Appendix B

Wetland Delineation and Shoreline Ecological Characterization

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

719 2ND AVENUE, SUITE 200 | SEATTLE, WA 98104 | P 206.394.3700

TECHNICAL MEMORANDUM

DATE: August 13, 2019

TO: Scott Christian, CTTA General Manager

FROM: Adam Merrill and Matt Murphy

SUBJECT: Cowlitz Timber Trails Association - Wetland Delineation and Shoreline Ecological Characterization

PROJECT NUMBER: 267-8092-001

INTRODUCTION

The purpose of this technical memorandum is to describe the findings of an ecological characterization and wetland investigation conducted at the Cowlitz Timber Trails Association (CTTA) property. The CTTA property is located off 1988 Spencer Road, Salkum, Washington, just east of the Cowlitz River in Lewis County, Washington, within Sections 22 and 27 of Township 12 North, Range 01 East (Figure 1). The objectives of the field effort were to: 1) assess and describe the ecological baseline of the lands within shoreline jurisdiction under the Lewis County Shoreline Management Program (SMP), which includes areas located within 200 feet of the Cowlitz River ordinary high water mark (OHWM), and 2) locate, delineate, and characterize wetlands located within this area, landward of the Cowlitz River. The assessment was limited to areas adjacent to existing roads and developed campsite lots.

METHODS

The ecological characterization was based on a review of existing information, followed by a field assessment. Wetland assessments were based on a review of existing information, previously mapped wetlands and streams, soil mapping, and other geographic and weather data, followed by field assessments, during which wetlands and streams were delineated. The methods for these assessments are described in the sections below.

Review of Existing Information

Prior to conducting the ecological characterization and wetland delineation fieldwork, project biologists reviewed maps and materials including, but not limited to:

- Aerial photography of the project corridor (Google Earth database)
- National Wetlands Inventory (NWI) online interactive mapper (U.S. Fish and Wildlife Service [USFWS] 2019)
- Washington Department of Fish and Wildlife (WDFW) SalmonScape and fish distribution maps (WDFW 2019a)
- Priority Habitats and Species (PHS) data (WDFW 2019b)
- Natural Resources Conservation Service (NRCS) Web Soil Survey (NRCS 2019)
- Washington Department of Natural Resources (WDNR) water type maps (WDNR 2019)

The background information is presented in Attachment A.

Field Investigation

Following the review of existing information, Parametrix biologists conducted field assessments of ecological conditions and wetlands within the study area. The ecological characterization field investigation was conducted by Parametrix biologists Adam Merrill and Trey Parry on December 18, 2018, and the wetland field investigation was conducted by Parametrix biologists Adam Merrill and Matt Murphy on March 5, 2019. Hand-held global positioning system (GPS) survey equipment was used to collect wetland boundaries. Only wetland boundaries adjacent to existing roads and developed lots were delineated and surveyed; other wetland boundaries were approximated.

Ecological Characterization

Parametrix biologists conducted a 1-day pedestrian survey of the study area and assessed plant community types and species, existing levels of human development and habitat alteration, and potential restoration opportunities. The survey also included a visual reconnaissance of stream and potential wetland areas.

Wetland Identification and Delineation

The methods specified in the U.S. Army Corps of Engineers (Corps) Wetlands Delineation Manual (Corps 1987) and indicators specified in the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Corps 2010) were used by project biologists to delineate onsite wetlands.

Wetlands are defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. An area must have at least one positive indicator of wetland vegetation, soils, and hydrology to be considered a wetland. The delineated wetlands were surveyed by professional land surveyors. Wetland determination data forms from the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Corps 2010) were completed for each wetland and are presented in Attachment B.

Vegetation

The dominant plants and their wetland indicator status were evaluated to determine if the vegetation was hydrophytic. Hydrophytic vegetation is generally defined as vegetation adapted to prolonged saturated soil conditions. To meet the hydrophytic vegetation criterion, more than 50 percent of the dominant plants must be Facultative (FAC), Facultative Wetland (FACW), or Obligate (OBL), based on the plant indicator status.

Scientific and common plant names follow generally accepted nomenclature. Most names are consistent with the PLANTS Database (U.S. Department of Agriculture, Natural Resources Conservation Service [USDA, NRCS] 2018), and the National Wetland Plant List (Lichvar et al. 2016). During the field investigations, dominant plant species were observed and recorded on data forms for each sampling point (Attachment B). Lichvar et al. (2016) was also used to assign plant indicator status for observed plant species.

Soils

Generally, an area must have hydric soils to be a wetland. Hydric soil forms when soils are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper layer. Biological activities in saturated soil result in reduced oxygen concentrations that produce a preponderance of organisms using anaerobic processes for metabolism. Over time, anaerobic biological processes result in certain soil color patterns, which are used as field indicators of hydric soil (Corps 2010). Typically, low-chroma colors are formed in the soil matrix. Bright-colored redoximorphic features form within the matrix under a fluctuating water table. Other important hydric soil indicators include organic matter accumulations in the surface horizon, reduced sulfur odors, and organic matter staining in the subsurface. Soils were examined by excavating sample plots to a depth of 16 inches or more to observe soil profiles, colors, and textures. Munsell® color charts (Munsell® Color 2015) were used as objective standards to describe soil colors.

Hydrology

The study area was examined for evidence of hydrology. An area is considered to have wetland hydrology when soils are ponded or saturated consecutively for 12.5 percent of the growing season. In the study area, the growing season, as determined using the Centralia weather station, is 308 days long and lasts from February 2 to December 7 (ACIS 2019). This means that for 38.5 consecutive days from February 2 to December 7 areas defined as wetland must be ponded or saturated.

Primary indicators of hydrology recorded in the field include, but are not limited to, surface inundation, sediment deposits, high water table, and saturated soils. Secondary indicators of hydrology include geomorphic position, and FAC-neutral test.

Wetland Classification, Rating, and Buffers

Delineated wetlands were classified according to the USFWS Classification of Wetlands and Deepwater Habitats of the United States (Federal Geographic Data Committee [FGDC] 2013; Cowardin et al. 1979). Hydrogeomorphic classifications were assigned to wetlands using methods established in a Hydrogeomorphic (HGM) Classification System for Wetlands (Brinson 1993). Wetlands were rated according to Lewis County Code (LCC), which uses the Washington State Wetland Rating System for Western Washington (Hruby, 2004) for wetlands within shoreline jurisdiction (LCC 17.35A.590), and the 2014 update to the rating system for wetlands outside of shoreline jurisdiction (LCC 17.38.230). Wetland rating forms are provided in Attachment C.

RESULTS

Review of Existing Information

Characteristics of the study area based on a review of existing information are described below.

Habitat and Species

One stream has been identified within the study area by the WDNR Forest Practices Application Mapping Tool (WDNR 2019; Attachment A). The stream is mapped in the northwest corner of the site flowing from southeast to northwest. The lower 1 mile of the stream is identified as fish-bearing. WDFW PHS data (2019b) indicate that the stream provides habitat for chum salmon (*Oncorhynchus keta*), coho salmon (*O. kisutch*), rainbow trout (*O. mykiss*), and steelhead (*O. mykiss*).

WDFW PHS data (2019b) also indicate that the upland portion of the study area provides habitat for Rocky Mountain elk (*Cervus canadensis*), and is located within a northern spotted owl (*Strix occidentalis caurina*) management buffer.

Soils

Five soil types are mapped within the study area (NRCS 2019):

- Cloquato silt loam
- Ledow sand
- Puget silt loam
- Xerorthents, steep
- Winston gravelly loam, 0 to 8 percent slopes

The Puget silt loam series consists of very deep, poorly drained soils that formed in recent alluvium on floodplains and low river terraces. This soil type is the only mapped soil within the study area that typically has hydric soil conditions (NRCS 2019). The Ledow sand, Cloquato silt loam, Xerorthents steep, and Winston gravelly loam series typically do not have hydric soil conditions.

The Ledow series consists of deep, somewhat excessively drained soils that formed in mixed alluvium from igneous rock, volcanic ash, and pumice (NRCS 2019). The Cloquato series consists of very deep, well-drained soils formed in mixed alluvium. The Xerorthents series consists of well-drained soils formed in mixed alluvium from steep mountain slopes. The Winston series consists of very deep, well-drained soils formed in glacial outwash, or old alluvium, with a mantle of loess and volcanic ash.

Wetlands

One wetland has been previously mapped by the NWI within the study area. (Attachment A; USFWS 2019). The wetland is mapped on the eastern part of the study area, approximately 700 feet south of Spencer Road. The wetland is recorded as a freshwater emergent wetland that is seasonally flooded with persistent vegetation (PEM1C).

Ecological Characterization Field Investigation

The ecological characterization pedestrian survey at the study area occurred on December 18, 2018. Weather conditions were seasonally cold (temperatures ranging from 30 to 40 degrees Fahrenheit [°F]) and rainy. Representative photographs are provided in Attachment D.

Upland (i.e., landward of Cowlitz River OHWM) habitat conditions are generally consistent throughout the study area. These areas are composed of a mixed forest, with tree ages estimated to average between 20 and 50 years (Photo 1). The dominant tree species include western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), bigleaf maple (*Acer macrophyllum*), and Douglas fir (*Pseudotsuga menziesii*). Tree removal appears to occur periodically, although the study area is largely covered under a dense tree canopy, with some small areas of clearing. Density of understory vegetation within the study area is low because the area has been developed as a private campground. The ground surface primarily consists of paved roadways or gravel campsite lots, which are developed with recreational vehicle covers, gazebos, sheds, and related structures (Photo 1). Some understory vegetation is present, primarily on the margins between the campsite lots. Dominant understory species include

vine maple (*Acer circinatum*), sword fern (*Polystichum munitum*), rhododendron, and various ornamental plantings.

The northwest end of the study area is bordered by a stream that flows into the Cowlitz River; the stream is mapped as fish-bearing (see above). Within the study area, the riparian corridor of the stream is primarily reed canarygrass (*Phalaris arundinacea*), which is an invasive species, with some scattered trees and shrubs (Photo 2). The southern bank of the stream within the study areas appears to be eroding into the adjacent campsite lot.

Habitat below the Cowlitz River OHWM consists of a large, contiguous riparian wetland area that varies between approximately 50 and 100 feet wide. From the northwest end of the study area southward to the boat launch, the majority of the wetland is dominated by a monoculture of reed canarygrass, with scattered groves of red alder (*Alnus rubra*) trees (Photo 3). Some patches of maintained lawn areas are also located near the OHWM, just downslope of the river bank.

A large patch of willow shrub/trees (*Salix spp*.) is present just upstream (southeast) of the boat launch, which is bordered to the southeast by reed canarygrass, with patches of Scot's broom (*Cytisus scoparius*), which is an invasive species, present on gravel bars. The wetland narrows and then ends near the southeast end of the study area. Several erosion control structures (i.e., riprap bars) extend below the OHWM near the southeast end of the study area (Photo 4).

Restoration Opportunities

There are several restoration opportunities within the study area that, if undertaken, could increase ecological functions and values within the shoreline jurisdiction. Along the unnamed stream at the northwest end of the study area, removing invasive species (primarily reed canarygrass) and planting native trees and shrubs would improve riparian habitat conditions. In addition, installing large woody debris near the creek mouth would increase in-stream structure and improve fish habitat, while potentially decreasing bank erosion of the adjacent campsite lot.

While the upland portion of the study area is largely constrained by existing development (roads and developed campsite lots), there may be some limited potential to plant additional native tree, shrub, and groundcover species. It may be feasible to plant these in common areas (such as near restroom buildings) or along lot boundaries. Plantings should be sited to minimize the potential for future removal, if/when adjacent new or re-development occurs.

There is significant potential to enhance the large riparian wetland along the Cowlitz River. Removing the invasive reed canarygrass and Scot's broom and planting with native, flood-tolerant trees and shrubs would significantly increase the habitat value of the wetland. Once mature, woody vegetation along the river would also increase organic inputs and large woody debris in the river, which would enhance fish habitat.

Wetland Field Investigation

Wetland field investigation at the study area occurred on March 5, 2019 under seasonally cool, sunny weather conditions with temperatures ranging between 40 and 60°F. An analysis of the previous 3 months (December 2019 through February 2019) of recorded precipitation at Centralia Weather Station using the WETS Tables (ACIS 2019) found that precipitation was below drier than normal for this period.

Parametrix biologists identified and delineated three wetlands (Wetlands A, B, and C) within the study area. Wetland boundaries within the study area that border existing roads and developed lots were delineated; wetland boundaries not bordering these areas were estimated using field observations, aerial imagery, and the review of existing information described in the methods section. Summaries of the wetlands within the study area

are provided in Table 1. General background information is provided in Attachment A, wetland determination forms are provided in Attachment B, wetland rating forms are provided in Attachment C, and representative photographs are provided in Attachment D. General characteristics of wetlands and streams are discussed in the sections below.

Wetlands

Table 1. Summary of Wetlands in the Study Area

Wetland	Area (acres)	Cowardin Class[a]	HGM Classification[b]	Wetland Rating—Within Shoreline Jurisdiction[c]	Buffer Width (feet) Within Shoreline Jurisdiction[d]	Wetland Rating—Outside Shoreline Jurisdiction[e]	Buffer Width (feet) Outside Shoreline Jurisdiction[f]
A[g]	~17	PAB, PEM, PSS, PFO	Depressional	Category: II Habitat Points: 27	160	Category: II Habitat Points: 8 Water Quality Points: 7	225
B	0.120	PEM	Depressional	Category: III Habitat Points: 7	60	Category: II Habitat Points: 5 Water Quality Points: 7	110
C	~3	PFO, PEM	Depressional	Category: II Habitat Points: 21	85	Category: II Habitat Points: 7 Water Quality Points: 7	110

[a] Cowardin et al. 1979

[b] Brinson 1993

[c] Hruby 2004, per LCC 17.35A.590

[d] LCC 17.35A.610. Level of adjacent land use assumed to be "moderate" based upon the criteria specified in LCC 17.35A.605.

[e] Hruby 2014, per LCC 17.38.230

[f] LCC 17.38.270. Level of adjacent land use assumed to be "moderate" based upon the criteria specified in LCC 17.38.260.

[g] According to both LCC 17.38.420 and LCC 17.35A.680, the buffer of the unnamed stream within Wetland A is 150 feet. Within the study area, the stream buffer is contained entirely within the wetland buffer.

PFO = palustrine forested; PSS = palustrine scrub-shrub; PEM = palustrine emergent; PAB = palustrine aquatic bed

Wetland A

Wetland A is an approximately 17-acre depressional wetland that contains palustrine forested, scrub-shrub, aquatic bed, and emergent habitats. The wetland is located in the northwest portion of the study area and contains an unnamed stream that drains into the Cowlitz River (Figure 2; Photos 5 to 7). The northern boundary of the wetlands extends outside of the study area. Wetland A is characterized by sample plots 2 and 4.

The forested stratum within Wetland A is dominated by red alder and black cottonwood (*Populus balsamifera*). The sapling and shrub stratum is dominated by red alder with trace amounts of Himalayan blackberry (*Rubus armeniacus*). The herbaceous stratum is dominated by reed canarygrass, slough sedge (*Carex obnupta*), and common cattail (*Typha latifolia*). Aquatic bed vegetation was observed from aerial photography in a ponded area of Wetland A, outside of the study area. Therefore, the species could not be determined.

The soils within Wetland A were recorded to have two layers. The surface layer (0 to 2 inches) is dark brown (10YR 3/3) silt loam. The second layer (2 to 16+ inches) is very dark brown (10YR 2/2) silty loam with dark reddish brown (5YR 3/4) concentrations. These soils meet hydric soil indicators F6 (redox dark surface).

Wetland A hydrology is supported primarily by a high groundwater table, hillslope seeps, and flow from the unnamed stream.

Wetland B

Wetland B is a 0.120-acre depressional wetland that contains palustrine emergent habitat. Wetland B is located approximately 150 feet south of Wetland A, and is surrounded by developed campsite lots (Figure 2; Photos 8 to 10). Wetland B is a depression with no surface water outlet. The northern boundary of the wetlands extends outside of the study area. Wetland B is characterized by sample plot 5.

The dominant plant species within Wetland B are reed canarygrass, slough sedge, and Kentucky bluegrass (*Poa pratensis*).

The soils within Wetland B were recorded to have two layers. The surface layer (0 to 8 inches) is very dark grayish brown (10YR 3/2) silt loam with dark brown (7.5YR 3/4) redoximorphic features present. The next layer (8 to 16+ inches) is very dark grayish brown (10YR 3/1) with strong brown (7.5YR 4/6) redoximorphic features present. These soils in Wetland B meet indicator redox dark surface (F6).

The primary source of hydrology within Wetland B is precipitation and overland flow. Primary indicators of Wetland B include sediment deposits (B2), and secondary indicators of Wetland B include geomorphic position and FAC-Neutral Test.

Wetland C

Wetland C is an approximately 3-acre depressional wetland with palustrine forested and emergent habitats. The wetland is located at the southeast end of the study area (Figure 2; Photos 11 and 12). Wetland C receives flow primarily from hillside seeps that collect in a shallow depression. The wetland drains to a culvert to the southeast, which appears to drain into the Cowlitz River. Wetland C is characterized by sample plot 8.

The forested stratum within Wetland C is dominated by Sitka spruce (*Picea sitchensis*) and western red cedar. The herbaceous understory includes giant horsetail (*Equisetum telmateia*) and Kentucky bluegrass.

The soils within Wetland C were recorded to have one layer. The surface layer (0 to 16 inches) is very dark brown (10YR 2/2) muck. These soils meet hydric soil indicators A2 (Histic epipedon).

The primary source of hydrology within Wetland C is a high groundwater table with additional inputs from precipitation and overland flow. Primary indicators of wetland hydrology include surface water, high water table, saturation, and algal mat. Secondary hydrology indicators include saturation visible on aerial imagery and FAC-Neutral Test.

REGULATORY IMPLICATIONS

Wetlands and streams within the project area are subject to federal, state, and Lewis County regulations. At the federal level, wetlands and streams are regulated by the Clean Water Act (CWA) Section 404, which regulates placement of fill in waters of the United States. The Corps is responsible for issuing permits under Section 404 of the CWA.

Activities that affect wetlands and streams may also require a water quality certification (Section 401 of the CWA), which is implemented at the state level by Washington State Department of Ecology (Ecology). Ecology reviews projects for compliance with state water quality standards and makes permitting and mitigation decisions based on the nature and extent of impacts, as well as the type and quality of wetlands or streams being affected. Activities that use, divert, obstruct, or change the flow of a water of the state, including some wetlands, typically require a Hydraulic Project Approval (HPA) permit. Washington Administrative Code (WAC) Chapter 220-110 regulates water crossing structures and describes requirements for an HPA from WDFW.

Lewis County designates and regulates activities within critical areas and their buffers under LCC Chapter 17.38 for areas outside of shoreline jurisdiction, and under LCC Chapter 17.35A for areas within shoreline jurisdiction. Outside of shoreline jurisdiction, Lewis County uses the 2014 version of the state wetland rating system to classify wetlands (LCC 17.38.230). Wetland buffers are determined based upon wetland category, habitat and water quality scores, and intensity of adjacent land use. Wetland buffers are shown in Table 1. In accordance with LCC 17.38.280(2), a wetland buffer can be reduced where a legally established improvement (such as a road or structure) serves to eliminate or "greatly reduce" the impact of a proposed activity upon a wetland buffer. In this case, the buffer may be reduced to the critical area edge of the existing improvement. Unavoidable alterations to wetlands and buffers are allowed under certain conditions, provided that the proposed alteration and mitigation complies with LCC 17.38.080 and 17.38.300.

Lewis County uses the 2004 version of the state wetland rating system to classify wetlands within shoreline jurisdiction (LCC 17.35A.590). Wetland buffers are determined based upon wetland category, habitat score, and intensity of adjacent land use (LCC 17.35A.610). Wetland buffers are shown in Table 1. LCC 17.35A does not specifically address wetland buffers that are disconnected from a wetland through a legally established improvement. However, similar to wetlands located outside of shoreline jurisdiction, it is assumed that regulated wetland buffers within shoreline jurisdiction do not cross existing roadways. Unavoidable alterations to wetlands and buffers within shoreline jurisdiction are allowed under certain conditions, provided that the proposed alteration and mitigation complies with LCC 17.35A.575 and 17.35A.620.

According to the SMP, shoreline jurisdiction extends landward 200 feet from the OHWM of designated shorelines of the state (including the Cowlitz River), and includes all wetlands associated with shorelines of the state. According to Ecology guidance (2017), the entire wetland is "associated" if any part of it lies within the area 200 feet from the shoreline of the state OHWM, or within the floodplain landward 200 feet of the floodway. Activities within wetland buffers that are within 200 feet of shorelines of the state are also regulated under the SMP. However, pursuant to Section 1.06.01 of the SMP, wetland buffers located outside of shoreline jurisdictions are not included within the shoreline jurisdiction.

POTENTIAL WETLAND BUFFER MITIGATION

Existing campsite lots 68, 69, and 70 in Block 12 are located entirely within the buffer of Wetland A (Figure 3). The total buildable area of the lots including existing disturbance is 7,356 square feet. The lots are partially forested but contain existing structures, such as RV covers and storage sheds.

LCC 17.35A.620(3) specifies buffer mitigation ratios; for Category II wetlands the ratio is 1.5:1 (mitigation area: impact area). To mitigate for the loss of buffer on lots 68, 69, and 70, CTTA proposes to restore 11,034 square feet of degraded Wetland A buffer in an area north of Cedar Road (Figure 3). The area has been previously disturbed by human activities and is currently dominated by a near-monoculture of reed canarygrass, with little to no existing woody vegetation.

Under LCC 17.35A.622, a mitigation plan is required for proposed impacts to wetlands and wetland buffers. Prior to any additional development or vegetation removal on lots 68, 69, or 70, a wetland buffer mitigation plan will be submitted to Lewis County for review.

REFERENCES

ACIS (Applied Climate Information System). 2019. Climate Data for Lewis County, Washington. Available at: http://agacis.rcc-acis.org/?fips=53061.

Brinson, M.M. 1993. A Hydrogeomorphic Classification for Wetlands, Technical Report WRP-DE-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Corps (U.S. Army Corps of Engineers). 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1, Environmental Laboratory, Department of the Army, Waterways Experiment Station, Vicksburg, Mississippi.

Corps (U.S. Army Corps of Engineers). 2010. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region. U.S. Army Corps of Engineers Engineer Research and Development Center, Vicksburg, Mississippi.

Cowardin, L.M., W. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of Wetland and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, Office of Biological Service. Washington, D.C. FWS/OBS-79/31.

Ecology (Washington State Department of Ecology). 2017. Shoreline Master Program Handbook: Chapter 5, Shoreline Jurisdiction. Accessed March 2019. Available at: https://fortress.wa.gov/ecy/publications/parts/1106010part5.pdf.

FGDC (Federal Geographic Data Committee). 2013. Classification of Wetlands and Deepwater Habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C.

Hruby, T. 2004. Washington State Wetland Rating System for Western Washington. Publication #04-06-025. Washington State Department of Ecology, Olympia, Washington.

Hruby, T. 2014. Washington State Wetland Rating System for Western Washington–2014 Update. Publication #14-06-029. Washington State Department of Ecology, Olympia, Washington.

Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. The National Wetland Plant List: 2016 wetland ratings. Phytoneuron 2016-30: 1–17. Published 28 April. ISSN 2153 733X.

Munsell® Color. 2015. Munsell soil color charts with genuine Munsell color chips. Grand Rapids, Michigan.

NRCS (Natural Resources Conservation Service). 2019. Web soil survey online interactive mapper. Available at: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed May 2017.

USDA, NRCS (U.S. Department of Agriculture, Natural Resources Conservation Service). 2018. The PLANTS Database. National Plant Data Center, Baton Rouge, Louisiana. Available at http://plants.usda.gov.

USFWS (U.S. Fish and Wildlife Service). 2019. National Wetlands Inventory (NWI) online interactive mapper. Available at: http://www.fws.gov/wetlands/.

WDFW (Washington Department of Fish and Wildlife). 2019a. SalmonScape fish database and mapping application. Available at: http://apps.wdfw.wa.gov/salmonscape/.

WDFW (Washington Department of Fish and Wildlife). 2019b. PHS on the Web: An interactive map of WDFW priority habitats and species information for project review. Available at: http://wdfw.wa.gov/mapping/phs/.

WDNR (Washington Department of Natural Resources). 2019. Forest Practices Application Mapping Tool. Available at: https://fpamt.dnr.wa.gov/default.aspx.