure individual birds are not harmed or disrupted during the breeding season, if necessary. Positive impacts could also result from the addition of new perch sites on towers and lines from which individual birds could hunt prey. Since the conservation status of this species is imperiled (breeding) to vulnerable (non-breeding) at the state level, and apparently secure at the federal level (NatureServe 2012), mortality or loss of habitat in one location would not likely contribute to a need for federal listing, and impacts would be **moderate**.

Pileated Woodpecker (WA Candidate). The Crossover Alternative crosses high-value riparian habitat within 1 mile of a documented occurrence of pileated woodpecker (the same occurrence as that listed for the West Alternative); therefore, there is a greater chance that individuals of this species could be present and affected by the project. Impacts could include habitat loss through right-of-way tree clearing, towers, and access roads, mortality through collisions with transmission lines, and temporary construction disturbance. Mitigation measures would be used to avoid harm to a nest or young during the breeding season, if necessary. Since the

conservation status is apparently secure at the state level and secure at the federal level (NatureServe 2012), and since not many individuals would likely be affected based on just one documented occurrence, impacts would not contribute to a need for federal listing and would be **moderate**.

Purple Martin (Federal SOC, WA Candidate). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

Vaux's Swift (WA Candidate). Observations of Vaux's swift in a WDFW biodiversity area and corridor priority habitat that is crossed by the Crossover Alternative indicates an increased likelihood for impacts. Impacts could include habitat loss through tree removal, temporary construction disturbance, and transmission line collisions, although collisions are not likely for this species (see Section 18.2.2, Impacts Common to Action Alternatives). Mitigation measures would be used to avoid mortality of young or loss of nests during the breeding season, if nests occur near the construction area. Since the conservation status of this species is vulnerable-to-apparently secure at the state level and secure at the federal level (NatureServe 2012), mortality or loss of habitat would not likely contribute to a need for federal listing and **moderate** impacts could occur.

Mammals

Columbian Black-Tailed Deer (WA Priority) and WDFW Columbian Black-Tailed Deer Priority Habitat. Impacts to this species would include negative impacts from the loss of 6 acres of habitat in a WDFW Columbian black-tailed deer wintering and migration priority area, and positive impacts from right-of-way clearing across 15 acres of this priority area. As for elk, impacts would be **low** since a relatively small portion of the total WDFW Columbian black-tailed deer wintering and migration priority area would be affected and the species has a secure conservation status at both state and federal levels (NatureServe 2012).

Elk (WA Priority) and WDFW Elk Priority Area. Adverse effects to elk would include temporary construction disturbance and habitat loss within the two WDFW elk winter range priority areas. Towers, substations, and access roads would remove 168 acres of habitat within the two WDFW elk priority areas. This would have a **low** impact on elk since a relatively small portion of the total WDFW elk winter range priority area would be affected, impacts would be spread out along the corridor, and the species has a secure conservation status at both state and federal levels (NatureServe 2012). Impacts from 485 acres of right-of-way clearing could be beneficial to elk since it would create a corridor of shrubland or open habitat adjacent to forested habitat.

Amphibians

Cascade Torrent Salamander (Federal SOC, WA Candidate). Given that the Crossover Alternative crosses riparian habitat within 1 mile of six documented occurrences of Cascade torrent salamander in three separate areas, there is a high likelihood that this species could be affected by the project. Impacts could include temporary construction disturbance, construction mortality or stress from both physical injury and increased water turbidity from in-water work, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Although there are a high number of occurrences near the affected area, they mainly occur in two areas. Also, the conservation status of the species is listed as vulnerable at the state and federal levels (NatureServe 2012). Given the limited distribution and conservation

status, habitat loss coupled with increased mortality would not likely contribute to a need for federal listing; impacts to this species would be **moderate.**

Cope's Giant Salamander (WA Monitor Species). Since the Crossover Alternative crosses riparian habitat within 1 mile of two documented occurrences of Cope's giant salamander, there is an increased likelihood that individuals could be present and affected by the project (this is one of the same occurrences as along the West Alternative). Impacts to a population of this species could include temporary construction disturbance, construction mortality or stress from physical injury and increased water turbidity, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Since the conservation status is vulnerable-to-apparently secure at both the state and federal levels (NatureServe 2012,) and since not many individuals would likely be affected based on just two documented occurrences, impacts would not contribute to a need for federal listing and would be **moderate**.

Rocky Mountain Tailed Frog (WA Candidate). Given that the Crossover Alternative crosses riparian habitat within 1 mile of three documented occurrences of this species, all occurring within one general area, there is a greater chance that it could be affected by the project (the same three occurrences also occur along the East Alternative). Impacts to a population of this species could include temporary construction disturbance, construction mortality, reduced reproduction or loss of young if construction takes place during the breeding season, and degradation or loss of habitat from right-of-way clearing, towers, and access roads. Although its conservation status is imperiled in the state of Washington (NatureServe 2012) and there are a relatively high number of occurrences near the affected environment, its federal conservation status is apparently secure, and so impacts would not likely contribute to a need for federal listing and would be **moderate**.

Reptiles

Western Pond Turtle (Federal SOC, WA Endangered, OR Sensitive-Critical). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives).

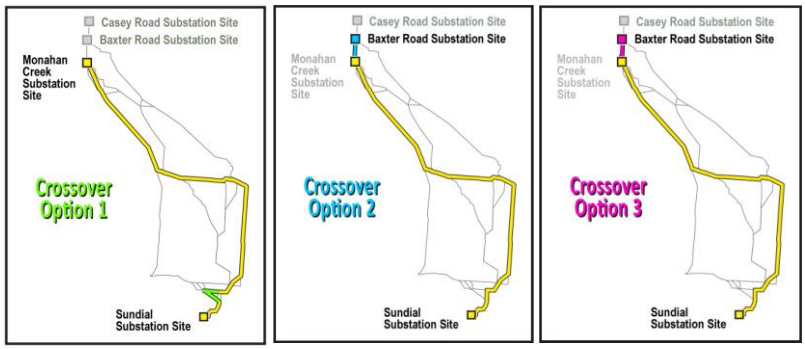
Invertebrates

California Floater (Federal SOC, WA Candidate). (See Special-Status Species in Section 18.2.2, Impacts Common to Action Alternatives.)

18.2.7.4 Crossover Options 1, 2, and 3

The levels of the impacts to wildlife and WDFW priority habitats would be the same as for the Crossover Alternative, except where stated otherwise.

Crossover Option 1 would alter 8 additional acres of riparian habitat and remove or alter 11 additional acres total of the three freshwater wetland types (see Tables 18-5 and 18-6). For special-status species, this option would come within 1 mile of a WDFW wood duck priority area that is avoided by the Crossover Alternative. The WDFW wood duck priority area would not be crossed so impacts would be **low-to-moderate**.



Crossover Options 2 and 3 would have similar effects to each other, with Crossover Option 2 affecting slightly more acreages in each case. They would both remove fewer acres of riparian habitat (10 and 9 acres) (see Table 18-6), but alter more of this habitat through right-of-way clearing (9 and 7 acres) (see Table 18-5). Regarding special-status species, both Crossover Options 2 and 3 would increase the amount of WDFW Roosevelt Elk Winter Range Priority Area altered by right-of-way clearing, including an additional 70 acres by Crossover Option 2 and 66 acres by Crossover Option 3.

18.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional mitigation measures have been identified to further reduce or eliminate adverse wildlife impacts by the action alternatives.

- Consult with USFWS as required under the ESA to assess impacts and identify any necessary mitigation measures for marbled murrelet and northern spotted owl.
- Determine mitigation measures needed for marbled murrelet and northern spotted owl on WDNR lands or private timber company lands based on existing Habitat Conservation Plans for those lands.
- Coordinate with WDFW for all construction during winter on elk and Columbian black-tailed deer winter range to eliminate any significant interference with big game wintering.
- Gate and sign any new or existing roads to prevent human encroachment into elk and Columbian black-tailed deer wintering areas or significant migration corridors.
- Where possible, locate new towers in line with existing towers to minimize vertical separation between conductors.
- Install appropriate bird flight diverters on overhead ground wires or fiber optic line in areas at high risk for bird collisions, such as at the crossing of the Cowlitz, Coweeman, Kalama, Lewis, East Fork Lewis, and the Columbia rivers; in wetland and riparian areas with high bird use; in WDFW waterfowl concentration priority areas; in WDFW bald eagle priority areas, and where the transmission line traverses steep slopes.
- Avoid construction activities within 0.25 mile of any active nests of peregrine falcon, bald eagle, and golden eagle during the breeding season, as determined in consultation with the USFWS and WDFW.
- Gate and sign new or existing roads at appropriate locations to prevent human encroachment into areas containing significant wildlife populations or relatively undisturbed wildlife habitat.

- Time construction, operation, and maintenance activities to avoid entry into sensitive wildlife habitats, such as blue heron rookeries and wood duck nest sites during critical breeding or nesting periods, as determined in consultation with the USFWS and WDFW.
- Limit vegetation removal to only the amount required to safely construct and operate the transmission line, substations, and new and existing access roads. Remove riparian vegetation only where necessary for safe line clearance purposes.

18.2.9 Unavoidable Impacts

Construction of towers, substations, access roads, and other facilities would cause permanent loss of wildlife habitat and temporary displacement of individuals or groups, and could harm or kill individuals. An increase in avian collisions with transmission lines could occur at river crossings, and in areas with high concentrations of waterfowl and other birds.

18.2.10 No Action Alternative

The No Action Alternative would have **no** impact on wildlife because no new transmission lines, towers, or substations would be constructed. Impacts from operation and maintenance of existing lines and substations, and vegetation management activities would continue unchanged.

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Chapter 19 Fish

This chapter describes fish resources in the project area and how the project alternatives could affect these resources. Related watershed information can be found in Chapter 14, Geology and Soils; Chapter 15, Water; and Appendix K, Assessment of Relative Fish Habitat and Fish Population Impacts of I-5 Corridor Reinforcement Project Alternatives and Options.

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

19.1 Affected Environment

The project area includes rivers and streams that provide habitat for **anadromous** fish species (such as salmon) and **resident** fish species (such as bull trout). These fish-bearing streams include the Columbia River and its Washington tributaries such as the Lower Cowlitz, Coweeman, Kalama, Lower North Fork Lewis, Upper North Fork Lewis, East Fork Lewis, and Washougal rivers and Salmon Creek (see Maps 19-1A through 19-1D).

19.1.1 Special-Status Species

The project area includes rivers and streams that provide habitat for special-status fish species (see Table 19-1 and Maps 19-1A through 19-1D). Special-status species are listed or are candidates for listing as threatened or endangered under the ESA, are regarded as species of concern by the USFWS or the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries), or are listed as endangered, threatened, candidate, sensitive, or monitored by the WDFW or the ODFW. These special-status fish include **evolutionarily significant units** (ESUs) of some salmon species. The ESA allows listing of **distinct population segments** (DPSs) of some species as well as total populations of named species and subspecies. Critical habitat has been designated for some ESA-listed species within the project area (see Maps 19-1A through 19-1D). Critical habitat includes streams and associated riparian habitats that are considered essential to a listed species survival.

Under the federal ESA, a species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become an endangered species within the foreseeable future. A species of concern is a species that the USFWS or NOAA Fisheries has concerns about regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the ESA.

Under state laws, the meaning of endangered and threatened is largely the same as under the federal ESA. In addition, under WDFW regulations, a candidate species is one that is under review for possible state listing as endangered, threatened, or sensitive. Monitored species are those monitored by the state of Washington for status and distribution and managed as needed to prevent them from becoming endangered, threatened, or sensitive. Under ODFW regulations, sensitive species are species facing one or more threats to their populations or habitats that can avoid decline to a threatened or endangered status if appropriate conservation measures are implemented.

Table 19-1 Special-Status Fish Species in the Project Area[1]

Species	Federal Status	State Status	Fish-Bearing Stream	Alternatives and/or Options[2,3]
Lower Columbia River Coho (*Oncorhynchus kisutch)*	Threatened	None	Arkansas Creek	Crossover
			Baxter Creek	Central, East, Crossover
			Cedar Creek	Central
			Chelatchie Creek	Central
			Coweeman River	West, Central, East, Crossover
			Cowlitz River	West, Central, East, Crossover
			Delameter Creek	West, Central, East, Crossover
			Goble Creek	Central
			North Fork Goble Creek	Central
			Hatchery Creek	West, Crossover
			Houghton Creek	West
			Jones Creek	East, Crossover
			Leckler Creek	West, Crossover
			Lewis River	West, Central, Crossover
			East Fork Lewis River	West
			Lockwood Creek	West
			Mason Creek	West
			Monahan Creek	West, Central, East, Crossover
			Ostrander Creek	Central, East
			South Fork Ostrander Creek	Central, East
			Pup Creek	Central
			Riley Creek	West
			Rock Creek	Central
			Salmon Creek	West, Central, East
			Sandy Bend Creek	East
			Washougal River	West, Central, East Crossover
			Little Washougal River	West, Central, East Crossover
			East Fork Little Washougal River	Central, East, Crossover
			Whittle Creek	Central, East

Species	Federal Status	State Status	Fish-Bearing Stream	Alternatives and/or Options[2,3]
Lower Columbia River Coho (*Oncorhynchus kisutch)* (continued)	Threatened	None	Unnamed Tributary to Boulder Creek	Central, East
			Unnamed Tributaries to Brezee Creek	West
			Unnamed Tributaries to Coweeman River	West, Central, East, Crossover
			Unnamed Tributaries to Cowlitz River	West, Central, Crossover
			Unnamed Tributary to North Fork Goble Creek	Central
			Unnamed Tributary to Houghton Creek	West
			Unnamed Tributaries to Leckler Creek	West, Central, Crossover
			Unnamed Tributaries to East Fork Lewis River	West
			Unnamed Tributary to Mill Creek	West
			Unnamed Tributary to Ostrander Creek	East
			Unnamed Tributary to South Fork Ostrander Creek	East
			Unnamed Tributary to Turner Creek	West, Crossover
			Unnamed Tributaries to Little Washougal River	West, Central, East, Crossover
Lower Columbia River Chinook (*O. tshawytscha*)	Threatened	WA Candidate OR Sensitive-Critical	Arkansas Creek	Crossover
			Cedar Creek	Central
			Coweeman River	West, Central, East, Crossover
			Cowlitz River	West, Central, East, Crossover
			Delameter Creek	West, Central, East Crossover
			Kalama River	West, Central, East, Crossover
			Lewis River	West, Central, Crossover
			East Fork Lewis River	West
			Monahan Creek	West, Central, East, Crossover
			Ostrander Creek	East
			South Fork Ostrander Creek	East
			Pup Creek	Central
			Salmon Creek	West
			Washougal River	West, Central, East, Crossover
			Little Washougal River	West, Central, East, Crossover
Columbia River Chum *(O. keta)*	Threatened	WA Candidate OR Sensitive-Critical	Arkansas Creek	Crossover
			Cedar Creek	Central

Species	Federal Status	State Status	Fish-Bearing Stream	Alternatives and/or Options[2,3]
Columbia River Chum *(O. keta)* (continued)	Threatened	WA Candidate OR Sensitive-Critical	Chelatchie Creek	Central
			Coweeman River	West, Central, East, Crossover
			Cowlitz River	West, Central, East, Crossover
			Delameter Creek	West, Central, East, Crossover
			Goble Creek	Central
			North Fork Goble Creek	Central
			Leckler Creek	West, Crossover
			Lewis River	West, Central, Crossover
			East Fork Lewis River	West
			Lockwood Creek	West
			Mason Creek	West
			Monahan Creek	West, Central, East, Crossover
			Pup Creek	Central
			Riley Creek	West
			Salmon Creek	Central, East
			Sandy Bend Creek	East
			Washougal River	West, Central, East, Crossover
			Little Washougal River	West, Central, East, Crossover
			Unnamed Tributaries to Coweeman River	West, Crossover
			Unnamed Tributaries to East Fork Lewis River	West
			Unnamed Tributary to Turner Creek	West, Crossover
Lower Columbia River Steelhead (*O. mykiss*)	Threatened	WA Candidate OR Sensitive-Critical	Arkansas Creek	Crossover
			Baxter Creek	Central, East, Crossover
			Cedar Creek	Central
			Chelatchie Creek	Central
			Coal Mine Creek	Central, East
			Colvin Creek	Central, Crossover
			Coweeman River	West, Central, East, Crossover
			Cowlitz River	West, Central, East, Crossover
			Coyote Creek	East, Crossover

Species	Federal Status	State Status	Fish-Bearing Stream	Alternatives and/or Options[2,3]
Lower Columbia River Steelhead (*O. mykiss*) (continued)	Threatened	WA Candidate OR Sensitive-Critical	Delameter Creek	West, Central, East, Crossover
			Gobar Creek	East
			Goble Creek	Central
			North Fork Goble Creek	Central
			Hatchery Creek	West, Crossover
			Houghton Creek	West
			Jones Creek	East, Crossover
			Kalama River	West, Central, East, Crossover
			Little Kalama River	West, Crossover
			King Creek	East, Crossover
			Knowlton Creek	Central
			Leckler Creek	West, Crossover
			Lewis River	West, Central, East, Crossover
			East Fork Lewis River	West, Central, East, Crossover
			Lockwood Creek	West
			Mason Creek	West
			Monahan Creek	West, Central, East, Crossover
			Ostrander Creek	Central, East
			South Fork Ostrander Creek	Central, East
			Pup Creek	Central
			Riley Creek	West
			Rock Creek	Central, East, Crossover
			Salmon Creek	West, Central, East
			Sandy Bend Creek	East
			Washougal River	West, Central, East, Crossover
			Little Washougal River	West, Central, East, Crossover
			East Fork Little Washougal River	Central, East, Crossover
			Whittle Creek	Central, East
			Unnamed Tributary to Arkansas Creek	Crossover
			Unnamed Tributary to Boulder Creek	Central, East

Species	Federal Status	State Status	Fish-Bearing Stream	Alternatives and/or Options[2,3]
Lower Columbia River Steelhead (*O. mykiss*) (continued)	Threatened	WA Candidate OR Sensitive-Critical	Unnamed Tributaries to Brezee Creek	West
			Unnamed Tributary to Cedar Creek	Central
			Unnamed Tributaries to Coweeman River	West, Central, East, Crossover
			Unnamed Tributaries to Cowlitz River	West, Central, Crossover
			Unnamed Tributary to Coyote Creek	East, Crossover
			Unnamed Tributary to North Fork Goble Creek	Central
			Unnamed Tributary to Houghton Creek	West
			Unnamed Tributary to Kalama River	Central
			Unnamed Tributary to Leckler Creek	West, Crossover
			Unnamed Tributaries to East Fork Lewis River	West
			Unnamed Tributary to Mill Creek	West
			Unnamed Tributary to Ostrander Creek	East
			Unnamed Tributary to South Fork Ostrander Creek	East
			Unnamed Tributary to Turner Creek	West, Crossover
			Unnamed Tributary to Little Washougal River	West
Pacific Lamprey *(Lampetra tridentata)*	None	WA Monitored OR Sensitive-Vulnerable	Coweeman River	West, Central, East, Crossover
			Cowlitz River	West, Central, East, Crossover
			Kalama River	West, Central, East, Crossover
			Lewis River	West, Central, East, Crossover
			East Fork Lewis River	West, Central, East, Crossover
			Salmon Creek	West, Central, East
			Washougal River	West, Central, East, Crossover
Eulachon *(Thaleichthys pacificus)*	Threatened	WA Candidate	Coweeman River	West, Central, East, Crossover
			Cowlitz River	West, Central, East, Crossover
			Kalama River	West, Central, East, Crossover
			Lewis River	West, Central, East, Crossover
			Washougal River	West, Central, East, Crossover
River Lamprey *(L. ayresi)*	None	WA Candidate	Coweeman River	West, Central, East, Crossover
			Cowlitz River	West, Central, East, Crossover
			Kalama River	West, Central, East, Crossover

Species	Federal Status	State Status	Fish-Bearing Stream	Alternatives and/or Options[2,3]
River Lamprey *(L. ayresi)* (continued)	None	WA Candidate	Lewis River	West, Central, East, Crossover
			East Fork Lewis River	West, Central, East, Crossover
			Salmon Creek	West, Central, East
			Washougal River	West, Central, East, Crossover
Bull Trout *(Salvelinus confluentus)*	Threatened	WA Candidate	Lewis River	West, Central, East, Crossover

Notes:

1. This table summarizes special-status fish species that may be present within tributaries to the Columbia River that are crossed by the action alternatives. These species are also potentially present within the Columbia River. Other special-status species are known to use the Columbia River as a migration corridor, but they do not use tributaries to the Columbia River that are crossed by the action alternatives. All species are described in Sections 19.1.1.1 and 19.1.1.2.

2. Alternatives as listed here include their options in most cases. In a few cases, one or more options of an alternative may not cross the listed stream (see Maps 19-1A through 19-1D for more detail).

3. See Maps 19-1A through 19-1D for location of critical habitat.

Sources: 69 Federal Register 77158, December 27, 2004; 70 Federal Register 37160, June 28, 2005; 71 Federal Register 834, January 5, 2006; 75 Federal Register 13012, March 18, 2010; NOAA 2010b; NOAA 2011; ODFW 2008; USFWS 2008b; USFWS 2010d; WDFW 2010a; WDFW 2010c; WDNR 2010g

Fish population categories (primary, contributing, stabilizing) reflect priorities in salmon recovery plans. They describe which populations to target for improvement and to which levels of improvement, to recover salmon species listed under the ESA (NMFS 2012). Through an iterative process, recovery planners for the Washington and Oregon Lower Columbia Region worked together to reach agreement on a target status for each fish population. The target statuses within an ESU or DPS are referred to collectively as the "recovery scenario" for that ESU or DPS. Setting the target status for each population in an ESU or DPS (i.e., developing the recovery scenario) involved consideration of several things including population productivity, genetic diversity, geographical location, and feasibility. Collectively, the target status of each population is consistent with biological viability criteria identified by NOAA Fisheries and is consistent with an ESU that no longer needs the protections of the ESA.

19.1.1.1 Anadromous Species

Lower Columbia River Coho

The Lower Columbia River coho are indigenous to major tributaries of the Columbia River. They are born and live in streams the first year of their life. Coho emerge in the early spring and distribute in tributaries and mainstem habitats where they drift feed within pool habitats. During the fall, **juveniles** generally leave the mainstem rivers and seek channel margins, side channels, off-channel habitats, and floodplain tributaries where they overwinter. The following spring they move seaward, then, return to their home streams at 3 years of age and 8 pounds. Coho are one of the more vulnerable salmon species to degradation of freshwater habitat and water quality because they spend extended periods in fresh water. They are vulnerable to many freshwater predators and require an adequate food supply through all seasons.

Lower Columbia River Chinook

The Lower Columbia River Chinook are also indigenous to major tributaries of the Columbia River. They generally spawn in the mainstems of the larger Columbia River tributaries. Chinook include spring, summer, and fall subspecies, depending on the time of the year they return from the ocean to spawn. Spring Chinook typically migrate to their **spawning** grounds from March through May, summer Chinook from June through July, and fall Chinook from August through November. Spring Chinook are known as "stream-type" salmon because the juveniles spend a year or more in fresh water before going to the ocean. Most summer and fall Chinook salmon are known as "ocean-type" salmon because they leave for the ocean sooner than other species. Summer Chinook spawn in the tributaries and rear in freshwater habitat for up to a year before going to the ocean. Summer Chinook tend to spawn in the lowest reaches of Columbia River tributaries. Fall Chinook juveniles can migrate to the sea a few months after hatching. Chinook average 3 to 4 years in the ocean before returning to their home rivers to spawn.

Columbia River Chum

Columbia River chum are typically found in the lower reaches of larger tributaries of the Columbia River. They seek spawning areas soon after returning to streams from salt water. Chum deposit their eggs from November through February and emerge in a few months as **fry** in the spring. Fry migrate directly to the Columbia River estuary or the sea and spend 3 to 4 years in the saltwater environment before returning. This short residence time and winter spawning behavior allow streams with little or no summer flows to support them. Chum are one of the salmon species least impacted by adverse changes in freshwater habitat quality.

Lower Columbia River Steelhead

Lower Columbia River steelhead are indigenous to major tributaries of the Columbia River. They return from the ocean between March and late September, although some winter steelhead also return through October and later. Steelhead may have the most life-history diversity of any species of Pacific salmon; they interbreed with non-anadromous populations (rainbow trout) and they can spawn more than once. They typically spawn in tributaries, emerge from the gravel in late spring, and spread throughout tributaries and mainstem habitats, migrating downstream as their body size increases. Yearling juvenile steelhead are usually found in **riffle** habitat, but some larger juvenile steelhead are found in pools and faster runs. Smolt emigration takes place primarily from March through June during spring freshets. They may spend 1 to 4 years in fresh water and 1 to 4 years in salt water, with differing combinations of fresh/saltwater residence times.

Eulachon

Eulachon (also known as smelt) are broadcast spawners (dispersing eggs in many locations) that spawn in lower reaches of rivers and tributaries and usually die after spawning. They occur in the Columbia, Coweeman, Cowlitz, Kalama, Lewis, and Washougal rivers in Washington and the Sandy River in Oregon. Eulachon typically spend several years in salt water before returning to fresh water to spawn from later winter through early summer. Shortly after hatching, the larvae are carried downstream and dispersed by estuarine, tidal, and ocean currents. Because juvenile eulachon spend less time in freshwater environments than juvenile salmon, returning eulachon may return to a wider range of spawning sites. In the portion of the species' range south of the U.S.—Canada border, most eulachon production originates in the Columbia River basin. Within the Columbia River basin, major spawning runs return to the mainstem of the Columbia River and the Cowlitz River.

Pacific Lamprey

Pacific lamprey are distributed throughout the major tributaries of the Columbia River. Their life history includes a larval phase that remains in streams, followed by metamorphosis and migration to the ocean. Adults remain in the ocean for 20 to 40 months and are parasitic, feeding on body fluids of other marine species. Returning adults usually enter rivers between April and June, migrate upstream until September, overwinter while sexually maturing, and spawn the following year from March through June. Eggs hatch in 2 to 3 weeks. Larvae burrow in silt and fine sediment to rear for 2 to 7 years, feeding on algae and detritus. Larvae emerge from the sediment and metamorphose into juvenile form. Juveniles out-migrate to the ocean from July through November.

River Lamprey

River lamprey are also anadromous and have life history and freshwater habitat requirements similar to those of Pacific lamprey. Adult river lamprey are of intermediate size, smaller than Pacific lamprey and larger than western brook lamprey (*L. richardsoni*), and typically inhabit estuarine areas. River lamprey is a "satellite" species to western brook lamprey: they interbreed and some genetic techniques cannot tell them apart.

Other Anadromous Fish

Besides these species, several special-status salmon species migrate through the portion of the Columbia River in the project area. All the action alternatives' routes crosses the Columbia River at river mile 120, between Lady Island on the Washington side of the river and a location about 0.5 mile west of the Sandy River near Troutdale, Oregon. The other species occasionally present at this crossing include the following: Snake River sockeye (*O. nerka*) (federal endangered), Upper Columbia River Chinook (federal endangered), Snake River Chinook (federal threatened), Upper Columbia River steelhead (federal threatened), and Middle Columbia River steelhead (federal threatened).

In addition, coastal cutthroat trout (*O. clarkii clarkii)*, is listed in Oregon (sensitive-vulnerable) and uses the Columbia River for migration. The action alternatives do not cross any other fish-bearing streams within Oregon used by coastal cutthroat trout.

19.1.1.2 Other Fish Species

Bull Trout

Bull trout, listed as threatened by the USFWS, have a variety of migratory and non-migratory life histories. Stream-resident bull trout complete their entire life cycle in the tributary streams where they spawn and rear. Most bull trout are migratory, spawning in tributary streams where juvenile fish usually rear from 1 to 4 years before migrating to either a larger river or lake where they spend their adult life, then return to the tributary stream to spawn. Resident and migratory forms may be found together, and either form can produce resident or migratory offspring. Bull trout have more specific habitat requirements than most other salmonids. Their distribution and abundance is particularly influenced by water temperature, cover, channel form and stability, spawning and rearing substrate conditions, and migratory corridors. Large patches within these habitat components are necessary to support robust populations. The action alternatives cross critical habitat for bull trout, but do not cross spawning populations.

Western Brook Lamprey

One special-status resident species, western brook lamprey, is listed in Oregon (sensitive-vulnerable), but its occurrence is incidental in the Columbia River where the action alternatives cross this river. The action alternatives do not cross any other fish-bearing streams within Oregon typically used by western brook lamprey.

Other resident fish species native to the project area include cutthroat (*O. clarkii*) and rainbow trout (*O. mykiss)*; largescale, bridgelip, and mountain sucker (*Catostomus macrocheilus, C. columbianus, C. platyrhynchus*); mountain whitefish (*Prosopium williamsoni*), sculpin (*Cottus* spp.), longnose dace (*Rhinichthys cataractae*), speckled dace (*R. osculus),* and northern pikeminnow (*Ptychocheilus oregonensis*). These species are distributed throughout the project area. Coastal cutthroat trout (*O. clarki clarki*) have diverse anadromous and non-anadromous life histories and are capable of spawning multiple times. They use similar habitats to the large-bodied Pacific salmon, but may require smaller gravel sizes for breeding.

Introduced resident species found in the project area include large and small mouth bass (*Micropterus salmoides, M. dolomieui*), brown trout (*Salmo trutta*), brook trout (*Salvelinus*

fontinalis), crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), and brown bullhead (*Ictalurus nebulosus*).

19.1.2 Fish Habitat

Salmon, trout and other fish species have specific freshwater habitat requirements: they need cool, clean (free of contaminants), well-oxygenated water; prefer gravel and cobble streambeds (**substrate**) without excessive fine sediments for spawning; and need a diversity of habitats that support migration, spawning, and rearing. Barrier-free access to and from spawning habitat is essential to these species. Juveniles and adults require abundant food sources, including insects, crustaceans, and other small fish, and juveniles need places to hide from predators such as those provided by large woody debris, boulders, and overhanging vegetation. Fish also need places to hide from periodic high flows and from warm summer temperatures. Riparian vegetation next to streams supports these requirements.

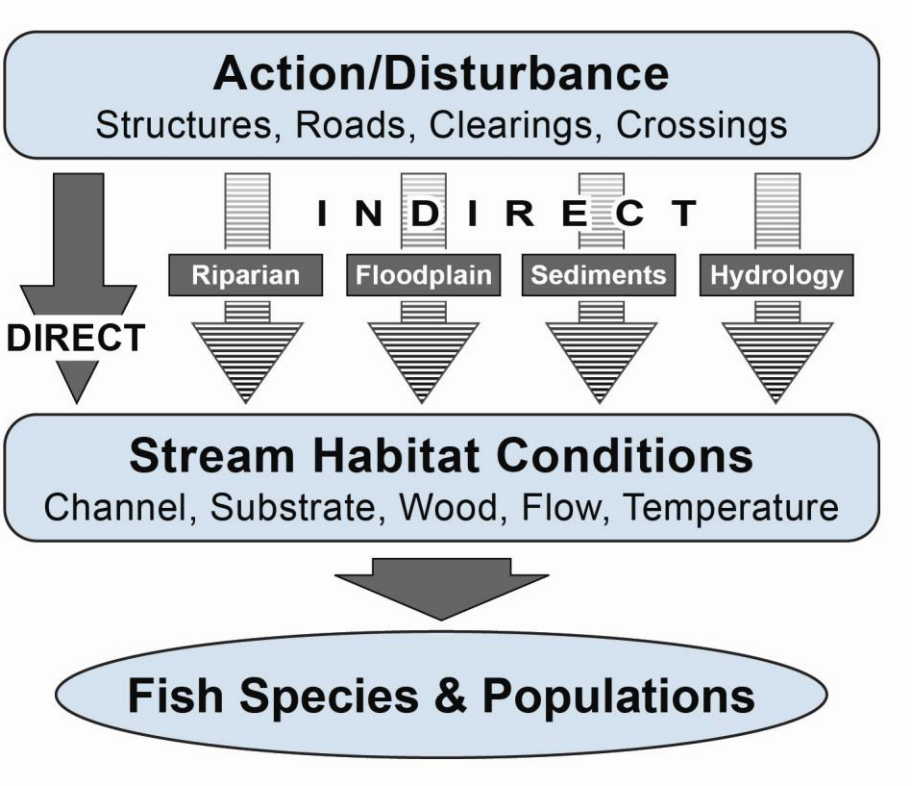
Tributaries in the project area provide diverse habitats for salmon and trout. These habitats were formed by the complex volcanic history and climate (including high precipitation amounts) of the region, and have varied landscapes including forested uplands, lowlands with large floodplain features, and gravel-rich environments (see Chapter 17, Vegetation and Chapter 14, Geology and Soils). These habitats support multiple salmon species with many different life histories.

Eulachon (also known as smelt) also require cool, clean, well-oxygenated water and prefer streambeds free of excessive fine sediment and debris for spawning. Eulachon are only present in fresh water during spawning, incubation, and migration of **larvae** to **estuarine** environments. Migration corridors need to be free of obstructions and with sufficient water flow to assist larvae moving downstream. Eulachon also require cool water temperatures, and prey items available once the larvae deplete their **yolk sacs**. During all adult and larval stages, freshwater habitat needs to be free of contaminants.

Lamprey are susceptible to several threats in freshwater habitat including barriers to migration, poor water quality, predation by non-native species, and stream and habitat degradation. Adults must be able to migrate upstream to spawn, and juvenile forms must be able to move downstream to complete their life cycle. Larvae and eggs need cool stream temperatures. Because larvae colonize streambeds in high densities for 2 to 7 years, a single action that degrades water quality and alters stream channels could affect many age classes.

19.2 Environmental Consequences

Potential impacts to fish range from those activities that could directly affect fish survival, such as degrading water quality or blocking passage, to changes in habitat quality or quantity that can alter the ability of watersheds to support fish over the long-term. To help identify impacts to fish for each alternative, detailed technical analyses were completed (see Appendix K). These analyses were based on the following model that identifies the conceptual relationship between project impacts and fish populations:



The technical analyses include some quantification of impacts from construction and maintenance of substations, transmission line rights-of-way, access roads, and transmission towers. Although they do not provide absolute estimates of impacts to fish resources, they do provide context for evaluating both the magnitude and relative level of project impacts from the action alternatives.

General impacts that would occur for the action alternatives are discussed below, followed by impacts unique to each alternative.

19.2.1 Impact Levels

Impacts were considered **high** where project activities were determined to cause the following:

- Long-term changes in watershed conditions that cause high impairment to hydrology or sediment functions
- Permanent changes in riparian habitat conditions that cause the loss of high large-woody debris recruitment potential
- Permanent changes in riparian habitat conditions that could decrease shade and lead to temperature increases that would adversely affect aquatic life
- Permanent alteration of floodplains that substantially inhibits long-term floodplain inundation patterns and natural rates of channel adjustment
- Direct or indirect habitat changes that cause substantial, short-or long-term risk to ESA-listed or other fish species at the population or ESU scale

Impacts were considered **moderate** where project activities were determined to cause the following:

- Long-term changes in watershed conditions that cause moderate impairment to hydrology or sediment functions
- Permanent changes in riparian habitat conditions that cause the loss of moderate large-woody debris recruitment potential
- Permanent alteration of floodplains that moderately inhibits long-term floodplain inundation patterns and natural rates of channel adjustment.
- Direct or indirect habitat changes that cause moderate, short- or long-term risk to ESA-listed or other fish species at the population or ESU scale.

Impacts were considered **low** where project activities were determined to cause the following:

- Long-term changes in watershed conditions that cause minor change in existing hydrology or sediment functional
- Permanent changes in riparian habitat conditions that cause the loss of low large woody debris recruitment potential
- Permanent changes in riparian habitat conditions that cause the loss of stream shade along streams that already have limited shade and stream cooling
- Permanent alteration of floodplains that results in none or only minor interference with floodplain inundation patterns or channel adjustment processes. Low impacts may occur where existing floodplain development has already significantly impaired floodplain functions.
- Direct or indirect habitat changes that result only in low, short-term risk to ESA-listed and other fish species at the population or ESU scale.

No impact would occur where there are habitat changes or project activities that would cause no discernable short- or long-term impacts to fish life or habitat.

19.2.2 Impacts Common to Action Alternatives

19.2.2.1 Construction

See Chapter 15, Water and Appendix K for more information about factors influencing hydrologic change and sediment delivery in the project area.

Clearing transmission line rights-of-way and construction of towers, substations, and access roads across or near streams could remove vegetation, disturb soil, decrease soil permeability, increase surface runoff and release sediment that, if delivered to streams, could cause direct impacts to water quality. Excessive peak flows can scour streambeds and cause debris torrents that alter stream channels. Flooding and debris torrents in fish-bearing streams can degrade fish habitats by destroying egg pockets and rearing areas, altering pool and riffle sequences, and removing large woody debris. Excessive peak flows can also flush available nutrients from streams. Water that runs off into streams is not available for recharging ground water sources that contribute to summer flows. Increased peak flows can cause simplified habitats, reduced

nutrients, and unsuitable summer conditions, which decrease fish growth and survival. Increased sediment loading in fish-bearing streams can alter habitats and reduce the growth and survival of fish. For many fish species, eggs are deposited among gravels on the stream bottom. When these gravels become clogged with sediments, the free flow of oxygenated water and waste removal is impaired, causing egg suffocation and mortality. Suspended sediments can clog and abrade fish gills, affecting behavior or causing suffocation, and can also reduce water clarity, making it difficult for some fish to find food or detect predators. Turbid water can cause a stress response in salmon, which may cause reduced growth and reduced ability to tolerate additional stressors. Turbid water can also alter outmigration behavior, impair immune system function, and make it difficult for fish to maintain the balance of salt and water in the body.

Precipitation zones and vegetation types crossed by the action alternatives have different snow accumulation and snowmelt, and alternatives and options requiring construction in rain-on-snow zones would cause higher peak flow impacts. Removal of mature conifer forests in the rain-on-snow zone can decrease interception of precipitation by the forest canopy, leading to greater snow accumulation. Decreased canopy cover increases snowmelt by allowing more rain, solar radiation, and wind to reach the snowpack.

The action alternatives cross soil types with different natural erodibility. Construction in more erodible terrain would cause higher sediment delivery impacts. Between about 100 acres and 1,000 acres of vegetation currently highly effective in limiting the water available for runoff would be cleared (depending on the action alternative). About 70 miles of new line, and access roads and two substations would then be built potentially causing additional sediment delivery. However, these impacts would occur across watershed areas of between about 160,000 acres and 240,000 acres. The percent change in runoff and sediment delivery to streams would be less than 1 percent (see Chapter 15, Water, and Appendix K). Long-term changes in watershed conditions would be minor; however, local **high** impacts from sediment delivery could occur. Properly implementing erosion control measures would minimize the amount of sediment delivered to streams. Generally, impacts from long-term changes to watershed function would be **low**.

Large woody debris recruitment potential and stream shade along fish-bearing streams were identified for each action alternative (see Appendix K). Trees and other vegetation would be removed from the transmission line right-of-way, substations, and new access roads constructed along fish-bearing streams, including trees within buffers that are normally protected under the Washington Forest Practices Act (76.09 RCW) and other land use regulations. Vegetation removal would not occur or be minimal at many crossings that do not have trees or important buffers. At these and existing crossings where vegetation has already been removed and is not allowed to regrow, there would be **no** impact. Elsewhere, removing vegetation in riparian areas could decrease large woody debris recruitment potential and streamside shade. Riparian vegetation can moderate stream temperature year-round and riparian forests are a source of large woody debris, which increases channel complexity. Shade loss from streamside vegetation removal can lead to higher stream water temperature, which can decrease fish survival. Removal of future wood sources can impact fish growth and survival through simplification of habitat and destabilization of channel beds, and a reduction in nutrients.

Forested vegetation would be cleared along about 2 to 3 miles of fish-bearing streams. Permanent changes to riparian function at project crossings could occur through the loss of large woody debris recruitment potential or stream shade. At the crossing scale, a range of

riparian function would be lost along any action alternative; however, this loss could be buffered by functions provided at the watershed scale. Generally, along any action alternative, crossing-scale impacts to large woody debris recruitment potential and shade from removal of riparian vegetation along fish-bearing streams would range from **low-to-high**. Detailed assessments in Appendix K assumed that all forested vegetation would be removed at each stream crossing; however, this could be mitigated on a crossing-by-crossing basis through very selective clearing. **High** impacts would occur where the current riparian function is greater and its removal would cause a greater loss of riparian function. **High** impacts would occur when the existing large woody recruitment potential is high. **High** impacts would also occur where the existing shade levels provide effective stream cooling. **Low** impacts would occur where there is less loss of riparian function. **Low** impacts would occur when the existing large woody recruitment potential is low or where the existing shade level is already low and provides limited stream cooling.

There are potential impacts to floodplain processes from clearing floodplain vegetation and construction of towers and roadways in the floodplain. These impacts could affect floodplain functions including flood inundation dynamics and rates of channel adjustment, factors that have long-term implications to creation and maintenance of aquatic habitat. In general, the greater the amount of clearing, road building, and tower building in the floodplain, the greater the amount of potential impacts; however, the existing degree of floodplain alteration is also an important consideration. For example, new clearing within floodplains that are already impaired due to diking and fill placement would not have the same degree of impact as clearing in an intact floodplain.

In Chapter 15, Water, numbers of towers and length of roads within the floodplain refers to the FEMA-designated 100-year floodplain. In some cases, these values may differ from the values in this chapter and Appendix K, which used additional techniques for floodplain delineation (for example, aerial photo interpretation and vegetation identification) in addition to the FEMA-designated floodplain boundaries.

Potential impacts to floodplains were assessed (see Appendix K). The total acreage of impact was calculated for each alternative by adding the floodplain areas affected by vegetation clearing, roadway construction, and tower construction together. Total acreages of impact ranged from 7.7 to 21.9 acres. In general, the action alternatives with the greatest total area of impact (i.e., West Alternative and options) also have the greatest amount of existing impairment and human development of floodplains.

Overall, only minor interference with reach-scale floodplain inundation patterns or channel adjustment processes would occur for the action alternatives because of the small total spatial extent of floodplain impacts and the degree of existing floodplain impairment. Higher impacts to floodplain functions are possible at the site-scale, particularly for crossings where floodplain processes are intact. Site-scale mitigation measures, such as locating towers and roads out of channel migration zones and constructing roadways at existing grade, would help mitigate these impacts. Overall impacts on fish from floodplain changes would be **low**.

Collectively, impairment of hydrology and sediment functions, loss of large woody debris recruitment potential and shade, and alteration of floodplains have the potential to affect ESA-listed and other fish species at the population or ESU scale. Generally, action alternatives with more crossings of high-value fish streams would have a greater potential for impact than routes with fewer crossings of low-value fish streams. The value of fish streams can be determined by fish distribution and the quantity and quality of fish habitat (e.g. pools,

hydrology, riparian conditions, sediment, water quality, and woody debris). Similarly, routes with greater hydrological, floodplain, riparian, or sediment disturbance are more likely to cause substantial degradation of fish production potential. Although the analyses done to identify fish impacts (using the Integrated Fish Impact index, see box and Appendix K) focus on ESA-listed anadromous salmonids, the results are a general indicator of impacts to other fish and aquatic species. Based on the analyses, none of the alternatives and options would be a substantial risk to ESA-listed salmonids.

Fish indices suggest that the net effect of any project route on anadromous fish populations would be less than 1 percent even using the most pessimistic assumptions for impact at stream crossings (e.g., fish production potential is degraded to zero and no effective mitigation occurs). However, any additional impacts would further degrade the status of ESA-listed species from current levels. Degradation of habitat conditions in high-priority fish populations and stream reaches is also contrary to objectives and strategies identified in the salmon and steelhead recovery plan. Generally, habitat changes from the project would cause **low**, short-term risk to ESA-listed and other fish species.

Integrated Fish Impact Index

The Integrated Fish Impact index estimates the proportional reduction in fish numbers from project-related habitat degradation at the crossing scale. Units of this index are expressed as the average percentage of high priority populations for listed salmon and steelhead species. The Integrated Fish Impact index identifies the percentage by which affected populations are likely to be reduced by project-related habitat changes (see Appendix K).

Accidental oil or gas spills from construction equipment and vehicles could cause petroleum products to enter surface water (see Chapter 15, Water). Petroleum could have toxic effects on fish and may cause direct mortality. Petroleum products can also cause chemical and physical changes in soil and water that can degrade habitat quality and reduce food resources, reducing fish growth and survival. The presence of hydrocarbons in the water column may also impede fish migration. Because BPA would require that fuel be stored and vehicle refueling occur at least 100 feet from rivers and streams and other surface waters, and because spill containment and clean-up procedures would be in place, the effects of accidental spills would be temporary, and limited to small areas. **Moderate** impacts would occur to fish.

19.2.2.2 Operation and Maintenance

Properly implementing road drainage BMPs, regular maintenance, and rocking roads would reduce erosion on unpaved roads, minimizing impacts, and ensuring that sediment delivery to streams is not increased (see Chapter 15, Water). Because the amount of sediment reaching a fish-bearing stream would be small and would not create conditions that would adversely affect individuals or populations of fish, **low** impacts would occur.

Continued vegetation maintenance prevents riparian vegetation growth and could reduce stream shade and large woody debris recruitment potential, causing localized increases in water temperature and habitat degradation in any adjacent streams. Crossing-scale impacts to fish habitat could be **low-to-high**.

Continued vegetation maintenance in floodplains has the potential to affect **floodplain hydraulic roughness** (natural barriers such as vegetation that could affect water flow) and nutrient exchange at the site-scale, but none to only minor interference with floodplain inundation or channel adjustment would be expected. Impacts to fish habitat would be **low**.

BPA uses herbicides approved in its Transmission System Vegetation Management Program. Overspray of herbicides used for noxious weed control within rights-of-way and substation yards could affect surface water and fish. BPA bases herbicide selection on toxicity level, proximity to aquatic habitat, and delivery potential. Direct contact with fish can cause mortality, decreased growth and survival, and impaired swimming ability. Fish can be indirectly affected by reductions in prey. Appropriate buffers would be used to prevent herbicides from being deposited in surface waters (BPA 2000b). Any adverse effects would be temporary and localized. **No to low** impacts would occur to fish.

19.2.2.3 Sundial Substation

The Sundial site, including tower reconfigurations, is not close enough to any water bodies to affect fish habitat or water quality, and is located outside the 100-year floodplain of the Columbia River, so **no** impacts on fish would occur.

19.2.3 Castle Rock Substation Sites

Impacts common to action alternatives are in Section 19.2.2. The remaining sections discuss impacts unique to each alternative, and recommended mitigation measures.

19.2.3.1 Casey Road

The Casey Road site is about 1,800 feet upslope of Rock Creek. This stream has presumed presence of Lower Columbia River coho and potential occurrence of Lower Columbia River steelhead. The project would not remove any vegetation along Rock Creek and the site is not within a floodplain. Any runoff, erosion, or sediment delivery would be controlled by use of permeable surfaces, silt fences, and detention ponds. Hazardous waste materials would be disposed of off-site. There is limited potential for petroleum products or herbicides to be delivered to Rock Creek because BPA would follow BMPs requiring that fuel is stored and vehicles are refueled away from aquatic resources. BPA would also apply herbicides at the lowest rate effective for vegetation maintenance. **No-to-low** impacts on fish would be expected.

19.2.3.2 Baxter Road

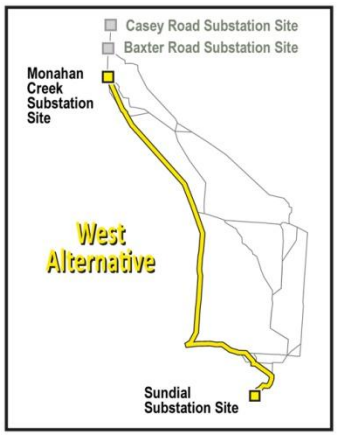
The Baxter Road site is about 1,000 feet upslope of Baxter Creek. Baxter Creek has presumed presence of Lower Columbia River coho and Lower Columbia River steelhead. Three small non-fish bearing streams are within the substation disturbance area. The project would not remove any vegetation along Baxter Creek and the site is not within a floodplain. Any runoff, erosion, or sediment delivery would be controlled by use of permeable surfaces, silt fences, and detention ponds. Hazardous waste materials would be disposed of off-site. There is limited potential for petroleum products or herbicides to be delivered to Rock Creek because BPA would follow BMPs requiring that fuel is stored and vehicles are refueled away from aquatic resources. BPA would also apply herbicides at the lowest rate effective for vegetation maintenance. **No-to-low** impacts on fish would be expected.

19.2.3.3 Monahan Creek

The Monahan Creek site is between Monahan and Delameter creeks. These streams have documented occurrence of Lower Columbia River coho, steelhead, and Chinook salmon and

presumed presence of Columbia River chum. The site would be across Delameter and Monahan roads about 450 to 500 feet from these streams. The project would not remove any vegetation along either creek and the site is not within a floodplain. Any runoff, erosion, or sediment delivery would be controlled by use of permeable surfaces, silt fences, and detention ponds. Hazardous waste materials would be disposed of off-site. There is limited potential for petroleum products or herbicides to be delivered to Rock Creek because BPA would follow BMPs requiring that fuel is stored and vehicles are refueled away from aquatic resources. BPA would also apply herbicides at the lowest rate effective for vegetation maintenance. **No-to-low** impacts to fish would be expected.

19.2.4 West Alternative



Transmission line clearing and road construction would cause about 84 miles (1,285 acres) of potential soil disturbance that could contribute sediment to streams through runoff or erosion (see Table 15-2). Compared to the other action alternatives, this would be the least amount of construction and it would cause the least percent increase in runoff (0.09 percent) because almost 80 percent of the land cover in sub-watersheds crossed by the West Alternative is hydrologically immature. **Hydrologically immature** land cover provides little function in intercepting precipitation or moderating snowmelt. There is higher urban development, greater agricultural land cover, and greater hardwood cover. There would also be greater use of existing transmission line clearings. Overall, there would be little decrease in the mature vegetation cover (see Appendix K). Clearing along the West Alternative would cause the greatest percent increase in sediment delivery (0.25 percent) to fish-bearing streams because the West Alternative would cross more erodible terrain. This alternative crosses large areas of unconsolidated sediments that have higher natural erodibility (see Appendix K). This change would occur across a large watershed area of about 161,000 acres. Isolated actions could cause **high** impacts to fish-bearing streams. Generally, however, long-term changes in watershed conditions and functions would be minor and impacts to fish would be **low**.

Riparian vegetation would be cleared at 47 forested crossings of fish-bearing streams (see Table 19-2; number of forested crossings equal the sum of high and low shade function numbers). Compared to other action alternatives, this would be the least number of forested crossings. Nineteen forested crossings would occur where the existing shade level provides effective stream cooling and where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts from loss of shade function would be **high**. Ten forested crossings would occur where the existing large woody debris recruitment potential is high; impacts from loss of large woody debris recruitment function at these crossings would be **high**. This is the fewest number of high impacts among the action alternatives because there are relatively fewer forested crossings of fish-bearing streams and because riparian vegetation at these crossings provides relatively lower shade and large woody debris recruitment potential. Crossings are also at lower elevations where hardwood species composition is greater.

Table 19-2 Potential Impacts on Fish and Stream Habitat[1]

Alternatives and Options	Percent Change in Runoff[2]	Percent Change in Sediment Delivery[3]	Total Number of Forested Fish-Bearing Streams Crossed by Transmission Line Corridors and Riparian Function[4] Total Crossings (Shade Function) = Total Crossings (Recruitment Potential)					Average Percent Reduction in Production of Affected Fish Populations[7]	Total Floodplain Impact Area (acres)[8]
			High Shade Function[5]	Low Shade Function[5]	High LWD Recruitment Potential[6]	Moderate LWD Recruitment Potential[6]	Low LWD Recruitment Potential[6]		
West Alternative	**0.09**	**0.25**	**19**	**28**	**10**	**18**	**19**	**0.11**	**18.0**
West Option 1	-0.01	N/C	N/C	-1	N/C	N/C	-1	N/C	+3.9
West Option 2	+0.01	N/C	-1	N/C	N/C	+1	-2	-0.03	-2.7
West Option 3	+0.01	-0.02	+1	+3	+2	+3	-1	-0.02	-2.4
Central Alternative	**0.59**	**0.15**	**49**	**19**	**46**	**16**	**6**	**0.15**	**9.2**
Central Option 1	+0.01	-0.01	+1	+1	+1	+1	N/C	N/C	N/C
Central Option 2	-0.01	+0.01	-9	+4	-7	-1	+3	-0.01	-1.5
Central Option 3	-0.05	N/C	-2	-6	-3	-1	-4	-0.03	+0.3
East Alternative	**1.02**	**0.00**	**35**	**17**	**38**	**13**	**1**	**0.19**	**10.9**
East Option 1	-0.05	+0.01	-11	+5	-11	+4	+1	N/C	-1.8
East Option 2	-0.24	N/C	+5	+2	+6	-1	+2	-0.10	-0.5
East Option 3	+0.03	N/C	+4	N/C	+4	N/C	N/C	-0.10	-0.7
Crossover Alternative	**0.47**	**0.17**	**32**	**23**	**31**	**18**	**6**	**0.20**	**9.0**

Alternatives and Options	Percent Change in Runoff[2]	Percent Change in Sediment Delivery[3]	Total Number of Forested Fish-Bearing Streams Crossed by Transmission Line Corridors and Riparian Function[4] Total Crossings (Shade Function) = Total Crossings (Recruitment Potential)					Average Percent Reduction in Production of Affected Fish Populations[7]	Total Floodplain Impact Area (acres)[8]
			High Shade Function[5]	Low Shade Function[5]	High LWD Recruitment Potential[6]	Moderate LWD Recruitment Potential[6]	Low LWD Recruitment Potential[6]		
Crossover Option 1	+0.01	N/C	+1	+2	N/C	+3	N/c	0.04	+1.7
Crossover Option 2	-0.01	-0.01	N/C	+1	N/C	N/C	+1	N/C	+0.4
Crossover Option 3	-0.07	-0.01	+1	+2	+1	+1	+1	N/C	+0.5

Notes:

N/C – No change from the alternative

1. The value for each option represents the net change from the action alternative. It was calculated as the value added by the option minus the total value in the segments the option replaces.

2. Represents the percent change in hydrologically immature vegetation in watersheds crossed by the action alternatives; hydrologically immature vegetation increases snow accumulation and snowmelt (see Appendix K).

3. Represents the percent change in sediment delivery in watersheds crossed by the action alternatives (see Appendix K).

4. This assessment focuses on the loss of riparian function from transmission line corridor crossings at fish-bearing streams. The length of stream cleared is at least 150 ft. and, because of stream orientation and sinuosity, it is often greater. At these scales, loss of wood recruitment could be enough to significantly alter geomorphic processes (Montgomery et al. 2003) and the loss of stream shade could be enough to warm streams to levels harmful to fish inhabiting the stream reach (Cristea and Janisch 2007). In comparison, riparian clearing would not be required at substations. Clearing of forested vegetation would be required at 10 or fewer new access road crossings for any alternative or alternative option; clearing would be limited to 30 ft.

5. Stream shade function is based on canopy closure, elevation, and WaDOE stream temperature standards. Crossings were classified into low and high categories using the assessment protocols in the WaFPB Manual (2011b). Canopy closure determinations were based the visibility of the stream surface and stream banks. Determinations were based on aerial photo interpretation at each crossing. Elevations were determined from USGS topographic maps. WaDOE stream temperature standards were determined from FPARS data (see Appendix K).

6. Large woody debris recruitment potential is based on the dominant vegetation types, average tree size classes, and stand density classes found within 100 ft of the stream at each crossing. Crossings were classified into low, moderate, and high categories using the assessment protocols in the WaFPB Manual (2011b). Determinations were based on aerial photo interpretation at each crossing. Low LWD recruitment potential is associated with hardwood dominated stands and high LWD recruitment potential is associated with mixed or conifer dominated stands (see Appendix K).

7. The Integrated Fish Impact index estimates the proportional reduction in fish numbers associated with project-related habitat degradation at the crossing scale. Units of this index are expressed as the average percentage of high priority populations for all listed salmon and steelhead species. The Integrated Fish Impact index identifies the percentage by which affected populations are likely to be reduced by project-related habitat changes (see Appendix K).

8. Sum of potential floodplain impacts within the transmission line corridor based on acreage of vegetation clearing, towers, and roads. Assumes 30 ft. width for new roads, 20 ft. width for reconstructed roads, and a 66-ft. diameter circle for towers. Overlapping impact areas were accounted for in the summed values.

Hardwoods are not as effective as conifers in providing shade for streams, including fish-bearing streams. Streams at lower elevations also tend to be wider and forest canopies cannot fully cover the stream surface. At lower elevations, air temperatures are higher and more shade is required to cool streams to adequate temperatures. It is less likely that there will be enough shade to adequately cool these streams. Hardwoods are also not as effective as conifers in providing large woody debris function and break down at a faster rate.

The West Alternative would clear 12.6 acres of floodplain vegetation and has a total floodplain impact area of 18 acres (includes towers, roads, and new right-of-way vegetation clearing) (see Appendix K). These amounts are the highest of the action alternatives. The number of new towers and the length of roads in the floodplain would also be the highest of the action alternatives. Broad floodplain areas of streams with potential fish populations would be crossed in the lower portions of large river systems, including the Lewis, East Fork Lewis, Salmon Creek, and Coweeman River. A large amount of floodplain area would also be crossed in the Lacamas Creek valley upstream of Lacamas Lake. Although the West Alternative would have a high total impact area, this route crosses floodplains that are already greatly affected by existing agricultural and residential uses that have caused widespread clearing, road construction, ditching, filling, and grading. Although the total amount of floodplain clearing would be 12.6 acres, as much as 86 percent of the total floodplain area is already cleared, which suggests considerable existing impairment to floodplain processes and their suitability for aquatic resources. An even greater portion of these floodplains are further affected by existing ditching and filling. Because of the existing degree of impairment and disconnection of floodplains crossed by this alternative, impacts to fish from floodplain-related impacts would be **low**.

The West Alternative has among the lowest fish impacts based on the Integrated Fish Impact index (see Appendix K and Table 19-2). The Integrated Fish Impact index estimates the average percent reduction in affected fish production (see Table 19-2). Fish production potential is generally higher because the West Alternative has a greater number of crossings and many occur at relatively high-value streams for anadromous species. However, project-related habitat effects would be relatively low compared to other alternatives because many stream crossings occur where conditions in the right-of-way are already altered. This alternative would generally require much less clearing of highly-functioning riparian vegetation (see Appendix K).

The average percent reduction in production of affected fish populations for the West Alternative would be about 0.11 percent (see Table 19-2), the lowest of the action alternatives. The West Alternative would not pose a substantial risk to listed species because only a fraction of the potential fish production is likely to be lost due to project effects; impacts would be **low**.

19.2.4.1 West Option 1

West Option 1 would replace a portion of the alternative that follows existing right-of-way just east of Vancouver with an option that is farther west and closer to Vancouver. This portion of the alternative includes replacing one of the existing 230-kV lines with a new double-circuit 500-kV line. The existing 230-kV line and the new line would be placed on new 500-kV towers. Impacts would be the same as the West Alternative on watershed function (**low**), riparian function (**low-to-high**; no added high impacts), floodplain (**low**), and from habitat changes affecting ESA-listed and other fish species (**low**).

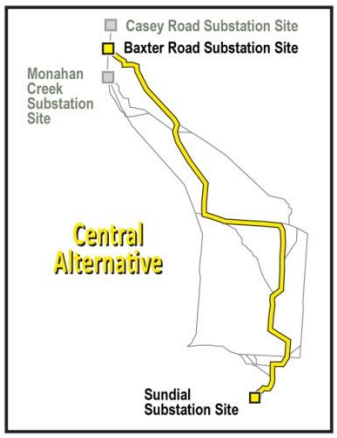
19.2.4.2 West Option 2

West Option 2 would replace a portion of the alternative in the rural residential areas north of Camas with an option farther to the east in the same area. Impacts would be the same as the West Alternative on watershed function, floodplain functions, and from habitat changes affecting ESA-listed and other fish species (all **low** impacts). Impacts to riparian function would also be similar (**low-to-high**), with one fewer stream with high shade function affected.

19.2.4.3 West Option 3

West Option 3 would replace a portion of the West Alternative in the rural residential areas north of Camas with a route crossing rural residential and rural areas farther east. Impacts would be the same as the West Alternative on watershed function, floodplain functions, and from habitat changes affecting ESA-listed and other fish species (all **low** impacts). Impacts on riparian function would also be similar (**low-to-high**), with one more stream with high shade function, and two more streams with high potential for large woody debris affected.

19.2.5 Central Alternative



Transmission line clearing and road construction would cause about 104 miles (1,503 acres) of potential soil disturbance that could contribute sediment to streams through runoff or erosion (see Table 15-2).. Among the action alternatives, this would be the greatest amount of construction, but it would cause relatively moderate percent increases in runoff (0.59 percent) and sediment delivery (0.15 percent) to fish-bearing streams because moderate levels of mature conifer vegetation would be cleared and less erodible terrain would be crossed. Compared to the West Alternative, there is less existing development, less agriculture, and more conifer cover. Losing more of this conifer cover decreases the amount of vegetation available to intercept snow and rain and causes a higher rate of snowmelt (see Appendix K). Still, the loss of mature vegetation would not be as great as the East Alternative. Compared to the West Alternative, the underlying geology along the Central Alternative is mostly hard rock that does not easily erode. Though more soil would be exposed, there would be less sediment delivery to fish-bearing streams. These changes would occur across a large watershed area of about 218,000 acres. Isolated actions could cause **high** impacts to fish-bearing streams. Generally, however, long-term changes in watershed conditions and functions would be minor, and impacts would be **low**.

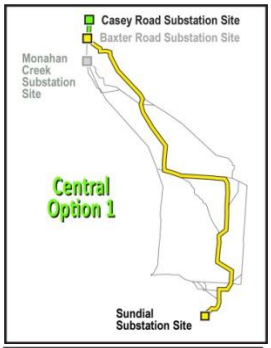
Riparian vegetation would be cleared at 68 forested crossings of fish-bearing streams (see Table 19-2). Among the action alternatives, this would be the greatest number of forested crossings. Most forested crossings (49) would occur where the existing shade level provides effective stream cooling and where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts to loss of shade function would be **high**. Most forested

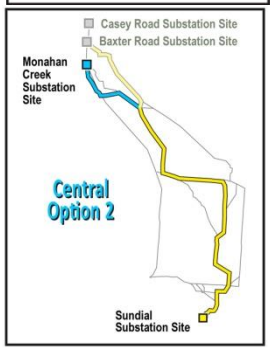
crossings (46) would also occur where the existing riparian vegetation provides high large woody debris recruitment potential; impacts to loss of large woody debris function would be **high**. This is the greatest number of high riparian function impacts among the other alternatives because of the greater number of forested crossings and because riparian vegetation at these crossings provide relatively greater shade and large woody debris function. Stream crossings, including fish-bearing streams, along the Central Alternative tend to have greater conifer species composition, narrower streams, and are at higher elevations. Conifers are more effective than hardwoods in providing shade. Forest canopies often can fully cover the stream surface along narrower streams. At higher elevations, air temperatures are lower and it is more likely that shade cover will adequately cool these streams. Conifers are also more effective than hardwoods in providing large woody debris in streams, including fish-bearing streams, and tend to remain intact and effective for a longer period of time.

The Central Alternative would clear 8.1 acres of floodplain vegetation and has a total floodplain impact area of 9.2 acres (includes towers, roads, and new right-of-way vegetation clearing) (see Appendix K). These amounts are near the lowest of the action alternatives because the route crosses smaller stream systems with small floodplain areas with potential fish populations. The number of new towers and length of roads in the floodplain area would be the lowest of the action alternatives. Also, there are more existing cleared areas in many of these floodplains. Because the amount of total impact area is small and existing floodplains are already impaired and disconnected, impacts to fish from floodplain-related impacts would be **low**.

This alternative generally falls between the West and East alternatives based on the Integrated Fish Impacts index (see Table 19-2). The number of anadromous fish-bearing stream crossings, amount of riparian clearing, functional rating of riparian zones, and fish production potential all fall in the middle range between the West and East alternatives (see Appendix K).

The average percent reduction in production of affected fish populations for the Central Alternative would be about 0.15 percent (see Table 19-2). The Central Alternative would not pose a substantial risk to listed species because only a fraction of the potential fish production is likely to be lost due to project effects; impacts would be **low**.





19.2.5.1 Central Option 1

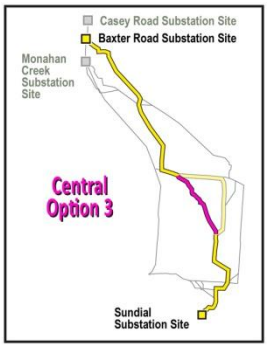
Central Option 1 would begin at the Casey Road substation site and the transmission line would cross unpopulated forest production and open space land. Impacts on watershed function (**low**), floodplain function (**low**) and from habitat changes to ESA-listed and other fish species (**low**) would be the same as the Central Alternative. Impacts on riparian function would also be similar (**low-to-high**), with one more crossing with high shade function and high potential for large woody debris affected.

19.2.5.2 Central Option 2

Central Option 2 would begin at the Monahan Creek substation site and would remove the portion of the Central Alternative crossing the Cowlitz River north of Castle Rock and running farther to the southeast. This option would add a new route running southeast from the

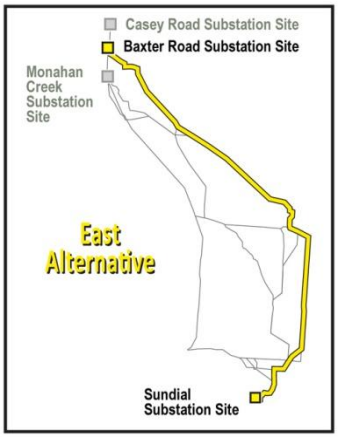
Monahan Creek substation site through sparsely populated land, crossing the unincorporated community of West Side Highway next to SR 411, the Cowlitz River and I-5, and running through largely unpopulated land toward the east. Impacts would be the same as the Central Alternative on watershed function, floodplain functions, and from habitat changes to ESA-listed and other fish species (all **low** impacts). Impacts on riparian function would also be similar (**low-to-high),** but with nine fewer streams with high shade function, and seven fewer streams with high potential for large woody debris affected.

19.2.5.3 Central Option 3



Central Option 3 would replace the Lewis River crossing near Ariel and a portion of the Central Alternative between Ariel and Venersborg, with a downstream river crossing and a new route running directly southeast from Ariel through rural residential areas toward Venersborg. Impacts would be the same as the Central Alternative on watershed function, floodplain functions, and from habitat changes to ESA-listed and other fish species (all **low** impacts). Impacts on riparian function would also be similar (**low-to-high**), but with two fewer streams with high shade function, and three fewer streams with high potential for large woody debris affected.

19.2.6 East Alternative



Transmission line clearing and road construction would cause about 98 miles (1,455 acres) of potential soil disturbance that could contribute sediment to streams through runoff or erosion (see Table 15-2). Compared to the other action alternatives, this would be the second greatest amount of construction, and it would cause the largest percent increase in runoff (1.02 percent) to fish-bearing streams because it clears the greatest amount of mature vegetation. Compared to the West Alternative, there is less existing development, less agriculture, and more conifer cover. Losing more conifer cover decreases the amount of vegetation available to intercept snow and rain and causes a higher rate of snowmelt (see Appendix K). Compared to the West Alternative, the underlying geology along the East Alternative is mostly hard rock that does not easily erode. Though more soil would be exposed, there would be less sediment delivery to fish-bearing streams. These changes would occur across a large watershed area of about 209,000 acres. Isolated actions could cause **high** impacts to fish-bearing streams. Generally, however, long-term changes in watershed conditions and functions would be minor, and impacts would be **low**.

Riparian vegetation would be cleared at 52 forested crossings of fish-bearing streams (see Table 19-2). Compared to other action alternatives, this would be the third most forested crossings. Most forested crossings (35) would occur where the existing shade level provides effective stream cooling and where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts would be **high**. Most forested crossings (38) would also occur where the existing riparian vegetation provides high large woody debris recruitment potential; impacts to loss of large woody debris function would be **high**. This is the second greatest number of high impacts among the action alternatives. Similar to the Central Alternative, crossings along the East Alternative provide greater shade function for streams,

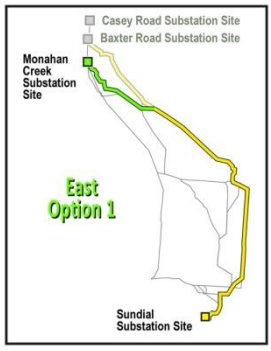
including fish-bearing streams. Crossings tend to have greater conifer species composition, narrower streams, and are at higher elevations. Conifers are also more effective than hardwoods in providing large woody debris. But there would be relatively fewer high impacts along the East Alternative than the Crossover Alternative because fewer fish-bearing streams would be crossed.

The East Alternative would clear 9.8 acres of floodplain vegetation and has a total floodplain impact area of 10.9 acres (includes towers, roads, and new right-of-way vegetation clearing) (see Appendix K). These amounts are near the middle of the action alternatives, but closer to the Central and Crossover alternatives than the West Alternative (and options) because the alternative crosses smaller stream systems with small floodplain areas with potential fish populations. The number of new towers and length of roads are less than the West and Crossover alternatives. Also, there are more existing cleared areas in many of these floodplains. Because the total impact area is small and existing floodplains are already impaired and disconnected, new impacts to floodplain processes would be **low**.

This alternative falls between the Central and Crossover alternatives, but is closer to the Crossover Alternative based on the Integrated Fish Impacts index (see Table 19-2). Fish production potential is relatively low because the number of anadromous fish-bearing stream crossings would be lower than other action alternatives and this alternative would generally cross smaller, higher elevation streams inhabited at relatively low densities by a limited number of species (typically steelhead and coho). However, many of these crossings would require substantial clearing of relatively high-functioning riparian vegetation (see Appendix K).

The average percent reduction in production of affected fish populations for the East Alternative would be about 0.19 percent (see Table 19-2). The East Alternative would not pose a substantial risk to listed species because only a fraction of the potential fish production is likely to be lost due to project effects; impacts would be **low**.

19.2.6.1 East Option 1

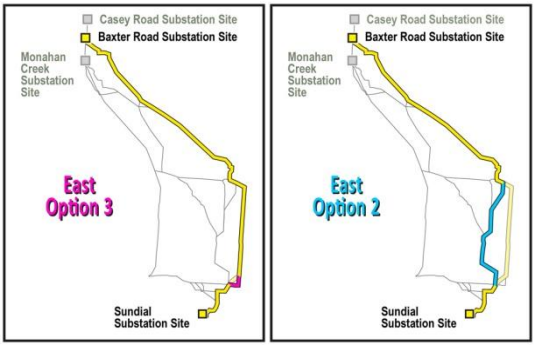


East Option 1 begins at the Monahan Creek substation site and would remove the portion of the East Alternative crossing the Cowlitz River north of Castle Rock. The option would use segments southeast of the Monahan Creek substation site that run through sparsely populated land, cross the Cowlitz River and I-5 and run through largely unpopulated land toward the east. Impacts would be the same as the East Alternative on watershed function, floodplain functions, and from habitat changes affecting ESA-listed and other fish species (all **low** impacts). Impacts on riparian function would also be similar (**low-to-high**), with 11 fewer streams with high shade function, and 11 fewer streams with high potential for large woody debris affected.

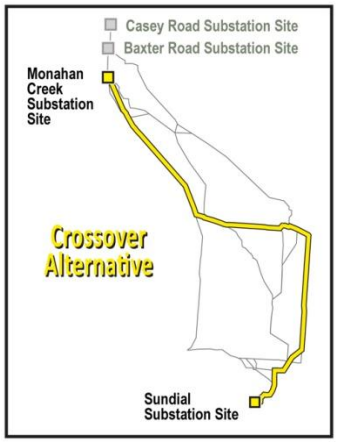
19.2.6.2 East Options 2 and 3

East Option 2 would replace a portion of the East Alternative between Yale and the rural residential areas north of Camas with a route farther to the west. East Option 3 would replace a short portion of the alternative in unpopulated land with a new route through unpopulated land. Impacts would be the same as the East Alternative on watershed function, floodplain

functions, and from habitat changes affecting ESA-listed and other fish species (all **low** impacts). Impacts on riparian function would also be similar (**low-to-high**). East Option 2 would affect five more streams with high shade function, and six more streams with high potential for large woody debris. East Option 3 would affect four more streams with high shade function, and four more streams with high potential for large woody debris.



19.2.7 Crossover Alternative



Transmission line clearing and road construction would cause about 95 miles (1,422 acres) of potential soil disturbance that could contribute sediment to streams through runoff or erosion (see Table 15-2). Compared to the other action alternatives, this would be the third greatest amount of construction and would cause relatively moderate percent increases in runoff (0.47 percent) and sediment delivery (0.17 percent) to fish-bearing streams because moderate levels of mature conifer vegetation would be cleared and less erodible terrain would be crossed. Compared to the West Alternative, there is less existing development, less agriculture, but more conifer cover. Losing more of this conifer cover decreases the amount of vegetation available to intercept snow and rain and causes a higher rate of snowmelt (see Appendix K). Still, the loss of mature vegetation would not be as great as the East Alternative. Also compared to the West Alternative, the underlying geology along the Central Alternative is mostly hard rock that does not easily erode. Though more soil would be exposed, there would be less sediment delivery to streams. This change would occur across a large watershed area of approximately 184,000 acres. Isolated actions could cause **high** impacts to fish-bearing streams. Generally, however, long-term changes in watershed conditions and functions would be minor, and impacts would be **low**.

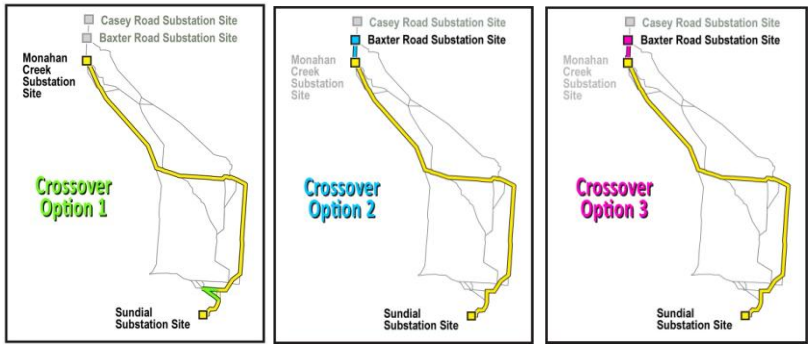
Riparian vegetation would be cleared at 55 forested crossings of fish-bearing streams (see Table 19-2). Compared to other action alternatives, this would be the second most forested crossings. Most forested crossings (32) would occur where the existing shade level provides effective stream cooling and where shade loss is more likely to cause temperature increases that adversely affect aquatic life; impacts from loss of shade function would be **high**. Most forested crossings (31) would occur where the existing riparian vegetation provides high large woody debris recruitment potential; impacts to loss of large woody debris function would be **high**. This is the third greatest number of high impacts among the action alternatives. Similar to the Central Alternative, crossings along the Crossover Alternative provide greater shade function for streams, including fish-bearing streams. Crossings tend to have greater conifer species composition, narrower streams, and are at higher elevations. Conifers are also more effective than hardwoods in providing shade and large woody debris. Relatively fewer high impacts would occur along the Crossover Alternative because fewer fish-bearing streams would be crossed.

The Crossover Alternative would clear 7.3 acres of floodplain vegetation and has a total floodplain impact area of 9 acres (includes towers, roads, and new right-of-way vegetation clearing) (see Appendix K). These amounts are the lowest of the action alternatives because the route crosses smaller stream systems with small floodplain areas with potential fish populations. The number of new towers and length of roads would be less than the West Alternative, but more than the East and Central alternatives. Also, a large amount of clearing has already occurred within many of these floodplain areas. Because the total impact area is small and existing floodplains are already impaired and disconnected, impacts to fish from project-related floodplain impacts would be **low**.

This alternative would potentially have the highest impacts on fish, based on the Integrated Fish Impacts index (see Table 19-2). Fish production potential is higher at this alternative's crossings, and highly-functioning riparian vegetation would be cleared. This alternative would cross a greater number of anadromous fish-bearing streams, including many low to intermediate elevation streams that produce more fish and more species of fish on a per unit-length basis. Affected populations are more frequently identified in the salmon recovery plan as high priorities for habitat protection or restoration (see Appendix K).

The average percent reduction in production of affected fish populations for the Crossover Alternative would be about 0.20 percent (see Table 19-2), the highest of the action alternatives. Still, the Crossover Alternative would not pose a substantial risk to listed species because only a fraction of the potential fish production is likely to be lost due to project effects; impacts would be **low**.

19.2.7.1 Crossover Options 1, 2 and 3



Impacts would be the same as the Crossover Alternative on watershed function, floodplain functions, and from habitat changes affecting ESA-listed and other fish species (all **low** impacts). Impacts on riparian function would also be similar (**low-to-high**). Crossover Option 1 would affect one more stream with high shade function. Crossover Option 3 would affect two more streams with high shade function, and one more stream with high potential for large woody debris.

19.2.8 Recommended Mitigation Measures

Mitigation measures included as part of the project have been identified (see Table 3-2). The following additional mitigation measures have been identified to further reduce or eliminate adverse impacts on fish resources by the action alternatives. If implemented, these measures would be completed before, during, or immediately after project construction unless otherwise noted.

- Route transmission lines to minimize the length of stream cleared.
- Avoid or minimize clearing of riparian and floodplain vegetation where possible.
- Plant riparian vegetation, hydroseed, or use geotextiles to stabilize stream banks.
- Place wood instream along streams cleared for transmission line crossings.
- Apply silvicultural treatments (hardwood conversion to conifer to improve conifer component and thinning) in adjacent riparian forests to improve adjacent timber stand conditions and subsequently, riparian function.
- Ensure that new or reconstructed floodplain roads are at grade and do not reduce flood inundation extents. Ensure that roads and towers are not placed in areas that would disrupt channel migration processes (e.g., lateral migration or avulsions).
- Follow all mitigation measures contained in any Biological Opinions issued by NOAA Fisheries and/or USFWS for ESA-listed fish species.
- Develop a compensatory mitigation plan to offset unavoidable impacts to fish habitat

19.2.9 Unavoidable Impacts

If erosion control mitigation measures are implemented, there would still be some increase in erosion and runoff to fish-bearing streams. Riparian vegetation would also be removed within and outside of the right-of-way and along some new access roads at fish-bearing streams. This would reduce shade at these streams, which could lead to increased temperatures that could affect fish. Removing vegetation also decreases the amounts of large woody debris and litter that could fall into streams, which would reduce the benefits to fish derived from this material, such as increasing channel complexity and aiding the formation of pool and backwater eddies necessary for fish survival. Reducing future wood sources can also lead to simplification of habitat and destabilization of channel beds over time. This would reduce the production of affected fish species in these streams. Clearing vegetation in currently connected and functional floodplains would have some impact on hydraulic roughness and could potentially increase the incidence of **channel avulsions** that are beneficial to fish. Clearing floodplain vegetation could also affect nutrient exchange with the stream as well as long-term large wood recruitment and stream shade.

19.2.10 No Action Alternative

The No Action Alternative would have **no** impact on fish because no construction would take place. Impacts from operation and maintenance of existing transmission lines would continue unchanged. Impacts from other land uses such as forest production, rural and urban land development, agriculture, and hydroelectric projects would continue.

Chapter 20 Climate

This chapter describes existing climate conditions in the project area, and how the project alternatives could affect or be affected by climate conditions.

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

20.1 Affected Environment

The term "climate" includes temperature, humidity, atmospheric pressure, wind, rainfall, fog and snow, atmospheric particulate concentration, and other meteorological elements, in a given region over long periods of time. Climate can be contrasted to "weather," which is the present condition of these same elements and their variations over shorter periods.

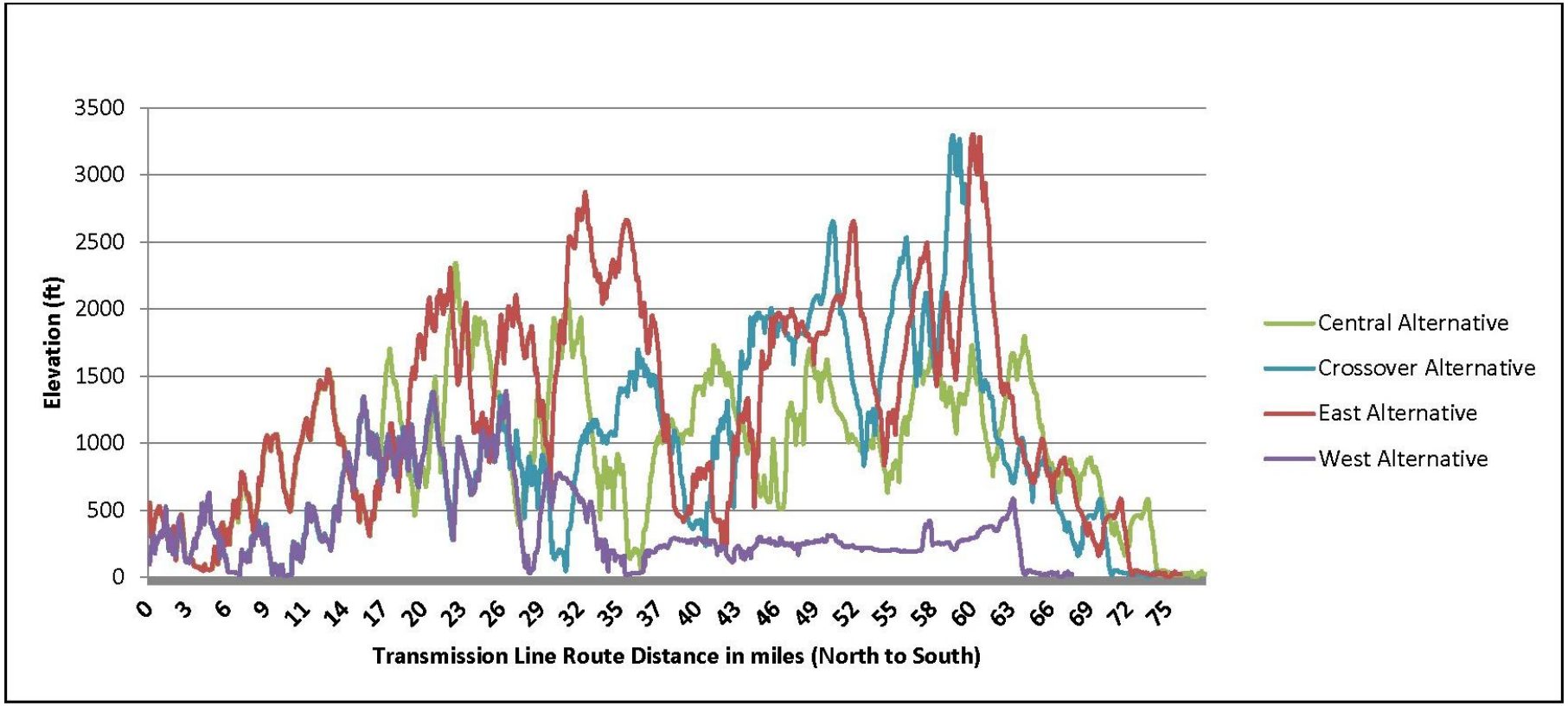
The Columbia River Valley, the Cascade Mountain Range, and the western foothills of the Cascade Mountains have a major influence on weather patterns in the project area.

The Columbia River Gorge provides an open passage between the Washington and Oregon Cascades that allows an exchange of air between the eastern and western parts of each state. The direction and speed of air movement through the Gorge is determined primarily by the pressure gradient between the eastern and western slopes of the mountains. In summer, the flow of air is usually from west to east, caused by rising air masses in the heat of eastern Oregon and Washington, and in winter from east to west, as low pressure winter storms come in from the Pacific Ocean. During the winter season, easterly winds in the Gorge sometimes reach gale force. Severe ice storms or "silver thaws," as they are frequently called, occur in a narrow area westward from the Gorge to the Vancouver, Washington area. Silver thaws are caused by rain falling through a layer of cold dry air flowing westward through the Gorge from sub-freezing conditions in eastern Washington.

Climate elements in the project area include precipitation (i.e., rain, snow), temperature, wind, fog, and severe storms. These elements can vary across the project area and between the lower elevations in the valleys and the higher elevations in the western foothills of the Cascade Range. In general, the likelihood of severe climatic conditions increases toward the higher-elevation eastern part of the project area, where portions of the East Alternative and East Option 2 routes and the southern part of the Central and Crossover alternatives and options are located. Some parts of the East and Crossover alternatives would be above 3,000 feet (see Figure 20-1).

The eastern parts of the project area get about 71 inches of snow and over 85 inches of rain each year. The higher elevations in the western foothills of the Cascade Range are also exposed to high winds, more heavy fog conditions, and frequent temperatures below 32°F during winter. The western parts of the project area are lower (less than 200 feet above mean sea level) and have a more moderate climate. About 46 inches of rain and less than 5 inches of snow occur each year, with only a few days with temperatures below 32°F. The lower elevations also have fewer heavy fog days and low winds relative to the higher elevations.

Figure 20-1 Elevation Comparison of the Action Alternatives



20.2 Environmental Consequences

General impacts that would occur for the action alternatives are discussed below. Impacts would be similar for all action alternatives.

20.2.1 Impact Levels

Impacts would be **high** where project activities would cause the following:

- Long-term, macro-scale changes in physical parameters occur to the local or regional climate.

Impacts would be **moderate** where project activities would cause the following:

- Long-term **micro-climate** changes in physical parameters occur to the local climate.

Impacts would be **low** where project activities would cause the following:

- Short-term, micro-climate changes in physical parameters occur to the local climate
- Short-term interruption of construction, operation, and maintenance of the transmission line due to climate could occur, but could be mitigated

No impact would occur where there would be no change in local or regional climate from the transmission line and where climatic conditions would not interrupt construction, operation, or maintenance of the transmission line.

20.2.2 Impacts Common to Action Alternatives

Climate could be directly affected by long-term, large-scale changes in physical parameters such as **transpiration** (loss of water vapor from parts of plants), **albedo** (solar reflectivity of the earth's surface), or changes in topography and atmospheric composition. The proposed project's effect on transpiration would be tiny on the climate scale because project activities that could affect the existing amount of transpiration (i.e., clearing of vegetation) occur in an area representing only a tiny fraction of the total amount of vegetation in the region (see Chapter 17, Vegetation, for acreages of vegetation that would be cleared under each alternative). In addition, although the project would clear taller growing vegetation within the right-of-way and danger trees outside of the right-of-way, areas in the right-of-way between towers and around the towers themselves would continue to support low-growing vegetation or be reseeded with a native plant mix. Beyond the right-of-way, trees would be allowed to grow back. The extremely small footprint of the project on the earth's surface also would not significantly alter solar reflectivity of the earth, causing no effects related to albedo. Finally, the project would cause only relatively minimal changes in topography at locations where minor grading is required, and would not create emissions that would affect overall, long-term atmospheric composition. For these reasons, **no** impact to climate would occur from the action alternatives.

Climate may have a direct effect on construction as well as ongoing operation and maintenance activities. Wind, rain, ice, or fog could prevent construction equipment from accessing the right-of-way, particularly in areas at higher elevations along the East Alternative and East Option

2 and parts of the Central and Crossover alternatives and options (see Figure 20-1). During operation of the project, snow and ice loading (including silver thaw events) and wind loading could add forces to and increase the stresses on transmission lines, towers, and tower foundations. Snow, ice, fog, rain, or wind could also accelerate the degradation of access roads, requiring increased maintenance. These impacts would be **low** because transmission facilities would be engineered and designed for climate conditions in the project area. Construction and maintenance activities would be scheduled to take advantage of seasonal weather conditions, if possible.

20.2.3 Recommended Mitigation Measures

Mitigation measures included as part of the project are identified in Table 3-2. The following additional mitigation measure is recommended to further reduce or eliminate adverse impacts from climate on the project.

- Schedule construction and maintenance activities by seasonal accessibility

20.2.4 Unavoidable Impacts

No unavoidable impacts to climate have been identified. Unavoidable impacts from climate on the project could include delayed or otherwise changed construction schedules, or delayed access to transmission facilities during operation and maintenance.

20.2.5 No Action Alternative

The No Action Alternative would have **no** impact to or from climate because no new transmission lines, substations, or access roads would be constructed. Operation and maintenance of existing lines, substation, and roads would continue to occur, and climate elements would continue to have impacts on these facilities and activities.