SECTION 3.1 EARTH
(WAC 463-60-302)

3.1.1 INTRODUCTION

The proposed Whistling Ridge Energy Project would be located approximately 7 miles west of the town of White Salmon and approximately 2 miles east of the Little White Salmon River in Skamania County, Washington. The project area is located on private land immediately north of the Columbia River Gorge National Scenic Area boundary. Existing conditions, potential impacts, and, where appropriate, mitigation measures are discussed below. The following sections include detailed evaluation of geology, soils, topography, unique physical features, and erosion/enlargement of the land area.

URS conducted a preliminary geotechnical investigation in 2007, including review of aerial photographs, geologic reconnaissance, test pit analyses, field soil resistivity testing, dynamic cone penetration tests, laboratory testing of soil samples, data analyses, and preparation of design and construction recommendations for the wind energy tower foundation systems and design of approach roadways. See Appendix A for an updated version of the November 2007 geotechnical report.

Site-specific measures have been identified to mitigate potential hazards. With standard and site-specific mitigation measures, impacts on the natural earth environment from the construction and operation of the Whistling Ridge Energy Project are expected to be minor.

3.1.2 GEOLOGY

The White Salmon, Washington area is located within the Cascade Range and the Columbia Intermontane Physiographic Province. The project area is located just within the western boundary of the Columbia Plateau, which is located at the western edge of the Columbia Intermontane Physiographic Province (Freeman et al. 1945). This lowland province is surrounded on all sides by mountain ranges and highlands, and covers a vast area of eastern Washington and parts of northeastern Oregon and western Idaho. The Columbia Plateau is underlain by a series of layered basalt flows extruded from vents (located mainly in southeastern Washington and northeastern Oregon) during the Miocene epoch (between 5.3 and 23.8 million years BP). Collectively, these basalt flows are known as the CRBG. Individual basalt flows range in thickness from a few millimeters to as much as 300 feet. Where significant time elapsed between successive flows, interflow zones developed. The interflow zones are characterized by the presence of highly weathered basalt and paleosols. These interflow zones are generally significantly weaker than the surrounding basalt and sometimes form basal failure surfaces for large landslide complexes within the CRBG.

A variety of younger volcanic rocks and sedimentary materials that range from Pliocene (1.8 to 5.3 million years BP) to Holocene (less than 10,000 years BP in age) overlie the CRBG in the project area. Sedimentary rocks are generally thought to underlie the basalts in the project area.

The proposed project site is located within the northern boundary of the structural Hood River Valley, which extends a few miles into southern Washington. In general, the geology of the area consists of basalt flows extruded from local vents, layered with conglomerate, tuff, tuff breccias, and other volcanoclastic deposits. These formations are typically overlain by silt and clay soil of varying thickness in the project vicinity.

The bedrock underlying the proposed project site consists of Grande Ronde Basalt of the CRBG and Quaternary basalt of Underwood Mountain—a shield volcano that lies approximately midway between the lower reaches of the Little White Salmon and White Salmon Rivers. Its southern slopes drain to the Columbia River. Site geology excerpted from Korosec (1987) is presented on Figure 3.1-1.

Underwood Mountain Basalt Unit: The Pleistocene-epoch (1.8 million years to 10,000 years BP) basalts and cinders erupted from the Underwood Mountain vents and overlie the Tertiary CRBG Grande Ronde and Wanapum basalts. Public records of wells located within the Underwood volcanic field indicate a 310-foot-thick repetitive sequence of thin lava flows (two to eight feet thick), cinders and silty-clays overlying a productive confined aquifer consisting of intensely fractured Grande Ronde basalt. The Miocene-epoch Grand Ronde Basalt consists of multiple basalt flows that are a subgroup of the CRBG, and has been described to have a thickness of up to 1,000 feet, although the thickness in the project vicinity is not known.

Field observations of rock outcrop and test pits excavated during a geotechnical investigation at the proposed site indicate that the near-surface rock consists of yellow-gray volcanoclastic rocks, medium to dark gray, fine-grained to medium-grained basalt and andesite, which is fractured into angular gravels, cobbles, and boulders. The basalt observed in the test pits was most commonly vesicular, very soft to moderately hard, and decomposed to slightly weathered. Some zones displayed non-vesicular characteristics and were generally harder. In most exposures the basalt was moderately to highly weathered, with fractures and vesicles filled by clayey residual soil. In most of the test pits excavated in this basalt, the rock is weathered into varying layers of residual (clay) soil, and clayey gravelly cobble-sized basalt. The residual soil layers often exhibit remnant rock structure.

Unconsolidated Deposits: Unconsolidated deposits are thin to absent in the project vicinity. Based on observations made during field reconnaissance, the surficial materials consisted primarily of a thin veneer of brown, silty topsoil that is likely derived from forest duff and wind-blown deposits. The thickness of this material varied across the site from a few inches to three feet, based on test pit observations. In several areas, bedrock and talus were observed at the ground surface.

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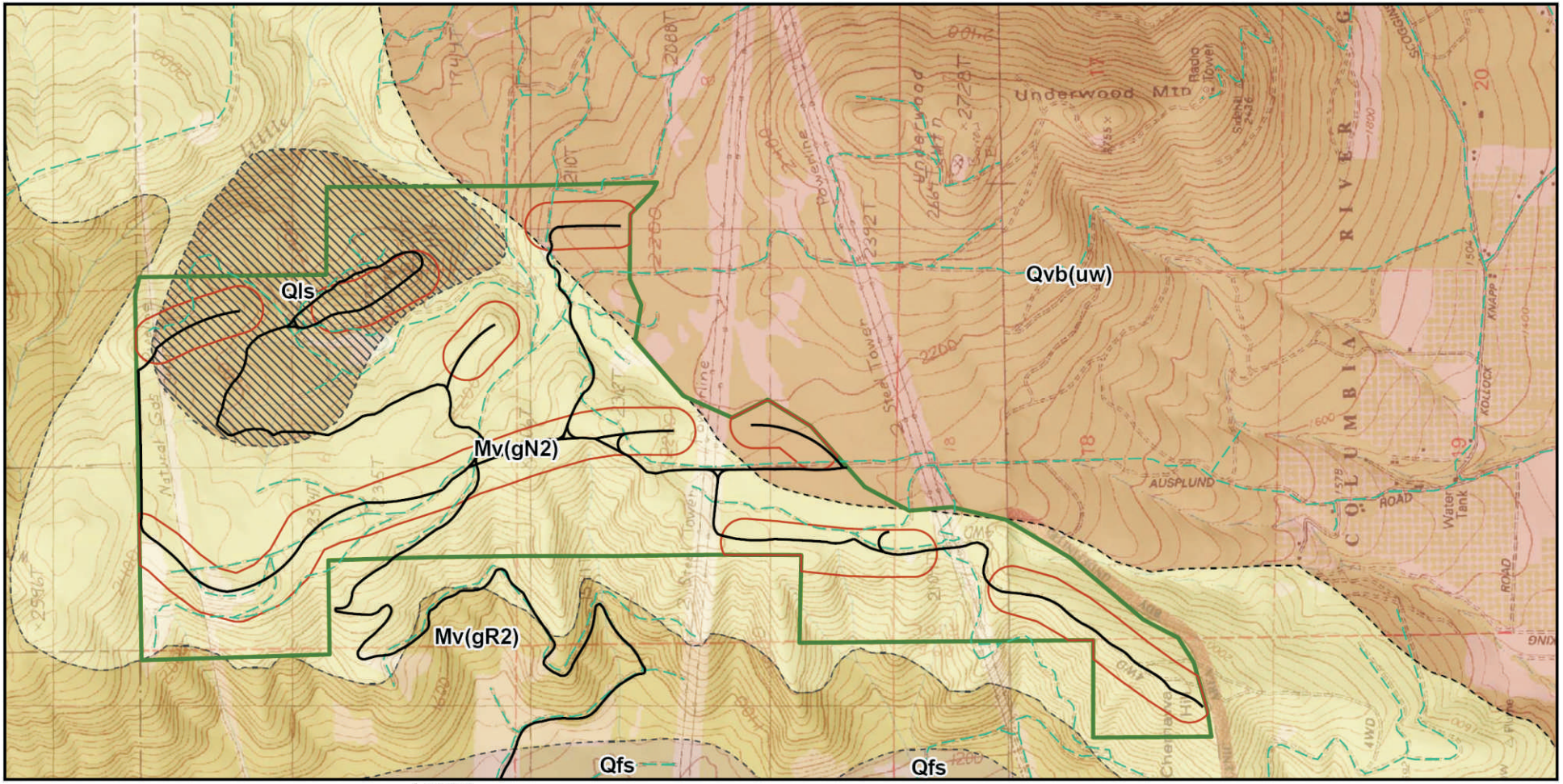

Legend

Geologic Rock Units (Legend)

- Mv(gN2)--Basalt Flows (Grande Ronde Basalt, upper flows of norm.mag.pol.)
- Mv(gR2)--Basalt Flows (Grande Ronde Basalt, upper flows of rev.mag.pol.)
- Qfs--Outburst Flood Deposits, Sand and Silt, Late Wisconsin
- Qls--Mass-Wasting Deposits, Mostly Landslides
- Qvb(uw)--Basalt Flows
- Local Road
- Micrositing Corridor
- Site Boundary

N E S W

0 500 1,000 2,000 3,000 4,000 Feet

Source: Korosec, 1987.

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Revised Figure 3.1-1

Site Geology

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Landslide Deposits: Regional geologic maps indicate the presence of Quaternary-age mass wasting landslide deposits located to the north of Underwood Mountain (Figure 3.1-1). These deposits are mapped as a large landslide, estimated to be approximately 1/3 square mile in area and almost a mile long. A URS engineering geologist reviewed stereo aerial photographs that were flown specifically for this project in 2007 and performed a one-day site reconnaissance. There is no obvious evidence, based on the review, to suggest the presence of a landslide as mapped on the 1:100,000 scale geologic map. If landslide deposits are present, they are so old that most or all of the geomorphic evidence has been removed by erosion.

During the current subsurface exploration, groundwater was not encountered in the site up to a depth of 16 feet bgs. It should be noted that these observations reflect groundwater levels at the time of the field investigation and actual groundwater levels may fluctuate significantly in response to seasonal effects, regional rainfall, and other factors not observed during this investigation. There may be regional or perched water tables at greater depth. Prior to final design of the tower foundations, additional subsurface investigations (boreholes) would be required to provide geotechnical data at foundation and anchor depths. Future deep foundation investigations would include observation of groundwater, if encountered.

3.1.3 SEISMICITY

Strong ground motions potentially affecting the site can be generated from earthquakes on several regional seismic sources. Earthquakes are the result of sudden releases of built-up stress within the tectonic plates that make up the earth's surface. The stresses accumulate because of friction between the plates as they attempt to move past one another. Earthquakes in the Pacific Northwest can originate from four different types of sources: (1) interplate earthquakes on the CSZ, (2) intraplate earthquakes within the subducting Juan de Fuca plate as it sinks and breaks up below the North American plate, (3) shallow crustal earthquakes on faults within the North American plate, and (4) volcanic earthquakes such as those associated with the eruption of Mount St. Helens. These sources are depicted on Figures 3.1-2 and 3.1-3. The largest historical earthquakes in Washington, southern British Columbia, and northern Oregon are shown on Figure 3.1-4 and summarized in Table 3.1-1.

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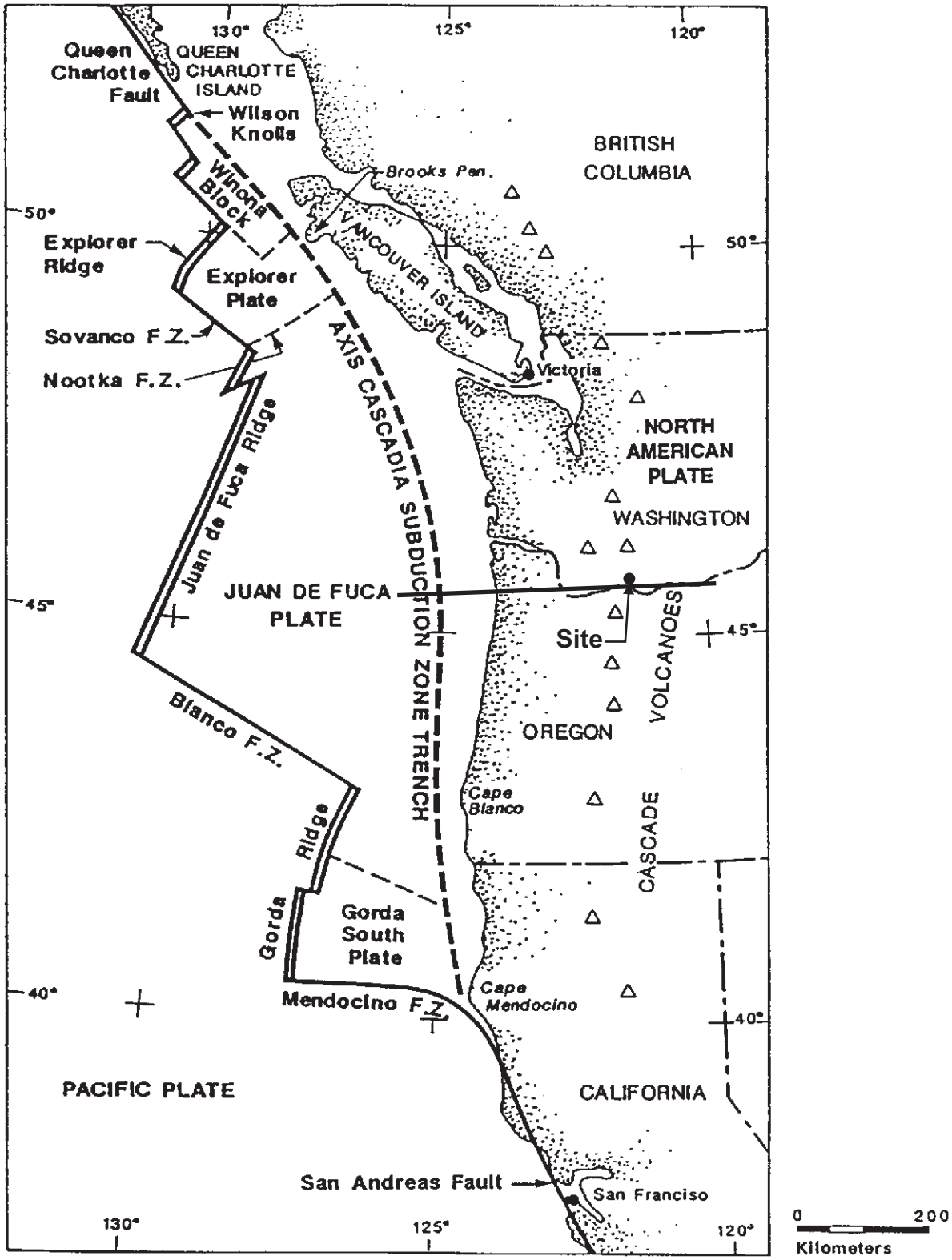

△ Cascade Volcano

Line of Cross Section on Figure 3.1-3

Modified from Washington Public Power Supply System (1988) (after Riddihough, 1984).

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Figure 3.1-2

Tectonic Setting of the Cascadia Subduction Zone

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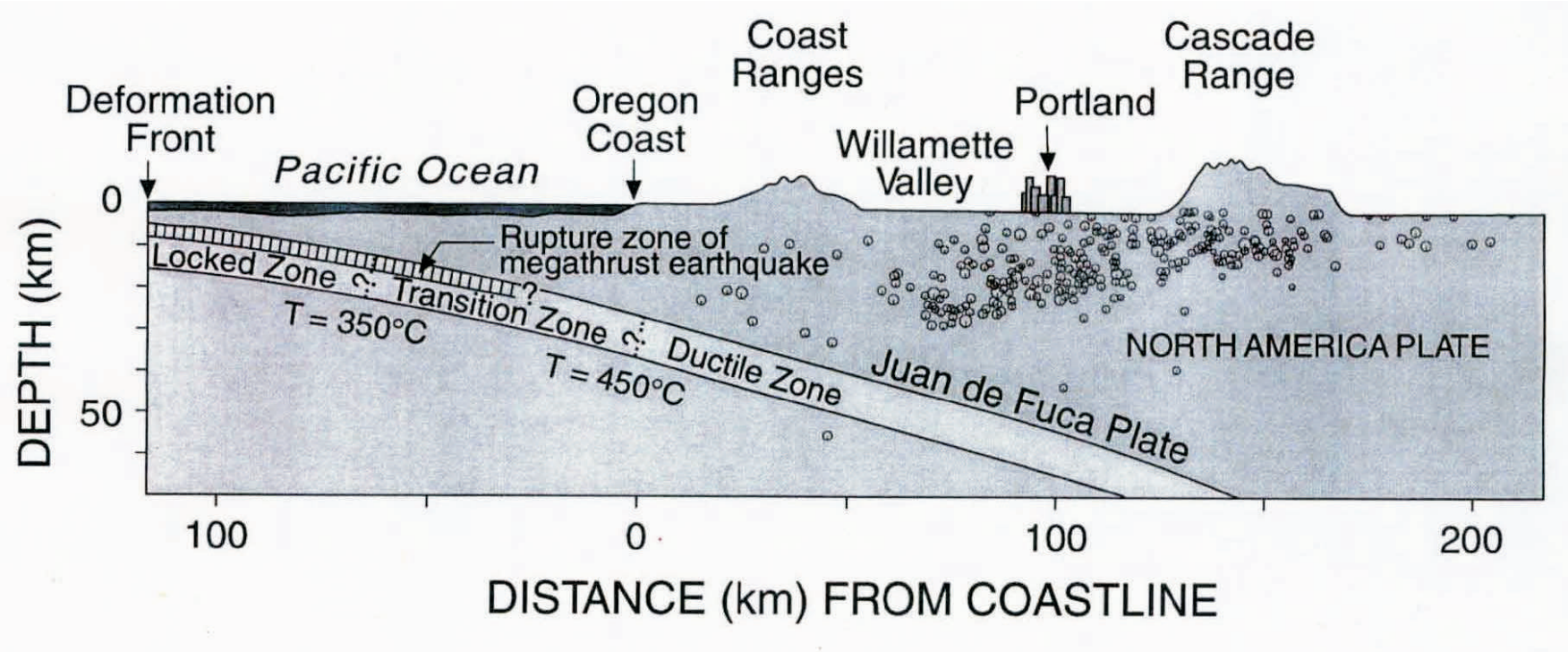

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Figure 3.1-3

Cascadia Subduction Zone

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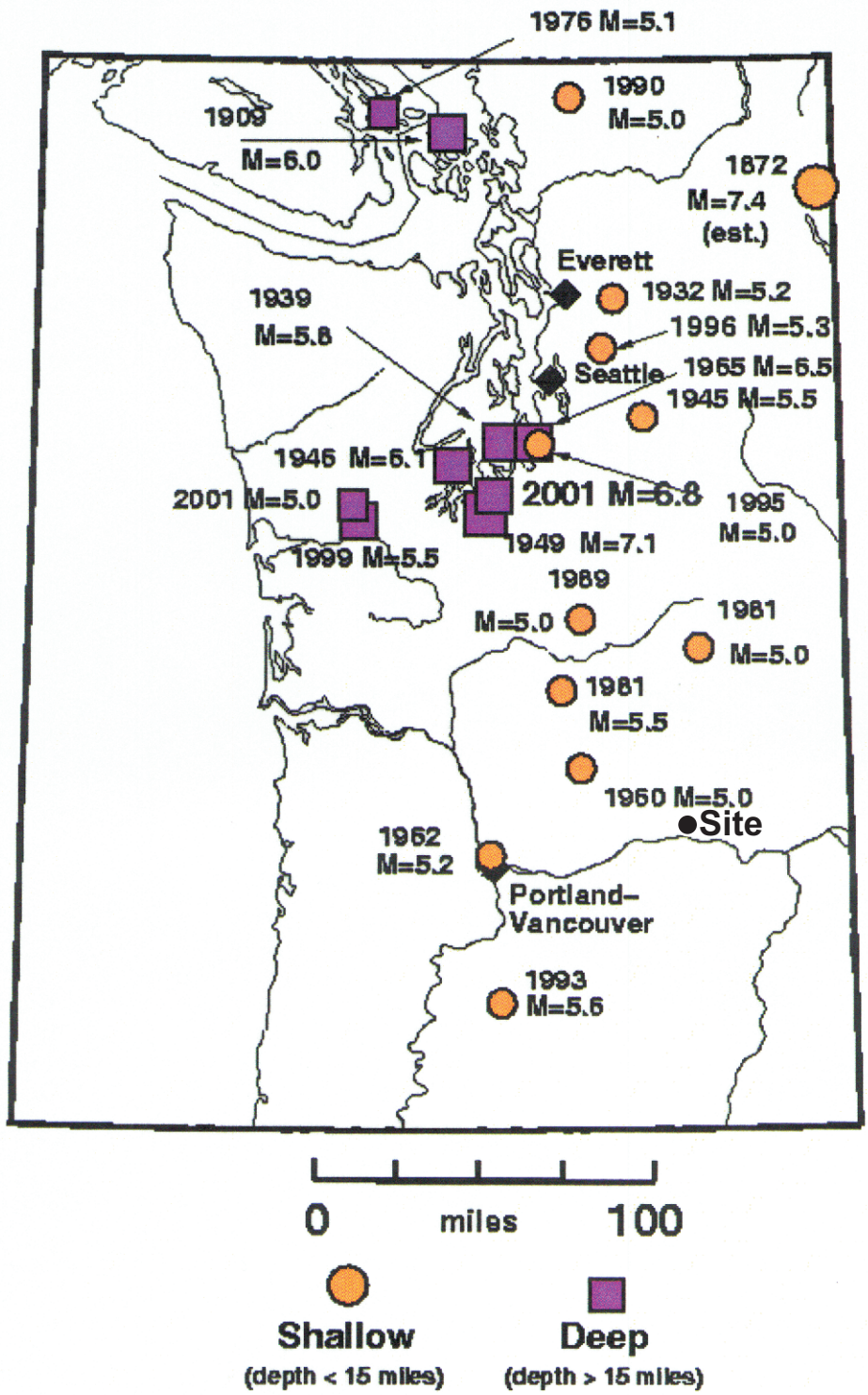

Source: University of Washington

Figure 3.1-4

Epicenters and Dates of
M 5.0 Pacific Northwest Earthquakes

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Table 3.1-1
Largest Known Earthquakes Felt in Washington

Year	Date	Time (PST)	North Latitude	West Longitude	Depth (km)	Mag (felt)[a]	Mag (inst)[b]	Max. Mod. Mercalli Intensity	Location[c]
1872	12-14	2140	48°48'00"	121°24'00"	shallow	7.3	None	IX	North Cascades (Chelan area[d])
1877[e]	10-12	1353	45°30'00"	122°30'00"	shallow	5.3	None	VII	Portland, Oregon
1880	12-12	2040	47°30'00"	122°30'00"			None	VII	Puget Sound
1891	11-29	1521	48°00'00"	123°30'00"			None	VII	Puget Sound
1893	3-6	1703	45°54'00"	119°24'00"	shallow	4.7	None	VII	Southeastern Washington
1896	1-3	2215	48°30'00"	122°48'00"		5.7	None	VII	Puget Sound
1904	3-16	2020	47°48'00"	123°00'00"		5.3	None	VII	Olympic Peninsula, eastside
1909	1-11	1549	48°42'00"	122°48'00"	deep	6	None	VII	Puget Sound
1915	8-18	605	48°30'00"	121°24'00"		5.6	none	VI	North Cascades
1918[e]	12-6	41	49°37'00"	122°55'00"		7	7	VIII	Vancouver Island
1920	1-23	2309	48°36'00"	123°00'00"		5.5	none	VII	Puget Sound
1932	7-17	2201	47°45'00"	121°50'00"	shallow	5.2	none	VII	Central Cascades
1936	7-15	2308	46°00'00"	118°18'00"	shallow	6.4	5.75	VII	Southeastern Washington
1939	11-12	2346	47°24'00"	122°36'00"	deep	6.2	5.75	VII	Puget Sound
1945	4-29	1216	47°24'00"	121°42'00"		5.9	5.5	VII	Central Cascades
1946	2-14	1918	47°18'00"	122°54'00"	40	6.4	6.3	VII	Puget Sound
1946[e]	6-23	913	49°48'00"	125°18'00"	deep	7.4	7.3	VIII	Vancouver Island
1949	4-13	1155	47°06'00"	122°42'00"	54	7	7.1	VIII	Puget Sound
1949[e]	8-21	2001	53°37'20"	133°16'20"		7.8	8.1	VIII	Queen Charlotte Isl., B.C.
1959	8-5	1944	47°48'00"	120°00'00"	35	5.5	5	VI	North Cascades, east side
1959[e]	8-17	2237	44°49'59"	111°05'	10-12	7.6	7.5	X	Hebgen Lake, Montana
1962[e]	11-5	1936	45°36'30"	122°35'54"	18	5.3	5.5	VII	Portland, Oregon
1965	4-29	728	47°24'00"	122°24'00"	63	6.8	6.5	VIII	Puget Sound
1981	2-13	2209	46°21'01"	122°14'66"	7	5.8	5.5	VII	South Cascades
1983[e]	10-28	606	44°03'29"	113°51'25"	14	7.2	7.3	VII	Borah Peak, Idaho
1990[f]	4-13	2133	48°50'42"	122°9'40"	3	12	5.2	VI	Deming
1993[e]	3-25	535	45°02'00"	122°36'26"	16		5.6	VII	Scotts Mills, Oregon
1995[g]	1-29	1511	47°23'24"	121°21'36"	20		5	V	Robinson Pt., Vashon Island
1996[h]	5-02	2104	47°45'36"	121°51'00"	7		5.3		Duvall

Year	Date	Time (PST)	North Latitude	West Longitude	Depth (km)	Mag (felt)[a]	Mag (inst)[b]	Max. Mod. Mercalli Intensity	Location[c]
1999[h]	7-02	0543	47°'33	123°'49"	41		5.8	VI	Satsop
2001[h]	2-28	1054	47°9'9"	122°43'11"	52		6.8	VIII	Nisqually
2001[h]	6-10	0519	47°9'58"	123°0'21"	41		5.0	V	Satsop

Data from Noson et al. (1988), except where noted otherwise

a. Mag (felt) = an estimate of magnitude, based on felt area; unless otherwise indicated, it is calculated from Mag (felt) = -1.88 + 1.53 log A, where A is the total felt area in km²; from Toppozada (1975).

b. Mag (inst) = instrumentally determined magnitude; refer to references listed in the original Table 2 of Noson et al. (1988), or (e) below, for magnitude scale used.

c. All earthquake epicenters are located within Washington unless noted otherwise.

d. Location uncertain but most recent study (Bakun et al., 2002) indicates the epicenter was near Lake Chelan

e. Earthquakes with epicenters outside Washington.

f. USGS

g. Dewberry and Crosson (1996)

h. Data from University of Washington Geophysics Program viahttp://www.pnsn.org/.

The historic record of seismicity in the Pacific Northwest (approximately 150 years) is insufficient to provide documentation of great earthquakes (i.e., M_w 8 or greater) on the CSZ. There has been a low rate of instrumental seismicity recorded and the CSZ was originally thought to be incapable of generating great earthquakes. In the late 1980s, Rogers (1988) and Heaton and Hartzell (1986) inferred that an M_w 9 CSZ earthquake could occur that would rupture the entire 900-kilometer length of the Juan de Fuca plate between the Explorer plate(offshore Vancouver Island, BC) and Gorda plate (offshore northwern California). Geodetic data indicate that western Washington and southwest British Columbia are moving to the northeast with respect to stable North America and the rates of movement diminish landward (McCaffrey et al. 2007). Geologic studies along the Oregon and Washington coasts in the late 1980s through mid-1990s provided data that indicated that multiple great (M_w 8+) earthquakes have occurred on the CSZ during the Holocene (Atwater 1987a, 1987b, and 1992; Carver and Burke 1987; Darienzo and Peterson 1987 and 1990; Grant and McLaren 1987; Peterson and Darienzo 1996; Savage et al. 1991; Adams 1996; Atwater et al. 1995; Nelson and Personious 1996; Shennan et al. 1996) and therefore could occur during the project lifetime. However, it was uncertain whether a single M_w 9+ earthquake or several separate M_w 8+ earthquakes closely spaced in time caused the geologic effects (e.g. subsidence, tsunami deposits, and drowned forests) with similar ages recorded at the various study locations along the Washington and Oregon coasts.

By the mid-1990s there was a general consensus that the CSZ has generated earthquakes of M_w 8+ in the past few thousand years (Atwater et al. 1995, Nelson and Personius 1996, and Weaver and Shedlock 1996), and since then there is increasing evidence that the CSZ has had multiple M_w 8+ and 9+ earthquakes in the last five thousand years (Kelsey et al. 2002 and 2005, Witter et al. 2003, Nelson et al. 1995). Geologic evidence for the most recent great earthquake in 1700 AD has been found at many coastal locations in Washington and Oregon, as well as northern California (Nelson et al. 1995, Yamaguchi et al. 1997). Analysis of historical records of tsunamis in Japan supports the interpretation that a 1700 AD great earthquake on the CSZ was about M_w 9 (Satake and Tanioka 1996, Satake et al. 2003, Atwater et al. 2005).

A single great earthquake of M_w 9+ or multiple M_w 8+ earthquakes occur on the CSZ every several hundred years. At least 10 great earthquakes have occurred in Washington and northern

Oregon in the last 5,000 years with recurrence intervals between the earthquakes ranging from 250 to 900 years. Eight of these 10 events ruptured at least 460 km of the CSZ along the Washington and northern Oregon coasts and the earthquake approximately 1,600 years BP was of similar size and rupture length as the 1700 AD earthquake (Nelson et al. 1995). These earthquakes are expected to occur at depths of approximately 6 to 25 miles beneath coastal and offshore Washington and/or Oregon. An M_w 8+ earthquake on the CSZ offshore southwest Washington and northwest Oregon would generate long period ground motions for a relatively long duration at the Whistling Ridge Energy Project site.

Intraplate seismic events appear to be more widespread geographically and result from rupture within the subducted Juan de Fuca plate at depths of 20 to 55 miles. Based primarily on the historical seismicity of intraplate origin in western Washington and other subduction zones of the world, the intraplate zone is considered capable of generating earthquakes as large as M_w 7.5. Because intraplate earthquakes do not cause deformation at the ground surface that can be distinguished from other types of earthquakes, the typical frequency of these earthquakes cannot be readily assessed. However, these types of earthquakes have historically caused the greatest amount of damage in the Puget Sound region. This source has generated three of the largest historical seismic events to affect the Pacific Northwest: the 1949 Olympia earthquake of magnitude (M) 7.1, the 1965 M_w 6.5 Seattle earthquake, and the 2001 Nisqually M_w 6.8 earthquake. These earthquakes caused substantial damage in central and southern Puget Sound but no substantive damage in the White Salmon area. There have not been any historical, damaging intraplate earthquakes with epicenters located in Oregon or southern Washington in the northern portion of the Willamette Lowland.

There is increasing geologic and geodetic evidence that other regional seismic sources in western Washington and Oregon have the potential to produce shallow continental crust earthquakes. Shallow crustal seismic events appear to be more widespread geographically relative to the other sources of historical seismicity, and often occur along mapped or postulated faults exposed at the earth's surface. A regional geologic fault slip model indicates that the predicted long term velocity of the Oregon Coast Ranges relative to stable North America in southern British Columbia is 1.8 $\pm$ 0.4 millimeters per year (mm/yr) east and 6.9 $\pm$ 0.2 mm/yr north measured at Astoria, Oregon. This is consistent with the geodetic data, which indicate a net velocity of 7.1 $\pm$ 0.4 mm/yr. Of this motion, 4.4 $\pm$ 0.3 mm/yr is likely accommodated by north-northeast shortening across western Washington and the Puget Sound region between Astoria and Bellingham, Washington (McCaffrey et al. 2007). Based primarily on historic and paleo-seismicity, Quaternary shallow crustal faults are considered capable of generating earthquakes greater than M_w 6 and potentially as large as M_w 7.0 to M_w 7.5. The largest historical shallow crustal earthquake is the 1872 North Cascade event, which was initially estimated to be M 7.3 (Noson et al. 1988), but more recently has been relocated to near Lake Chelan and is estimated to have been between M_w 6.5 and M_w 7.0 at the 95% confidence interval (Bakun et al. 2002). The largest instrumentally recorded shallow crustal earthquake in the Portland Basin area is the 1962 M 5.5 earthquake, located 15 km northeast of downtown Portland (Wong and Bott 1995). This has not been definitively associated with a recognized late Quaternary fault.

Studies by Pezzopane (1993), Geomatrix Consultants (1995), and Wong et al. (1999), among others, and more recent compilations by the USGS (Lidke et al. 2003 and Personius et al. 2003)

show numerous shallow crustal faults with evidence of Quaternary displacement and a potential to generate an M_w 6+ earthquake exist in southwestern Washington and northwestern Oregon (Figure 3.1-3). A decade ago, many of these faults were unknown or not recognized as being seismogenic.

No faults are mapped within the footprint of the proposed project area. However, faults are mapped approximately 1.5 miles southwest and northeast of the proposed project area. Many of these faults are inferred and ~~shown as dotted lines~~assumed to be buried by younger surficial deposits. The activity of the area faults is unknown. However, a review of aerial photography shows no indication of recent movement along the trace of the inferred faults.

There has not been an historical surface-rupture earthquake on any fault within northwestern Oregon or southwestern Washington, and paleoseismic investigations of the regional faults have been limited to date. The closest Quaternary faults to the site are the Hood River fault south of the site in Northern Hood River County, Oregon (No. 29 in Figure 3.1-5), the faults near the Dalles east and west of the site (No. 48 in Figure 3.1-5), and the Columbia Hills fault zone on the north shore of the Columbia River southeast of the site (No. 45 in Figure 3.1-5).

According to the updated National Seismic Hazard Maps published by the USGS in 2008 (Peterson et al. 2008 and http://earthquake.usgs.gov/research/hazmaps/), the peak ground acceleration estimated for the ~~Kalama Energy~~Whistling Ridge Energy Project site area is 0.12~~8~~g for a 475-year return period earthquake (i.e., ground motion with a 10 percent chance of being exceeded in 50 years) and 0.24~~40~~g for a 2,475-year return period earthquake (i.e., ground motion with a 2 percent of being exceeded in 50 years).

3.1.3.1 Impacts

Liquefaction is a phenomenon whereby soils undergo significant loss of strength and stiffness when they are subjected to vibration or large cyclic ground motions produced by earthquakes. Typically, cyclic loading of saturated soils leads to the buildup of excess pore-water pressure as a result of soil particles being rearranged with a tendency toward denser packing. Under undrained conditions (such as during earthquake shaking), loads are transferred from the soil skeleton to the pore-water with consequent reduction in the soils' shear strength.

Saturated granular soils without cohesive fines (i.e., gravels, sands, and silts) are most susceptible to liquefaction. Other factors affecting the potential for liquefaction in soils are density, amplitude of loading, confining pressure, past stress history, age of soil deposit, the size, shape and gradation of particles, and the soil fabric structure. Liquefaction-induced ground settlement and lateral spreading have been the primary cause for extensive damage to aboveground structures, foundations, and pipelines during many earthquakes.

Test pits excavated at the project site encountered shallow bedrock covered with a combination of cohesive and cohesionless soil. No groundwater was observed in any of the test pits. Based on the soils encountered during the field explorations, it is URS's opinion that the potential for liquefaction is very low at this site.

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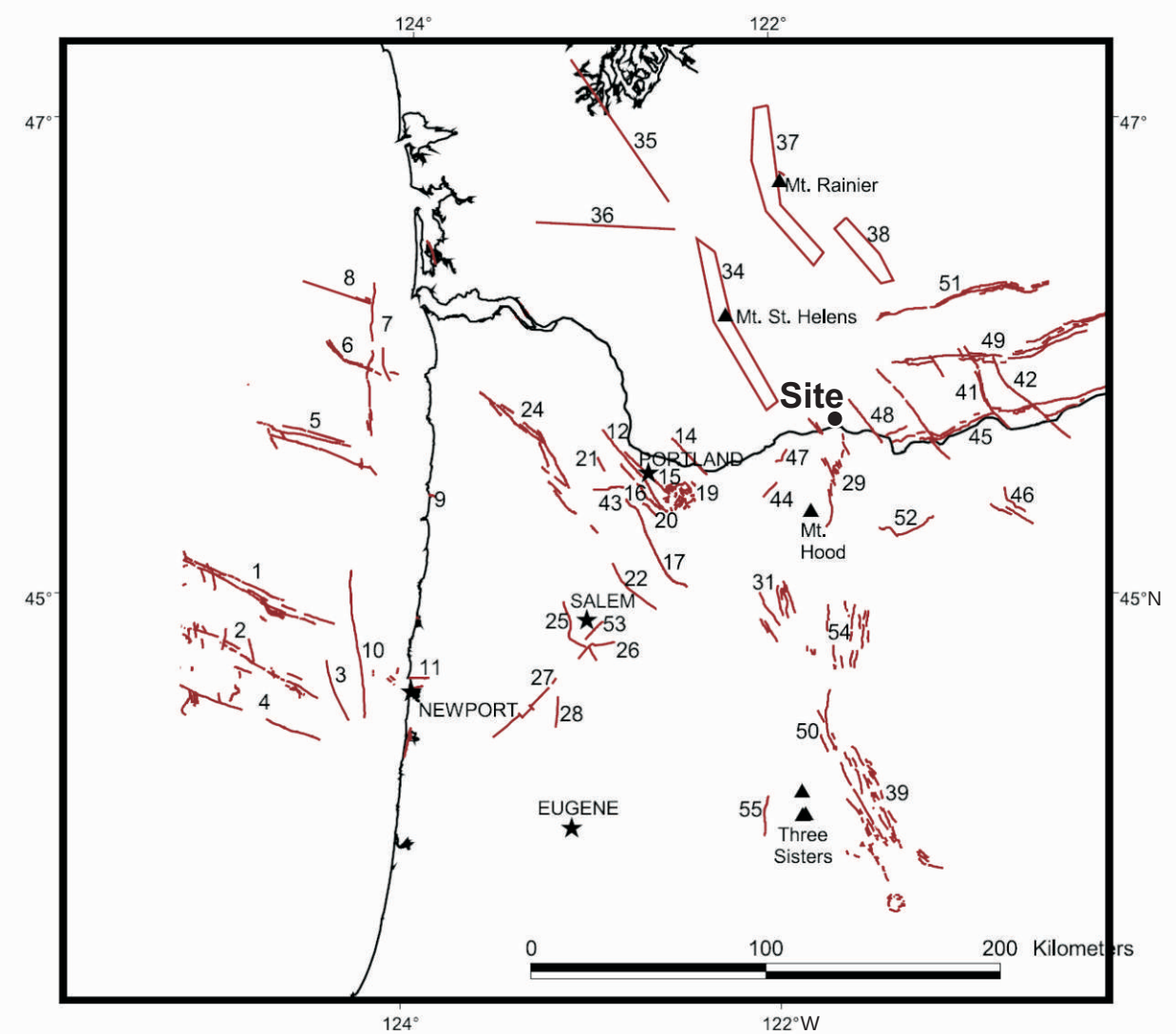

01 - Wecoma Fault
02 - Daisy Bank Fault
03 - Stonewall Bank Fault
04 - Alvin Canyon Fault
05 - Fault G
06 - Fault H
07 - Nehalem Bank Fault
08 - Fault J
09 - Netarts Bay Fault
10 - Yaquina Bay Fault
11 - Waldport Fault
12 - Portland Hills Fault A
14 - Frontal Fault - Lacamas Lake
15 - East Bank Fault
16 - Oatfield Fault
17 - Mollala Canby Fault
19 - Grant Butte Fault
20 - Bolton Fault
21 - Helvetia Fault
22 - Mt. Angel Fault
24 - Gales Creek Fault
25 - Salem Hills Fault
26 - Mill Creek Fault
27 - Corvallis Fault
28 - Owl Creek Fault
29 - Hood River Fault
31 - Clackamas River Fault
34 - St. Helens Fault Zone
35 - Olympia Fault
36 - Doty Fault
37 - Western Rainer Zone
38 - Goat Rocks Zone
39 - Sisters Fault Zone
41 - Oak Flat Fault
42 - Arlington-Shutler Butte Fault
43 - Beaverton Fault
44 - Bull Run Fault
45 - Columbia Hills
46 - Condon Northwest Fault
47 - Eagle Creek Fault
48 - Fault Near Dalles
49 - Horse Heaven Hills Fault
50 - Metolius Fault
51 - Toppenish Ridge Fault
52 - Tygh Ridge Fault
53 - Waldo Hills Fault
54 - Warm Springs-Shitike Fault
55 - White Branch Fault

Figure 3.1-5

Quaternary Faults and Seismic Source Zones in Northwest Oregon and Southwest Washington

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Skamania County, Washington

The risk of seismically induced settlement and lateral spreading is low due to the low liquefaction potential. It is URS's opinion settlements and lateral spread induced by a seismic event would be minimal.

Coseismic surface rupture occurs when a fault breaks to the land surface during an earthquake. Surface rupture is usually associated with moderate to large earthquakes (M_w 6.5 or greater) or rarely during smaller, very shallow events. There are no mapped faults crossing the site. Therefore, the potential for coseismic primary surface rupture at the proposed project site is small.

Seismic slope instability could potentially affect the site access road. However, the proposed access road does not cross any mapped landslides, nor were any observed during a preliminary site investigation.

3.1.3.2 Mitigation Measures

No mitigation measures are proposed beyond adhering to local building codes and standard turbine and foundation design. The proposed facility would comply with the state building code provisions for seismic hazards applicable to the proposed location. Access road designs would comply with applicable county, state, and federal codes.

3.1.4 SOILS

3.1.4.1 Existing Environment

Whistling Ridge Energy Project Site

Soils in the project area are shown on Figure 3.1-6. The NRCS describes the soils in the project vicinity as follows (USDA 2003):

- ~~**Chemawa Series:** The Chemawa series consists of very deep soils (up to five feet) formed in alluvium from volcanic ash and basalt. The soils exist on terraces, footslopes and backslopes at elevations between 800 and 2,500 feet in southeast Skamania County and southwest Klickitat County. Chemawa Soils are well drained with slow to medium runoff and moderate permeability. The Chemawa series soils are present in areas that would be crossed during access to the site, but are not present within the boundaries of the proposed wind turbine site~~

- **McElroy Series:** The McElroy series consists of very deep soils (up to five feet) formed in colluvium and residuum from basalt with a mantle of volcanic ash that influences soils in the top nine to 13 inches. The soils exist on the footslopes and backslopes of mountains on slopes from five to 90 percent at elevations from 400 to 2,600 feet in eastern Skamania County and western Klickitat County. McElroy Soils are well drained with medium to rapid runoff and moderate permeability. The series was established in 1981 following the introduction of volcanic ash from the eruption of Mt. St. Helens.

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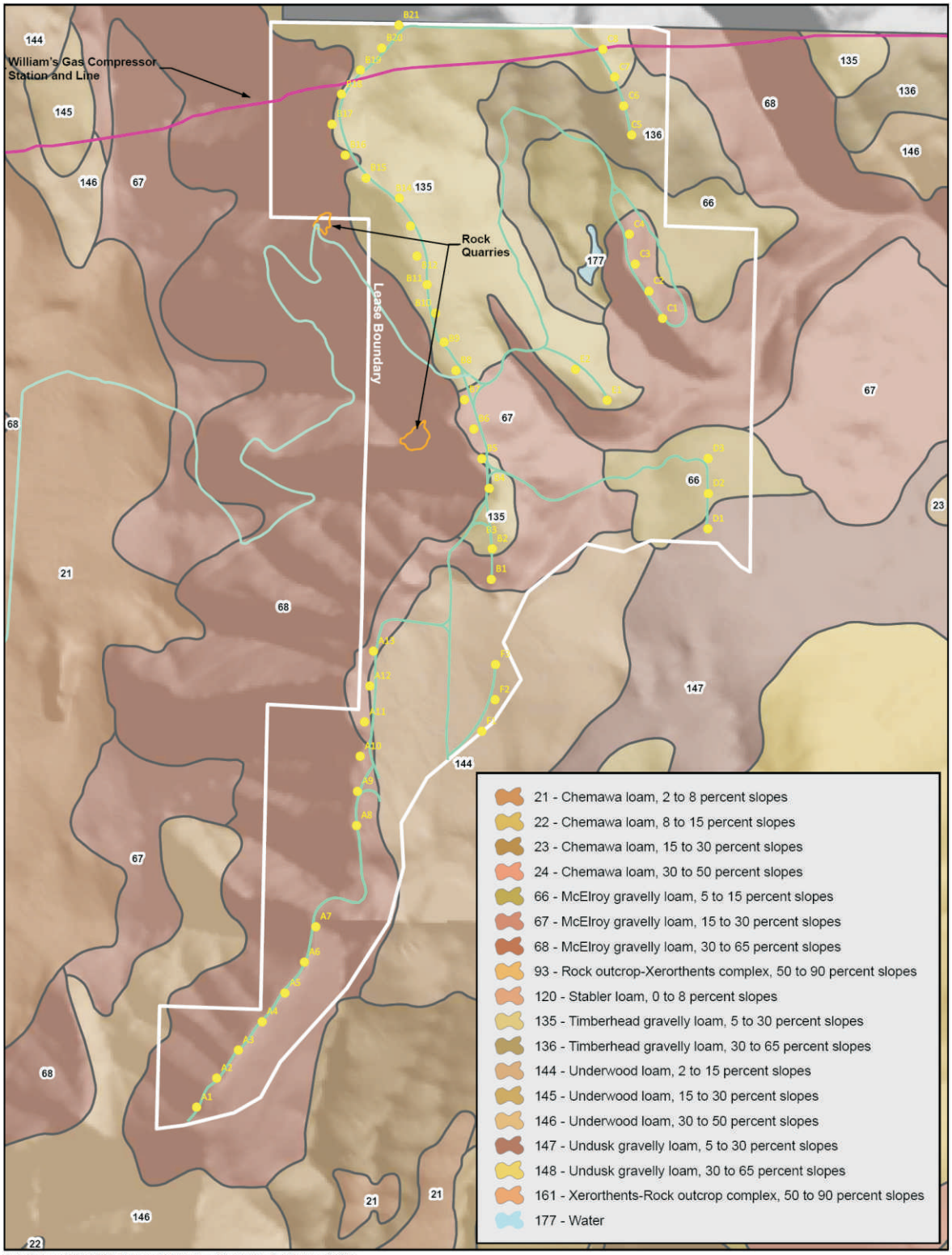

Data Source: USDA NRCS, Skamania County Area, Washington, Soil Survey - WA659

Soil Areas

Towers

Access Roads

N W E S

0 1,250 2,500 Feet

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.1-6

Soil Classifications

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Skamania County, Washington

- **Timberhead Series:** The Timberhead series consists of very deep soils (up to five feet) formed in residuum and colluvium from basalt mixed with volcanic ash. The soils exist on mountain ridges between five and 30 percent at elevations from 2,000 to 3,600 feet in Skamania County and western Klickitat County. Timberhead Series soils are well drained with medium to rapid runoff and moderately high to high permeability.

- **Underwood Series:** The Underwood series consists of very deep soils (five feet or more) formed in residuum and colluvium from basalt and andesite with a thin mantle of volcanic ash. The soils exist on benches, backslopes, and footslopes of mountains with slopes between two and 50 percent at elevations between 500 and 2,700 feet in southeast Skamania County and west Klickitat County. Underwood Series soils are well drained with slow to medium runoff and moderately high permeability.

- **Undusk Series:** The Undusk series consists of very deep soils (five feet or more) formed in residuum and colluvium from basalt and andesite with a thin mantle of volcanic ash. The soils exist on benches, backslopes, and footslopes of mountains with slopes between five and 65 percent at elevations between 2,000 and 2,800 feet in southeast Skamania County and west Klickitat County. Undusk Series soils are well drained with slow to medium runoff and moderately high permeability.

Based on the current test pits and field observations, the site soil is best represented as ~~Stiff Soil~~Soft Rock (IBC Soil Site Class ~~D~~B). Rock, with varying strength and weathering characteristics, was encountered at shallow depths (ranging from three to 12 feet bgs).

Prior to final design of the tower foundations, additional subsurface investigations (boreholes) would be required to provide geotechnical data at foundation and anchor depths.

3.1.4.2 Impacts

Whistling Ridge Energy Project Site

Foundations for the wind turbines and the grading plan would be determined during final design.

Because surface soils on the project site are considered moderately susceptible to erosion, there is potential for adverse impacts on the site soil in areas of steep topography during grading and foundation construction activities.

Roadway Improvements

Improvements to existing roadways and construction of new access and maintenance roads are anticipated for construction and operations of the proposed facility. For the current proposed number of wind turbines, approximately 350 over-size and/or overweight loads would be required over the County and site roads for the towers only, in addition to construction equipment. This quantity does not include delivery of construction materials such as concrete required for the foundation, grading equipment to construct roads and prepare the site or other

construction traffic not associated with the Whistling Ridge Energy Project. Improvements to the County roadways and the private logging roads would be necessary to support the long and heavy loads that would be required for the delivery of the wind energy components from SR 14 to the proposed project site are discussed in Section 4.3.2.2, Roadway Improvements~~.~~.

URS drove and observed the haul roads on the property during our September 2007 and June 2009 site visits. The existing logging road (~~CG2930~~West Pit Road) to the site has been used primarily for accessing stands of timber for harvesting and exporting timber from the site. At the time of the June 2009 site visit, ~~The~~ the dirt road ~~is currently~~ was surfaced with soil and rock, ~~and is~~ was in poor condition, and ~~. In its current state the road is~~ not suitable for the trucks that would be carrying the wind tower equipment. Roadway improvements were made during the summer 2009 to widen the road for logging purposes, however additional widening and surface improvements would be required for the wind project.

URS would analyze the existing topography and work within the equipment limitations of the haul trucks that would be transporting the equipment to the site. Likely this would include rebuilding large sections of the existing road and surfacing with rock. For areas with steep slopes, there may be a need to flatten and rebuild the slopes to allow access by the hauling equipment. In addition, a new connection would be made between West pit Road and Willard Road, and portions of the West Pit Road widened and realigned beyond the improvements made for logging access. These modifications would likely require construction of new cut and fill slopes.

3.1.4.3 Mitigation Measures

Site-specific geotechnical engineering evaluations would be conducted prior to design of the project to identify design methods to address the potential impacts presented above. Mitigation of soil impacts at the site would be incorporated into the final design of the foundations and roadways. A SWPPP would be developed prior to construction or modification of any roads or facilities. The SWPPP would be submitted for approval to EFSEC and followed throughout construction at the site.

3.1.5 TOPOGRAPHY

3.1.5.1 Existing Environment

Whistling Ridge Energy Project Site

The area of the proposed project is approximately 1,152 acres. The project site is located on a series of north trending ridges that range in elevation from approximately 2,100 to 2,300 feet above msl. The land west of the proposed project site drops sharply to a narrow river terrace and then to an elevation of less than 800 feet above msl in the Little White Salmon River valley. The topography northeast of the site drops gradually toward the White Salmon River or climbs gently up the northeast flank of Underwood Mountain at 2,728 feet above msl. To the south, the topography drops to a terrace of largely agricultural use and then toward the Columbia River. Site topography is shown on Figure 3.1-7.

3.1.5.2 Impacts

Whistling Ridge Energy Project Site

Impacts to the topography due to construction of the Whistling Ridge Energy Project would include grading of access roads and foundations. The areal footprint of the grading and total volume of material excavated would depend on the final foundation design(s) of the turbine towers.

Roadway Improvements

Roadway improvements would be necessary to accommodate the heavy and long loads associated with the turbine towers. It is anticipated that some steep sections of existing or new roads would be regraded to create shallower grades. Some tight-radius turns may require localized ~~rerouting~~ realignment of existing site roadways. These modifications would likely require construction of new cut and fill slopes.

3.1.5.3 Mitigation Measures

No mitigation measures for topography are anticipated at this time.

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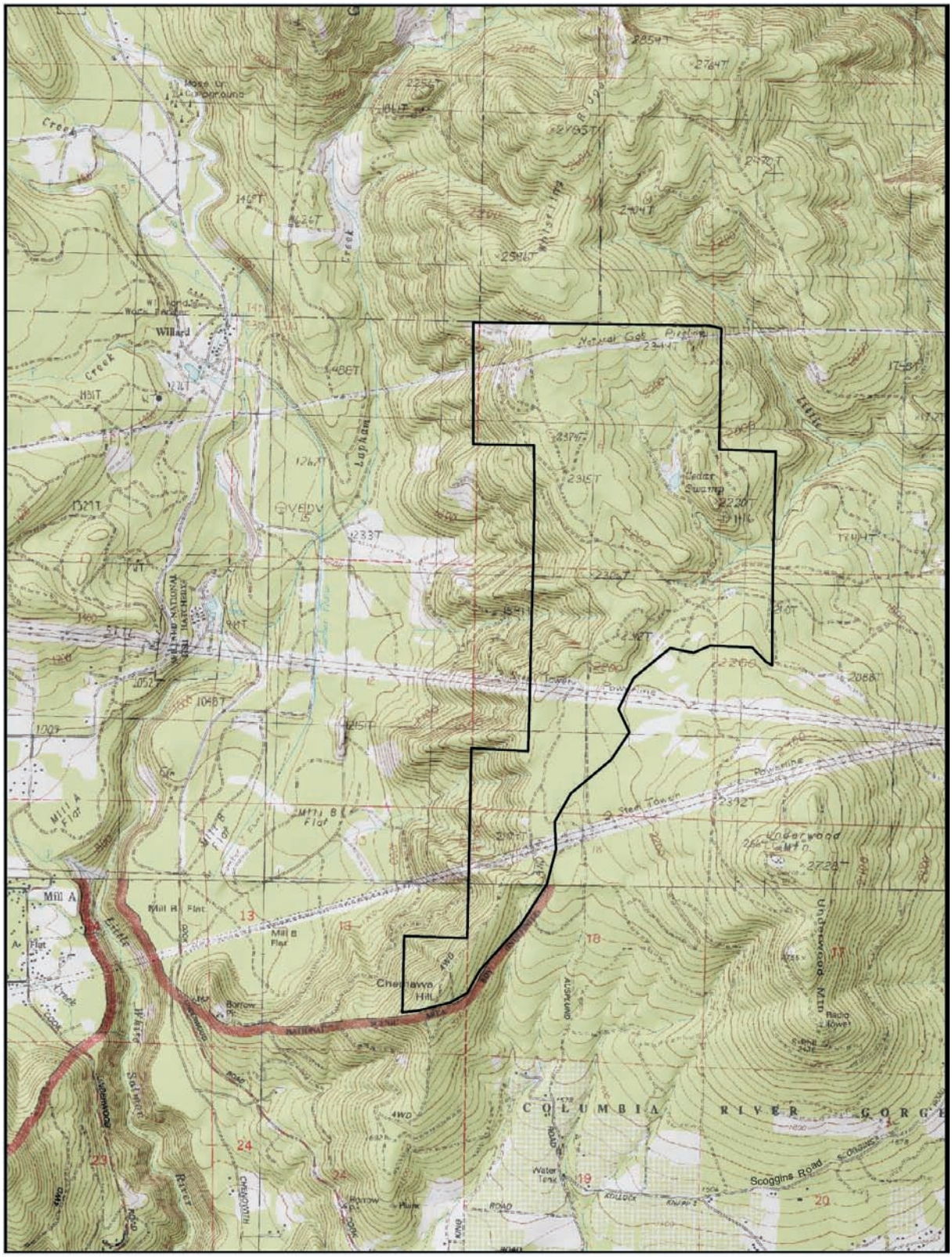

Source: GeoDataScape.

Job No. 33758687

Figure 3.1-7

Site Topography

URS

Whistling Ridge Energy Project
Skamania County, Washington

3.1.6 UNIQUE PHYSICAL FEATURES

3.1.6.1 Existing Environment

URS conducted a preliminary landslide hazard evaluation of the proposed Whistling Ridge Energy Project wind turbine site pursuant to SCC Title 21A, Chapter 21A.06 - Landslide Hazard Areas.

A URS Licensed Engineering Geologist conducted a site-specific landslide hazard investigation that consisted of:

- Reviewing sections of the County Code that address geologically hazardous areas
- Reviewing existing available topographic, geologic, and soils literature and maps
- Analyzing project-specific stereo aerial photographs
- Reviewing project test pit logs and soil samples
- Performing a one day site reconnaissance

According to the County Code, the primary criteria for landslide hazard designations are: presence of pre-existing, known mappable landslides; slope angle; and/or composition of the near-surface soils or rock.

URS created a color-coded map of the study area using an existing USGS 10 meter DTM to segregate slopes into three categories: slopes less than 20%; slopes between 20% and 30%; and slopes greater than 30%. We then superimposed the NRCS soil survey map onto the slope map to provide soil type information. The resulting Landslide Hazard Map is presented as Figure 2.15-1.

Landslide Hazard Area Delineation

Skamania County recognizes three classes of LHAs. Class I (Severe) LHAs are considered to present a severe landslide hazard and are distinguished as areas of known mappable landslide deposits which have been designated landslide hazard areas by the local legislative body. Class II (High) LHAs are areas with slopes between twenty and thirty percent that are underlain by soils that consist largely of silt, clay or bedrock, and all areas with slopes greater than thirty percent. Class III (Moderate) LHAs are areas with slopes between twenty percent and thirty percent not included in Class II.

URS reviewed available geologic and soils literature to develop a landslide hazard classification for the proposed project. An existing published regional geologic map (partially recreated in Figure 3.1-1) indicates a large landslide in the northeast corner of the study area underlying Tower Line C. Review of stereo photographs of the area where the landslide deposits are

mapped, coupled with a site reconnaissance, indicate that there is little geomorphic evidence for landslide activity such as obvious scarps, hummocky or benched terrain, lobate toe areas, or redirected watercourses. No deep subsurface investigations have been carried out at the site to date, but future explorations in support of design for the turbine tower foundations would provide subsurface information regarding the presence of landslide deposits in the area. Based on our preliminary investigation, there does not appear to be any area of the site that meets Skamania County's criteria for a Class ~~1~~ I LHA.

Class II LHAs are shown in green on Figure 2.15-1. The Class II LHAs at the site are predominantly associated with the steep slopes to the west of proposed Tower Lines A and B. The proposed site access road, West Pit Road, ascends these slopes to reach the site from the Little Salmon River valley. There are also steep slopes to the east of the 7 southernmost Tower Lines A towers, and on both sides of Tower Line C.

3.1.6.2 Impacts

Although none of the proposed turbines are located within Class II LHAs, several of the towers along the western side of the project site (Tower Lines A and B) are located along ridgelines with descending slopes that are locally greater than 35 degrees (70%). The heads of some of the drainages along these slopes are arcuate, indicating possible mass-wasting activity such as landslides, debris flows, and/or earthflows. The access road from the Little Salmon River valley to the project site will traverse Class II LHAs.

Based on aerial photo and field observations, the primary mass wasting process below the ridgelines appears to be debris flows and soil creep. No evidence for deep-seated, block failure type landslides was observed. Local surficial creep of near-surface soils is indicated by the presence of pistol-butted trees on some of the slopes, primarily on the descending slope west of the northern portion of Tower Line A. Other slopes have mature conifer stands that indicated little or no soil creep. Further subsurface investigation in support of final tower foundation design would help determine if there are weak rock or soil layers that could contribute to more deep-seated failure of the ridges and provide information on the quality of the rock mass underlying the ridgelines.

It appears that the primary concern for towers located adjacent to the Class II LHAs is the potential for headward erosion of the steep drainages by debris or earth flow processes. Debris flows could potentially damage to the proposed site access road. Erosion rates of these drainages are unknown, but no obvious recent mass wasting features were observed in the aerial photos or during the site reconnaissance.

Class III LHAs have been delineated adjacent to proposed wind turbines along the southern Tower Line A and along Tower Line C. Class III LHAs are not anticipated to have any impact on the proposed facilities due to the robust nature of the proposed foundation designs.

The landslide hazard evaluation identified several areas where the proposed wind turbine generators are located adjacent to slopes that meet Skamania County's criteria for Class II and Class III LHAs. The proposed site access road will traverse Class II LHAs as well. The primary hazard to the proposed towers appears to be the potential for exposure to headward erosion of

steep drainages on the slopes below some of the tower locations. Exposure of the towers to headward erosion of the steep slope drainages can be minimized by providing maximum possible setbacks from the tops of the steep slopes and/or by siting the turbines along portions of the ridgelines that are above intervening spur ridges. The most critical area of exposure to Class II LHAs is the narrow ridge at the southern portion of Tower Line A. The primary hazard to the access road would be damage sustained due to debris flow or mass wasting. This hazard would not pose an immediate threat to the operation of the towers, but could temporarily limit access to the site. Interruption to site access could be minimized with regular slope monitoring and contingency plans for slope instability (such as alternate access routes and identification of contractors available for emergency assistance).

It is URS's opinion that the proposed Whistling Ridge Energy Project facilities can be constructed and operated without danger to human life or the surrounding environment due to landslide hazards.

3.1.6.3 Mitigation Measures

At this time, no mitigation measures are anticipated. Additional geotechnical investigations for tower foundation design would provide deeper (> 16 feet) subsurface data. If the additional data indicates potential for slope instability, mitigation would be accomplished through engineering design or avoidance.

3.1.7 EROSION/ENLARGEMENT OF LAND AREA (ACCRETION)

Erosion is the breakdown and transport of soils and bedrock by natural processes, including water, wind, and glaciation. The susceptibility of any material to erosion depends on 1) chemical and physical characteristics (e.g., cohesion); 2) topography; 3) the amount and intensity of precipitation and surface water; 4) the intensity of wind; and 5) the type and density of vegetative ground cover, if present.

The assessment of erosion potential is principally based on the erosion potential specified for the surficial soils by the NRCS (formerly the Soil Conservation Service). The NRCS uses an erosion factor, K, to indicate the susceptibility of a soil to sheet and rill erosion by water. This is one of the six factors used in the Universal Soil Loss Equation to predict the average annual rate of soil loss by sheet and rill erosion. The values of K range from 0.05 to 0.69, with higher K indicating more erosion susceptible soil. K-values below 0.13 are considered to have low potential for erodibility; values in the range of 0.13 to 0.26 are considered medium; and values higher than 0.26 are considered high. The effect of wind erosion is given by grouping the soils into different wind erodibility groups.

3.1.7.1 Existing Environment

~~Plant Site~~

The K-values for soil at the proposed development site and access roads are 0.20 for the McElroy and Timberhead gravelly loams, 0.24 for the Undusk gravelly loam, and 0.37 for the Underwood loam (USDA NRCS 1988). These erosion factors indicate that the Underwood loam

has a high potential for erosion by water and the McElroy, Timberhead, and Undusk units have a medium potential. Most soils found in the site vicinity are classified as having a low susceptibility to wind erosion.

3.1.7.2 Impacts

~~Plant Site~~

The potential for erosion or aggradation related to the planned development would be greatest during and immediately after the construction process. The NRCS classifies surficial soils at the site as generally having medium erosion potential. During the dry season, soils that are disturbed and stripped of vegetative cover may be susceptible to wind erosion. The potential for erosion by wind and water would be minimized through the use of erosion control measures to be outlined in the SWPPP as described in Section 2.10.

3.1.7.3 Mitigation Measures

BMPs and other measures would be taken to mitigate the erosion hazard at the project site.

Erosion control measures for construction at the site are outlined in Sections 2.10.2 and 2.14.1. The sequences and methods of construction activities would be controlled to limit erosion and are summarized below:

- Construction activities would be controlled to help limit erosion. Clearing, excavation and grading would be limited to those areas of the project absolutely necessary for construction of the project. Areas outside the construction limits would be marked in the field and equipment would not be allowed to enter these areas or to disturb existing vegetation.

- The construction contractors would implement the EFSEC-approved Erosion and Sedimentation Control Plan during construction to minimize soil loss due to surface water flows.

- The EFSEC-approved Environmental Protection Control Plan would be implemented to provide adequate maintenance and inspection of the erosion and sediment control system. The plan specifies that control structures would be inspected at a frequency sufficient to provide adequate environmental protection. Such inspections would increase in frequency during rainfall periods. In addition, supplies including sandbags and channel-lining materials would be stored on site for emergency use.

- Surface runoff would be diverted around and away from cut and fill slopes and conveyed in pipes or protected channels. If the runoff is from disturbed areas, it would be directed to a sediment trap prior to discharge.

SECTION 3.2 AIR
(WAC 463-60-312)

3.2.1 AIR QUALITY

Air quality in Washington is typically regulated by several agencies. In Skamania County, the Southwest Region Clean Air Agency is typically the local authority for air quality permitting of industrial sources, and permits minor sources through the Notice of Construction permit process. Ecology generally retains the authority for air quality permitting of major sources in attainment areas through the Prevention of Significant Deterioration (PSD) permit process. The United States Environmental Protection Agency (EPA) also has a role in the PSD process and in ensuring all states have plans in place to maintain compliance with ambient air quality standards.

The fuel source for the Whistling Ridge Wind Energy Facility would be wind that is transformed from kinetic energy into electrical energy by wind turbine generators. No air emissions would be generated from operation of the wind turbine generators at the project. The operation of the project would have no effect on the climate (visible plumes, fogging, misting, icing, or impairment of visibility, and changes in ambient levels caused by emitted pollutants). There would no emissions from the operation of the project, and thus none to be regulated. There are no areas within Skamania County that are currently designated as non-attainment areas for air quality. For a description of the meteorological conditions at the site, see Section 2.1.3.2, Climate.

In recent years, many of the new power plants proposed and constructed in the Pacific Northwest have been fossil fuel fired plants, primarily using natural gas as fuel. Fossil fuel fired plants, in contrast to wind power projects, emit significant quantities of the carbon dioxide that is the primary cause of anthropogenic climate change. Natural gas fired plants also emit sulfur oxides and nitrogen oxides, which contribute to both ground-level air quality problems and acid rain. By producing electricity without generating air emissions, which would otherwise be produced by fossil fuel fired plants, the project would have a significant beneficial impact on overall air quality and climate.

3.2.2 CONSTRUCTION EMISSIONS

Construction of the project would result in temporary air emissions from the following sources:

- Exhaust from the diesel construction equipment used for project site preparation, grading, excavation, and construction of on-site structures
- Exhaust from water trucks used to control construction dust emissions
- Exhaust from diesel trucks used to deliver equipment, concrete, fuel, and construction supplies to the construction site

- Exhaust from pickup trucks and diesel trucks used to transport workers and materials around the construction site and from vehicles used by workers to commute to the construction site

- Exhaust from diesel-powered welding machines, electric generators, air compressors, etc.

These emissions would be similar in nature to those produced by any construction project that involves heavy equipment and transportation of materials to the project site.

3.2.3 OPERATION EMISSIONS

Operation of the project would produce no air emissions as no fuel would be burned to produce energy. Operation of the project would therefore have no negative impact on air quality. According to the EPA, air emissions from fossil fuel combustion for electricity production are a leading source of air pollution nationally, accounting for:

- 67% of sulfur dioxide emissions

- 28% of nitrogen oxide emissions

- 36% of carbon dioxide

- 3% of mercury

The most likely alternative to wind energy generated by the project would be electricity generated from the combustion of fossil fuels. Fuel combustion from electric utilities generated 6.6 million tons of carbon monoxide and 6.0 million tons of nitrogen oxides in 2006. Total fossil fuel combustion produced 5,638 million metric tons carbon-equivalent of carbon dioxide in 2006 (EPA 2008).

As the energy produced by the project would displace the need for other energy produced by fossil fuel combustion, operation of the project would have a positive effect on air quality and climate change by reducing overall air emissions.

3.2.4 ODOR

Construction of the project would produce limited odors associated with exhaust from diesel equipment and vehicles. Mitigation efforts are described in Section 3.2.6, Mitigation Measures.

Operation of the project would create no odors as no combustion is involved and no odor-producing materials would be used in project operations.

3.2.5 DUST

Construction of the project would create fugitive dust emissions from construction-related traffic and additional wind-blown dust as a result of ground disturbance. Whistling Ridge Energy LLC would implement an effective dust control program to minimize any potential disturbance from

construction-related dust. Dust suppression would be accomplished through application of either water or a water-based, environmentally safe dust palliative such as lignin. The use of a dust palliative such as lignin (a non-toxic, non-hazardous compound derived from trees) would result in the use of substantially less water for dust suppression and therefore less traffic from water trucks to the construction site. The final decision regarding dust suppression techniques would be made by the EPC contractor in consultation with local authorities.

Operation of the project would result in minimal or no increase in dust levels. Project related-traffic increases on gravel access roads would generate small amounts of additional fugitive dust. This increased traffic would consist largely of weekly or less frequent trips to turbines in service vehicles for maintenance and repair activities.

3.2.6 MITIGATION MEASURES

The following mitigation measures for construction-related air emissions and dust are proposed:

- All vehicles used during construction would comply with applicable Federal and state air quality regulations
- Operational measures would be implemented, such as limiting engine idling time and shutting down equipment when not in use
- Active dust suppression would be implemented on unpaved construction access roads, parking areas and staging areas, using water-based dust suppression materials in compliance with state and local regulations
- Traffic speeds on unpaved project roads would be kept to 25 mph to minimize dust generation
- Carpooling among construction workers would be encouraged to minimize construction-related traffic and associated emissions
- Disturbed areas would be replanted or graveled to reduce wind-blown dust
- Erosion control measures would be implemented to limit deposition of silt to roadways

Mitigation measures for construction impacts are described in greater detail in Section 2.3, Construction on Site, and Section 1.4, Mitigation Measures.

No mitigation is proposed for project operations, as there would be no air or odor emissions.

SECTION 3.3 WATER
(WAC 463-60-322)

Project operation would require water use primarily for the Operations and Maintenance building. When the project is operational, there would be eight to nine permanent full-time and/or part-time employees on the Operations and Maintenance staff. The average total water supply needs would be less than 5,000 gpd.

A well would be drilled to provide potable water for the bathroom and kitchen in the Operations and Maintenance building. All water would be discharged to a septic tank installed on site. There would be no process water generated on site, so no water associated with plant operations would be discharged to surface waters. The project would have negligible impacts on surface water and groundwater resources in the vicinity.

Stormwater runoff drains to open land and the ephemeral and perennial streams that flow either westward toward the Little Salmon River or eastward toward the White Salmon River. Stormwater is conveyed to these streams via ditches and culverts.

3.3.1 SURFACE WATER RESOURCES (MOVEMENT/QUALITY/QUANTITY)

3.3.1.1 Existing Surface Water Conditions

The project area is generally mountainous with steep-sided narrow drainages. Elevations of the turbine positions generally range from 2,100 feet to 2,300 feet above msl. The Columbia River flows south of the site and receives runoff via the White Salmon drainage area from the east portion of the site and via the Little White Salmon Basin from the west portion of the site.

USGS review identified one undelineated wetland occurring outside the impacted area, west of turbine E3. This wetland is labeled as “Cedar Swamp” on the USGS topographic map (Figure 3.3-1). Five intermittent drainage ways were identified on the map at the northeastern portion of the project area. Three of the drainage ways drain to Cedar Swamp from the north. The remaining two drainage ways are to the south of Cedar Swamp, and ultimately drain intermittently to Little Buck Creek, a perennial stream that is outside of the project area to the east. The planned improvements to existing roads that would occur inside the Scenic Area would cross one intermittent stream (shown on Figure 3.3-1). This stream has no defined channel and carries water only during runoff events. It is classified as a Class V stream under SCC 21.04.020(B).

The project area soils are classified as well-drained, with slow to moderate runoff, and slight to moderate hazard of water erosion. The presence of scour, sedimentation, steep slopes, ephemeral and perennial streams, and the soil classifications suggest that surface water runoff and infiltration within the project are moderate (Haagen 1990). Water runoff from the northeast area of the project drains southeast via Cedar Swamp and tributaries to Little Buck Creek before flowing south to the White Salmon River, and ultimately to the Columbia River. Water runoff from the southwest area of the project drains west and southwest to a flat area east of the project, ultimately draining to the Columbia River.

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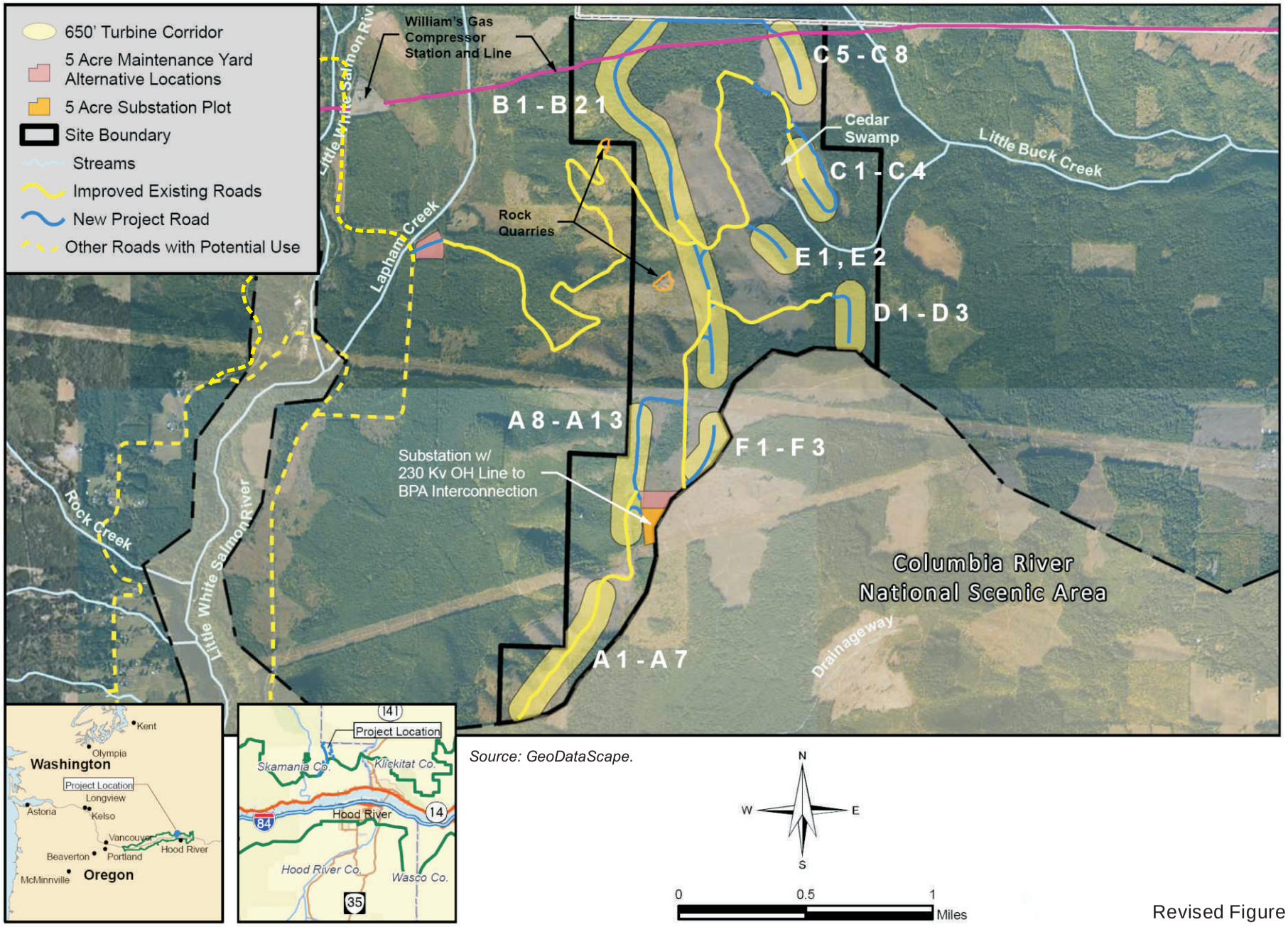

Source: GeoDataScape.

Revised Figure 3.3-1

Waterways in the Project Vicinity

Job No. 33758687

URS

Whistling Ridge Energy Project
Skamania County, Washington

The proposed access road, West Pit Road, crosses one unnamed drainage in the Lapham Creek watershed. This stream had observed flow through the existing culvert under West Pit Road at the time of the July 2009 field visit. However, the surface flow and the channel disappear downstream of the culvert. There is no surface water connection to Lapham Creek.

3.3.1.2 Impacts to Surface Water

No wetlands or other surface water bodies are proposed to be filled as a result of the project. Wetlands are discussed in further detail in Section 3.5, Wetlands.

The planned improvements to ~~existing roads that would occur inside the Scenic Area~~West Pit Road would cross one ~~intermittent stream~~unnamed drainage which currently flows under West Pit Road through a culvert (Figure 3.3-1). This ~~stream~~ drainage has no defined channel ~~and carries water only during runoff events~~downstream of the culvert. It is classified as a Class V stream under SCC 21A~~.04.020(B)~~ Appendix C. Buffers are established for Class V streams. However, expansion of existing uses is allowed within these water resource buffers. Development review would be required under SCC 21A.05 and SCC 21A.06 in Fish and Wildlife Protection Areas and Geologically Hazardous Areas in consultation with WDFW. However, existing roadways would be allowed without review. The road improvements in these regulated fish and wildlife protection areas do not exceed the allowed expansion threshold. For a full discussion of fish, wildlife, their habitats, and project impacts to these, please see Section 3.4.

The impacts to surface water relating to site drainage during and following construction are expected to be minimal. The highest risk of construction-related impacts to surface water quality is expected to be associated with the construction and improvement of new and existing roadways. These activities are expected to disturb the largest areas, exposing soils in potentially steep areas. Roadway improvements to West Pit Road would be needed. The culvert under West Pit Road through which the unnamed drainage flows would be maintained however would likely be extended along with the roadway widening. The highest priority for these activities would be to control erosion and sedimentation. A SWPPP would be developed for the project, consisting of structural and non-structural BMPs, to minimize the potential for discharge of pollutants from the site during and after construction activities.

The SWPPP would be developed to meet the requirements of the Ecology General Permit to Discharge to Stormwater pollution control program associated with construction activities. Examples of structural BMPs included in the SWPPP to be implemented during construction activities are the installation of silt curtains, mats, hay bales, check dams, silt traps, and other methods for controlling and diverting runoff away from exposed soils or areas susceptible to erosion. Examples of non-structural BMPs to be included in the SWPPP are management practices for handling and disposing of materials, as well as spill prevention. BMPs associated with construction are discussed in further detail in Section 2.10, Surface Water Runoff.

Stormwater would be conveyed through roadside ditches, discharging to existing on-site drainage ways. New culverts would be constructed in the newly constructed roads, where required, to convey runoff toward the existing drainage ways, and existing culverts would be

replaced to better accommodate seasonal flow regimes of intermittent streams crossing roadways. Culvert outlets to natural channels would be armored to control erosion and scouring of site soils. Permanent vegetation would be established and other permanent BMPs would be used to control erosion and sedimentation. With all permanent stormwater BMPs in place, operation-related impacts to stormwater are expected to be minor.

The amount of chemicals kept on site would be very minimal, and all would be located at the Operations and Maintenance building, under cover. An SPCC Plan would be developed and kept on site for the prevention and response to spills.

3.3.1.3 Mitigation Measures

Permanent BMPs would be designed and incorporated into the final construction plans and specifications prepared by the site civil design engineer. These permanent BMPs would include erosion and sediment control through site landscaping, grass, and other vegetative cover. All final designs would conform to the applicable Stormwater Management Manual. Non-structural BMPs also would be incorporated into the operations manual including good housekeeping, preventative and corrective maintenance procedures, steps for spill prevention and response, employee training, and inspection and record-keeping procedures.

3.3.2 RUNOFF/ABSORPTION

3.3.2.1 Existing Runoff/Absorption Conditions

As discussed in Section 3.3.1.1, site soils are well-drained with slow to moderate runoff and slight to moderate hazard of water erosion. This infers that currently there is both moderate stormwater runoff and infiltration onsite.

3.3.2.2 Impacts to Runoff/Absorption

The current site is not developed, with the exception of private, gravel logging roads, and is composed of well-draining soils. The construction of the Whistling Ridge Energy Project would involve roadway improvements on approximately ~~7.2~~7.9 miles of existing private, gravel logging roads, construction of about 2.4 miles of new gravel access roads, the project substation, an Operations and Maintenance building, the collector system pad, a pad for each turbine tower, and underground electric cables buried in trenches along the access roads Temporary roadways would be built to provide additional access for heavy machinery during construction.

As a result of permanent improvements, site surface water runoff is expected to increase slightly. However, since the increased area of impervious surfaces is small compared to the total project area (estimated at less than 1 acre), these impacts are expected to be minimal. Stormwater would continue to be routed off site via culverts and some stormwater would continue to infiltrate in the way it does currently. Based on the conditions and implementation of BMPs, the net impact to absorption on the site is considered negligible. No negative impacts on runoff and no negative impacts on adjacent surrounding properties are anticipated as a result of the permanent site improvements. See Section 2.10, Surface Water Runoff for further detail of permanent improvement areas.

3.3.2.3 Mitigation Measures

The required BMPs are expected to: minimize erosion, control sedimentation, prevent run-on of stormwater onto disturbed areas, and prevent runoff from disturbed areas. One measure may be treatment of stormwater exiting disturbed areas. Construction-phase erosion and sedimentation control BMPs, as described in Section 2.10, Surface Water Runoff, would be implemented to mitigate the expected impacts of soil disturbance. These may include chemical source control, silt fencing, stabilized construction entrances, street sweeping, straw bale check dams, and rock check dams. With implementation of BMPs, no negligible impacts on runoff or on adjacent surrounding properties are anticipated during construction activities. Construction BMPs are described in further detail in Section 2.10, Surface Water Runoff.

Permanent, operations-phase runoff control and water quality enhancement BMPs, also described in Section 2.10, Surface Water Runoff would be implemented to mitigate the expected impacts of increased runoff rate and pollution from vehicle traffic. These BMPs would include stabilized landscaped areas and vegetated ditches or swales, and would provide the necessary control of stormwater runoff.

3.3.3 FLOODPLAINS

3.3.3.1 Existing Conditions

The project area is located outside the 100-year floodplain for the Little White Salmon and Columbia Rivers as currently mapped by FEMA. The project site is located on a series of north trending ridges that range in elevation from approximately 2,100 to 2,300 feet above msl. The land west of the proposed project site drops sharply to a narrow river terrace and then to an elevation of less than 800 feet above msl in the Little White Salmon River valley. Because the current elevation of the site is above the 100-year floodplain, additional mitigation measures for flooding are not planned.

3.3.3.2 Potential for Flooding and Protective Measures

Because the site is above the 100-year floodplain, an evaluation of the change in surface water elevation created by the additional fill placed for site development would not be necessary.

3.3.4 GROUNDWATER RESOURCES

This section describes the hydrogeologic resources at the Whistling Ridge Energy Project site, project impacts, and mitigation.

3.3.4.1 Hydrogeologic Setting

The project site is located approximately 7 miles west of the town of White Salmon, Washington, and approximately 2 miles east of the Little White Salmon River. A subsurface investigation was conducted in September 2007, which included twelve test pits excavated from seven to 16 feet in depth to assess near-surface soil and rock characteristics. Surficial soils are primarily characterized as soft, moist sandy silt to clay with sand, and clayey sand. Immediately

beneath the unconsolidated soils, rock with variable strength and weathering properties is present. The test pit data is limited to depths no greater than 16 feet bgs. It is anticipated that rock quality of basalts would improve with depth but that weaker interflow zones consisting of volcaniclastic material and paleosols are possible at any depth. The bedrock underlying the proposed project site consists of Grande Rhonde Basalt of the CRBG and Quaternary basalt of Underwood Mountain. Groundwater was not encountered up to a depth of 16 feet bgs during subsurface exploration. However, these observations reflect groundwater levels at the time of the field investigation and actual groundwater levels may fluctuate significantly in response to seasonal effects, regional rainfall, and other factors no observed during this investigation. Regional or perched water tables may be present at a greater depth.

3.3.4.2 Impacts to Groundwater Resources

Operation of the project would have minimal impacts to groundwater. For operations, a well would be installed by a licensed installer to serve the Operations and Maintenance facility. A well using less than 5,000 gallons of water a day, and thus exempt from permit requirements in RCW 90.44.040, would be installed to provide water for use to the Operations and Maintenance building. The well would be installed by a well contractor licensed pursuant to Chapter 173-162 WAC, and in compliance with the requirements and standards of Chapter 173-160 WAC. The well would be installed consistent with Skamania County Community Development Department and Ecology requirements for the new wells. This well would provide water for bathroom and kitchen use and is expected to consume less than 5,000 gpd. It is unlikely that the project water use would have a direct effect on groundwater quantity, quality, and flow direction in the immediate area below the proposed facilities. Although the impervious surfaces would increase slightly with the construction of the project, they are not expected to be significant enough to notably affect the water recharge and runoff on site. Therefore, impacts to the hydrologic setting within the Whistling Ridge Energy Project site are considered negligible.

3.3.4.3 Mitigation Measures

No impacts have been identified regarding the quantity of water infiltrating the site following construction. BMPs that are recommended for site development include stabilized landscaped areas and vegetated ditches or swales.

Storage of chemicals onsite is minimal; however, the site development plan would require an SPCC Plan that would protect groundwater (See Section 2.9, Spillage Prevention and Control). Therefore, mitigation for groundwater quality impacts is not necessary.

3.3.5 PUBLIC AND PRIVATE WATER SUPPLIES

3.3.5.1 Existing Conditions and Water Authorization

The Pleistocene epoch (1.8 million years to 10,000 years BP) basalts and cinders erupted from the Underwood Mountain vents and overlie the Tertiary CRBG Grande Ronde and Wanapum basalts. Public records of wells located within the Underwood volcanic field indicate a 310-foot thick repetitive sequence of thin lava flows (two to eight feet thick), cinders and silty-clays overlying a productive confined aquifer consisting of intensely fractured Grande Ronde basalt.

The Miocene-epoch Grand Ronde Basalt consists of multiple basalt flows that are a subgroup of the CRBG, and has been described to have a thickness of up to 1,000 feet, although the thickness in the project vicinity is not known. There are no public water supplies within the project area.

3.3.5.2 Impacts to Public and Private Water Supplies

Water Usage

As described earlier, water use during operations is expected to be less than 5,000 gpd and would be provided by a well that would be drilled on site. Water use is expected to be consistent year-round.

Water Supply During Construction

Water used during construction would be primarily associated with road construction, wetting of concrete, dust control, and other activities. Water consumed during construction activities would be purchased by the contractor from an off-site vendor with a valid water right and transported to the site in water-tanker trucks. No water would be used from the site during construction. There would be no water treatment requirements or methods on site. Environmentally benign dust palliatives such as lignin may be added to water used for dust suppression to improve efficiency and reduce water use.

Future Conditions

The well that would be drilled for the project, and its associated use of less than 5,000 gpd, is not expected to impact water levels in private wells in the vicinity of the project. There are no public water supplies within the project area; therefore, no impacts are anticipated to public water supplies.

3.3.5.3 Mitigation Measures

No impacts to public water supplies and no adverse impacts to private water supplies (water wells) are expected. Therefore, no mitigation measures are required.

SECTION 3.4 HABITAT, VEGETATION, FISH AND WILDLIFE (WAC 463-60-332)

3.4.1 HABITAT AND VEGETATION

This section describes existing habitat and vegetation resources within the Whistling Ridge Energy Project site, the potential impacts of the proposed project on these resources, and the mitigation planned for the project.

3.4.1.1 Existing Conditions

The project site is located in the Southern Washington Cascades Province, within the grand fir (*Abies grandis*) and Douglas-fir (*Pseudotsuga menziesii*) major vegetation zones (Franklin and Dyrness 1988). Topography in the area is characterized by generally accordant ridge crests, separated by steep, deeply dissected valleys. The prevailing climate is cool and wet. The majority of precipitation falls as snow, which may accumulate one to three meters during the winter season.

Whistling Ridge Energy Project Site

The proposed Whistling Ridge Energy Project site is located on Underwood Mountain, northwest of White Salmon, Washington. The project site, which includes turbine strings, access roads, laydown staging areas, the operations and maintenance facility, and substation, measures 1,152 acres. Major drainages in the vicinity of the project site include the White Salmon Basin to the east and the Little White Salmon River Basins to the west, both of which drain to the Columbia River, which is located south of the project site.

Historically, the project site was dominated by grand fir and Douglas-fir. The relative abundance of each of these coniferous species was driven by elevation, aspect, underlying soil, and previous disturbance history (Franklin and Dyrness 1988). Mixed conifer and deciduous forest stands were present, typically following natural disturbance events. Deciduous forests also were present, composed mainly of alder (*Alnus rubra*, *A. viridis* ssp. *sinuata*), Pacific dogwood (*Cornus nuttallii*), and big-leaf maple (*Acer macrophyllum*).

For the last century, the predominant land use in the area located between Underwood Mountain and the Little White Salmon River has been commercial forest production. Lands within the project site are privately owned, and have been actively-managed for timber for the last century. As a result of ongoing timber harvest, forests within the project site are characterized by a mosaic of stand ages; however, average stand age has declined as a result of relatively short stand rotations. Forest management practices have resulted in a shift in species dominance to the commercially valuable Douglas-fir. Changes in stand structure and complexity, patch size, and species distribution also have occurred. Few large, old-growth conifers exist in the vicinity of the project site, and there are no known late-successional stands within or adjacent to the project site. A linear clearing associated with a high voltage transmission line corridor traverses the southern portion of the project site in an east-west axis. Canopy species within the corridor have been removed, and areas are managed to be devoid of shrub and tree species. The project site

contains a network of roads ranging in width from approximately 8 to ~~12~~ 20 feet. These roads are currently used to support logging activity and for accessing BPA transmission lines. Existing roads within the project site can be accessed from County roads extending north from SR 14.

Habitat, vegetation, and rare plant surveys were conducted within the Whistling Ridge Energy Project site in 2003. Environmental assessments included a pre-field information review and field surveys designed to classify habitats and identify rare plants that may occur within the project site.

Habitat Types

Habitat maps were created by CH2M Hill (Figure 3.4-1). Existing data was obtained from Washington Natural Heritage Program (WNHP) and through discussions with the USFWS. Habitats were identified using WDNR orthophotos from January 2002 and classified using the US Forest Service Classification System (USFS 1985). Habitat maps were field-verified during the 2003 plant survey season. These data were entered into a GIS database and used to calculate the total acres of each habitat type that would be crossed by the proposed project elements. The results of the habitat survey are provided in the Vegetation Technical Report (Appendix B-1).

Five vegetation communities and wildlife habitats were identified within the project site:

- Grass-Forb Stand (recent clearcuts)
- Brushfield/Shrub Stand
- Conifer-Hardwood Forest
- Conifer Forest
- Riparian-Deciduous Forest

Grass-Forb Stand. Grass-forb stands are defined as habitats where shrubs comprise less than 40 percent crown cover and are less than 5 feet tall (USFS 1985). This stand type typically occurs when a natural or anthropogenic disturbance such as a wildfire, wind, or timber harvest results in the removal or death of the majority of large trees, or when brushfields are cleared for planting. These habitats may be devoid of vegetation, or covered by herbaceous grasses and forbs. Tree regeneration in grass-forb stands is typically less than 5 feet tall and 40 percent crown cover.

Grass-forb stands within the project site are primarily located in recently clearcut harvest areas. Vegetation in these areas is minimal and consists predominantly of weedy herbaceous species, including bull thistle (*Cirsium vulgare*), Canada thistle (*Cirsium arvense*), and dandelion (*Taraxacum officinale*). Coarse woody material (CWM), occasional slash piles, and large areas of bare ground are common in these areas.

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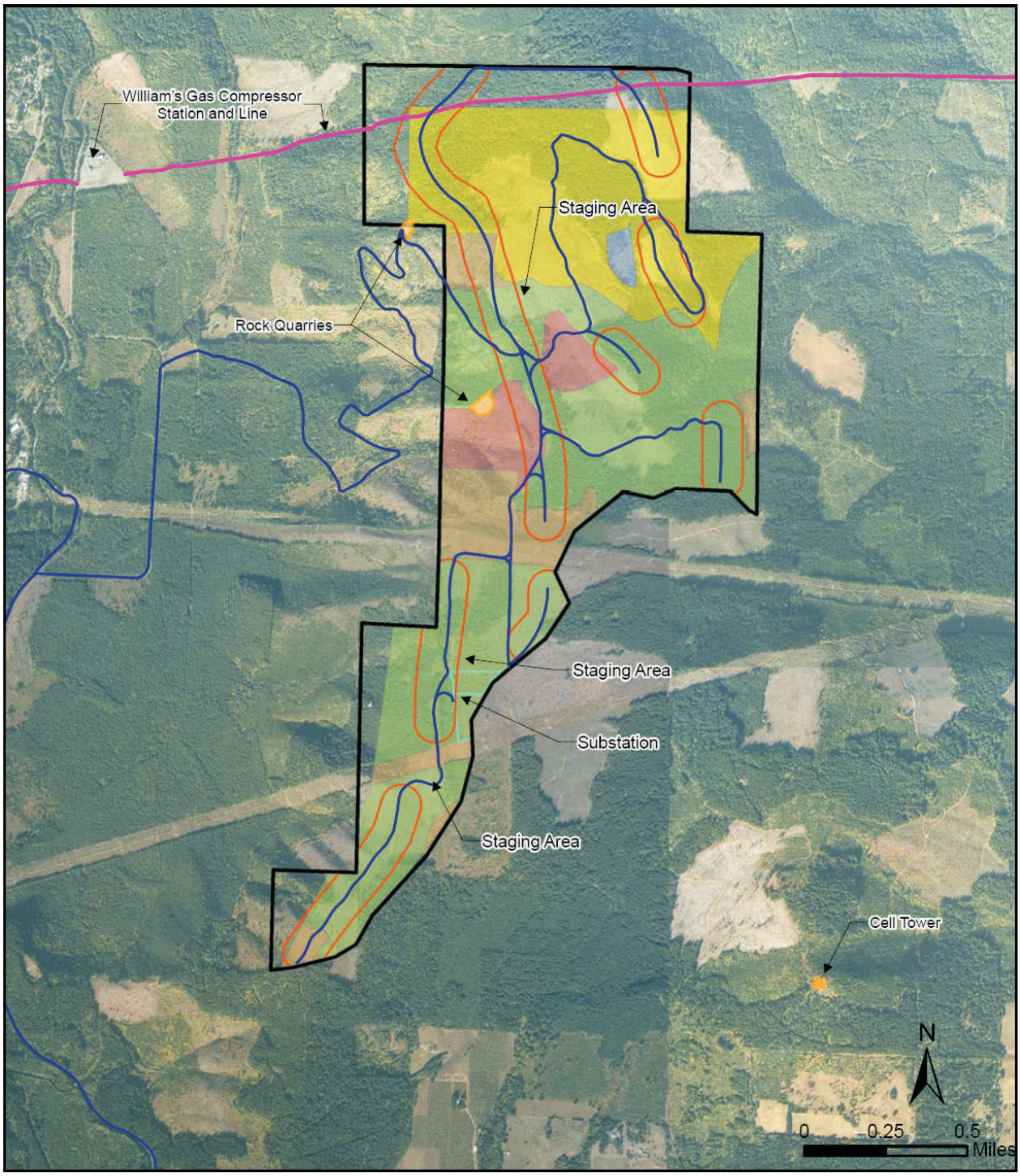

Brushfield/Shrub	650' Turbine Corridor
Conifer Forest	Access Roads
Conifer-Hardwood	Substation
Grass-Forb	Site Boundary
Riparian-Deciduous	

Aerial Photo: Bergman Photographic, Portland, OR 2008

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-1

Habitat Types, 2003 Survey

URS

Whistling Ridge Energy Project
Skamania County, Washington

Brushfield/Shrub Stand. Brushfields are defined as the shrub-dominated habitats (USFS 1985). These habitats typically develop following clearcut harvest, or natural disturbance that may result in removal of vegetation.

The majority of brushfields are young plantations that have been planted with Douglas-fir. The plantations typically have not reached the closed-canopy stage. Vegetation consists of remnant forest understory species, such as vine maple (*Acer circinatum*), Sitka alder, beaked hazelnut (*Corylus cornuta* var. *californica*), serviceberry (*Amelanchier alnifolia*), oceanspray (*Holodiscus discolor*), bracken fern (*Pteridium aquilinum*), sword fern (*Polystichum munitum*), and early successional species such as Himalayan blackberry (*Rubus armeniacus*), fireweed (*Epilobium angustifolium*), common yarrow (*Achillea millefolium*), pearly everlasting (*Anaphalis margaritacea*), and grasses. Large amounts of bare soil, slash and other logging debris are common.

Vegetation control has occurred in some areas as part of existing forest management practices. Control methods include herbicide application and/or mechanical control. Areas where vegetation management has occurred are visually and functionally different from areas where control has not been implemented. In areas where vegetation control has not occurred, dense vine maple thickets with occasional alder or Douglas-fir frequently occur. Patches of alder saplings, salmonberry (*Rubus spectabilis*), vine maple, red elderberry (*Sambucus racemosa*), oceanspray, lupine (*Lupinus* spp.), Oregon oxalis (*Oxalis oregana*), and grass also may be present in these areas. Small diameter CWM is common.

Conifer-Hardwood Forest. Conifer-hardwood forests within the project site are predominantly characterized by the presence of bigleaf maple and Douglas-fir, with some red alder. The forest stand condition is characterized as a multi-layer, closed sapling-pole forest (USFS 1985). Canopy height ranges from 40 to 60 feet, and canopy closure is between 60 and 80 percent. The majority of canopy cover results from the presence of Douglas-fir (~70 percent). The shrub layer is characterized by vine maple, salmonberry, thimbleberry (*Rubus parviflorus*), red elderberry, beaked hazelnut, and Pacific dogwood. Density of the shrub layer is variable. The herbaceous layer is characterized by sword fern, trailing blackberry (*Rubus ursinus*), oxalis, grasses, and moss. CWM is generally low to moderate. Deciduous snags are more common than conifer snags; however, short well-decayed conifer snags may be present.

Conifer Forest. Coniferous forests located within the project site are dominated by grand fir and Douglas-fir. Forest stand condition is primarily closed sapling-pole-sawtimber and large sawtimber. The diameter at breast height (dbh) of pole-size conifers measures 8–12 inches. The dbh of sawtimber measures 12 to 23 inches. Closed sapling-pole-sawtimber stands are characterized by closed canopy, relative short live crowns, and exclusion of shrub species and many forb species. CWM in these stands is typically low, consisting mainly of remnants from historic forests. Snags are rare; however, small diameter snags become more common in the pole and sawtimber stages, as smaller individuals are out-competed.

Large sawtimber is considered to be at least 21 inches in dbh. Large sawtimber stands are characterized by within-stand differentiation of canopy species, the emergence of dominant trees,

and a more diverse and multilayer understory composed of shrubs and forbs. Snags and CWM are generally rare; however, this may vary depending on past harvest practices, stand management, and actual stand age.

The majority of coniferous forests within the project site is managed for commercial timber production, and is replanted following harvest. Commercial timber lands are widespread throughout the vicinity of the project site.

Riparian Deciduous Forest. Riparian deciduous forests may develop in near-stream areas as a result of natural or anthropogenic disturbance. Riparian deciduous forest habitats are present within the project site in an area known as "Cedar Swamp". Historically this area was dominated by large, old-growth western redcedar (*Thuja plicata*); however, these trees have since been harvested. Cedar Swamp is now dominated by willow (*Salix sp.*) and cottonwood (*Populus balsamifera*), with scattered occurrences of young western redcedar.

The vegetation communities described above are common throughout the Southern Washington Cascades Province. In the proposed project site, these communities are primarily maintained through forest management. Because the project is located within private commercial timber lands, existing forest management practices are expected to continue for the foreseeable future. The total acreage of each habitat type was calculated during the 2003 surveys; however, because of active forest rotation schedules, some of these areas have been harvested. Aerials photos from ~~2008~~ 2009 were used to update the habitat maps from 2003 with recent timber harvests. The updated acreages of each habitat type can be found in Table 3.4-1 and are shown on Figure 3.4-2.

Table 3.4-1
Habitat Types within the Project Site

Habitat Type	Area (acres)
Grass-Forb Stand	~~414~~522
Brushfield/Shrub Stand	103
Conifer-Hardwood Forest	~~346~~310
Conifer Forest	~~281~~209
Riparian Deciduous Forest	8
Total	1,152

Rare Plant Species and Vegetation Communities

Several sources were used to identify special-status plants that have been documented or have the potential to occur within the vicinity of the proposed project, including:

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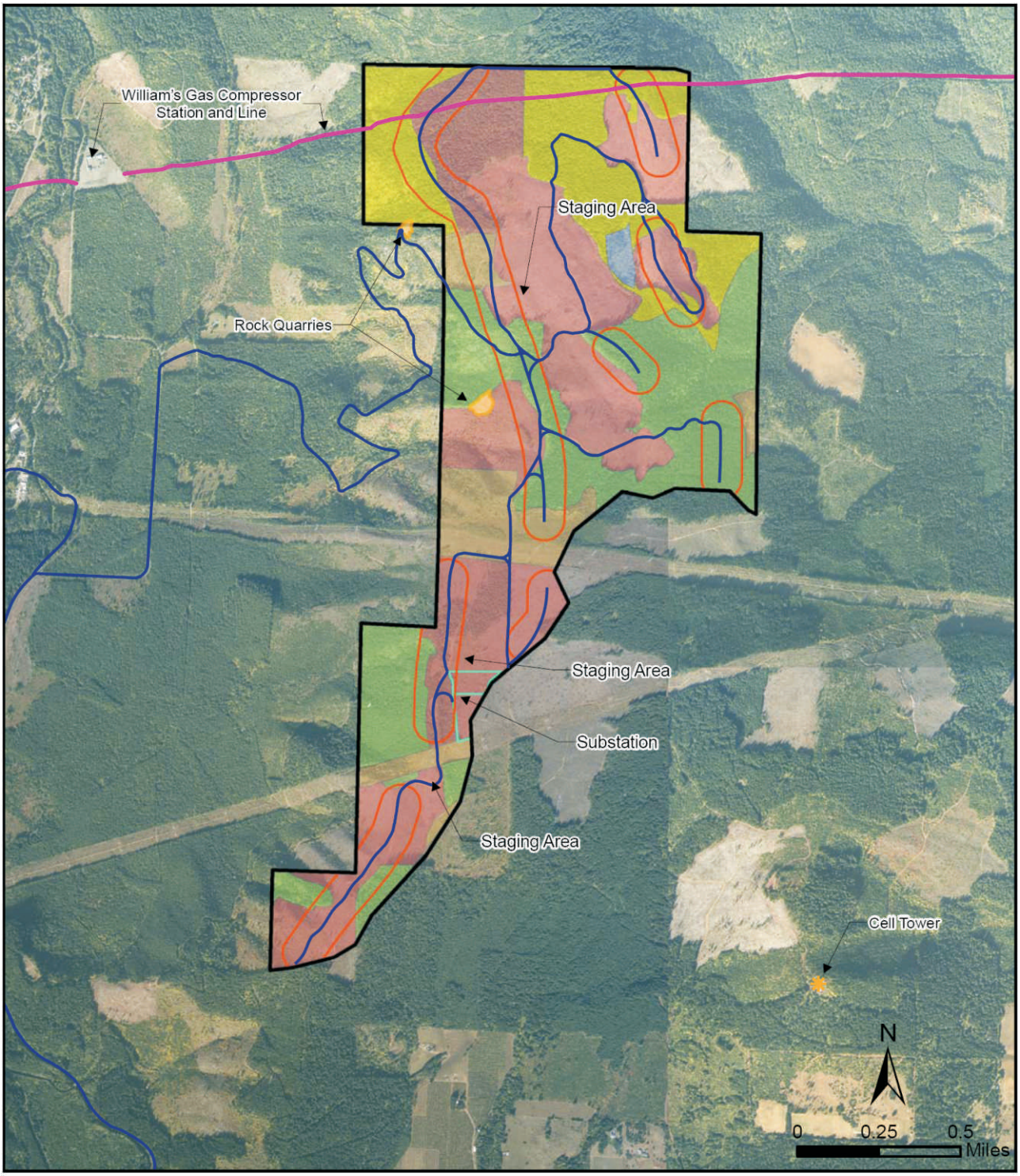

Brushfield/Shrub	650' Turbine Corridor
Conifer Forest	Access Roads
Conifer-Hardwood	Substation
Grass-Forb	Site Boundary
Riparian-Deciduous	

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-2

Habitat Types, 2009 Aerial

URS

Whistling Ridge Energy Project
Skamania County, Washington

- Federal-listed or proposed as a rare, threatened, or endangered species in Skamania County (USFWS 2009)

- A WNHP record search of known rare plant locations in the vicinity of the project site (WNHP 2003a)

- *Rare Plant List for Skamania County* (WNHP 2003b)

These data indicated that no federal-listed plant species are known to occur in the vicinity of the project site. However, four rare plants occur within two miles of the project site, including branching montia (*Montia diffusa*), Suksdorf's desert parsley (*Lomatium suksdorfii*), Siskiyou false hellebore (*Veratrum insolitum*), and golden chinquapin (*Chrysolepis chrysophylla*). Two additional rare plant species are reported as historically occurring in the vicinity of the project site, including bolandra (*Bolandra oregana*) and white-top aster (*Aster curtus*). Three occurrences of the Oregon white oak/Idaho fescue (*Quercus garryana/Festuca idahoensis*) vegetation community, a Known High-Quality or Rare Plant Community and Wetland Ecosystem of Washington, are documented within two miles of the project site (WNHP 2003a). These are located along the Columbia and White Salmon Rivers. No additional rare plants sites have been recorded in the vicinity of the project site since the rare plant surveys were conducted in 2003 (WNHP 2009).

Surveys were conducted in May and June 2003, and followed methods described in the Bureau of Land Management (BLM) Survey Protocols for Survey and Manage Strategy 2 Vascular Plants (Whiteaker et al. 1998). Survey dates were selected to encompass all or a portion of the blooming times of all rare plants potentially occurring in the project site. All surveys were completed by CH2M HILL. Surveys were conducted within a 300-foot corridor centered on proposed turbine strings and associated access roads, and a 100-foot corridor centered on existing roadways that were identified as needing improvement. Rare plant surveys also were conducted in proposed locations for the Operations and Maintenance facility, substation, and staging areas. No rare plant or habitat surveys were conducted on County roads used to access the site or along the underground cable routes. However, much of this area has been harvested recently and does not contain rare plant habitat.

No rare plant species or plant communities were detected on the project site. A detailed account of survey methods and results can be found in the Rare Plant Survey Report (Appendix B-2). A list of plant species observed during vegetation surveys also can be found in Appendix B-2.

Because turbines have been added and removed from the initial alignment, field surveys conducted ~~to date~~prior to the March 2009 Application submittal (Figure 3.4-3) may not cover 100% of the proposed wind farm. Additional surveys ~~are planned for~~were conducted in May and July 2009 to supplement the previous studies and ~~would~~ included County roads and underground cable routes where potential rare plant habitat could exist.

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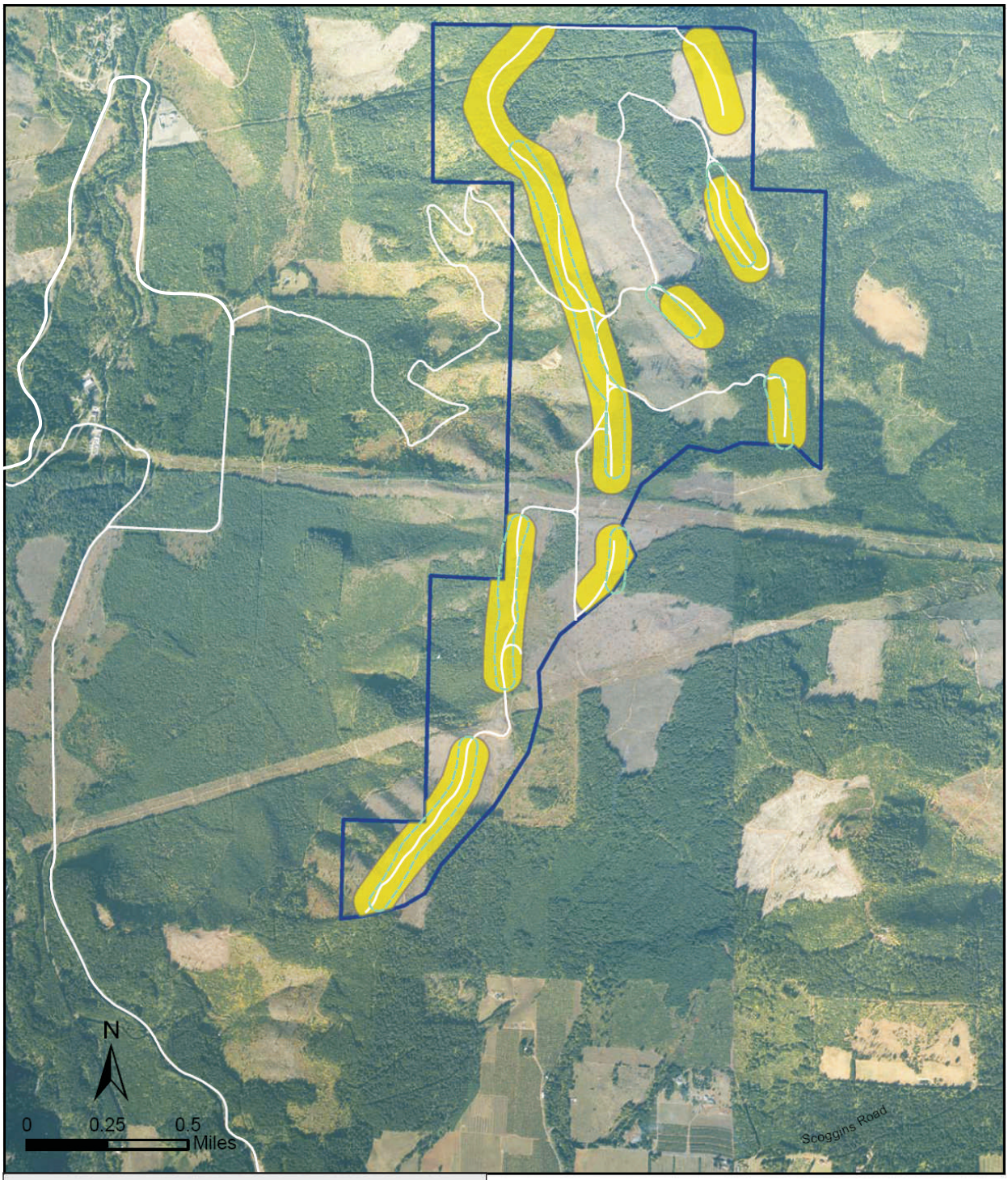

Surveyed Turbine String Area
Access Roads
650' Turbine Corridor
Site Boundary

Aerial Photo: Bergman Photographic, Portland, OR 2008

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-3

Rare Plant Surveys (2003 - 2006)

URS

Whistling Ridge Energy Project
Skamania County, Washington

Noxious Weeds

The project site contains several noxious weed species, which are nonnative, invasive plants. The weed species observed during field visits to date are listed in Table 3.4-2.

Table 3.4-2
Noxious Weed Observations

Scientific Name	Common Name	Status
Centaurea diffusa	Diffuse knapweed	Class B
Cirsium arvense	Canada thistle	Class C
Cirsium vulgare	Bull thistle	Class C
Cytisus scoparius	Scot's broom	Class B
Daucus carota	Queen Anne's lace	Class B
Hypericum perforatum	Common St. John's-wort	Class C
Linaria dalmatica	Dalmatian toadflax	Class B

The Washington Noxious Weed Control Board identifies lists of noxious weed species that require control, eradication, or monitoring. Class A noxious weeds are nonnative species with a limited distribution within a state and require eradication to reduce the potential of becoming more widespread.

Class B noxious weeds are regionally abundant, but may have limited distribution in some counties. In Washington, in regions where a Class B noxious weed is unrecorded or of limited distribution, prevention of seed production is required. In these areas the weed is a "Class B designate." However, in regions where a Class B species is already abundant or widespread, control is a local option. In these areas the weed is a "Class B non-designate."

Class C noxious weeds are already widely established, but placement on the state list allows counties to enforce local control if desired.

Improved Roadways outside the Site Boundary

Access to the proposed project site from SR 14 would ~~require traversing lands located within the Columbia River Gorge National Scenic Area.~~be via Cook-Underwood Road to Willard Road, and then via a new direct connection to West Pit Road, an existing private logging road. Approximately ~~2.1~~2.5 roadway miles in this area would require ~~minor~~ improvements as a result of the proposed project. ~~This improved~~West Pit ~~road~~ Road is owned and operated by S.D.S Co., LLC~~, and would be used to connect existing County roads within the Scenic Area to project roads owned by S.D.S Co., LLC on the project site~~. ~~In addition, four existing roadway intersections in the Scenic Area would require slight modification to accommodate transportation~~

~~of the large turbine segments (Figure 4.3-2). These intersections have not been surveyed for habitat or rare plants.~~ Surveys ~~are planned for spring~~for habitat and rare plants were conducted in May and July 2009 and none were found.

3.4.1.2 Impacts

Whistling Ridge Energy Project Site

Habitat Types

Construction and operation of the Whistling Ridge Energy Project would require the removal of vegetation in some areas to accommodate roadway construction and improvement, turbine siting, staging, and construction. Each turbine footings and foundations would measure approximately 3,100 square feet. Vegetation surrounding each turbine would be managed according to the following specifications:

- A circular area extending 50 feet from each turbine would be harvested and graveled
- From 50 feet to 150 feet from the base of the turbines, tree heights would be limited to 15 feet above the elevation of the base of the turbine
- From 150 feet to 500 feet from the base of the turbines, tree height would be restricted to 50 feet above the turbine base within an area formed by a 90 degree arc centered on the ordinary downwind direction

The A and F turbine strings and parts of the B and C turbine strings would be accessed by existing roads. Modifications to these roads are anticipated in order to support the long and heavy loads required for delivery of the wind turbine systems. An estimated 5.1 miles of roads within the project site would require improvements as a result of the proposed project. The majority of new roads would be constructed to access parts of the B and C turbine strings, and all of the D and E turbine strings. Access to these turbines would require 2.4 miles of new roadway. All roads used to access turbines would be maintained throughout the life of the project.

All vegetation clearing would be completed using crawler tractors, rubber-tired skidders, mobile feller-bunchers, or cable yarding equipment. This equipment is typically used in timber harvest, and is currently used to harvest other mature stands located on S.D.S. Co., LLC property. Logs would be transported by truck to SDS Lumber Company facilities in Bingen, Washington. Except for maintained and permanently cleared areas, cleared areas would be replanted with trees within one year following completion of construction (typically the following spring). Areas where trees are permanently removed would be replanted with appropriate native grasses and low-growing shrubs. Because it is being implemented for the purpose of the project, cleared areas would be considered “forest conversion” under the Washington Forest Practices Act. However, cleared areas would still be reforested in accordance with typical commercial forestry management practices when feasible.

Permanent and temporary impacts to habitat types within the project site can be found in Tables 3.4-3 and 3.4-4.

Table 3.4-3
Temporary Impacts from Project Elements to Habitat Types (acres)

Habitat Type	Turbine Corridor[a]	Road Corridor[b]	Transmission Line Corridor[c]	Total
Grass-Forb Stand	19.44	5.19	1.39	26.02
Brushfield/Shrub Stand	2.97	1.27	1.26	5.50
Conifer-Hardwood Forest	14.87	1.62	2.22	18.71
Conifer Forest	9.52	2.43	0.05	12.00
Riparian Deciduous Forest	0	0	0	0

a. Total temporary impact area of proposed development within the 650-foot corridor measured on either side of an imaginary line connecting each turbine string.
b. The temporary impact area of proposed roadway modifications ~~development~~ within the ~~region~~ project site area encompassed by a 100-foot corridor along all roads ~~in the project starting at the intersection of the site boundary and the Scenic Area~~. Does not include overlap of transmission corridor or turbine corridor.
c. The temporary impact area of proposed development within the area encompassed by a 100-foot corridor along all project transmission lines. Does not include overlap of road corridor or turbine corridor.

Table 3.4-4
Permanent Impacts from Project Elements to Habitat Types (acres)

Habitat Type	Turbine Corridor[a]	Road Corridor[b]	Transmission Line Corridor[c]	Total
Grass-Forb Stand	11.89	4.81	0.43	17.13
Brushfield/Shrub Stand	1.49	1.33	1.36	4.18
Conifer-Hardwood Forest	9.85	1.22	2.34	13.41
Conifer Forest	5.61	2.84	0	8.45
Riparian Deciduous Forest	0	0	0	0

a. Total permanent impact area of proposed development within the 650-foot corridor measured on either side of an imaginary line connecting each turbine string.
b. The permanent impact area of proposed ~~development~~ roadway modifications within the ~~region~~ project site area encompassed by a 100-foot corridor along all roads ~~in the project starting at the intersection of the site boundary and the Scenic Area~~. Does not include overlap of transmission corridor or turbine corridor. Also excludes existing roadway.
c. The permanent impact area of proposed development within the area encompassed by a 100-foot corridor along all project transmission lines. Does not include overlap of road corridor or turbine corridor.

Rare Plant Species and Vegetation Communities

Because no rare plants were identified in the portion of project site surveyed to date, no project-related impacts are anticipated to any federal- or Washington State-listed plant species during construction or operation of the proposed project. Impacts to habitats are expected to vary depending on the location and quality of habitat. Mature forests within the project site would be harvested to accommodate the facility. However, timber harvest in these areas would occur in the absence of the proposed project based on existing harvest rotation schedules.

Noxious Weeds

While no Class A weeds have been observed in the project area, several Class B and C weeds are present. Constructing the project can foster the spread of noxious weeds throughout the project area. New roads are a pathway for weeds to invade. Many weeds are adapted to disturbed conditions and can establish immediately after construction. Increased traffic also can lead to the spread of weeds. Noxious weeds can threaten the general ecological health and diversity of native ecosystems. Noxious weed infestations are the second leading cause of wildlife habitat degradation. Noxious weeds would be managed within the project site. By implementing BMPs, weeds are not anticipated to spread further as a result of the development of the wind energy facility.

Improved Roadways outside the Site Boundary

A total of ~~2.1~~2.5 roadway miles located outside the proposed project site would require upgrades as a result of the proposed project. ~~These roads~~West Pit Road traverses forests of varying stand age. ~~Half~~ Much of the ~~upgraded~~ road~~s~~ ~~are~~ is adjacent to areas characterized by ~~recent~~ clearcut harvest. Road improvements are expected to have negligible impact on habitat and vegetation. ~~Preliminary assumptions of the degree of anticipated impact will be verified during 2009 field surveys.~~

~~In addition, four existing roadway intersections in the Columbia River Gorge National Scenic Area would require slight modification to accommodate transportation of the large turbine segments. These intersections have not been surveyed for habitat or rare plants. However, the impact areas for most of these modifications would be immediately adjacent to the road in previously disturbed areas and do not appear to contain natural habitat conditions. Preliminary assumptions of the degree of anticipated impact would be verified during 2009 field surveys.~~

3.4.1.3 Mitigation Measures

Mitigation for potential impacts resulting from the proposed project includes the following:

- The applicant has commissioned extensive studies by qualified biologists of rare plants and habitats at the project site to avoid impacts to sensitive populations. The results and recommendations of these studies have been incorporated into the proposed design, construction, and operation of the project. In the event that the final project layout includes areas that contain suitable habitat for rare plants which have not previously been surveyed, an additional rare plant survey would be conducted at the appropriate time of year.

- The turbine strings have avoided sensitive riparian areas.

- Locating wind turbines in an actively-managed commercial forest avoids impacts to higher quality habitats.

- To the extent possible, new road construction and associated habitat impacts have been minimized by improving and using existing roads instead of constructing new roads.

- Use of certified "weed free" straw bales during construction to avoid introduction of noxious weeds

- All temporarily disturbed areas would be reseeded with an appropriate mix of native plant species as soon as possible after construction is completed to accelerate the revegetation of these areas and to avoid the establishment and spread of noxious weed species.

- Implementation of a noxious weed control program, in coordination with the Skamania County Noxious Weed Control Board, to control the spread and prevent the introduction of noxious weed species.

3.4.2 FISH

3.4.2.1 Existing Conditions

Lands surrounding the Whistling Ridge Energy Project are generally mountainous with steep-sided narrow drainages. Elevations of the turbine positions range from approximately 2,100 feet to 2,300 feet above msl. The Columbia River flows south of the site and receives runoff via the White Salmon drainage area from the east portion of the site and via the Little White Salmon River from the west portion of the site.

The Whistling Ridge Energy Project is sited on lands characterized by shallow slopes, located between Underwood Mountain and the White Salmon River, approximately three miles from the Columbia River. The proposed layout is situated on a ridge above the Little White Salmon River drainage; however, project elements such as roadway, turbine strings, and facilities do not cross tributaries to this system. The ridgeline is oriented in a north-south direction. A tributary to Little Buck Creek is located in the northeast portion of the project site, and drains into the White Salmon River (Figure 3.4-4). Little Buck Creek is not crossed by any project elements. No perennial streams are located in or adjacent to the Whistling Ridge Energy Project footprint.

~~Road CG2930 crosses one unnamed, intermittent creek that drains to the south. This road would require small radius improvements to support loads required for construction of the project.~~West Pit Road crosses one unnamed drainage in the Lapham Creek watershed. This stream had observed flow through the existing culvert under West Pit Road at the time of the July 2009 field visit. However, the surface flow and the channel disappear downstream of the culvert. There is no surface water connection to Lapham Creek and fish are not present in this stream.

Although no special status fish species are present in Little Buck Creek, this creek does drain into Northwestern Lake, which in turn drains into the White Salmon River. The White Salmon River contains evolutionarily significant units and designated critical habitat for three species listed as threatened under the ESA: (1) Lower Columbia River Chinook, (2) Middle Columbia River Steelhead, and (3) Columbia River Chum (Figure 3.4-4).

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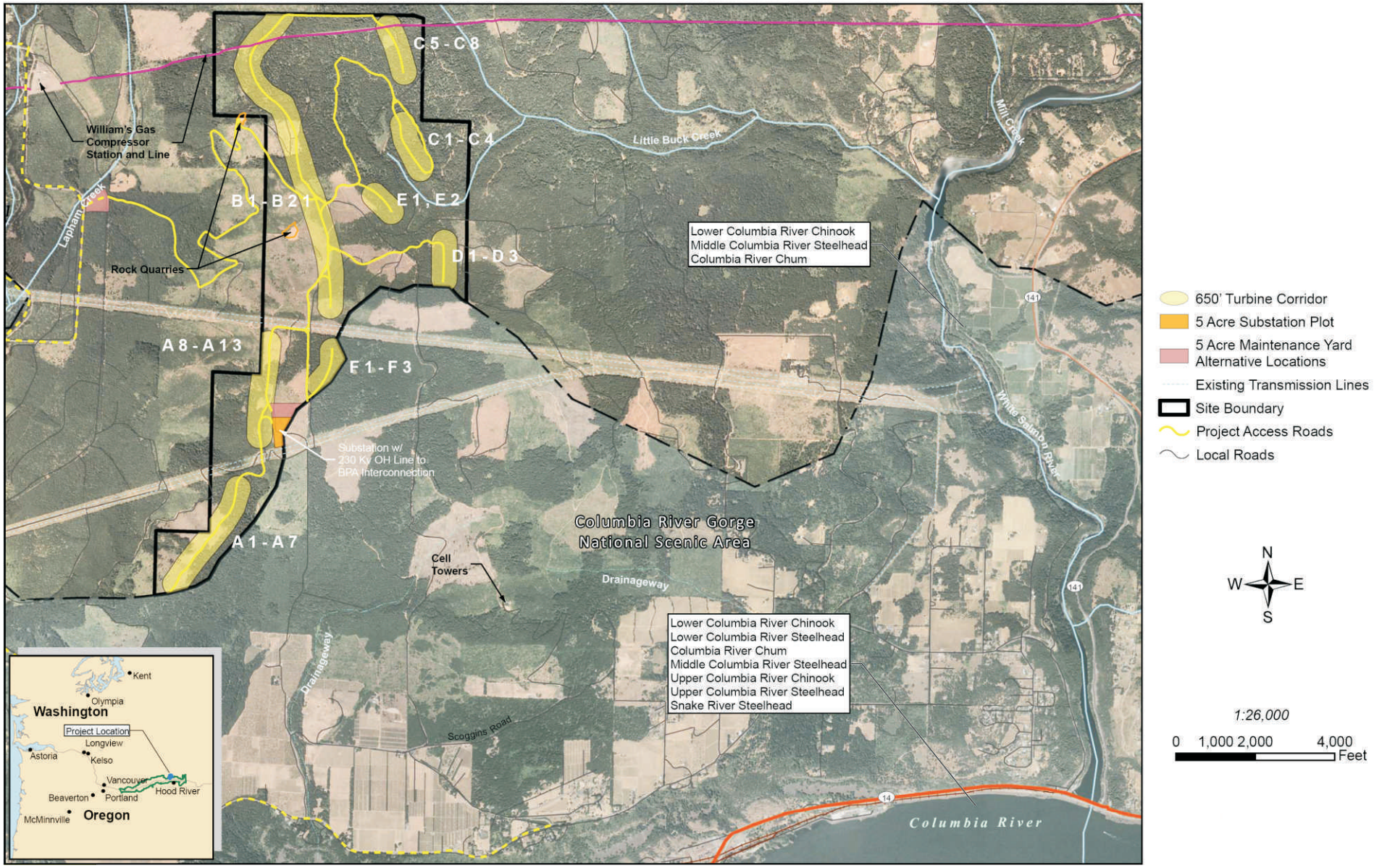

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-4

Location of Designated Critical Fish Habitat

URS

Whistling Ridge Energy Project
Skamania County, Washington

3.4.2.2 Impacts

Due to the location of water bodies on the project site, no impacts to aquatic species, their habitat, or designated critical habitat are expected as a result of construction and operation of the proposed facility. Water quality would be maintained during construction and operation of the project by incorporating BMPs.

3.4.2.3 Mitigation Measures

Section 3.3, Water, lists the project BMPs that would be incorporated to protect water quality and quantity. Pursuant to an erosion control plan for the project and an NPDES permit, drainage improvements would be made as needed. All temporarily disturbed areas would be regraded and reseeded with an appropriate mix of native plant species to restore vegetation after the construction phase is completed.

3.4.3 WILDLIFE

3.4.3.1 Existing Conditions

Whistling Ridge Energy Project Site

This section summarizes baseline wildlife surveys conducted at the Whistling Ridge Energy Project site discusses potential impacts that may result from the proposed actions, and lists potential mitigation for these impacts.

While the information provided in this section reflects survey efforts comparable to other wind energy facilities permitted in the Northwest, evaluation of wildlife resources within the project site is ongoing. Data presented in this Application were collected during preliminary wildlife and avian surveys. In order to provide the best information available to the decision-making process, the applicant believes that additional data is warranted. Final impact assessments would be conducted during the SEPA process.

The applicant contracted Turnstone Environmental Consultants (TECI), and Western Ecosystems Technology (WEST) to conduct wildlife investigations on the project site. Wildlife surveys were conducted between 2004 and 2008, and included:

- Surveys for northern spotted owl, western gray squirrel, and northern goshawk (TECI)
- Fall avian migration and summer avian breeding/nesting surveys (WEST)
- Bat acoustic surveys (WEST)

In addition, WEST performed avian surveys as part of an analysis of potential avian/wind plant interactions in Klickitat County contained in the Klickitat County Energy Overlay Draft EIS (Kennedy Jenks 2003) and Final EIS (Anchor Environmental 2004). The surveys included two

observation points in Skamania County, in the vicinity of the project site, shown on Figure 1, Avian Survey Points and Geographic Regions Used for Data Analysis, in the Draft EIS.

Current habitat conditions are described in Section 3.4.1 Habitat and Vegetation, and are not repeated below. For complete reports on surveys discussed below, see Appendices B-1 and B-2.

Special Status Species

Three special-status wildlife species are documented present within the vicinity of the proposed project: northern spotted owl (*Strix occidentalis caurina*), western gray squirrel (*Sciurus griseus)*, and northern goshawk (*Accipiter gentilis*) (Table 3.4-5).

Table 3.4-5
Federal and State Status of Special Status Species
with the Potential to Occur at the Whistling Ridge Energy Project Site

Common Name	Scientific Name	Washington State Status	Federal Status
northern spotted owl	*Strix occidentalis caurina*	Endangered	Threatened
western gray squirrel	*Sciurus griseus*	Threatened	Species of Concern
northern goshawk	*Accipiter gentilis*	Candidate	Species of Concern

Northern Spotted Owl. The northern spotted owl is listed threatened under the ESA. This species also is included as a state-listed threatened species in State of Washington. In Washington State, northern spotted owls inhabit the Eastern and Western Cascades, Western Lowlands and Olympic Peninsula Provinces. Within these regions, the northern spotted owl is associated with a variety of areas containing suitable habitat for nesting, roosting, foraging and dispersal. The species prefers forest habitats characterized by multi-layered canopy, and a high incidence of large trees that provide suitable structure for nesting and roosting. Northern spotted owls have large home ranges and use large tracts of land containing late successional forests. Fragmented forest habitats may be used for dispersal and foraging. Spotted owls will nest in stick nests of northern goshawks, on clumps of mistletoe, in large tree cavities, on broken tops of large trees, or on large branches or cavities in banks and rock faces.

Two historical northern spotted owl activity centers, Mill Creek (MSNO# 0991) and Moss Creek (MSNO#1003), are located north of the project site. The nest cores of both activity centers are located on public lands managed by the WDNR and the US Forest Service (USFS). The Mill creek activity center is composed of contiguous yet scattered northern spotted owl habitat located on private and public (WDNR) lands. This site was designated in 1992, and was last known to have spotted owls present in 2000. Surveys performed since 2000 have not resulted in any spotted owl sightings. The Moss Creek activity center is comprised of patchily distributed northern spotted owl habitat and a mix of rural residential lands, industrial timberland, and lands administered by WDNR and USFS. This activity center was established in 1994 and was last considered to have spotted owls present in 2002. Typically spotted owl activity centers will have their status changed to "historic" after three consecutive years with no documented spotted owl observations. ~~However, the state of Washington currently has a moratorium on changing the status of a known spotted owl activity center.~~ Northern spotted owl critical habitat is designated on lands located to the west/ northwest of the project site, and is almost entirely within the Gifford Pinchot National Forest Boundary. No spotted owl critical habitat is present on the project site.

Spotted owl surveys followed the 1992 Revised Version of "Protocol for Surveying Proposed Management Activities That May Impact Northern Spotted Owls" (USFWS 1992). Surveys were conducted in suitable habitat located in and adjacent to the proposed project site, and included Mill Creek and Moss Creek spotted owl activity centers (Figure 3.4-5).

Suitable habitat was identified using topographic maps, aerial photography, and stand classification data from S.D.S Co., LLC.

During the 2003–2004 survey periods, the project site was surveyed between March 24, 2003 and July 23, 2003 using the one-year survey methodology, and between March 31, 2004 and August 18, 2004 using the two-year survey methodology. An additional survey was completed by TECI in 2004 in order to lengthen the time period in which management activities could occur before surveys would again be required. No spotted owls were detected during the 2003–2004 surveys.

Detailed methodology and results for the 2003 and 2004 northern spotted owl surveys can be found in Appendix B-3.

More recent spotted owl surveys were conducted in May 2008 and spring - summer of 2009. Surveys were conducted using the two-year survey methodology, which requires a minimum of three visits for two consecutive years in order to determine presence/absence of the spotted owl. During the three 2008 surveys, only barred owls were detected. USFWS is developing a new survey protocol addressing interactions between barred owls and spotted owls. The protocol is not due to be available until 2010, however Turnstone was able to obtain suggestions on new survey techniques to be used. One of those suggestions was to visit core areas in the day time looking for spotted owls that may not respond in the presence of barred owls. Turnstone has taken these suggestions and used them in the field, conducting four day site visits up and above the current protocol parameters. Turnstone has completed all required night visits and performed the last day visit on August 10th, all in the core areas where spotted owls were found historically. There have been no visuals or responses to date. Surveys were implemented in all potentially suitable habitat located within a 1.8 mile radius of the corridor (Figure 3.4-5). This area totaled 14,901 acres. The survey area also included the Moss Creek and Mill Creek activity centers, which expanded the survey area by 7,222 acres. No spotted owls were detected in either the survey area or historic activity centers. Detailed methodology and results for the 2008 northern spotted owl surveys can be found in Appendix B-4. The 2009 survey data will be included as part of the EIS.

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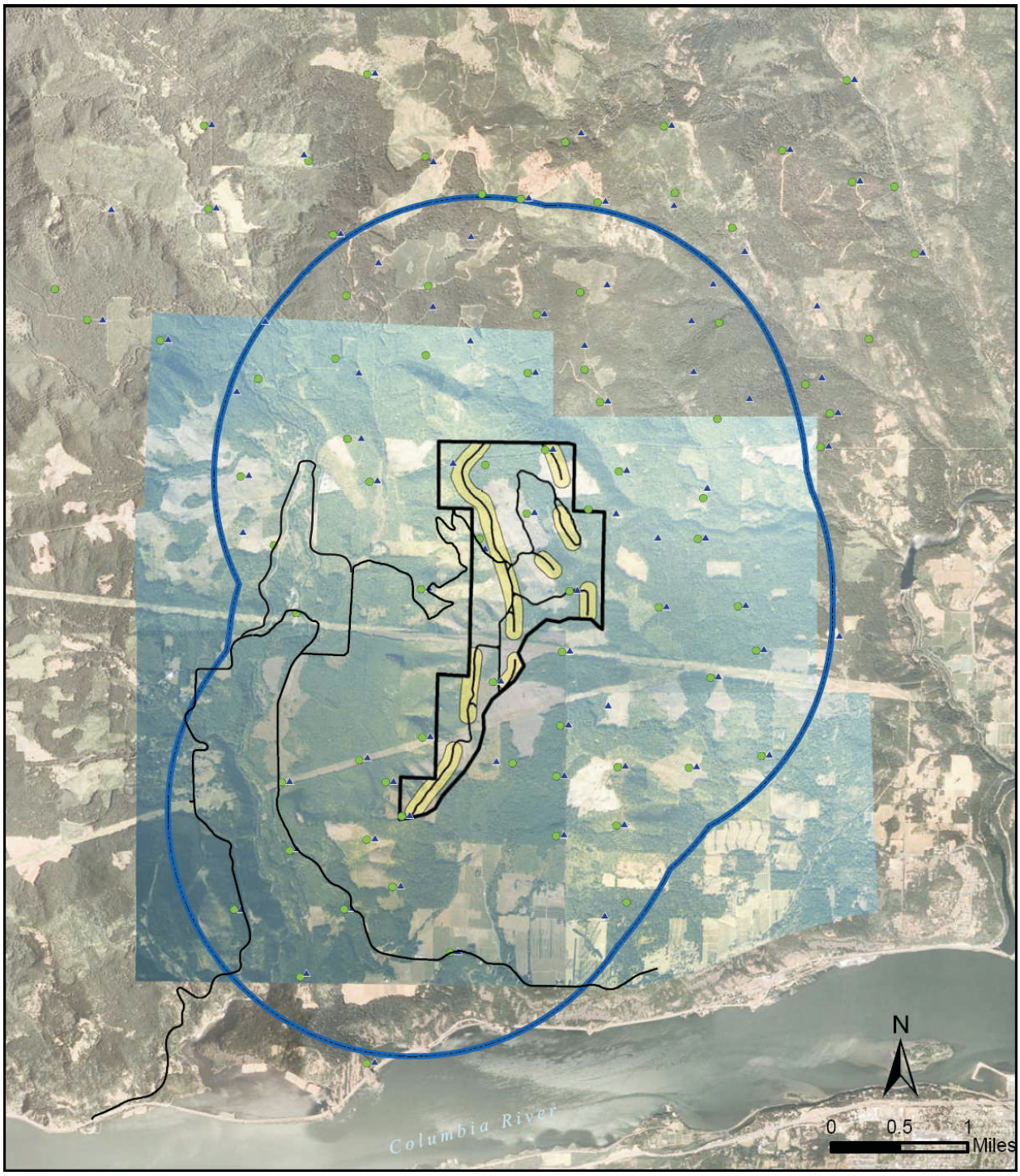

2003/2004 Calling Stations
2008 Calling Stations
Potential Habitat Area
Site Boundary
Access Roads
650' Turbine Corridor

Aerial Photo: Bergman Photographic, Portland, OR 2008
2006 USDA NAIP Imagery

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-5

Potential Spotted Owl Habitat Area

URS

Whistling Ridge Energy Project
Skamania County, Washington

Western Gray Squirrel. The western gray squirrel is listed as a "threatened" species by the WDFW. In Washington, western gray squirrel distribution has been reduced to three geographically isolated populations: the "Puget Trough" population, centered in Thurston and Pierce counties, the "South Cascades" population, located in eastern Skamania County and Klickitat and Yakima Counties, and the "North Cascades" population, located in Chelan and Okanogan Counties. Western gray squirrels are arboreal species. Although they forage on the ground, this species rarely strays far from trees. They use tree canopies for cover and nesting. Western gray squirrels prefer areas where contiguous tree canopy allows arboreal travel in a minimum of a 198 feet (60 meters) radius around the nest (Ryan and Carey 1995). Western gray squirrels are diurnal species, with most activity occurring during morning hours. This species is most active during August and September, when this species is collecting and storing food for winter (Ryan and Carey 1995). The principal food source for the gray squirrel is acorns; however, conifer seeds are also eaten (Dalquest 1948). While pine nuts and acorns are considered essential foods for accumulating body fat in preparation for winter, green vegetation, seeds, nuts, fleshy fruits, and mushrooms also are consumed (WDW 1993, Carraway and Verts 1994, Ryan and Carey 1995).

Western gray squirrel surveys were implemented by TECI on lands located in and adjacent to the project site in 2004 and 2008 (Figure 3.4-6). Surveys conducted in 2004 included a general search for western gray squirrels and nests while conducting northern goshawk station placement and surveys. Two adult western gray squirrels were identified through that effort.

An additional protocol survey was completed following methods described in "Surveys for western gray squirrel nests on sites harvested under approved forest practice guidelines: analysis of nest use and operator compliance" (Van der Haegen, Van Leuven, and Anderson 2004). No western gray squirrels were detected during protocol surveys. Detailed methodology and results for western gray squirrel surveys can be found in Appendix B-3.

Additional western gray squirrel surveys were completed by TECI in 2008. Prior to implementing field surveys, TECI consulted with a WDFW biologist to identify survey criteria and methodology. It was determined that gray squirrels surveys should be performed in areas where project activities would result in the removal of potential western gray squirrel habitat or structural modification (i.e., stand thinning), and these surveys should include unaltered habitat within 400 feet of potential disturbance.

An area consisting of a 1,050-foot buffer around the proposed turbine layout to account for lands that may be impacted by the project, and also the 400-foot buffer of undisturbed lands, was identified for potential survey. This area included 1,420 acres; however, only 738 acres was identified as potentially suitable to support western gray squirrel (Figure 3.4-6). Surveys were conducted following methods described by Van der Haegen, Van Leuven, and Anderson (2004). Surveyors searched for individuals and nests, focusing mainly on gray squirrels, but also noting other species. When possible, historical use by western gray squirrels was determined. No gray squirrels or nests were detected during these surveys. Detailed methodology and results can be found in Appendix B-4.

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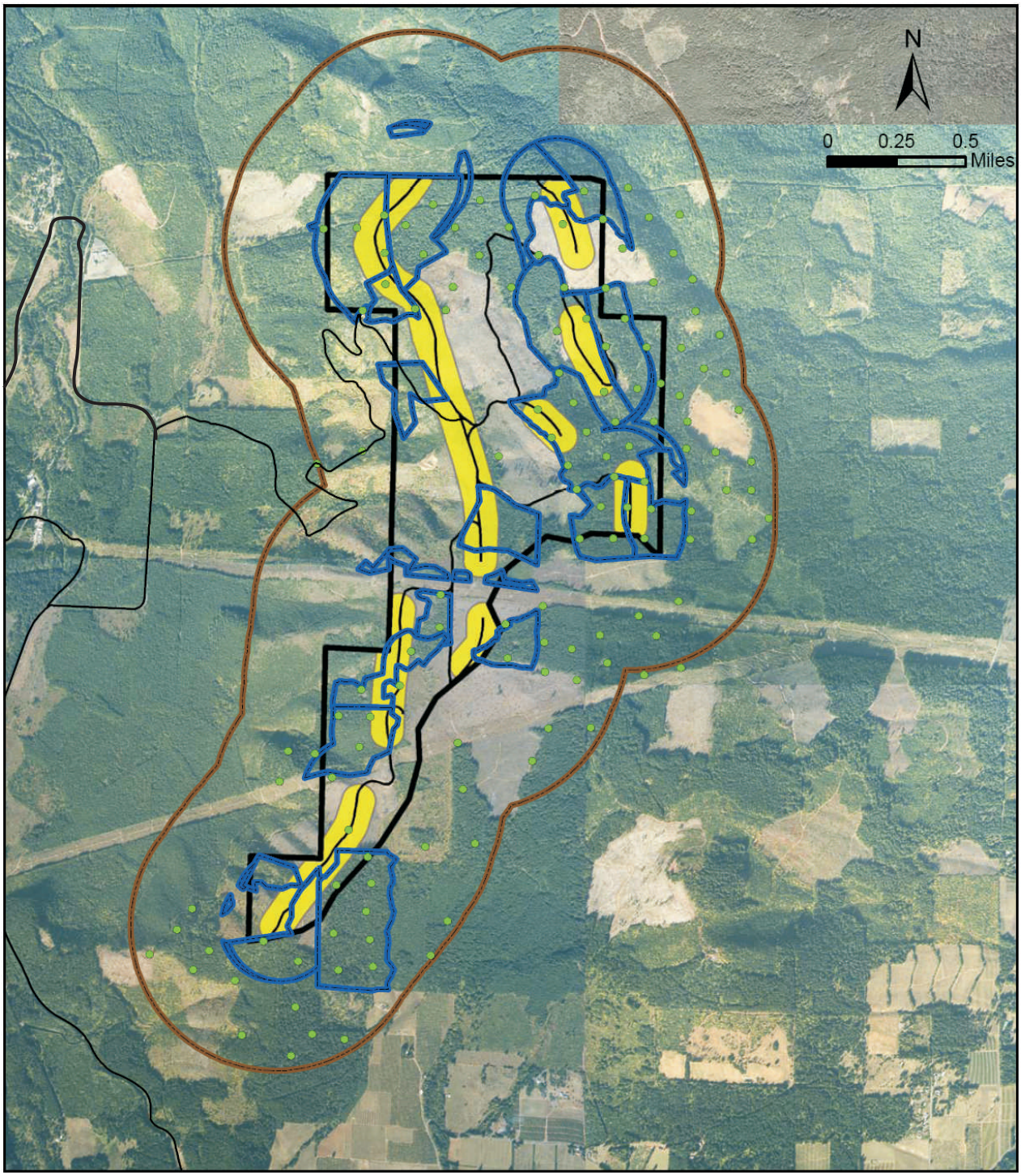

2008 Northern Goshawk Calling Stations

2008 Northern Goshawk Survey Area

2008 Western Gray Squirrel Survey Areas

650' Turbine Corridor

Site Boundary

Access Roads

Aerial Photo: Bergman Photographic, Portland, OR 2008

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-6

Northern Goshawk and Western Gray Squirrel Surveys

URS

Whistling Ridge Energy Project
Skamania County, Washington

Northern Goshawk. The northern goshawk is categorized as a "species of concern" by the U.S. FWS, and as a "listing candidate" for sensitive, threatened or endangered species by the State of Washington. Goshawks inhabit a wide variety of forest habitats, including true fir (red fir, white fir, and subalpine fir), mixed conifer, lodgepole pine, ponderosa pine, Jeffrey pine, montane riparian deciduous forest and Douglas fir. They are occasionally found nesting in coast redwood and mixed hardwood forest. Goshawk nest sites tend to be associated with patches of relatively large, dense forest; however, home ranges often consist of a wide range of forest age classes and conditions. Nest sites tend to be positively correlated with proximity to water or meadow habitat, forest openings, level terrain or "benches," northerly aspects and patches of larger, denser trees, although variation in habitat associations does occur (USFWS 2002).

Northern goshawk surveys were conducted by TECI biologists in 2003 and 2008 on properties managed by S.D.S. Co., LLC and adjacent private land. In 2003, surveys were conducted in suitable habitat located in four core project sections, including the provincial home range radius of 0.5 mile around the core area (Figure 3.4-6). Suitable habitat was identified using topographic maps and aerial photography. Survey stations were establish at 0.2-mile intervals on roads and trails located in suitable habitat within 0.5 mile of a proposed wind turbine location. Potential goshawk habitat was surveyed in accordance with "Survey Methodology for Northern Goshawks in the Pacific Southwest Region" (Woodbridge and Hargis 2006). All raptor species responses detected during surveys also were recorded.

TECI completed two protocol surveys during the 2004 northern goshawk survey season. One hundred eighty five calling stations were surveyed each time. No northern goshawk responses were recorded during any of the two site visits. Detailed methodology and results for northern goshawk surveys can be found in Appendix B-3.

In 2008, the potential survey area for the northern goshawk was determined by protocol parameters outlined in the Northern Goshawk Inventory and Monitoring Technical Guide (USFS 2006), consultation with biologists from the WDFW and GIS analysis. The survey area was established by placing a 150-foot buffer around the turbine string layout, and then adding an additional 2,624 foot buffer per protocol. Forest stands with greatest potential to contain suitable habitat structure and composition to support northern goshawk were identified using GIS data and aerial photographs. Criteria for selecting stands included stand age greater than 25 years, and an average tree dbh of at least 12 inches. Based on these criteria, 1,093 acres was identified for surveys (Figure 3.4-6).

It was determined that the "Broadcast Acoustical Survey" methodology would be used for a two-year survey effort. TECI biologists completed two protocol surveys at 136 calling stations during the 2008 goshawk survey season. The first survey was conducted during the nesting period, and the second during the fledgling period. No northern goshawk responses were documented during either of the two site visits. Detailed methodology and results can be found in Appendix B-4.

Summary of Survey History. The project layout was finalized in October 2008, and included additions to proposed turbine strings, removal of previously proposed turbines, and identification

of areas requiring improved roadways. Changes to the project layout resulted in lands added to the project area that, in some cases, were not included in wildlife surveys conducted prior to October 2008. The effect of these changes regarding special status species are:

- For northern spotted owls, the final turbine alignment did expand the area requiring owl surveys; however, because the survey area had included spotted owl activity centers located at the northern reach of the project site, the area was accounted for in the May 2008 surveys.

- For western gray squirrels, the final turbine alignment did expand the area requiring western gray squirrel surveys. These areas were identified after surveys were completed; however, the survey window was still open and an additional field survey was implemented in added areas.

- The applicant completed northern goshawk surveys in accordance with protocols accepted and recommended by WDFW. The surveys were conducted during the relevant seasons in 2004, 2005, 2008 and again in ~~2008~~2009. No goshawks were found on the project site, nor were any observed on any surrounding properties. ~~It is highly unlikely that goshawks will be found on the project site or in areas to the north, owned and managed by WDNR.~~ The applicant ~~would~~ conducted an additional survey on the project site in spring 2009 ~~to~~ and confirmed these findings, in accordance with agreed protocols. The WDNR property near the project site has similar habitat characteristics to the project site, and was recently logged. ~~While no goshawks are expected on the area to the north, due to the proximity of turbines to the WDNR property to the north, the Applicant would conduct an intensive survey effort on approximately 360 acres to the north of the project site to confirm that the project does not present any significant impact to this species.~~

- Anabat detection surveys proposed for 2009 ~~would be~~have been started ~~implemented~~ for the~~during the~~ months of July through October, and ~~would~~ will augment our understanding of bat activity within the vicinity of the proposed micrositing corridors. Anabat detectors have also ~~would be~~been elevated to gain a better understanding of bat activity at rotor swept height.

Avian Migration and Breeding/Nesting Surveys

Avian surveys were conducted during the fall migration period (September 11 to November 4, 2004) and the breeding/nesting season (May 15 to July 14, 2006) by WEST biologists. Study protocol followed methods described by Reynolds et al. (1980). An 800-meter circular plot was centered on each observation point (Figures 3.4-7 and 3.4-8). All observations, behavior, and flight patterns of birds in and near plots were recorded. Flight patterns, such as direction of travel and flight altitude also were recorded. Observations of birds beyond the 800-meter radius were recorded; however, these data were analyzed separately from data collected from survey plots. The location of raptors, other large birds, or species of concern observed during counts was recorded on field map.

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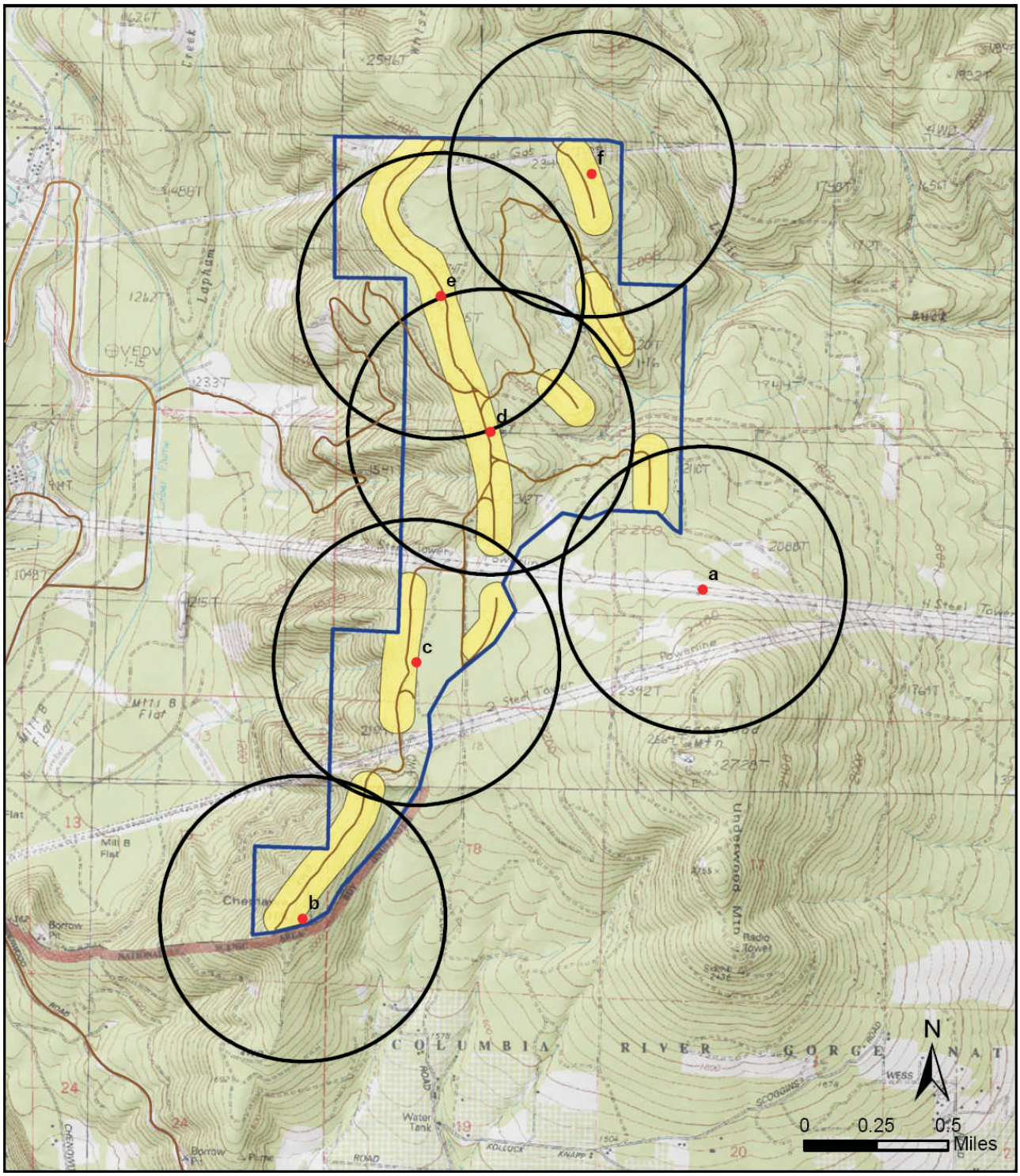

Avian Observation Points
800 m Buffer
650' Turbine Corridor
Site Boundary
Access Roads

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-7

Location of Avian Surveys (Fall 2004)

URS

Whistling Ridge Energy Project
Skamania County, Washington

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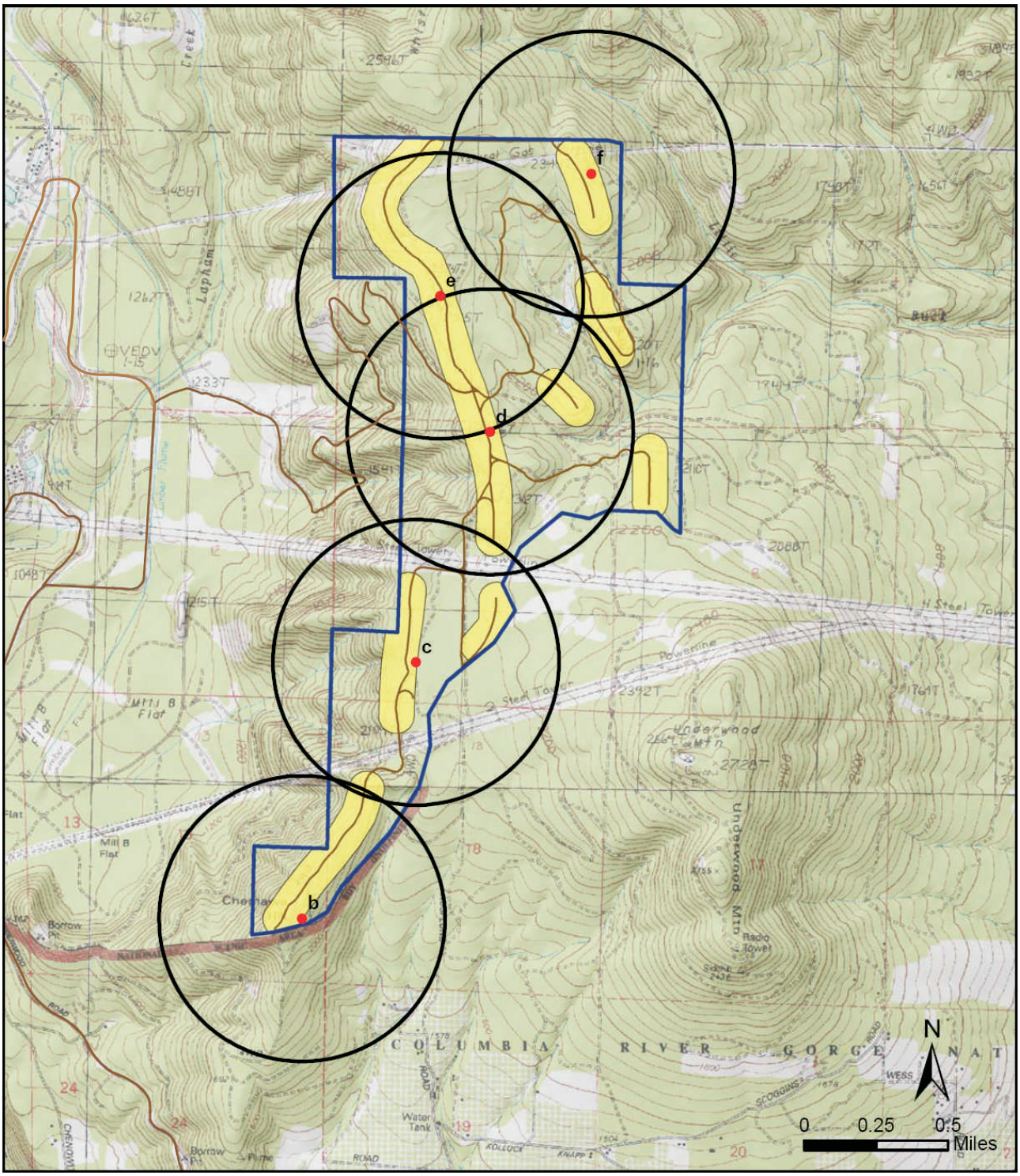

Avian Observation Points
800 m Buffer
650' Turbine Corridor
Site Boundary
Access Roads

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-8

Location of Avian Surveys (Spring 2006)

URS

Whistling Ridge Energy Project
Skamania County, Washington

A relative index to collision risk (R) was calculated for bird species observed in the survey area using the following formula:

$$R = A*P_f*P_t$$

Where A = mean use for species i averaged across all surveys, P_f = proportion of all observations of species i where activity was recorded as flying (an index to the approximate percentage of time species i spends flying during the daylight period), and P_t = proportion of all flight height observations of species i within the rotor-swept height.

This index does not account for differences in behavior other than flight characteristics (i.e., flight height and proportion of time spent flying). Point count data were used to establish diurnal indices of avian use, and how these indices compare to other wind resource areas in the United States.

Fall Migration Surveys (2004). General avian surveys identified thirty-nine 39 species of bird in the survey area (Figure 3.4-8). Passerines (songbirds) were the most abundant avian group, constituting 87.4% of observations. This group was also observed with the greatest frequency (94.4% of surveys). Raptors were the second most abundant group observed; however, this group represented only 4.9% of observations. Raptors were observed during 38.5% of the surveys, followed by woodpeckers (22.6% of surveys) and doves/pigeons (9.3% of surveys).

The most common species at the project site included dark-eyed junco, American goldfinch, Steller's jay, common raven, and white-crowned sparrow. The species of birds most frequently observed during fall surveys were common raven, Steller's jay, dark-eyed junco, red-breasted nuthatch, and golden-crowned kinglet. Eight species of raptor were observed during the survey. Those with the highest use of the site were sharp-shinned hawk, Cooper's hawk, and red-tailed hawk. The highest raptor use observed at the site during 2004 surveys occurred between September 11 and October 12, 2004. These data do not indicate that any areas within the proposed site have substantially higher raptor use than others.

No federal or state listed endangered or threatened avian species were observed during the survey period. Four state candidate species were observed: golden eagle, northern goshawk, pileated woodpecker, and Vaux's swift. Two State Monitor species were also observed, including four single turkey vultures and four groups totaling 27 western bluebirds. Detailed results and summary tables can be found in Appendix B-5.

Summer Breeding Nesting Surveys (2006). Fifty-five species of birds were observed during summer breeding and nesting surveys in 2006. Passerines were the most abundant group (88.5%), followed by raptors and woodpeckers (3.3% each), and doves/pigeons (3.2%). The most frequently observed groups were passerines (100% of surveys), woodpeckers (35.6% of surveys), and raptors (31.1% of surveys). Species with the highest use of the project site included white-crowned sparrow, red crossbill, western tanager, spotted towhee, and MacGillivray's warbler. The most frequently observed species included white-crowned sparrow (77.8% of the surveys), western tanager (75.6% of surveys), spotted towhee (64.4% of surveys), MacGillivray's warbler (48.9%), and dark-eyed junco (48.9%). Three species of raptors were

observed, including red-tailed hawk, northern goshawk, and sharp-shinned hawk. Raptor use in the fall was only slightly higher than during the summer breeding season. The data do not indicate that any portions of the project site have substantially higher raptor use than other areas. For all bird species combined, use of the project site by avian species was slightly higher during the summer breeding season than during the fall migration period.

Detailed results and summary tables can be found in Appendix B-6.

Bats

This section describes the results of bat acoustic studies conducted for the Whistling Ridge Energy Project in 2007 and 2008. Detailed information on these investigations can be found in Appendices B-7 and B-8.

Bat acoustic studies conducted in 2007 and 2008 were implemented at various locations on the project site. The purpose of these surveys was to quantify bat use of this area, and use these data to estimate the seasonal and spatial use of the project site. Passive Anabat® II echolocation detectors coupled with Zero Crossing Analysis Interface Modules (ZCAIM; Titly Electronics Pty Ltd., NSW, Australia) were used in both survey years. Anabat detectors record bat echolocation calls using a broadband microphone. Bat species are generally grouped into those that emit low frequency (<35 kHz) or high frequency (≥ 35 kHz) calls. The units of activity equaled the number of bat passes, and were used to calculate the number of bat passes per detector night (Hayes 1997). The data thus indicate the level of bat activity rather than absolute abundance.

In 2007, detectors were placed at two locations from August 20 through October 21 (Figure 3.4-9). The northernmost detector was located just outside the proposed corridor. This detector was initially placed at ground level; however, it was raised to a height of 130 feet (40 meters) on September 7. The southernmost detector was located outside the project site (i.e., outside of the Township, Range, and Section described above); however, it was placed in habitat believed to be representative of that found on the project site. The southernmost detector was placed at ground level, and remained at that location for the duration of the study.

Due to equipment failures, both Anabat detectors were only operable for 24% of the sampling period, amounting to 45 detector-nights. During this survey period, 348 bat passes were recorded. Bat activity was similar between north and south ground level Anabat units (mean = 11.67 ± 2.0 and 9.6 ± 4.1, respectively). At both ground-level locations, the number of high-frequency bat passes per detector night was approximately one and a half times greater than the number of low-frequency passes. High frequency calls are associated with species such as western red bat and mouse-eared bats (*Myotis* spp). Bat activity recorded after the northern Anabat detector was elevated was much lower (mean = 2.47 ± 1.1) than that recorded at ground level, and passes of low-frequency bats greatly outnumbered high-frequency bat passes. Low-frequency calls are associated with big brown bat, silver-haired bat, and hoary bat. Conclusive species identification was only possible for hoary bat, which accounted for approximately 5% of all species.

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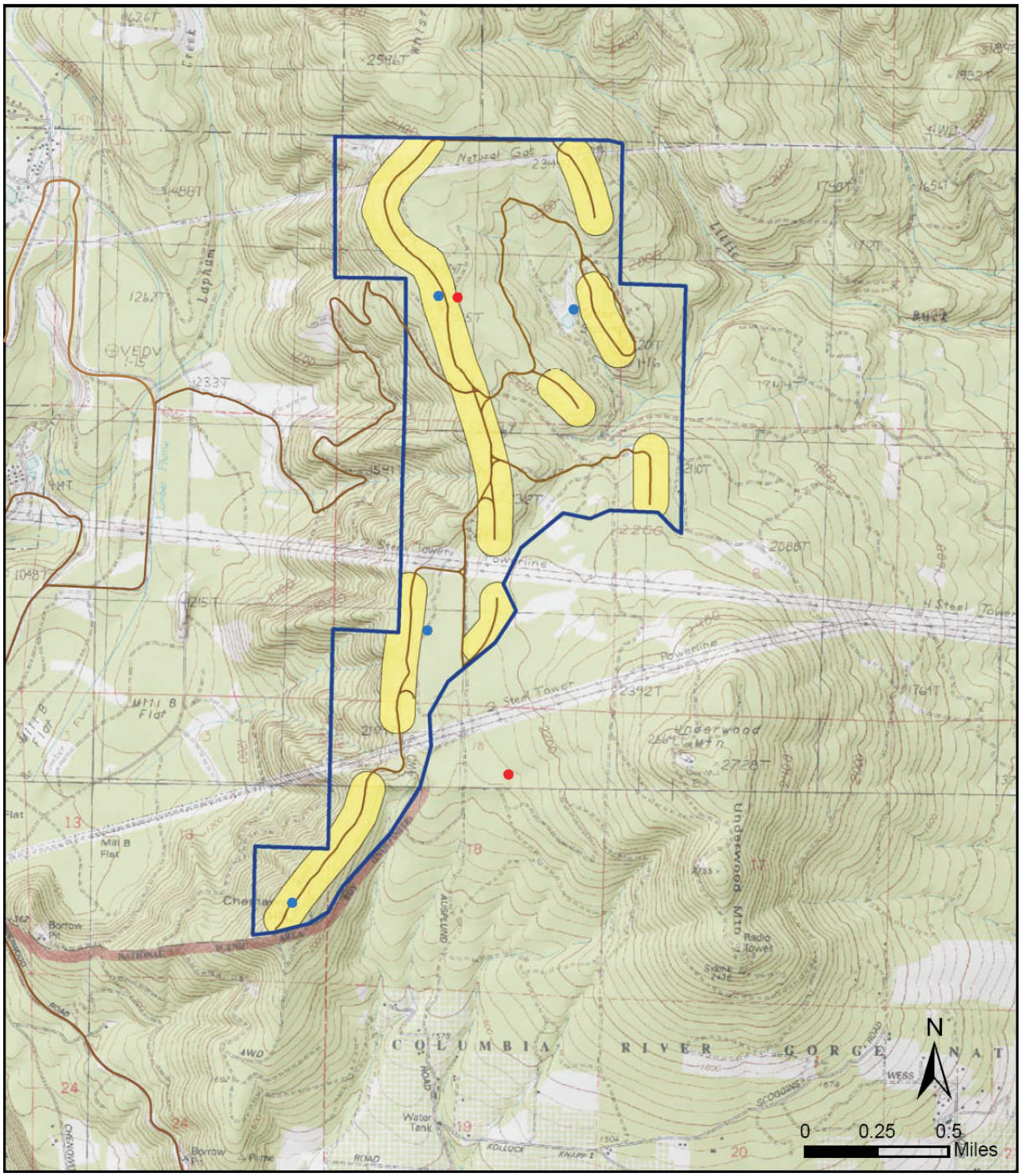


Anabat Locations 2008
Anabat Locations 2007
650' Turbine Corridor
Site Boundary
Access Roads

Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.4-9

Location of Bat Acoustic Studies

URS

Whistling Ridge Energy Project
Skamania County, Washington

Patterns of nightly activity were similar among detector locations; however, definitive comparisons cannot be made because the timing of when the north detector was placed at ground-level did not coincide with when data was collected from the southern ground-level detector.

The bat acoustic survey effort was greater during the 2008 survey period. Four Anabat detectors were placed in the project vicinity from July 3 to October 7, 2008 (Figure 3.4-9). This period corresponded with summer breeding and fall bat migration. One detector was placed at a wetland located to the west of turbines C1–C4. Data collected at this site are use to assess activity levels of local breeding bats that may be using the wetland, but was not used to evaluate risk of bats to collision mortality. The remaining three detectors were placed in upland habitats that more closely resembled habitat where turbines may be placed (one in a linear road corridor that passed through forested habitat, and two others in clearcuts).

For the three upland survey locations, bat activity was monitored for a total of 97 nights. Anabat detectors were operational for 95.5% of the sampling period. A total of 39,326 bat passes were recorded during 278 detector-nights. Average bat passes per detector night at the upland locations equaled 138.44. A total of 80.7% of all bat passes was recorded from the detector located in the road corridor. Bat passes recorded in clearcut habitats accounted for only 19.1% of all bat passes.

Bat activity at the wetland location was monitored for a total of 97 nights, and was operational 100% of the time. A total of 17,269 bat passes were recorded during 97 detector-nights. The average number of bat passes per detector night at this location equaled 178.03.

Temporal activity patterns were similar among the upland survey locations, with the highest bat activity occurring during the months of July and August. Peak activity across all upland sites occurred between July 10 and July 16. Bat activity in the wetland area was highest during the month of July, with peak activity occurring on July 5. Bat activity in this area between July 3 through mid-August was over four times higher than activity from mid-August through October 7 (mean = 218.6/detector night and 52.3/detector night, respectively).

At the upland sites, low-frequency bats accounted for 67% of all bat passes. The opposite was true for the wetland site, where high-frequency bats accounted for 69.7% of all bat passes. As in 2007, species identification was only possible for the hoary bat. Hoary bats comprised 6.0% of passes recorded at upland locations, and use was similar across the three sites. This species comprised 2.0% of total bat passes recorded at the wetland location. Activity was relatively high at the wetland and road corridor stations, and accounted for the majority of the calls recorded. Increased activity near the wetland is likely due to bats drinking and foraging in this area. Increased activity along the linear road clearing is likely due to its use as a travel corridor by local bats.

The 2008 acoustic surveys resulted in a vastly higher detection rate than that observed during 2007 surveys. Several factors contributed to the high level of detected bat activity during the 2008 surveys, including increased number of survey sites and the fact that all detectors were placed at ground level where heightened foraging activity occurs. However, the primary reason

for the greater number of detections recorded during 2008 surveys were due to timing and locations of the equpiment. In 2008, four times the number of bats was recorded from July 3 to mid-August, as mid-August through October; the peak activity period recorded in 2008 was thus missed during 2007 surveys as detectors were not installed until late August.

The temporal variation in activity levels is indicative of the importance of conducting detection surveys during this period. Anabat detection surveys proposed for 2009 ~~would be~~has been implemented ~~during~~ for the months of July through October, and ~~would~~ will augment our understanding of bat activity within the vicinity of the proposed corridor. Anabat detectors have also ~~would be~~been elevated to gain a better understanding of bat activity at rotor swept height.

Priority Wildlife Habitats

Priority wildlife habitats, including mule deer and black-tailed deer winter range, are present to the east of Underwood Mountain, extending to lands located to the north/northeast. Winter range for Columbia black-tailed deer is present in lands located west of Underwood Mountain, and extends north and south from the project site. Elk winter range is present throughout the project site.

Improved Roadways outside the Site Boundary

Access to the Whistling Ridge Energy Project would ~~require traversing lands located within the Columbia River Gorge National Scenic Area~~be using Cook-Underwood Road to Willard Road, and then via a new connection to West Pit Road to the project site boundary. West Pit Road is an existing private logging road. Approximately ~~2.1~~2.5 roadway miles in this area would require improvement as a result of the proposed project. This section would be used to connect existing County roads ~~within the Scenic Area~~ to other existing roads owned by S.D.S. Co., LLC.

3.4.3.2 Impacts

Whistling Ridge Energy Project Site

Construction and operation of the Whistling Ridge Energy Project is expected to have limited impacts on wildlife resources. Project actions would include the construction of permanent roadways, improvement (i.e. widening and resurfacing) of existing roadway, and the installation and operation of wind turbines. Impacts to wildlife habitat may result from vegetation removal in forested areas where the proposed roadway and turbine alignment is planned. Vegetation management in areas surrounding each turbine would range from complete removal of vegetation to limitations on tree height.

Wildlife and avian investigations conducted to date quantify the use of habitats located within the project site. Surveys for federally listed and candidate species, avian migration and breeding, and bat acoustic studies are ongoing, and include northern goshawk and bat surveys planned for 2009. The analysis presented below establishes an analytical framework and data for evaluation of the Application.

Special Status Species

Three federally listed or candidate species have the potential to occur within the project site, including northern spotted owl, western gray squirrel, and northern goshawk.

Northern Spotted Owl. The spotted owl prefers forest habitats characterized by multi-layered canopy, and a high incidence of large trees that provide suitable structure for nesting and roosting. No late seral forests are present within the project site. It is assumed that active timber harvest that has occurred in this area has altered the landscape such that limited suitable habitat exists. Further, no spotted owls have been detected in the proposed project site or spotted owl activity centers located in proximity to the proposed project. No impacts to northern spotted owls are expected.

Western Gray Squirrel. The gray squirrel prefers habitat where contiguous tree canopy allows arboreal travel in a minimum of a 198-foot (60-meter) radius around the nest (Ryan and Carey 1995). Ongoing forest management on lands located within the proposed project site has reduced suitable habitat for this species through fragmentation of mature forest stands. Contiguous forest habitat located on the project site would not persist indefinitely in the absence of the proposed project. The project site also contains very few oak trees, and those that were observed were of small stature (less than 20 feet tall), stunted, and growing in openings on exposed rocky slopes in shallow soils. Acorn crops from oak trees are an important food source for western gray squirrels, and the lack of this primary food source may deter use of the project site by gray squirrels. Because habitat for this species is considered rare or of moderate/poor quality on the project site, impacts to western gray squirrel are expected to be negligible.

Northern Goshawk. Goshawks inhabit a wide variety of forest habitats, including true fir, mixed conifer, montane riparian deciduous forest and Douglas fir forests. Goshawk nest sites tend to be associated with patches of relatively large, dense forest located in proximity to water; however, home ranges often consist of a wide range of forest age classes and conditions. Although no goshawks were detected during protocol surveys, individuals were spotted during general avian migration and breeding surveys. Potential impacts to this species may include turbine collision-related mortality or displacement; however, the risk for this species is considered low.

Avian Species (General)

Construction Impacts. Impacts to avian species are not anticipated during construction of the proposed project. Certain species may be temporarily displaced due to construction related noise and increased traffic volume; however, permanent impacts to these species are not expected.

Operational Impacts. Potential operation-related impacts to avian species include turbine collision and displacement. Based on the exposure index derived from abundance and flight behavior, the species most likely to collide with wind turbines located at the project are red crossbills (R = 0.77), Steller's Jay (R = 0.37), common raven (R = 0.33), American Goldfinch (R = 0.29), and western bluebird (R = 0.22). The highest index for any raptor was 0.08 for red-tailed hawk, indicating a risk approximately 10 times lower than for the red crossbill. A regression analysis using data collected during avian surveys estimated a raptor/vulture fatality

rate of 0.049/MW/year, or 4–5 raptors per 100 MW per year. This fatality estimate is relatively low compared to many wind projects (Appendix B-6). Further, data collected from the project site indicate that the area is not within a major migratory pathway, at least during fall migration.

Based on the two seasons of surveys, overall use of the project site by golden eagle, northern goshawk, pileated woodpecker, prairie falcon, and willow flycatcher was very low. Adverse impacts to these species are not anticipated. Of the species that were commonly observed, turkey vultures have very low susceptibility to turbine collisions (Orloff and Flannery 1992). To date, this species has not been documented as a turbine fatality in the Pacific Northwest. Vaux's swifts, western bluebirds, and olive-sided flycatchers were commonly observed flying at rotor-swept heights, and some turbine-related mortality may occur for these species over the life of the project. These collisions would likely be rare, and it is unlikely that the Whistling Ridge Energy Project would have any negative impacts on population levels on and near the project site. Higher numbers of Vaux's swifts and western bluebirds were recorded during fall migration, whereas olive-sided flycatcher appears to primarily use the project site for breeding.

Waterfowl, waterbirds, and shorebirds were not observed using lands within the project site during this study, and mortality involving this group is expected to be rare. Based on abundance, passerines are expected to make up the largest proportion of fatalities at the Whistling Ridge Energy Project. Post-construction mortality data collected at other windfarms in Washington and Oregon indicate that less correlation between pre-construction surveys and turbine-related mortality is observed in non-raptor species. The lack of correlation may be because most fatalities are among nocturnal migrants that are not accounted for during surveys.

The avian use information for the project site is based on detections of birds seen and/or heard calling. Because songbirds are less vocal during fall, this information may be skewed toward summer use. Similarly, the level of night migration for species associated with the project site is also not known. Risk analyses presented above provide some insight into which species are most vulnerable to turbine collision; however, estimates are based on abundance, proportion of daily activity budget spent flying, and flight height of each species. Observations were made during daylight hours, and do not take into consideration flight behavior or abundance of nocturnal migrants. Further, the analysis also does not account for varying ability among species to detect and avoid turbines, habitat selection, or other factors that may influence exposure to turbine collision. As a result, actual risk may be lower or higher than indicated by these estimates (Orloff and Flannery 1992).

In addition to direct mortality through collisions, the presence of wind turbines may alter the landscape, thereby displacing wildlife away from the project facilities. Habitat for avian species may be lost through vegetation clearing for roadways construction and improvement, and in areas surrounding wind turbines. Several studies have reported on this effect and are summarized in Appendix B-6.

Bats

Construction Impacts. Impacts to bats are not expected during the construction of the proposed project.

Operational Impacts. It is likely that some bat mortality would occur during operation; however, mortality estimates are difficult due to our lack of understanding of why bats collide with wind turbines (Kunz et al. 2007, Baerwald et al. 2008). Several factors may aid in the assessment of potential impacts to bats, including site-specific habitat and topography, species composition, and activity patterns. Investigations of bat use of the project site are ongoing. Ongoing surveys would augment existing data and better define our understanding of spatial and temporal patterns of bat use of the project site. A preliminary assessment of potential impacts to bats that may result from construction or operation of the Whistling Ridge Energy Project is provided below. This assessment was completed by examining site-specific habitat features and bat acoustic data collected to date. Additional insight from investigations conducted at other wind farms is presented where relevant.

Turbine-related mortality to bats on the project site may be lower than expected based on observed bat activity levels. The majority of detected species were high-frequency species, most of which were likely from the genera *Myotis*. This genus has among the lowest recorded mortality rates at wind resource areas throughout the US, comprising only 0–13.5% of the fatalities (Arnett et al. 2008). At existing wind-energy facilities in eastern Oregon and Washington, approximately 96% of all recorded fatalities were low-frequency species. These data indicate that high-frequency species, such as *Myotis* bats, are much less susceptible to turbine collisions than low-frequency species. Ongoing studies would help to better understand whether more susceptible low-frequency species have been underestimated in surveys conducted to date.

The timing of peak bat activity on the proposed project site (July to mid-August) does not coincide with when the highest levels of bat mortality have been documented at other wind farms in the US. Fatality studies have shown a peak in mortality in August and September and generally lower mortality earlier in the summer (Johnson 2005, Arnett et al. 2008). While the survey effort varies among the different studies, the studies that combine Anabat surveys and fatality surveys show a general association between the timing of increased bat call rates and timing of mortality, with both call rates and mortality peaking during the fall (Kunz et al. 2007). The highest use of the project site occurred in July and early August, prior to the time that most bat mortality occurs at wind resource areas in the Pacific Northwest as well as throughout the US.

High bat activity in July and early August is likely due to use of the project site by local bats during the reproductive season, when pups are being weaned and foraging rates are high. Activity beyond mid-August likely represents movement of migrating bats through the area. Activity by hoary bats also was substantially higher in July, and dropped off significantly beginning in early August. After August 31, activity for all bats was very low relative to earlier dates, indicating that most bats had left the area for winter hibernacula or warmer climates. These data indicate higher use of the project site by resident populations of bats, rather than by migrants passing through the area. Further, high bat activity levels during the breeding season, as seen on the project site, do not equate to high bat fatality rates. Low mortality has been documented during the breeding season at several wind farms, even when relatively large bat populations were present in the area (Fiedler 2004, Gruver 2002, Howe et al. 2002, Johnson et al. 2004, Schmidt et al. 2003).

Finally, no known large bat colonies are present near the proposed Whistling Ridge Energy Facility. The nearest known hibernaculum is located near the town of Trout Lake, nearly 20 miles north of the proposed project (B. Weiler, personal communication). The project site does not contain topographic features, such as canyons, that may funnel migrating bats toward corridors where turbines would be placed. No turbines would be constructed near wetlands or ponds, and cleared areas surrounding turbine strings would closely mimic clearcuts, where to date, recorded bat activity levels on the project site were the lowest.

Based on data collected to date on species composition, activity patterns and habitat use, significant adverse impacts to bats are not anticipated as a result of the proposed project. Data collected during 2009 surveys would improve our understanding of bat use and activity patterns, and help to refine our assessment of the degree of impacts and potential mitigation measures, if any.

Priority Wildlife Habitats

Construction Impacts. Mule deer, black-tailed deer, and elk may be displaced temporarily from winter range if the timing of construction activities coincides with use of these habitats. Construction-related displacement is expected to be of short duration.

Operational Impacts. Because data on impacts to big game as a result of wind farm operation is limited, it is difficult to predict the impact of the proposed project on wildlife using priority habitats on the proposed project site. Additional coordination with WDFW is ongoing, and would continue to address this resource.

Improved Roadways outside the Site Boundary

A total of ~~2.1~~2.5 roadway miles located outside the proposed project site would require upgrades as a result of the proposed project. ~~These roads~~This road, West Pit Road, would traverse forests of varying stand age. ~~Half~~ Much of ~~upgraded roads~~West Pit Road ~~are~~ is adjacent to areas characterized by recent clearcut harvest. Based on minimal habitat loss as a result of roadway construction and improvement, impacts to wildlife are expected to be minimal.

Temporary impacts to wildlife may occur as a result of construction-related traffic and noise. These impacts would terminate after the project is constructed, and traffic levels similar to that currently observed would resume.

3.4.3.3 Mitigation Measures

The primary mitigation goal for the Whistling Ridge Energy facility is to avoid sensitive wildlife resources when siting turbines and access roads. Because of the relatively small footprint of wind energy facilities and the flexibility of the process, it is likely that avoidance can be achieved. Wind turbines would also be sited in areas already actively managed for timber harvest. New road construction would be minimized by improving and using existing roadways. All temporarily disturbed areas would be regraded and reseeded with an appropriate mix of native plant species to restore vegetation after the construction phase is over.

Mitigation for potential impacts resulting for the proposed project includes the following sequentially-performed actions:

- Rectify the impact by repairing, rehabilitating, or restoring the affected environment in consultation with relevant wildlife agencies.

- Conduct thorough analysis of sensitive natural resources to avoid impacts and increase avoidance during micrositing.

- Implement a two year minimum post-construction mortality study

- The Applicant plans to convene a Technical Advisory Committee to evaluate the mitigation and monitoring program and determine the need for further studies or mitigation measures. The Technical Advisory Committee would be composed of representatives from WDFW, USFWS, Skamania County, and the Applicant. The role of the Technical Advisory Committee would be to coordinate appropriate mitigation measures, monitor impacts to wildlife and habitat, and address issues that arise regarding wildlife impacts during construction and operation of the project. The post-construction monitoring plan would be developed in coordination with the Technical Advisory Committee .

- Implement project design features that would minimize project impacts, including:

  - Installing tubular steel turbine towers to eliminate perching opportunities provided by lattice towers

  - Burying electrical lines between turbines and from turbine strings to substation

  - Using the minimum amount of turbine lighting required by the FAA

  - Installing newer generation up-wind turbines

SECTION 3.5 WETLANDS AND OTHER JURISDICTIONAL WATERS (WAC 463-60-333)

3.5.1 EXISTING CONDITIONS

A wetland investigation was performed at the project site and along roads proposed to be upgraded for the project on October 26, 2006 and January 9, 2007 (CH2M Hill 2007) (Appendix C). Since the time of those surveys, a new site access route has been identified between SR 14 and the project site to be used for equipment delivery and construction and operation labor. Additional wetland field work ~~will be~~was completed in ~~performed in spring~~July 2009 along the roadways proposed for construction access and~~to~~ confirmed that no additional wetland areas are present that would be affected by construction or operation of the project.

3.5.1.1 Project Site

No wetlands or wetland indicators were identified within the study area (the turbine corridors and originally proposed access roadways). One undelineated wetland is identified to occur outside the study area perimeter west of turbines C1-C4 (Figure 3.5-1, Project Site Wetlands).[1] This wetland is labeled as "Cedar Swamp" on the USGS map and is listed as palustrine unconsolidated bottom, semipermanently flooded, impounded (PUBFh) on the National Wetland Inventory (CH2M Hill 2007). The Cedar Swamp wetland buffer does not extend into the study area.

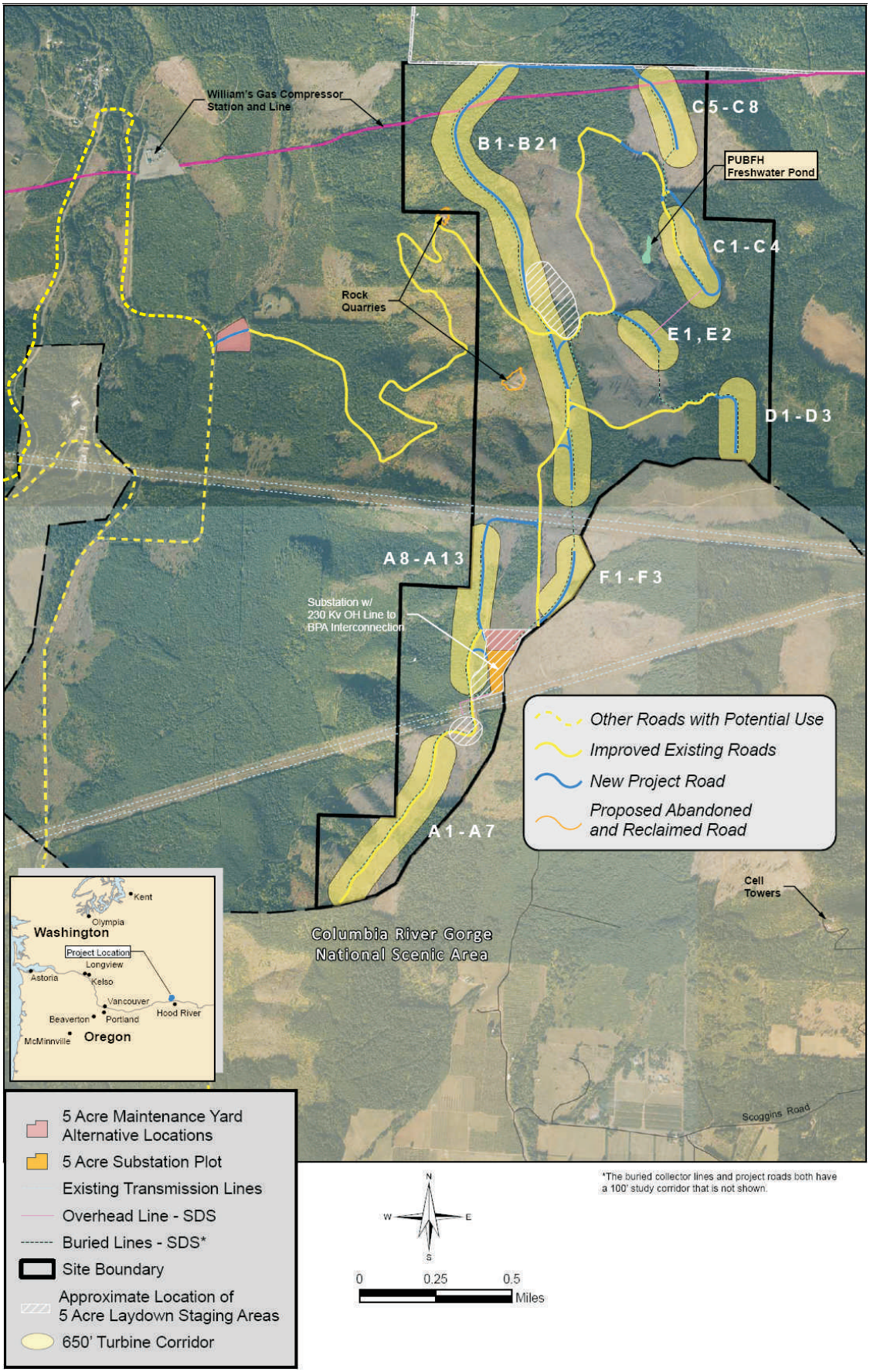
Five intermittent drainage ways that provide short duration runoff during storm events or spring snowmelt meet the Skamania County Critical Areas criteria for Class V Streams (CH2M Hill 2007). The drainage ways do not contain channels, scour marks, or other characteristics that meet the definition of waters of the US or Washington state. The planned improvements to existing roads that would occur inside the Scenic Area would cross one intermittent stream (shown on Figure 3.3-1). See Section 3.3 for a discussion of surface water.

3.5.1.2 Improved Construction Access Roadways

A preliminary review of the National Wetland Inventory indicates wetlands occur along SR 14 near White Salmon, Washington (Figures 3.5-2a and 3.5-2b, Access Route NWI Wetlands). As described in Section 4.3 Transportation, ~~very minor intersection~~no improvements to SR 14 would be required ~~but~~ and no wetland impacts are anticipated to occur. The National Wetland Inventory does not show the presence of wetlands along the local secondary and forest roads proposed to be used by the project. As the National Wetland Inventory is based on historic aerial photography interpretations, a field investigation ~~will occur in spring~~was conducted in July 2009 ~~to~~ confirmed ~~whether or not~~that wetlands ~~and other regulated waters of the US or the State may~~would not be impacted by the project.

[1] The wetland on the project site results from a constructed impoundment according to National Wetland Inventory maps and so is not regulated locally as a critical area according to SCC Title 21A.04.020(A)(1)(b).

33758687_100.cdr



Source: GeoDataScape.

Job No. 33758687

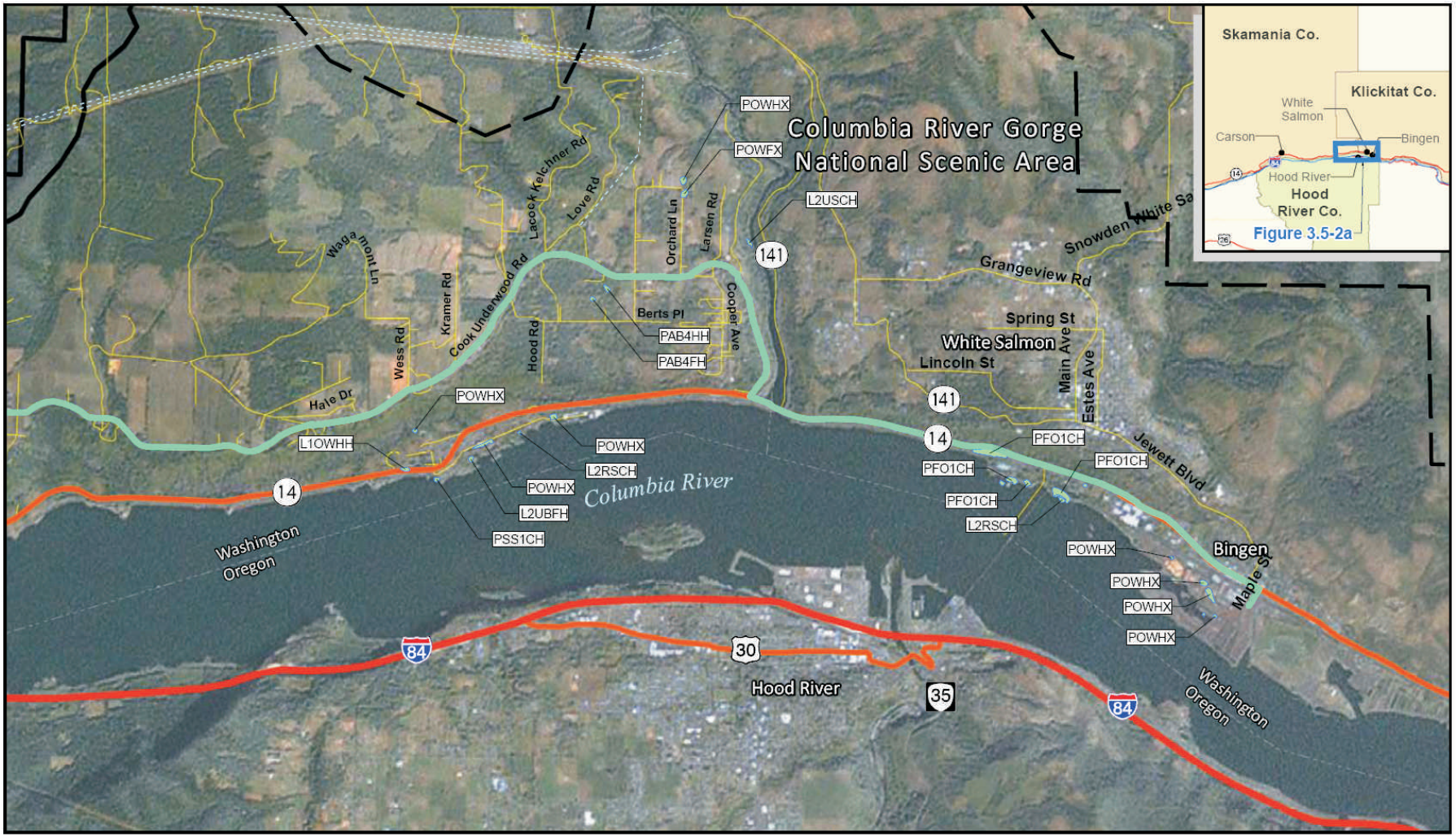
Revised Figure 3.5-1

Project Site Wetlands

URS

Whistling Ridge Energy Project
Skamania County, Washington

33758687_75.cdr



Site Boundary
Columbia River Gorge National Scenic Area
Other Roads with Potential Project Use
Local Roads
National Wetlands Inventory - Wetland

Source: GeoDataScape.

N
W E
S

0 0.5 1 Miles

Revised Figure 3.5-2a

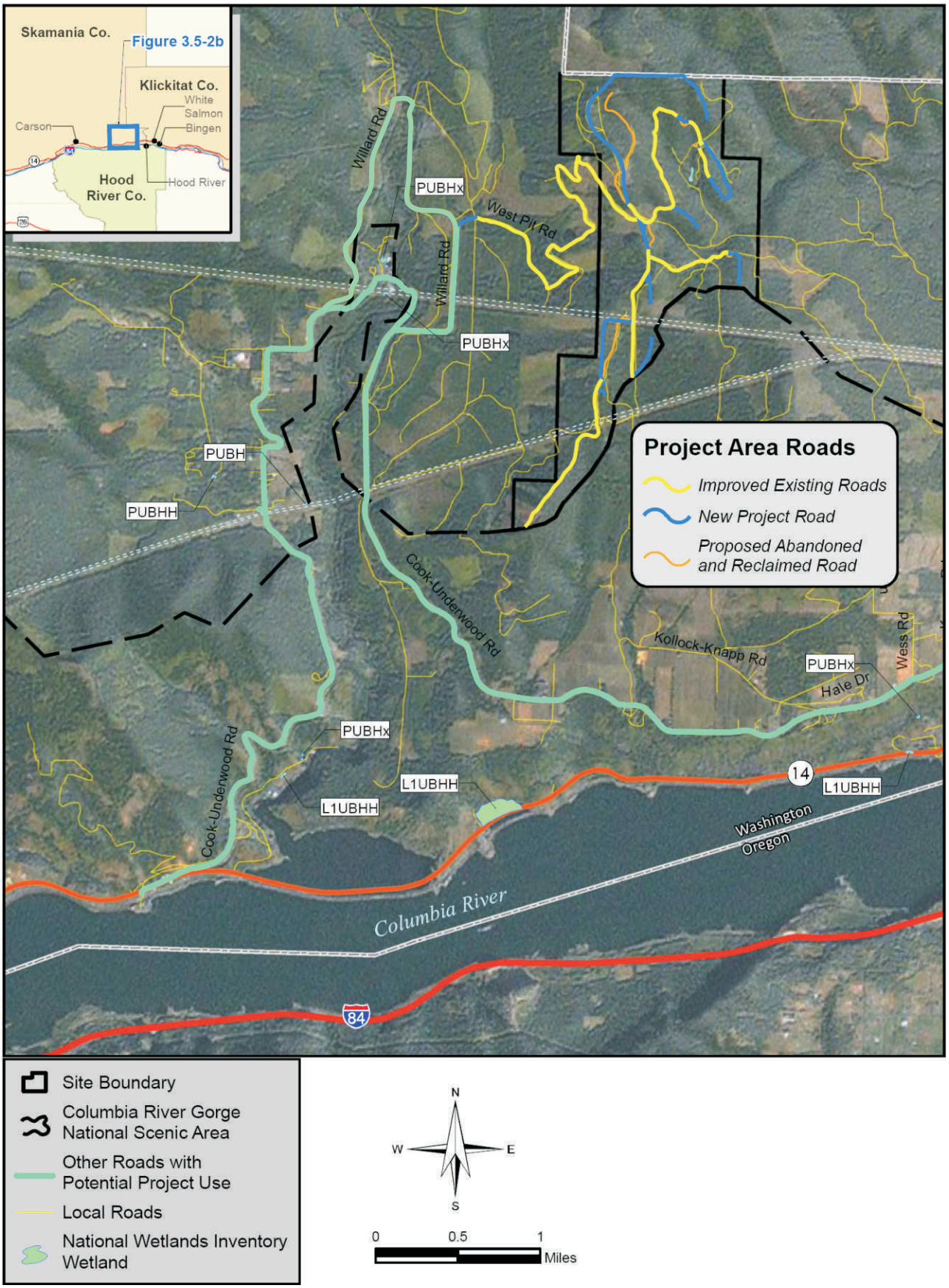
Access Route NWI Wetlands

Job No. 33758687

URS

Whistling Ridge Energy Project
Skamania County, Washington

33758687_106.cdr



Source: GeoDataScape.

Job No. 33758687

Revised Figure 3.5-2b

Access Route NWI Wetlands

URS

Whistling Ridge Energy Project
Skamania County, Washington

3.5.2 IMPACTS

3.5.2.1 Project Site

No wetlands or wetland buffers are located within the project construction or operation area. Therefore, no wetlands or buffers are expected to be impacted by construction or operation of the project.

3.5.2.2 Improved Construction Access Roadways

A review of the National Wetland Inventory indicates that wetlands may occur along SR 14 but not along County or private roads proposed for the project's construction access and turbine delivery routes. ~~Very minor~~No intersection improvements to SR 14 are anticipated to be required, and ~~with~~ no wetland-related impacts would occur. Roadway improvements to the County or private logging roads are not expected to permanently impact wetlands or waters of the US or State. This information ~~will be~~was confirmed through field investigations ~~planned for spring~~performed in July 2009.

3.5.3 MITIGATION MEASURES

No impacts to wetlands are expected to occur and therefore no mitigation measures would be required.

SECTION 3.6 ENERGY AND NATURAL RESOURCES (WAC 463-60-342)

3.6.1 INTRODUCTION

The Whistling Ridge Energy Project would consume limited amounts of energy and natural resources, primarily during construction. Operation of the project would consume very limited amounts of natural resources, as the wind turbine generators would use wind, an abundant, naturally occurring renewable resource, to generate electricity. By using wind to generate electricity, operation of the project would help reduce overall consumption of non-renewable natural resources.

Wind farms have a very high "energy payback" (ratio of energy produced compared to energy expended in construction and operation), and wind's energy payback time is one of the shortest of any electrical generation technology. It takes approximately three to eight months, depending on the wind speed at the site, for a wind farm to produce the total amount of energy used to construct the equipment and build the project. (AWEA 2008).

3.6.2 ENERGY REQUIRED

3.6.2.1 Construction

Types and quantities of energy and natural resources consumed during construction are as follows:

- 19,250 gallons of fuel (diesel and gasoline) for construction equipment
- 3,700 tons of steel for turbine towers
- 1,000 tons of steel for tower foundation reinforcement
- 100,000 yards of gravel (aggregate) for roads and crane pads
- 10,000 cubic yards of concrete for turbine foundations
- 1.7 million gallons of water for road compaction, dust control, wetting concrete, etc., assuming plain water is used for dust control (this amount could be reduced through the use of lignin or other dust palliative if permitted by EFSEC)

3.6.2.2 Operation of Facility

Operation of the project would consume limited amounts of energy and non-renewable natural resources. During operations, electrical energy would be consumed on a limited basis during times when the wind generated on site is insufficient to power FAA lights and security lights at the Operations and Maintenance and substation facilities. In addition, turbines require electrical energy to run lubrication pumps and cooling systems, electrical monitoring systems, and positioning motors even when wind speeds are below generation levels. Energy would be

generated using wind transformed into electricity by turbine generators. Types and quantities of energy and natural resources consumed during operations are as follows:

- Fuel for Operation and Maintenance vehicles (approximately 8,500 gallons annually)
- Minor quantities of lubricating oils, greases and hydraulic fluids for the wind turbine generators
- Electricity for project operations (less than approximately 600 kilowatt hours per wind turbine generator per month
- Water for use at the Operations and Maintenance facility and periodic maintenance of turbine blades (less than approximately 5,000 gpd)

3.6.3 SOURCE AND AVAILABILITY OF ENERGY AND NATURAL RESOURCES

3.6.3.1 Sources during Construction

The source of fuel for construction equipment and vehicles would be licensed fuel distributors or gas stations, as described in Section 2.9, Spill Prevention. Water for construction would be obtained from a local source, as described in Section 3.3, Water Resources. Concrete would be purchased from existing suppliers located near the project site. Electricity for construction equipment would be provided from portable generators.

3.6.3.2 Sources during Operation

Fuel used for Operation and Maintenance vehicles would be purchased from local gas stations. Lubricating oils and hydraulic fluids used for wind turbine generator maintenance would be purchased from distributors. Electricity for project operations would mostly be generated by the project itself; during periods when the wind turbines are not generating power, it would be purchased from the Skamania County Public Utility District #1.

3.6.3.3 Materials and Commodities

As described in Subsection 3.6.1, bulk materials such as aggregate gravel and sand, in addition to soils, would not be required. Any additional material would be supplied locally from existing quarries. Other building materials, equipment, and other operational commodities would be purchased from equipment and material suppliers.

3.6.4 NONRENEWABLE RESOURCES

While a wide variety of natural resources are used in the construction of a project such as the Whistling Ridge Energy Project, the amounts of most resources used are very small. The largest quantities would be steel (coming from iron ore) and concrete (coming from aggregate, sand, and cement quarries and pits). Diesel fuel and electricity also would be consumed during construction.

3.6.5 CONSERVATION AND RENEWABLE RESOURCES

The project would provide the region with low-cost, clean, renewable energy, in accordance with state and national policies and priorities. It would provide benefits because it would emit substantially lower quantities of air pollutants per unit of energy output compared to other forms of energy. The project would help maintain air quality, given that some new generation resources must be developed to meet growing energy demand and to replace generation that will be retired.

3.6.6 SCENIC RESOURCES

The project is not located inside the Columbia River Gorge National Scenic Area; ~~however, the~~nor is the proposed access road ~~for~~ to the proposed site, West Pit Road ~~is~~. ~~Conformance with the Scenic Area plan for roadway development would be followed as described in Section 2.20, Pertinent Federal, State and Local Requirements and in Section 4.2.1, Land Use~~.

State Highway 14 in this area is a recognized scenic roadway. Typically, this designation means that a scenic corridor management plan would be prepared to provide policy-level guidance in the local adoption of comprehensive plan policies, zoning, and other land use regulation. There is no scenic corridor management plan for Highway 14 and, therefore, no regulatory control of aesthetic impacts within the corridor.

3.6.7 MITIGATION MEASURES

No impacts to energy and natural resources are expected to occur and therefore no mitigation measures would be required.