January 2022

West Seattle and Ballard Link Extensions

Draft Environmental Impact Statement

ECOSYSTEMS TECHNICAL REPORT

Appendix N.4

SOUNDTRANSIT

U.S. Department of Transportation
Federal Transit Administration

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Appendix N.4
West Seattle and Ballard Link Extensions
Ecosystems Technical Report

January 2022

Sound Transit

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Acronyms and Abbreviations

Ecology	Washington State Department of Ecology
NEPA	National Environmental Policy Act
NOAA Fisheries	National Oceanic and Atmospheric Administration National Marine Fisheries Service
SEPA	State Environmental Policy Act
Sound Transit	Central Puget Sound Regional Transit Authority
Suquamish Tribe	Suquamish Indian Tribe of the Port Madison Reservation
U.S.	United States
WAC	Washington Administrative Code
WSBLE	West Seattle and Ballard Link Extensions
WSDOT	Washington State Department of Transportation

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1 INTRODUCTION

1.1 Overview

Central Puget Sound Regional Transit Authority (Sound Transit) is proposing to expand Link light rail transit service from Downtown Seattle to West Seattle and Ballard (Figure 1-1). The West Seattle and Ballard Link Extensions (WSBLE) Project is an 11.8-mile corridor in the city of Seattle in King County, Washington, the most densely populated county of the Puget Sound region. The West Seattle Link Extension would be about 4.7 miles and include stations at SODO, Delridge, Avalon, and Alaska Junction. The Ballard Link Extension would be about 7.1 miles from Downtown Seattle to Ballard's Northwest Market Street area. It would include a new 3.3-mile light rail-only tunnel from Chinatown-International District to South Lake Union and Seattle Center/Uptown. Stations would serve the following areas: Chinatown-International District, Midtown, Westlake, Denny, South Lake Union, Seattle Center, Smith Cove, Interbay, and Ballard.

The WSBLE Project is part of the Sound Transit 3 Plan of regional transit system investments, funding for which was approved by voters in the region in 2016. The project would provide fast, reliable light rail in Seattle and connect to dense residential and job centers throughout the Puget Sound region, while the new Downtown Seattle light rail tunnel would provide capacity for the entire regional system to operate efficiently. The Puget Sound Regional Council (the regional metropolitan planning organization) and the City of Seattle have designated the following regional growth centers, Manufacturing/Industrial Centers, and urban villages in the project corridor:

- **Regional Growth Centers**. The project corridor includes three regional growth centers designated by the Puget Sound Regional Council and the City of Seattle: Seattle Downtown, South Lake Union, and Uptown. The First Hill/Capitol Hill growth center is also just east of the project corridor.

- **Manufacturing/Industrial Centers**. The project corridor includes two Manufacturing/Industrial Centers designated by the Puget Sound Regional Council: the Duwamish and Ballard Interbay Manufacturing/Industrial Centers. The City of Seattle has designated these areas as the Duwamish Manufacturing/Industrial Center and the Ballard Interbay Northend Manufacturing/Industrial Center.

- **Urban Villages**. There are two neighborhoods in the project corridor designated by the City of Seattle as urban villages: West Seattle Junction and Ballard neighborhoods.

These designations indicate that these areas will continue to increase in residential and/or employment density over the next 30 years.

Regional transit service in the project corridor includes regional bus service, light rail, Sounder commuter rail, Washington State Ferries, and Amtrak passenger rail service. Light rail currently operates between the Angle Lake Station in the city of SeaTac and the Northgate Station in Seattle, traveling through the Downtown Seattle Transit Tunnel. Extensions of light rail are under construction north to Lynnwood, east to Bellevue and Redmond, and south to Federal Way, and are anticipated to begin operation in 2024. Planned light rail extensions would continue south to Tacoma Dome, expected to begin service in 2032, and north to Everett, planned to begin service in 2037. The West Seattle Link Extension is scheduled to open in 2032. The Ballard Link Extension is scheduled to begin service in 2037. Depending on funding availability, service from Smith Cove to Ballard Station is scheduled to open in 2037 or 2039.

Figure 1-1. West Seattle and Ballard Link Extensions Project Corridor

Table 1-1 lists the WSBLE Project Build Alternatives for each extension (West Seattle and Ballard).

1.2 Purpose of Report

The purpose of this report is to document ecosystems and their associated species in the WSBLE Project vicinity and evaluate potential impacts associated with the alternatives. This report covers both aquatic and upland ecosystems and the species they support, as well as wetland resources in the study area. This report describes the affected environment as well as the expected long-term impacts (during transit operations) and short-term impacts (during project construction) on these ecosystem resources for each of the project alternatives. This report also discusses measures intended to avoid and minimize impacts, including compensatory mitigation for unavoidable impacts.

The WSBLE Project would pass through primarily urban and industrial areas, as well as dense residential areas that are highly modified from pre-development conditions. However, the routes would also cross or run adjacent to greenbelts, parks, waterbodies, and several small wetlands where vegetation, wildlife, and water quality could be affected by the project. This report focuses on those potential effects.

1.3 Data Gathered

The Central Puget Sound Regional Transit Authority (Sound Transit) performed a literature and data review to identify and characterize potentially affected resources in and near the WSBLE Project. Before the field reconnaissance, existing documentation and information were compiled and reviewed so that the reconnaissance effort could focus on verifying data and filling information gaps.

Existing ecosystem resource information was gathered from many local, state, and federal agencies. These information sources included published and unpublished reports, maps, websites, aerial photographs, and communication with agency staff familiar with resources within the study area.

1.3.1 Agency and Public Contacts

The Ecosystems project team contacted the following agencies to obtain natural resources information specific to the WSBLE Project:

- **City of Seattle.** Maggie Glowacki, Seattle Department of Construction and Inspections Planner, was contacted to find out whether the City of Seattle had a database or map of wetland mitigation sites in the WSBLE vicinity. Ms. Glowacki indicated that she did not have any information other than the data on the City of Seattle interactive mapping website (City of Seattle 2018a).
- **Washington Department of Fish and Wildlife**. Sound Transit obtained priority habitat and species data, including sensitive data, to determine whether sensitive species and habitats may be affected by the WSBLE Project.
- **Washington Department of Fish and Wildlife**. Sound Transit consulted with the Washington Department of Fish and Wildlife about additional sensitive species and habitats that may be affected by the project, and management options for sensitive bird species along the Duwamish Segment (Sound Transit 2020).

Table 1-1. Summary of West Seattle and Ballard Link Extensions Build Alternatives

Extension	Segment	Alternative	Alternative Abbreviation	Stations (and Station Profile)	Connections
West Seattle	**SODO**	**Preferred At-Grade**	**SODO-1a**	**SODO (At-Grade) or SODO Staggered Station Configuration (At-Grade)**	**All Duwamish Segment alternatives.**
West Seattle	SODO	At-Grade South Station Option	SODO-1b	SODO (At-Grade)	All Duwamish Segment alternatives.
West Seattle	SODO	Mixed Profile	SODO-2	SODO (Elevated)	All Duwamish Segment alternatives.
West Seattle	**Duwamish**	**Preferred South Crossing**	**DUW-1a**	**None**	**All SODO Segment alternatives. All Delridge Segment alternatives.**
West Seattle	Duwamish	South Crossing South Edge Crossing Alignment Option	DUW-1b	None	All SODO Segment alternatives. All Delridge Segment alternatives.
West Seattle	Duwamish	North Crossing	DUW-2	None	All SODO Segment alternatives. All Delridge Segment alternatives.
West Seattle	**Delridge**	**Preferred Dakota Street Station**	**DEL-1a**	**Delridge (Elevated)**	**All Duwamish Segment alternatives. Connects to WSJ-1, WSJ-2, and WSJ-4*.**
West Seattle	Delridge	Dakota Street Station North Alignment Option	DEL-1b	Delridge (Elevated)	All Duwamish Segment alternatives. Connects to WSJ-1, WSJ-2, and WSJ-4*.
West Seattle	**Delridge**	**Preferred Dakota Street Station Lower Height***	**DEL-2a***	**Delridge (Elevated)**	**All Duwamish Segment alternatives. Connects to WSJ-3a* and WSJ-3b*.**

Extension	Segment	Alternative	Alternative Abbreviation	Stations (and Station Profile)	Connections
West Seattle	Delridge	Dakota Street Station Lower Height North Alignment Option*	DEL-2b*	Delridge (Elevated)	All Duwamish Segment alternatives. Connects to WSJ-3a* and WSJ-3b*.
West Seattle	Delridge	Delridge Way Station	DEL-3	Delridge (Elevated)	All Duwamish Segment alternatives. Connects to WSJ-1, WSJ-2, and WSJ-4*.
West Seattle	Delridge	Delridge Way Station Lower Height*	DEL-4*	Delridge (Elevated)	All Duwamish Segment alternatives. Connects to WSJ-3a* and WSJ-3b*.
West Seattle	Delridge	Andover Street Station	DEL-5	Delridge (Elevated)	All Duwamish Segment alternatives. Connects to WSJ-1, WSJ-2 and WSJ-4*.
West Seattle	Delridge	Andover Street Station Lower Height*	DEL-6*	Delridge (Elevated)	All Duwamish Segment alternatives. Connects to WSJ-5*.
West Seattle	**West Seattle Junction**	**Preferred Elevated 41st/42nd Avenue Station**	**WSJ-1**	**Avalon (Elevated), West Seattle Junction (Elevated)**	**Connects to DEL-1a, DEL-1b, DEL-3, and DEL-5.**
West Seattle	**West Seattle Junction**	**Preferred Elevated Fauntleroy Way Station**	**WSJ-2**	**Avalon (Elevated), West Seattle Junction (Elevated)**	**Connects to DEL-1a, DEL-1b, DEL-3, and DEL-5.**
West Seattle	**West Seattle Junction**	**Preferred Tunnel 41st Avenue Station***	**WSJ-3a***	**Avalon (Tunnel), West Seattle Junction (Tunnel)**	**Connects to DEL-2a*, DEL-2b*, and DEL-4*.**
West Seattle	**West Seattle Junction**	**Preferred Tunnel 42nd Avenue Station Option***	**WSJ-3b***	**Avalon (Tunnel), West Seattle Junction (Tunnel)**	**Connects to DEL-2a*, DEL-2b* and DEL-4*.**
West Seattle	West Seattle Junction	Short Tunnel 41st Avenue Station*	WSJ-4*	Avalon (Elevated), West Seattle Junction (Tunnel)	Connects to DEL-1a, DEL-1b, DEL-3, and DEL-5.

Extension	Segment	Alternative	Alternative Abbreviation	Stations (and Station Profile)	Connections
West Seattle	West Seattle Junction	Medium Tunnel 41st Avenue Station*	WSJ-5*	Avalon (Retained Cut), West Seattle Junction (Tunnel)	Connects to DEL-6*.
Ballard	**SODO**	**Preferred At-Grade**	**SODO-1a**	**Not applicable**	**Connects to CID-1a*, CID-2a, and CID-2b.**
Ballard	SODO	At-Grade South Station Option	SODO-1b	Not applicable	All Chinatown-International District Segment alternatives.
Ballard	SODO	Mixed Profile	SODO-2	Not applicable	Connects to CID-1a* and CID-2a.
Ballard	Chinatown-International District	4th Avenue Shallow* [a]	CID-1a*	Stadium (existing station would be rebuilt) and International District/Chinatown (tunnel)	All SODO Segment alternatives. All Downtown Segment alternatives.
Ballard	Chinatown-International District	4th Avenue Deep Station Option*	CID-1b	International District/Chinatown (Tunnel)	Connects to SODO-1b. Connects to DT-1.
Ballard	Chinatown-International District	5th Avenue Shallow	CID-2a	International District/Chinatown (Tunnel) or International District/Chinatown Diagonal Station Configuration (Tunnel)	All SODO Segment alternatives. All Downtown Segment alternatives.
Ballard	Chinatown-International District	5th Avenue Deep Station Option	CID-2b	International District/Chinatown (Tunnel)	Connects to SODO-1a and SODO-1b. Connects to DT-1.
Ballard	**Downtown**	**Preferred 5th Avenue/Harrison Street**	**DT-1**	**Midtown, Westlake, Denny, South Lake Union, and Seattle Center (Tunnel)**	**All Chinatown-International District Segment alternatives. Connects to SIB-1 and SIB-2.**

Extension	Segment	Alternative	Alternative Abbreviation	Stations (and Station Profile)	Connections
Ballard	Downtown	6th Avenue/Mercer Street	DT-2	Midtown, Westlake, Denny, South Lake Union, and Seattle Center (Tunnel)	Connects to CID-1a* and CID-2a. Connects to SIB-3.
Ballard	**South Interbay**	**Preferred Galer Street Station/Central Interbay**	**SIB-1**	**Smith Cove (Elevated)**	**Connects to DT-1. Connects to IBB-1a, IBB-2a*, and IBB-2b*.**
Ballard	South Interbay	Prospect Street Station/15th Avenue	SIB-2	Smith Cove (Elevated)	Connects to DT-1. Connects to IBB-3 and IBB-1b.
Ballard	South Interbay	Prospect Street Station/Central Interbay	SIB-3	Smith Cove (Retained cut)	Connects to DT-2. Connects to IBB-1a, IBB-2a*, and IBB-2b*.
Ballard	**Interbay/Ballard**	**Preferred Elevated 14th Avenue**	**IBB-1a**	**Interbay (Elevated), Ballard (Elevated)**	**Connects to SIB-1 and SIB-3.**
Ballard	Interbay/Ballard	Elevated 14th Avenue Alignment Option (from Prospect Street Station/15th Avenue)	IBB-1b	Interbay (Elevated), Ballard (Elevated)	Connects to SIB-2.
Ballard	**Interbay/Ballard**	**Preferred Tunnel 14th Avenue***	**IBB-2a***	**Interbay (Retained cut), Ballard (Tunnel)**	**Connects to SIB-1 and SIB-3.**
Ballard	**Interbay/Ballard**	**Preferred Tunnel 15th Avenue Station Option***	**IBB-2b***	**Interbay (Retained cut), Ballard (Tunnel)**	**Connects to SIB-1 and SIB-3.**
Ballard	Interbay/Ballard	Elevated 15th Avenue	IBB-3	Interbay (Elevated), Ballard (Elevated)	Connects to SIB-2.

* As described in the introduction to Chapter 2, Alternatives Considered, of the Draft Environmental Impact Statement, at the time the Sound Transit Board identified alternatives for study in the Draft Environmental Impact Statement, some alternatives were anticipated to require third-party funding based on early cost estimates. The asterisk identifies these alternatives and the alternatives that would only connect to these alternatives in adjacent segments.

[a] The 4th Avenue Shallow Alternative (Alternative CID-1a*) would require the existing Stadium Station to be rebuilt to the west of its current location due to the tunnel portal, although the Ballard Link Extension would not connect to Stadium Station.

- **United States (U.S.) Fish and Wildlife Service and National Oceanic and Atmospheric Administration (NOAA) Fisheries**. Sound Transit consulted with these agencies for their input on potential ESA challenges or fatal flaws in the alternatives being studied during the Alternatives Development Phase (Sound Transit 2018).

1.3.2 Maps and Existing Documentation

Maps and existing documents reviewed while preparing this report are listed below:

- Aerial photography of the project corridor (including the King County aerial photography database or Google Earth database).
- City of Seattle critical area maps, including City of Seattle Department of Construction and Inspections environmentally critical areas geographic information system data (City of Seattle 2018b).
- City of Seattle State of the Waters 2007 Report: Volume 1, Seattle Watercourses.
- City of Seattle street tree inventory GIS data.
- National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries) Critical Habitat Designation Maps.
- NOAA Fisheries Endangered Species Act Status of West Coast Salmon and Steelhead.
- NOAA Fisheries 2007 Puget Sound [Chinook] Salmon Recovery Plan.
- NOAA Fisheries 2008 Recovery Plan for Southern Resident Killer Whales.
- NOAA Fisheries 2019 ESA Recovery Plan for the Puget Sound Steelhead Distinct Population Segment.
- National Wetlands Inventory data.
- Natural Resources Conservation Service Soil Survey maps for King County (NRCS 1952).
- U.S. Fish and Wildlife Service and Washington Department of Fish and Wildlife lists of listed and proposed endangered and threatened species and critical habitat, candidate species, and species of concern in King County.
- U.S. Fish and Wildlife Service 2015 Recovery Plan for the Coterminous United States Population of Bull Trout.
- U.S. Fish and Wildlife Service Critical Habitat Maps for threatened and endangered species.
- Washington Department of Fish and Wildlife Priority Habitats and Species data.
- Washington Department of Fish and Wildlife SalmonScape fish data and maps.
- Washington Department of Fisheries catalog of Washington streams and salmon utilization.
- Washington State Department of Ecology (Ecology) 303(d) listed waters information.
- Washington Department of Natural Resources Natural Heritage Program database.

1.4 Related Laws, Regulations, and Guidelines

Federal, state and local regulations guide the management of aquatic ecosystems, upland ecosystems, plant species, and wildlife species in the Seattle area. Specific regulations that would apply to the West Seattle and Ballard link extensions are noted in the following sections.

1.4.1 Federal

The following federal regulations would apply to the WSBLE Project:

- National Environmental Policy Act (NEPA).
- Sections 404, 402, and 401 of the Clean Water Act.
- Section 7 of the Endangered Species Act.
- Magnuson-Stevens Fishery Conservation and Management Act.
- Marine Mammal Protection Act.
- Bald and Golden Eagle Protection Act.
- Migratory Bird Treaty Act.
- Protection of Wetlands, Presidential Executive Order 11990.
- Final Rule on Compensatory Mitigation for Losses of Aquatic Resources (2008 or as revised).
- Coastal Zone Management Act.

1.4.2 State

The following Washington state regulations would apply to the WSBLE Project:

- Washington State Environmental Policy Act (SEPA).
- Hydraulic code (Washington Administrative Code [WAC] Chapter 220-110).
- Shoreline Management Act.
- Washington State Growth Management Act.
- Protection of Wetlands, Governor's Executive Order 89-10.
- Protection of Wetlands, Governor's Executive Order 90-04.
- Water Pollution Control Act (Revised Code of Washington 90.48).
- *Wetland Mitigation in Washington State* (Ecology et al. 2006).

1.4.3 Local

The following City of Seattle regulations would apply to the WSBLE Project:

- Critical Area Ordinances, Seattle Municipal Code Chapter 25.09, Regulations for Environmentally Critical Areas.
- Seattle Municipal Code Chapter 23.60A, Seattle Shoreline Master Program Regulations.
- Seattle Municipal Code Chapter 25.11, Tree Protection.
- City of Seattle, Department of Construction and Inspections, Director's Rule 16-2008, Designation of Exceptional Trees.
- City of Seattle Executive Order 03-05, Tree Replacement.
- City of Seattle, Department of Construction and Inspections, Director's Rule 13-2018, Great Blue Heron.

1.5 Study Areas

The study area for ecosystem resources varies according to the type of resource. Each area was measured from the project footprint and area used for construction (the project limits). The project limits encompass all alternatives currently under consideration and include areas that would be temporarily disturbed during construction.

1.5.1 Wetlands

The study area for wetlands covers all lands 300 feet from the project limits.

1.5.2 Aquatic Species and Habitat

The study area for aquatic resources covers shorelines and waters 300 feet downstream and 100 feet upstream at each waterbody crossing (or up to 300 feet upstream if channel configuration could result in stream buffers overlapping the project limits) or to the extent that sound could travel underwater (for example, to the first bend in a waterway). The additional area of waters downstream on directional waterways was studied to capture the distance to which turbidity or other water quality concerns could affect downstream areas and the species residing there. The study area also includes the entire stretch of any waterbody paralleling the project within 200 feet from the edge of the project limits. Documented observations of sensitive federal or state-listed species within 0.25 mile and in Elliott Bay are also included.

For streams or waterbodies with Endangered Species Act-listed species, the study area includes at least the segment of stream or waterbody through which sound could travel in water (that is, to the first bend in the channel or where noise would dissipate to background levels).[1]

1.5.3 Vegetation and Wildlife Resources

The study area for vegetation (including regulated trees) and wildlife reaches 200 feet from the project limits. The study area also includes documented occurrences of sensitive wildlife species within 0.25 mile of the project limits (or up to 0.5 mile if higher noise sources such as blasting or pile-driving are proposed).

[1] For this technical report draft, the study area for Endangered Species Act-listed species includes Elliott Bay outside the East Duwamish Waterway's outlet. When the project Biological Assessment is complete, and underwater noise calculations are made, Elliott Bay may be eliminated from the study area if it is determined that harmful in-water construction noise would not extend outside the waterway.

2 STUDY OBJECTIVES AND METHODS

This section outlines the study objectives used to guide the ecosystems analysis effort, and the methods used to gather data. Detailed methods are provided in the *Ecosystems Technical Analysis Methodology* report (see Attachment N4.A). The Federal Transit Administration invited cooperating and participating agencies to review and comment on the draft report. The following discussion summarizes the approach defined in the finalized methodology report.

2.1 Wetlands

2.1.1 Study Objectives

The wetland study was carried out to locate all wetlands in the project limits and determine their ratings, buffers, and the functions and values they provide to wildlife, local hydrology, and water quality. The intent was to provide a conservative estimate of the potential impacts to wetlands from each alternative.

2.1.2 Methods

A field survey was conducted to identify, map, and describe wetlands within the study area (within 300 feet of the project limits). Field surveys occurred on publicly owned property and rights-of-way, and private properties where accessible. Vegetation and potential wetlands for areas where rights of entry were not obtained were reviewed based on field reconnaissance from public areas; current City of Seattle, state, and federal habitat maps and reports including the National Wetland Inventory database (U.S. Fish and Wildlife Service 2018); and the examination of aerial photographs. This reconnaissance determined the presence or absence of wetlands, and the wetlands were generally mapped based on soil test pits, vegetation, and aerial photos. Due to this, mapping may differ from other public wetland mapping sources.

At accessible wetlands, vegetation, soil, and hydrology conditions were documented at sample plots using methods outlined in the U.S. Army Corps of Engineers Wetland Delineation Manual (U.S. Army Corps of Engineers 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region Version 2.0 (U.S. Army Corps of Engineers 2010). Wetlands were classified according to the U.S. Fish and Wildlife Service (Cowardin et al. 1979) and hydrogeomorphic (Brinson 1993) classification systems and rated according to the City of Seattle critical area ordinance and the Washington State Wetland Rating System for Western Washington, 2014 Update (Hruby 2014). Wetland functions were evaluated using the Washington State Department of Transportation (WSDOT) Wetland Functions Characterization Tool for Linear Projects (Null et al. 2000). Regulatory buffers were determined based on Seattle Municipal Code Chapter 25.09. Completed survey forms and wetland rating forms are included in Attachments N.4B and N.4C. Photographs of the wetlands are provided in Attachment N.4D.

Those areas that appear to possess all three wetland indicators are included in this technical report to provide a conservative estimate of potential impacts from each alternative. Note that wetland buffer analyses included paved areas within the buffer. The City of Seattle sometimes requires mitigation for changes to such paved areas within a buffer. The mitigation required for affected paved areas will be determined during final permitting on a case-by-case basis.

2.2 Aquatic Habitat and Species

2.2.1 Study Objectives

The aquatic assessment was performed to determine which key aquatic features (streams, lakes, and bays) were present in the study area, and what species they could support.

2.2.2 Methods

A field reconnaissance survey was conducted to identify, map, and describe aquatic species and habitat within public rights-of-way within the study area (such as Longfellow Creek riparian corridor). Project team biologists used methods outlined in Sound Transit's stream habitat assessment guidelines (see Attachment N.4A), which uses a Phase 1 Project approach (planning level study) to provide analysis for SEPA/NEPA and Endangered Species Act compliance. Within the Phase 1 approach, Track A methods were used for assessing riparian vegetation effects where property access was not granted, and Track B methods were used on Sound Transit, WSDOT, or City of Seattle right-of-way and easement areas.

Biologists collected information about the condition of in-stream and riparian habitats and identified the ordinary high water mark of streams. Field assessment was limited to areas accessible from public rights-of-way, lands open to the public, or where private property owners allowed access. Aquatic habitats outside of public rights-of-way were identified based on field reconnaissance from public areas; current local, state, and federal habitat maps and reports; and aerial photographs.

Background information about riparian vegetation, physical in-stream habitat, biological connectivity, water quality and quantity, stream typing, fish presence, known fish barriers, and habitat use were collected during the pre-field review phase. Field observations were limited to the study area; however, available information (like the Washington Department of Fish and Wildlife SalmonScape map) was used to evaluate downstream fish passage.

2.3 Upland Habitat and Species

2.3.1 Study Objectives

The upland assessment was performed to determine what natural or semi-natural habitats were found within the study area, what wildlife species these habitats could support.

2.3.2 Methods

Project team biologists delineated and classified land cover on aerial photographs and visited a sample of these areas within the study area during a field reconnaissance survey. Major plant communities/habitat types were identified and classified based on the structural categories defined in *Wildlife-Habitat Relationships in Oregon and Washington* (Johnson and O'Neil 2001). As the Johnson and O'Neill cover categories were not available as geographic information system layers, maps were created using data from the National Land Cover Database (National Land Cover Database 2016), and Green Seattle Partnership data on forested areas in the city.

Heritage and exceptional trees, as defined by the City of Seattle, were identified using a geographic information system layer of trees available from the City of Seattle. Invasive species

populations were identified during field reconnaissance surveys and through maps available from King County. Washington Department of Natural Resources Natural Heritage Program data were also be used to identify rare plant occurrences in the study area.

Biologists identified vegetation types and wildlife species associated with the cover types and habitat elements in the study area through literature review and field visits. Data and geographic information system map review included Audubon Society bird surveys (2018); Washington Department of Natural Resources Natural Heritage Program data (2019), U.S. Fish and Wildlife Service and NOAA Fisheries critical habitat and essential fish habitat databases (U.S. Fish and Wildlife Service 2017, NOAA Fisheries 2019b and 2019c), and the Washington Department of Fish and Wildlife Priority Habitats and Species database (Washington Department of Fish and Wildlife 2019a).

The City of Seattle has mapped management areas for great blue heron (*Ardea herodias*) and bald eagle (*Haliaeetus leucocephalus*) in the West Seattle Link Extension study area, in the West Duwamish Greenbelt. As the mapping for these nests might be outdated, biologists conducted surveys of the north portion of the greenbelt in July 2018, May 2019, and January 2020. The biologists visited known nesting sites and scanned for new great blue heron nest trees or any eagle nests. The survey was conducted by walking transects in the greenbelt and by observing the greenbelt from nearby public locations (t̓uʔəlaltxʷ Village Park and Shoreline Habitat, Diagonal Avenue South public shoreline, and Harbor Island Marina).

Monitoring of the West Duwamish Greenbelt would be conducted annually throughout the Environmental Impact Statement phase of the WSBLE Project to determine heron and eagle nesting activity.

2.4 Impact Assessment Methods and Assumptions

2.4.1 Impact Assessment Methods

This ecosystems impact assessment describes the extent, magnitude, duration, and character of impacts on ecosystems resources for each alternative and option. Impacts were quantified where quantitative data were available, such as the area of wetland and wetland buffer impacts, and acreage of land cover types.

2.4.1.1 Direct Impacts

The impacts analyzed in this report include direct impacts that occur in the same time and place as the project. These include both temporary impacts resulting from construction, and long-term impacts resulting from the operation of the project.

Long-term Impacts during Operation

Long-term impacts refer to impacts that would occur during the operation of the project, and include impacts where the operations footprint would result in permanent changes to the land cover type. Project team biologists assessed long-term impacts by overlaying the conceptual designs for the Build Alternatives onto ecosystem resource base maps (see Attachment N.4E). The operational project footprint includes the guideway, station footprints (including parking), roadway improvements, storm drainage ponds and stormwater vaults, ground improvement areas, and ancillary features.

Not all areas within the operational project footprint would be subject to long-term impacts—especially where tunnels would be excavated using mined excavation. Conversely, some

impacts could take place outside of the footprint. For example, some hazard trees adjacent to the footprint may need to be removed to protect light rail safety and reliability.

Long-term impacts would include shading of vegetation from the elevated guideway. This analysis conservatively assumes that the area under the elevated guideway would be a long-term impact on upland vegetation because guideway column placement is unknown, and depending on the height and orientation of the guideway, light and precipitation could be blocked by the structure. However, shrubs and herbaceous plants may be able to grow where the guideway is high enough above the ground. Sound Transit will re-evaluate this assumption during the permitting phase.

The wetland impact analysis also conservatively assumes a complete loss of any wetland or buffer that is under the guideway, regardless of the guideway's profile at that location. Although elevated guideways would not permanently fill the wetlands within the permanent footprint, some wetland areas below it would likely experience long-term effects from shading. During the project permitting phase, Sound Transit would prepare a more detailed assessment of long-term impacts and identify detailed temporary construction limits to distinguish which resources might be temporarily affected and could be restored following construction.

Short-term Impacts during Construction

This ecosystems analysis covers estimations of short-term impacts that would occur within the construction footprint. For this analysis, Sound Transit assumes that areas supporting native upland or wetland vegetation outside of the operational footprint would be restored after construction is completed. Site restoration features would be installed immediately following construction in each project segment.

2.4.1.2 Indirect Impacts

Indirect impacts can be positive or negative. They may be caused by the project, but occur later in time or at a distance, but are reasonably foreseeable. These may include station area development impacts by others, which could change the pattern of land use, population density, or water quality. If a project leads to changes in the distribution of plants or wildlife outside of the study area, this would also be an indirect impact. Indirect impacts may also occur through the implementation of mitigation measures for other environmental impacts, or through supporting projects that are not yet defined or part of the project alternatives.

2.4.1.3 Cumulative Impacts

Cumulative impacts cover the potential long-term incremental effects of the project in conjunction with past, present, and reasonably foreseeable future actions. These impacts were considered in accordance with cumulative impact analysis regulatory guidance.

Development actions were placed into three categories:

- Past actions include non-native settlements dating back to the 1800s, and continuing trends in development patterns up to the present.
- Present actions are those projects by private developers or local, state, or federal agencies just completed or under construction.
- Reasonably foreseeable future actions are those that are reasonably likely to occur by virtue of being funded, approved, or under consideration for regulatory permitting; undergoing environmental review under NEPA or SEPA; or part of an officially adopted planning document or publicly available development and thus could be under construction at any time from the present through 2042 (the WSBLE Project's design year).

Ecosystems impacts are studied at a broad level to capture how reasonably foreseeable future actions would affect the function of ecosystems at a system-wide level. The study area for examining these impacts differed by resource, as follows:

- Habitats, migratory animals, animals with large foraging areas, and avian species are analyzed at the wildlife corridor level.
- Fish species are analyzed at the watershed level to capture impacts on stream quality.

2.4.2 Impact Assessment Assumptions

Sound Transit would implement best management practices where necessary to avoid or minimize impacts. Also, where possible, Sound Transit will design and locate project features to avoid or minimize impacts on sensitive resources. For example, guideway columns and fill slopes would be situated outside of sensitive areas to the maximum extent practicable. Attachment N4.F provides a compilation of best management practices that could be used to avoid or minimize project construction and operational impacts on sensitive ecosystem resources, including state and federal protected species and their habitats, wetlands, and aquatic resources. These best management practices are either required by state or federal agencies to obtain the permits that would be necessary for the project or may be required to comply with permit conditions.

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3 AFFECTED ENVIRONMENT

This section describes the affected environment of the West Seattle and Ballard Link extensions.

3.1 West Seattle Link Extension

The West Seattle Link Extension would start in the SODO area, cross over the Duwamish Waterway (also known as the Duwamish River) on a bridge paralleling the West Seattle Bridge, pass along the north end of the West Duwamish Greenbelt at Pigeon Point, follow the northern edge of the West Seattle Golf Course in the Delridge neighborhood, and end in the West Seattle Junction area. An overview of the wetlands, aquatic habitat, and terrestrial habitat along the alignments is shown on Figure 3-1. Figures 3-2 through 3-5 show individual segments.

3.1.1 Wetlands

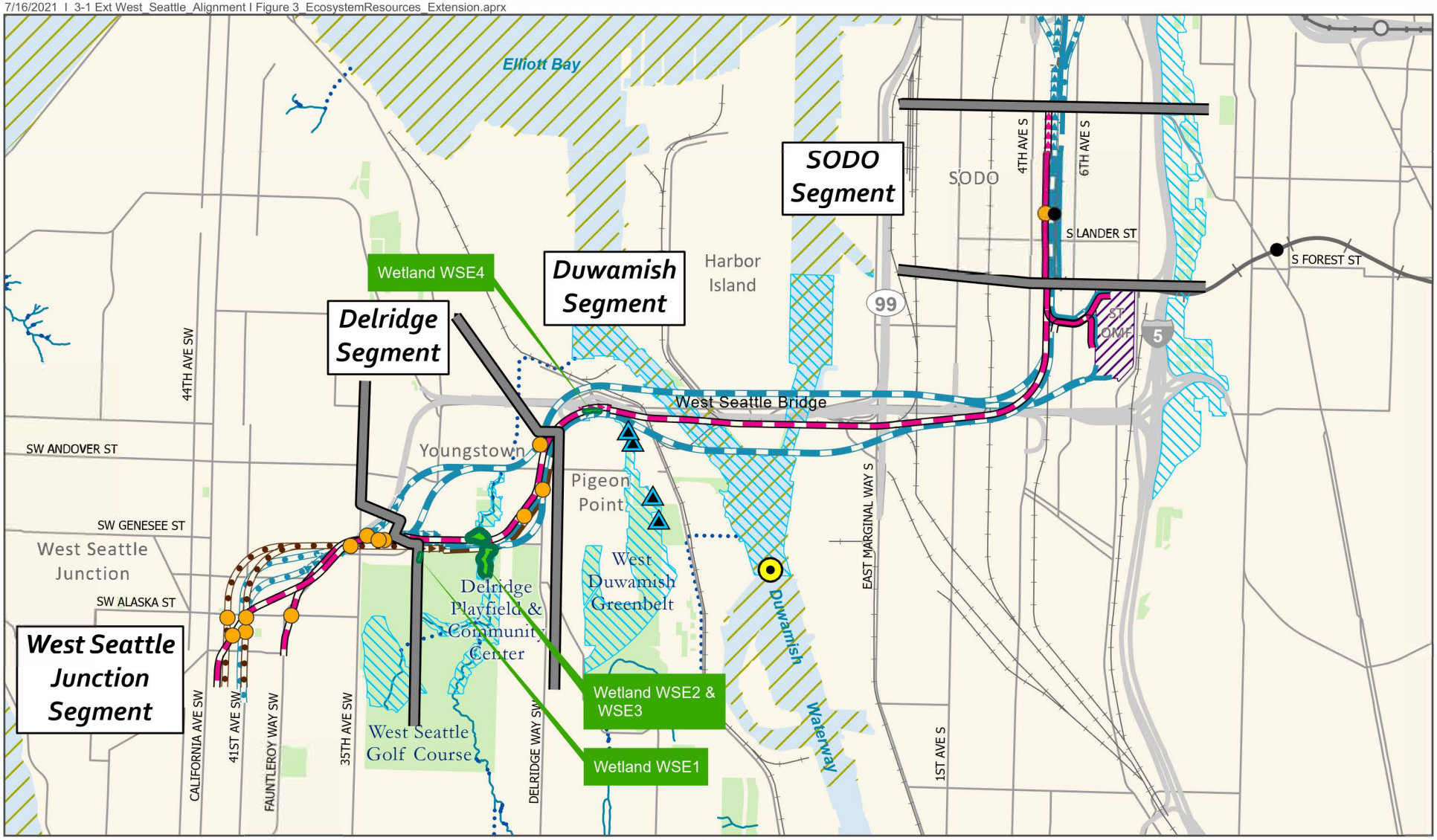
Four wetlands were identified in the West Seattle Link Extension study area. Two wetlands (wetlands WSE1 and WSE4) are slope wetlands associated with the West Seattle Golf Course and the north end of the West Duwamish Greenbelt, and two wetlands (wetlands WSE2 and WSE3) are riverine wetlands associated with Longfellow Creek where it runs between Southwest Nevada Street, Southwest Genesee Street, and the West Seattle Golf Course. Table 3-1 summarizes classification and rating information for the field-identified wetlands in the study area.

All of the wetlands are in areas altered by human development. Two wetlands (WSE1 and WSE4) are small Category IV wetlands, with low habitat scores (Ecology 2014) because they have limited habitat complexity and are isolated from other wildlife habitats. Wetlands WSE2 and WSE3 are Category II due to their higher levels of water quality functions, flood storage, and wildlife habitat. These wetlands flank the fish-bearing Longfellow Creek, to the north and south of Southwest Genesee Street. Beaver activity is evident in both wetlands WSE2 and WSE3; shrub and tree layers could provide shelter for other wetland-associated mammals and birds; and areas with seasonal inundation could provide amphibian habitat. Physical and biological restoration efforts have occurred in the creek, starting in the 1990s, and included native tree and shrub plantings around wetland WSE3 and along the forested portions of the creek.

Wetland determination data forms and wetland rating forms are provided in Attachments N4.B and N4.C. Photographs of the individual wetlands are included in Attachment N4.D. Detailed wetland descriptions are provided in Attachment N4.E.

3.1.2 Aquatic Habitat and Species

The West Seattle Link Extension would cross two waterbodies: the Duwamish Waterway and Longfellow Creek. Both of these waterbodies are in Water Resource Inventory Area 9.



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Railroad
- Stream
- Piped Stream
- Park

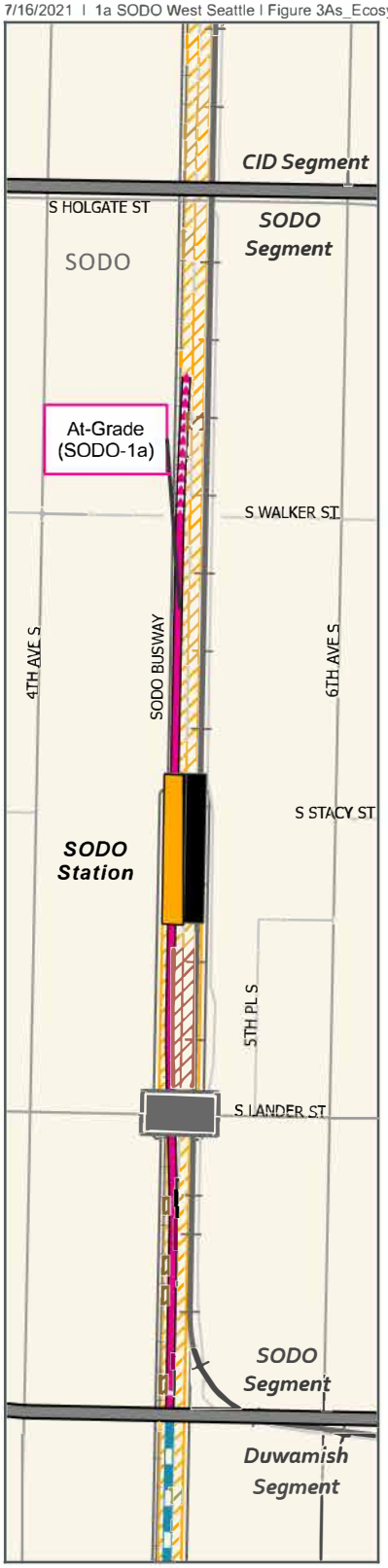
- Great Blue Heron Nest
- Other Seabird Sighting
- Critical Habitat
- WDFW Priority Habitat
- Wetland
- Wetland Buffer

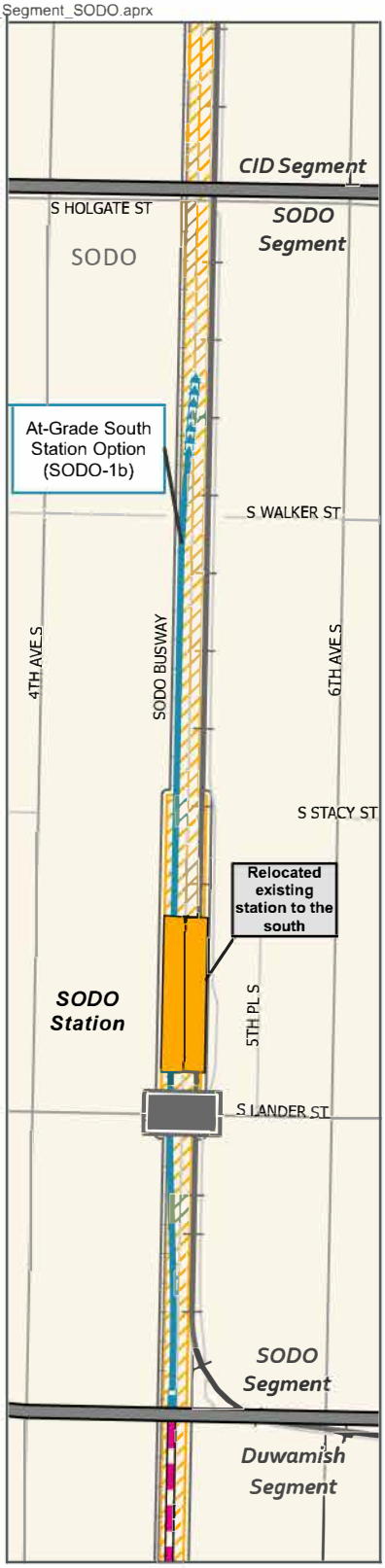
Note: 1) Critical habitat species identified on Figures 3-3b and 3-4b. 2) City and federal mapping of wetlands was reviewed and field verified where possible. Mapping may differ from other public wetland mapping sources.

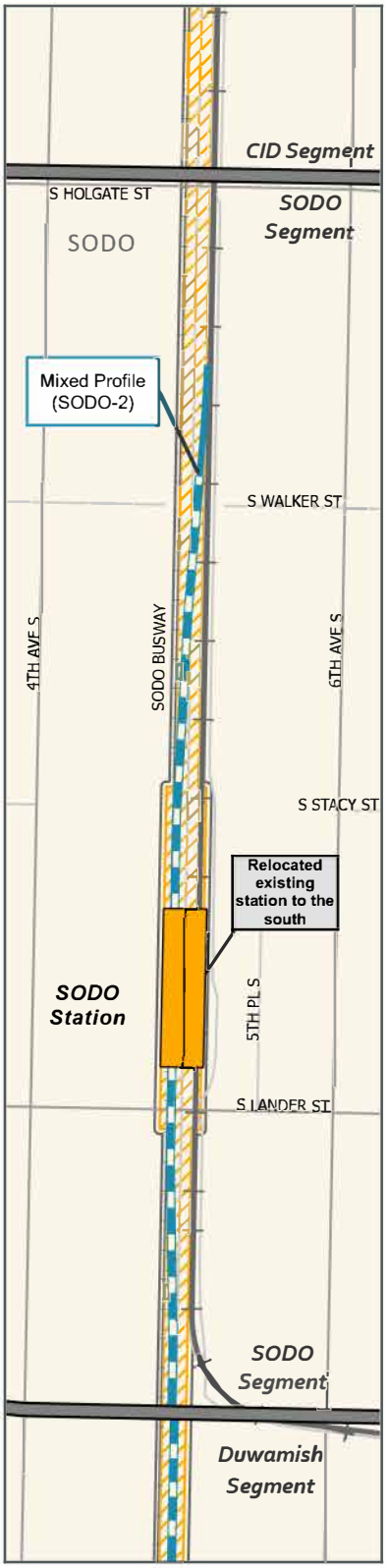
0 0.5 1 Mile

N

FIGURE 3-1
Ecosystem Resources
West Seattle Link Extension
West Seattle and Ballard Link Extensions







Source: City of Seattle, King County (2019, 2020, 2021).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Existing Link Light Rail
- Railroad
- SODO Busway
- Proposed Overpass

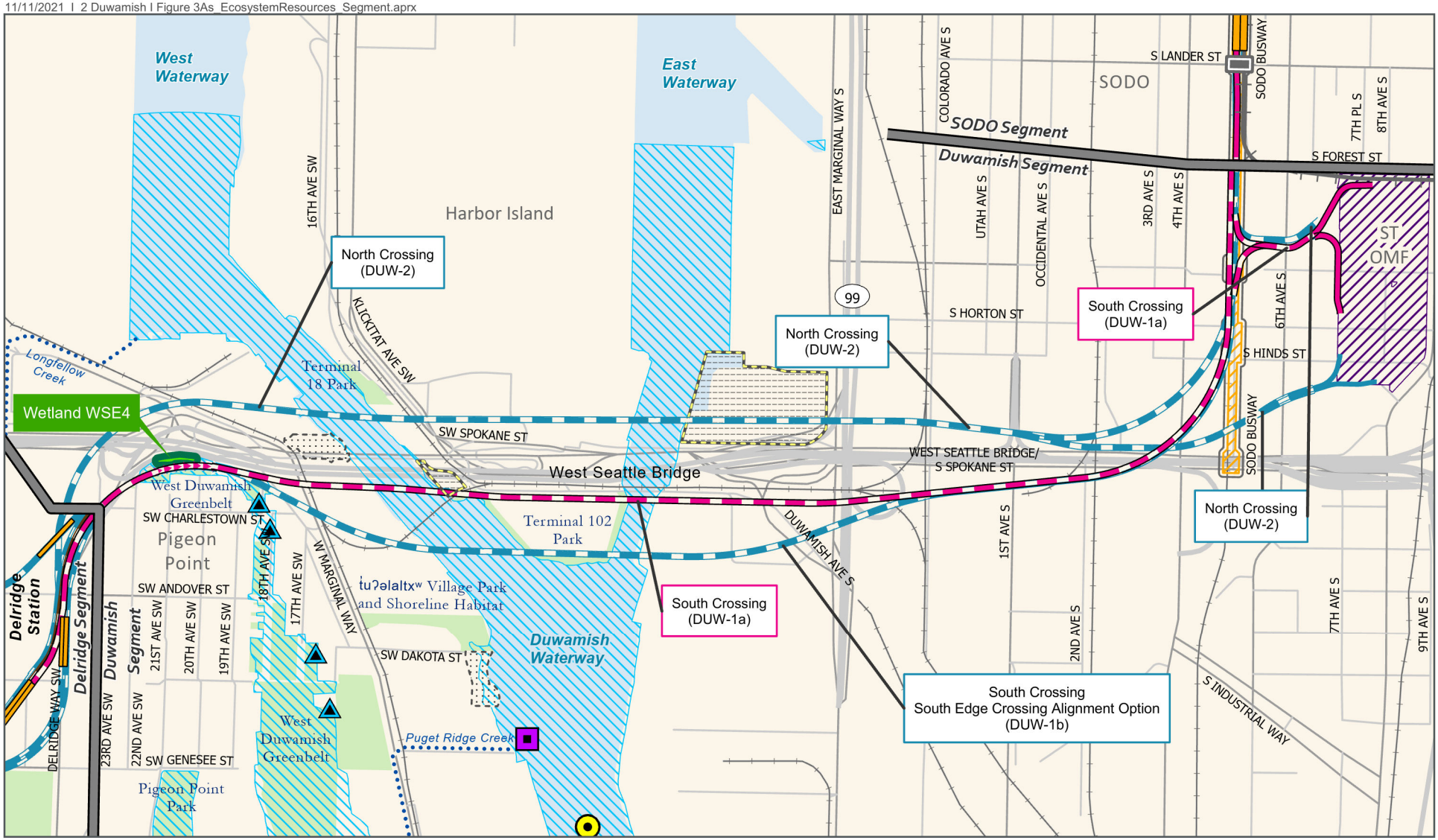
Notes: 1) USFWS, NOAA, WDFW, and the City of Seattle do not map any critical areas or priority habitats in this map view. 2) No wetlands are present along the SODO alignment.

FIGURE 3-2
Ecosystem Resources
West Seattle Link Extension - SODO Segment

West Seattle and Ballard Link Extensions

0 300 600 Feet

N



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Existing Link Light Rail
- Railroad
- SODO Busway
- Proposed Overpass
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Park
- Existing Mitigation Site (not related to this project)
- Proposed Mitigation Site (not related to this project)

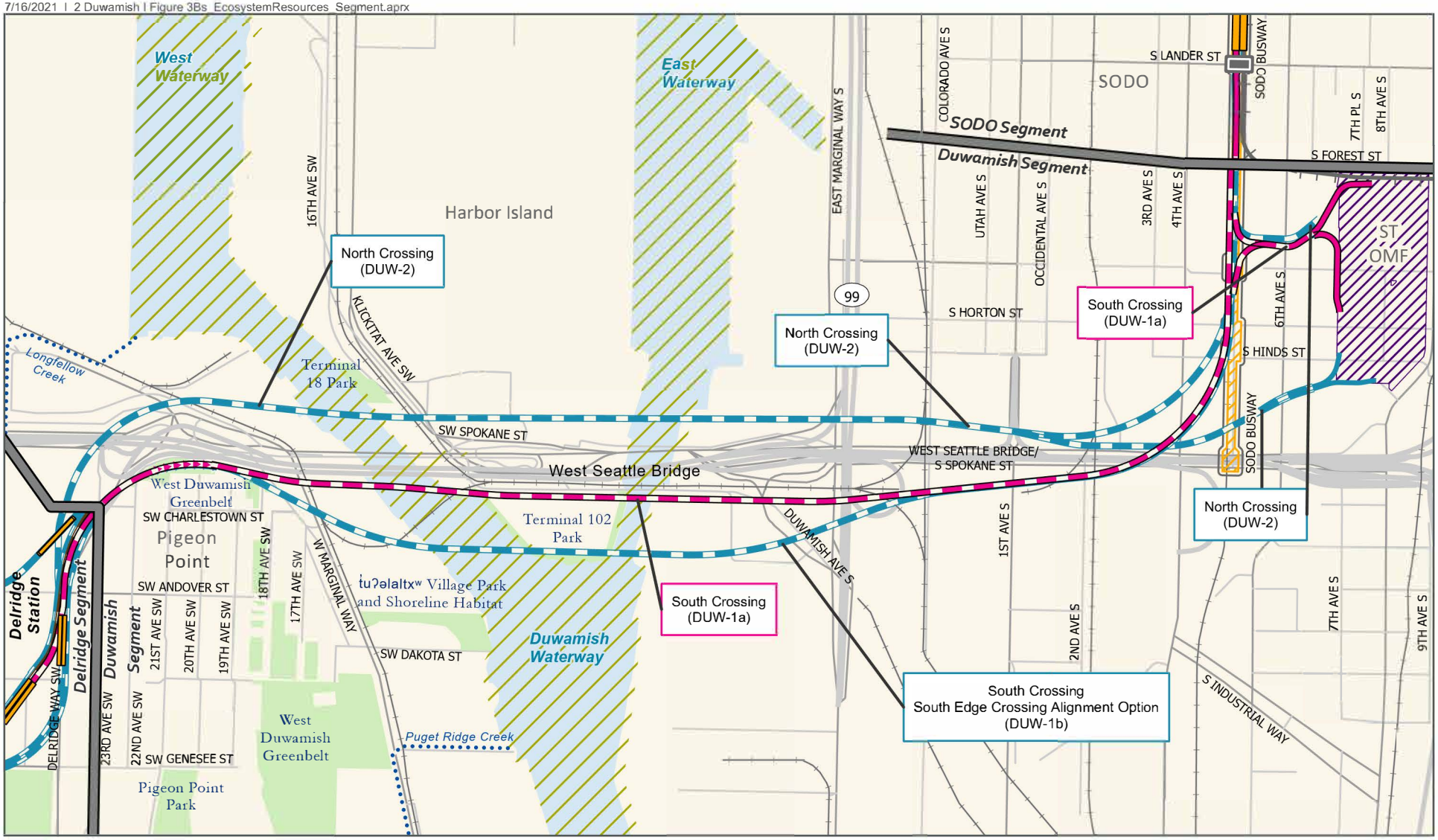
- Great Blue Heron Nest
- Purple Martin Colony/Nest
- Other Seabird Sighting
- Piped Stream
- Wetland
- Wetland Buffer
- WDFW Priority Habitat

Notes: 1) The WDFW Salmon Stock Inventory maps wild populations of salmon in the Duwamish Waterway and Longfellow Creek. 2) City and federal mapping of wetlands was reviewed and field verified where possible. Mapping may differ from other public wetland mapping sources.

FIGURE 3-3a
Wetlands and Priority Habitat/Species
West Seattle Link Extension - Duwamish Segment

West Seattle and Ballard Link Extensions

0 800 1,600 Feet



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Existing Link Light Rail
- Railroad
- SODO Busway
- Proposed Overpass
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Park
- Piped Stream
- Critical Habitat

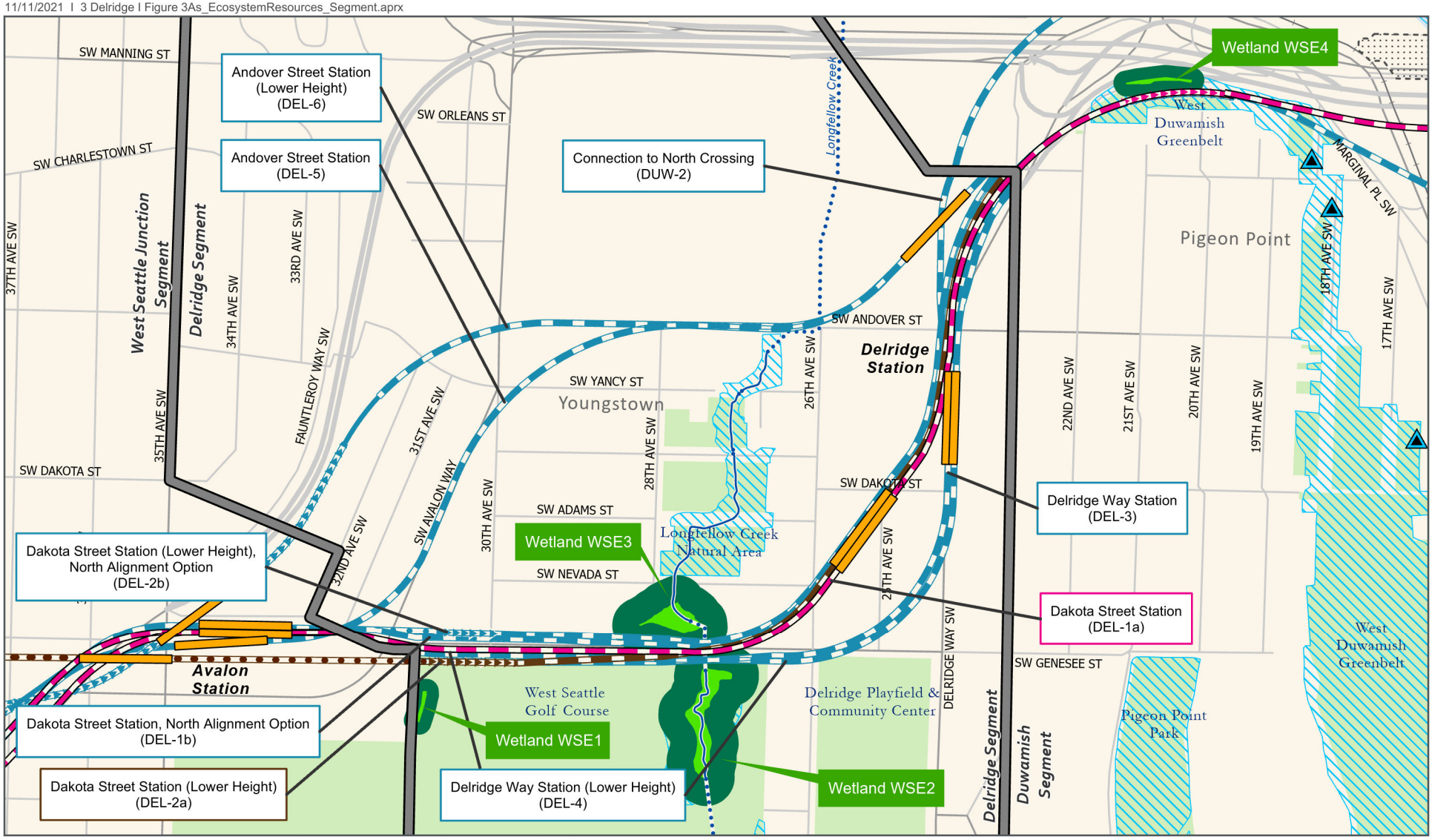
Note: The critical habitat shown is for Chinook salmon, steelhead and bull trout.

FIGURE 3-3b
Endangered Species Critical Habitat
West Seattle Link Extension - Duwamish Segment

West Seattle and Ballard Link Extensions

0 800 1,600 Feet

N



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Railroad
- Park
- Existing Mitigation Site (not related to this project)

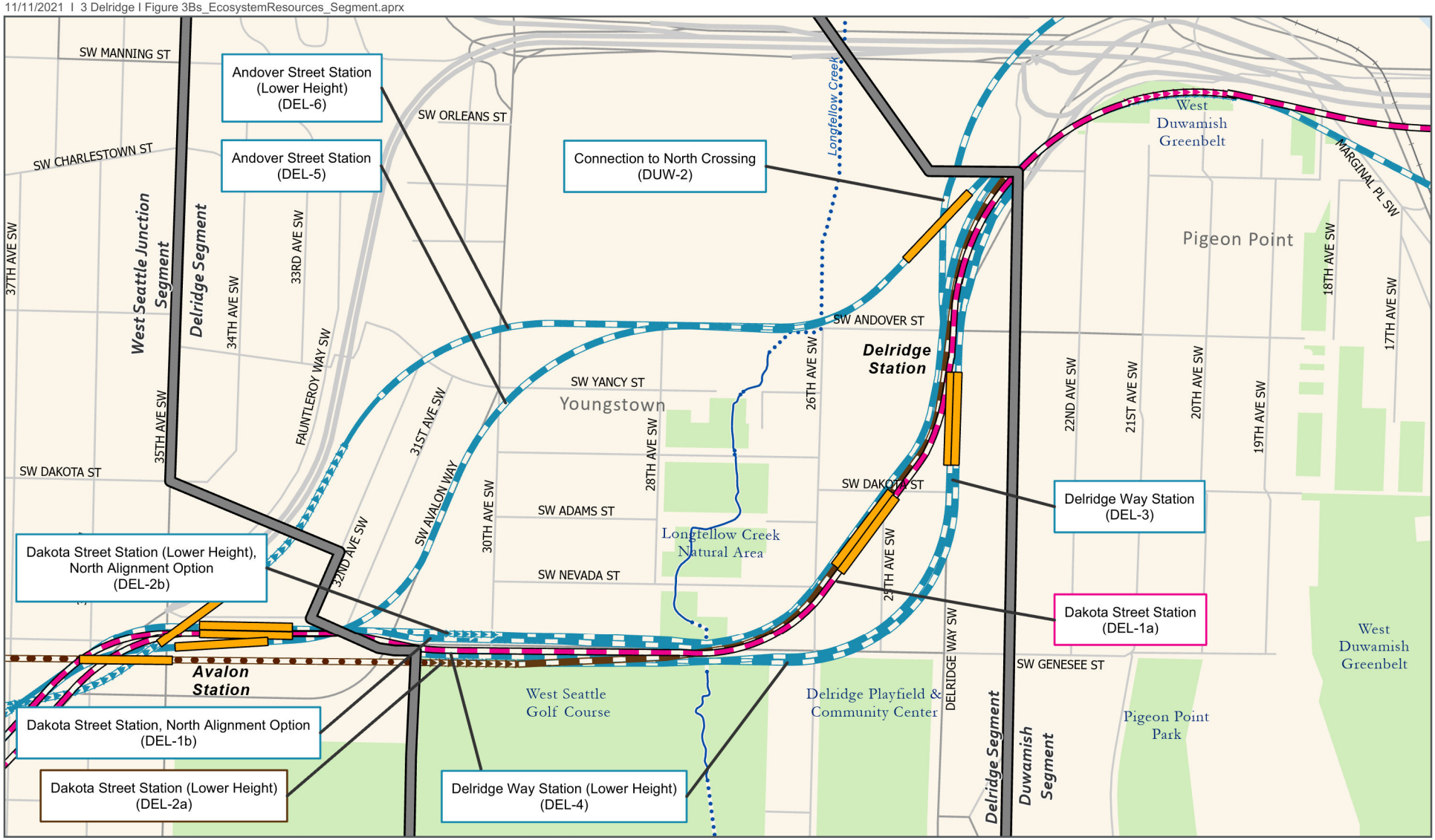
- Great Blue Heron Nest
- Stream
- Piped Stream
- Wetland
- Wetland Buffer
- WDFW Priority Habitat

Notes: 1) The WDFW Salmon Stock Inventory maps wild populations of salmon in Longfellow Creek. 2) City and federal mapping of wetlands was reviewed and field verified where possible. Mapping may differ from other public wetland mapping sources.

FIGURE 3-4a
Wetlands and Priority Habitat/Species
West Seattle Link Extension - Delridge Segment

West Seattle and Ballard Link Extensions

0 400 800 Feet
N



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Railroad
- Park
- Stream
- Piped Stream

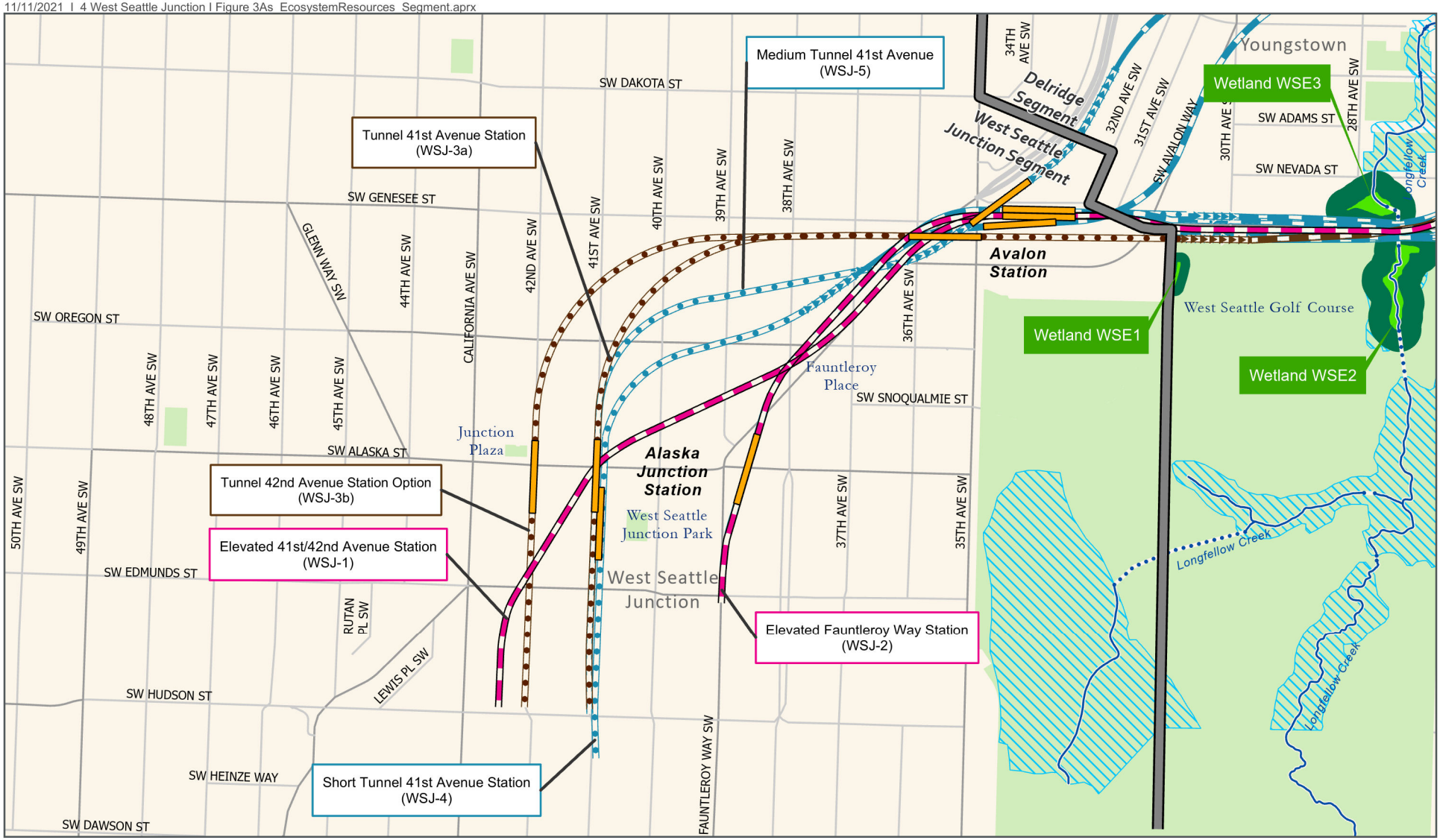
Note: The steelhead trout critical habitat follows the streams.

FIGURE 3-4b
Endangered Species Critical Habitat
West Seattle Link Extension - Delridge Segment

West Seattle and Ballard Link Extensions

0 400 800 Feet

N



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Park
- Stream
- Piped Stream
- Wetland
- Wetland Buffer
- WDFW Priority Habitat

Notes: 1) The WDFW Salmon Stock Inventory maps wild populations of salmon in Longfellow Creek. 2) City and federal mapping of wetlands was reviewed and field verified where possible. Mapping may differ from other public wetland mapping sources.

FIGURE 3-5
Wetlands and Priority Habitat/Species
West Seattle Link Extension -
West Seattle Junction Segment

West Seattle and Ballard Link Extensions

0 500 1,000 Feet
N

Table 3-1. Wetlands in the West Seattle Link Extension Study Area

Wetland Identification	Estimated Size (acres) [a]	Cowardin Class	Hydrogeomorphic Class	Rating [b]	Function Score [b, c]	Buffer Width [d]	Location
WSE1	0.05	palustrine, emergent	Slope	IV	3 (low)	50 feet	West Seattle Golf Course
WSE2	0.45	palustrine, emergent, palustrine scrub-shrub	Riverine	II	6 (moderate)	110 feet	West Seattle Golf Course along Longfellow Creek
WSE3	0.35	palustrine forested	Riverine, Depressional	II	6 (moderate)	110 feet	Along Longfellow Creek between Southwest Genesee and Southwest Nevada streets
WSE4	0.08	palustrine, emergent, palustrine scrub-shrub	Slope	IV	4 (moderate)	50 feet	Pigeon Point under West Seattle Bridge

[a] Based on field reconnaissance and ArcGIS estimates to determine size relative to rating thresholds; wetlands will be fully delineated prior to the Final Environmental Impact Statement.

[b] Ecology 2014.

[c] Seattle Municipal Code 25.09.160 classifies habitat function score (Ecology 2014) of 3 to 4 as low, 5 to 7 as moderate, and 8 to 9 as high.

[d] Seattle Municipal Code 25.09.160: Category IV wetlands 1,000 square feet or more, regardless of connections to waters, receive a 50-foot buffer. Category II wetlands over 100 square feet (or of any size abutting a Type S, F, Np, or Ns water) with a moderate habitat score receive a 110-foot buffer.

3.1.2.1 Duwamish Waterway

The Duwamish Waterway is an urban waterway at the outlet of the Lower Duwamish River that provides tidally influenced saltwater habitat, pockets of shoreline habitat in between industrial shoreline areas, and estuary habitat where it merges with Elliott Bay. In the study area, the waterway splits into the East Waterway and West Waterway on either side of Harbor Island before reaching Elliott Bay (see Figures 3-3a and 3-3b).

The waterway flows through a heavily developed industrial area, and very little natural estuarine habitat or intertidal shoreline habitat remains within the study area along the East Waterway (eastern side of Harbor Island) or West Waterway (western side of Harbor Island) (Figure 3-6). Historically, the lower portions of the Duwamish River meandered through tidal wetlands and shallows. Over time, the river changed significantly due to industrialization, dredging, and straightening (Elliott Bay Trustees 2019). Conditions of the waterway in the study area now include a deep channel and steep shorelines armored with rock or wood bulkheads; some patches of steep shoreline contain rock or gravel with some silty areas. Some of the shoreline is hidden by over-water structures, and little vegetation is present. Substrates of exposed shoreline include sand/mud, gravel or rock, with limited aquatic vegetation. Small pockets of degraded habitat for shorebirds is present among rocks or where silty sediment is exposed, such as along the shorelines of Harbor Island south of and underneath the West Seattle Bridge. Upland habitat within 200 feet is fully developed with streets, office buildings, a marina, parking lots, and industrial storage areas.

Many water quality concerns exist in the Duwamish Waterway; the Lower Duwamish River has experienced historical discharges of hazardous wastes for over 100 years. Industries along the lower waterway that affect water quality include manufacturing, shipyards, cargo handling and storage, lumber milling, and petroleum storage. The river also provides a discharge point for many storm drains and combined sewer overflows. Three active Superfund sites along the river are undergoing remediation: the Harbor Island Superfund site, the Lockheed West Seattle Superfund site, and the Lower Duwamish Waterway Superfund site (Elliott Bay Trustees 2019). The Harbor Island Superfund site and the Lower Duwamish Superfund site overlap the study area. The East Waterway still contains high levels of polychlorinated biphenyls, arsenic, polycyclic aromatic hydrocarbons, and mercury. Ecology also lists several water quality concerns in the waterway, including fecal coliform, Ammonia-N, and temperature (Ecology 2019). Temperatures at monitoring stations throughout the Duwamish River have occasional exceedances of criteria, which could temporarily alter the behavior of salmonids, or be detrimental to spawning, survival, or migration. Temperatures exceeding potentially lethal limits have been measured in the Lower Duwamish River estuary (King County and Washington State Conservation Commission 2000). Detailed information on water quality in the waterway can be found in Appendix L4.8, Water Resources Technical Report.

A final restoration plan for the Lower Duwamish River was completed in 2013 (NOAA Fisheries 2013). In 2014, as part of a National Resource Damage Assessment settlement, the Boeing Company constructed one of the largest restoration projects on the Lower Duwamish River—almost 5 acres of mudflat, marsh, and riparian vegetation, thus providing habitat for fish and wildlife. This site along the shoreline of the river is about 3 miles upstream from the study area. Three additional completed or planned restoration sites along the river are within the WSBLE ecosystems study area (see their locations on Figure 3-3a):

- City of Seattle's Bluefield Holdings/Wildlands Site 1: The company Bluefield Holdings, Inc. completed this restoration project on the west side of the West Duwamish Waterway below the West Seattle Bridge. The industrial property has been converted to tidal

marsh, mudflat, and a riparian buffer. Credits derived from the project have been sold to responsible parties to address injuries to natural resources.

- City of Seattle's Bluefield Holdings/Wildlands Site 2. Bluefield Holdings purchased one portion of this site from the Port of Seattle; the other portion is City of Seattle property. The site is intended for restoration and use as a mitigation bank. It is located on the east side of the West Duwamish Waterway, just south of the West Seattle Bridge.
- Terminal 25 South Project. The Port of Seattle has identified this potential 9-acre habitat restoration project at Terminal 25 on the East Duwamish Waterway, just north of the West Seattle Bridge. This project would restore estuarine wetland functions as well as restore and create riparian habitat and off-channel rearing and refuge habitat for salmonids and other fish and wildlife.

Figure 3-6. Shoreline Habitat at Duwamish Waterway in the West Waterway (Left) and East Waterway (Right)

Studies for remediation projects in the area, including an injury assessment plan finalized in 2019, have identified over 80 species of birds, 6 species of mammals, and over 50 species of fish that use the lower portions of the Duwamish River for foraging, resting, or reproducing for at least some of the year (Elliott Bay Trustees 2019). Over 60 species of benthic invertebrates are also found in the waterway, including clams, marine worms, crab, and shrimp species (Windward 2010). Marine mammals such as harbor seals and California sea lions might also travel up the waterway into the study area. Osprey, bald eagle, great blue heron, and many species of gulls and waterfowl use the waterway for foraging. Osprey might use trees or utility poles near the waterway for nesting. River otters, raccoons, and muskrats forage on shorelines in the Duwamish Waterway and might also forage along shorelines in the study area.

Salmonids passing through the waterway include coho salmon (*Oncorhynchus kisutch*), Chinook salmon (*O. tshawytscha*), chum salmon (*O. keta*), and pink salmon (*O. gorbuscha*), as well as steelhead (*O. mykiss*) and cutthroat trout (*O. clarki*). Sockeye salmon (*O. nerka*) may also occasionally enter or spawn in the river (NOAA Fisheries 1997). The Duwamish River and its tributaries support both natural and hatchery salmon runs. The waterway provides the single point of entry for these salmon species to access the Duwamish River/Green River system from Puget Sound and travel up to 60 miles inland. Peak juvenile salmon outmigration occurs through the waterway between late April and early June (Simenstad et al. 1982). Other fish species that might use the Lower Duwamish River, including the Duwamish Waterway, include English sole (*Parophrys vetulus*), Pacific staghorn sculpin (*Leptocottus armatus*), Pacific cod

(*Gadus macrocephalus*), walleye pollock (*Theragra chalcogramma*), Pacific herring (*Clupea pallasii*), and brown rockfish (*Sebastes auriculatus*) (Elliott Bay Trustees 2019).

Outside the study area, the Duwamish Waterway flows into Elliott Bay, a large estuary system that provides habitat for a wide variety of fish species and marine mammals, including California sea lions (*Zalophus californianus*), harbor seals (*Phoca vitulina*), harbor porpoise (*Phocoena phocoena*), and southern resident killer whales (*Orcinus orca*). Humpback whales (*Megaptera novaeangliea*), grey whales (*Eschrichtius robustus*), and minke whales (*Balaenoptera acutorostrata*) have also been sighted in south Puget Sound and are possible visitors to Elliott Bay (Orca Network 2021).

Applicable City of Seattle Shoreline Habitat Regulations

Seattle's Shoreline Master Program, which regulates development in shorelines of the state, was adopted pursuant to the Shoreline Management Act (Seattle Municipal Code 23.60A). Operating in much the same way as a zoning code, the Shoreline Master Program regulates in-water or over-water development on shorelines of the state and on uplands within 200 feet of the ordinary high water mark of these jurisdictional shorelines. The Seattle Shoreline Master Program specifies shoreline zones, permitted uses, and development standards.

The Shoreline Master Program regulations apply to the Duwamish Waterway in the West Seattle Link Extension study area. However, there is very little existing vegetation or wildlife habitat within 200 feet of the waterway in the study area. Shoreline designations within 200 feet of the waterway fall within the Urban Industrial shoreline zone (City of Seattle 2018b).

Applicable Tribal Treaty Rights

The Muckleshoot Indian Tribe has treaty-protected fishing rights and Usual and Accustomed Areas in the Puget Sound region, which includes the Duwamish Waterway. The Suquamish Indian Tribe of the Port Madison Reservation (Suquamish Tribe) also has treaty-protected fishing rights and Usual and Accustomed Areas in the Puget Sound region, which includes the Duwamish Waterway. The Muckleshoot Indian Tribe is signatory to the Treaty of Point Elliott and the Treaty of Medicine Creek. The Suquamish Tribe is signatory to the Treaty of Point Elliott.

3.1.2.2 Longfellow Creek

Longfellow Creek is an approximately 4-mile-long, Type F (fish-bearing) perennial stream that drains into the Duwamish Waterway. Its watershed drains 2,685 acres of West Seattle. The upper 0.9 mile of the creek (upstream of the study area) has been diverted into underground pipes, and roughly one-third of the total creek flow drains through pipes beneath shopping centers, houses, and roads (City of Seattle 2018b). The middle portion of the creek, including the portion within the study area, includes daylighted sections with riparian vegetation and large, deep pools that can support fish. The lowest portion of the creek flows about 0.5 mile through underground pipes from just south of Southwest Andover Street to a grated outlet near Terminal 5, where it outfalls to the Duwamish Waterway).

The City of Seattle regulates Longfellow Creek and its buffer area as a fish and wildlife habitat conservation area and the creek itself as a riparian watercourse (Seattle Municipal Code 25.09.012 and 25.09.200). The City regulates any development in or over Longfellow Creek, and within 100 feet of the creek in the riparian management area. The riparian management area is mapped perpendicular from daylighted sections of stream; the piped stream and areas perpendicular from the piped stream are excluded from City of Seattle riparian management regulations.

The City of Seattle allows some development within the outer portion of the regulated riparian area. This limited riparian development area is 75 to 100 feet from the stream for streams with anadromous fish. At Longfellow Creek along Southwest Genesee Street and Southwest Andover Street, most of this limited riparian development area has already been developed as housing, parking lots, or streets; south of Southwest Genesee Street, this limited development area is managed as golf course fairway. The 100-foot fish and wildlife habitat conservation area at Southwest Genesee Street (including the limited development area), is overlapped by the larger 110-foot regulated wetland buffers for wetlands WSE2 and WSE3.

Water quality in the creek is of high concern, as rated by Ecology's water quality index that integrates several water quality parameters into one number used to rank streams in the state. Longfellow Creek has periodic exceedances of dissolved oxygen, temperature, and fecal coliform bacteria beyond levels suitable for aquatic life; pH levels are also a concern, though pH levels rarely exceed the Ecology water quality criterion (King County 2016b, Ecology 2019; City of Seattle 2007).

Concentrations of metals in the creek are very low during non-storm flow conditions, but can be higher during storm flow events (City of Seattle 2007). During the summer, the creek periodically fails to meet the dissolved oxygen and temperature criteria necessary for salmonid spawning, rearing, and migration (City of Seattle 2007). Stormwater runoff from urban areas can bring elevated concentrations of nutrients, bacteria, metals, pesticides, or other organic pollutants such as petroleum hydrocarbons and phthalates (City of Seattle 2007). These pollutants originate from sources such as roads, yards, buildings, automobiles, and pet waste. Recent surveys of coho salmon in Longfellow Creek (and in many other streams in the Central Puget Sound) have documented abnormally high levels of pre-spawn mortality in the creek related to toxicity. Contaminants in water are being investigated as a potential contributor to this mortality; stormwater runoff may be a constraining factor in species recovery in the region (Spromberg and Scholz 2011; Scholz et al 2001). Chinook and chum salmon using the creek have not shown this level of sensitivity to contaminants in Longfellow Creek (King County 2016a).

Longfellow Creek passes through the West Seattle Golf Course while flowing south to north. Within the golf course, fish barriers are present such as at the twelfth fairway in the golf course. Migrating coho salmon can access the creek up to these barriers. (City of Seattle 2007; Washington Department of Fish and Wildlife 2019b). Within the study area, the creek meanders through patches of reed canarygrass (*Phalaris arundinaceae*) before reaching a beaver dam within wetland WSE2. Salmon have access to the stream within the study area. Vegetation on the stream banks through the golf course consists of Pacific willow (*Salix lucida*), big leaf maple saplings (*Acer macrophyllum*), Himalayan blackberry (*Rubus armeniacus*), Canada thistle (*Cirsium arvense*), jewelweed (*Impatiens capensis*), reed canarygrass, horsetail (Equisetum sp.), and black cottonwood saplings (*Populus trichocarpa*). After the beaver dam, the creek flows into a 3-foot-diameter culvert under Southwest Genesee Street.

North of Southwest Genesee Street, the creek exits the culvert into a pool about 20 feet wide. This point is within the Longfellow Creek Natural Area. Riparian vegetation along the pool consists of red alder (*Alnus rubra*) trees. North of the pool, the creek continues through a channel that is 6 to 15 feet wide with steep banks. Moderate riparian vegetation along this reach is provided by willows and red alder. Jewelweed, bittersweet nightshade (*Solanum dulcamara*), reed canarygrass, willows, and slough sedge (*Carex obnupta*) are present along the banks of the pool and channel, as well as tree and shrub plantings between the channel and the pedestrian trail. As noted above, ongoing physical and biological restoration efforts have occurred in the creek, starting in the 1990s, including the large woody debris placement and riparian plantings within the study area, north of Southwest Genesee Street. These efforts, in

addition to other restoration efforts in the watershed, may contribute to improved water quality in the creek (King County 2016a).

Downstream from the pool, the channel widens out before crossing underneath a pedestrian bridge about 100 feet north of Southwest Genesee Street. Signs of beaver (such as gnawed trees) are present near the pool.

Longfellow Creek continues flowing northward as an open channel through forested habitat. As it approaches Southwest Andover Street, the stream is about 8 to 12 feet wide, with riprapped banks near the culvert. Streamside vegetation includes red alder, western red cedar (*Thuja plicata*), and spruce. The understory is composed of mostly invasive species, including Himalayan blackberry, English ivy (*Hedera helix*), English holly (*Ilex aquifolium*), and reed canarygrass. About 70 feet south of Southwest Andover Street, the stream enters underground pipes and continues flowing northward underground until its outlet into the Duwamish Waterway near Terminal 5.

Longfellow Creek's waters and streamside habitat supports amphibians, benthic invertebrates, and several fish species. Several sculpin species have been documented in the lowest portions of creek (City of Seattle 2007). Adult Chinook, steelhead, and coho salmon have been observed in the creek within the study area and upstream of the study area to the barriers within the West Seattle Golf Course (King County 2016a, City of Seattle 2007, McMillan 2007). Volunteers in the King County Salmon Watcher Program, who have been surveying the creek since 1999, have consistently sighted adult coho and chum salmon; Chinook salmon and cutthroat trout have been observed on occasion (King County 2016a). Coho migrate upstream through the creek October through December, and chum migrate upstream in November (Salmon Conservation and Restoration 2019). Rainbow trout (*Oncorhynchus mykiss*) have also been documented in the creek. No occurrences of bull trout (*Salvelinus confluentus*) have been documented in the creek (City of Seattle 2018b, Washington Department of Fish and Wildlife 2018a and 2018b).

Longfellow Creek supports salmonid spawning activity. Surveys in 1999 also located juvenile rainbow trout and coho in the creek, which indicated that the stream supports spawning activity (City of Seattle 2018b). Numerous releases of coho fry have also occurred in the creek. Redds (spawning beds) have also been observed in the creek (City of Seattle 2007). The highest-quality spawning habitat in the creek currently accessible to salmonids is near Southwest Adams Street, which is a few hundred feet north of where Longfellow Creek crosses under Southwest Genesee Street (City of Seattle 2007).

3.1.2.3 Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance – Aquatic Species

Table 3-2 summarizes the federally listed species under the jurisdiction of the U.S. Fish and Wildlife Service and NOAA Fisheries that might occur in aquatic habitats in the study area. All of these species are documented in or have the potential to be present in the Duwamish Waterway, including Chinook salmon, steelhead trout, and bull trout. The listed salmonid species spawning upriver do not spawn in the study area but use the Duwamish Waterway for migration, and smolts use the shoreline habitat for shelter when moving downstream to Elliott Bay and when adjusting to saltwater conditions. Chinook salmon and steelhead are also present in Longfellow Creek up to the West Seattle Golf Course (King County 2016a, Kerwin and Nelson 2000).

Table 3-2. Federally Listed Aquatic Species and Species of Concern in Aquatic Habitat – West Seattle Link Extension

Common Name	Scientific Name	Status	Occurrence in Study Area
Puget Sound/Coastal Distinct Population Segment bull trout	*Salvelinus confluentus*	Federal Threatened; State Candidate	Documented in Duwamish Waterway; critical habitat in Elliott Bay and Duwamish Waterway.
Puget Sound Evolutionarily Significant Unit Chinook salmon	*Oncorhynchus tshawytscha*	Federal Threatened; State Candidate	Documented in Elliott Bay, Duwamish Waterway, and Longfellow Creek; critical habitat in Elliott Bay and Duwamish Waterway; essential fish habitat in Duwamish Waterway and Longfellow Creek.
Puget Sound Distinct Population Segment steelhead trout	*Oncorhynchus mykiss*	Federal Threatened	Documented in in Elliott Bay and Duwamish Waterway. Critical habitat in the Duwamish Waterway and Longfellow Creek.
Coho salmon	*Oncorhynchus kisutch*	Federal Species of Concern	Documented in Duwamish Waterway and Longfellow Creek; essential fish habitat in Duwamish Waterway and Longfellow Creek.
Puget Sound bocaccio	*Sebastes paucispinis*	Federal Endangered; State Candidate	Likely in Elliott Bay, potential in Duwamish Waterway; critical habitat in Elliott Bay.
Puget Sound yelloweye rockfish	*Sebastes ruberrimus*	Federal Threatened; State Candidate	Likely in Elliott Bay, potential in Duwamish Waterway; critical habitat in Elliott Bay.
Pacific cod	*Gadus macrocephalus*	Federal Species of Concern; State Candidate	Documented in Elliott Bay and Duwamish Waterway.
Pacific herring	*Clupea pallasi*	Federal Candidate; State Candidate	Likely in Elliott Bay; documented in Duwamish Waterway; Washington Department of Fish and Wildlife maps spawning habitat on Elliott Bay shorelines.
River lamprey	*Lampetra ayresii*	Federal Species of Concern	Potential in Duwamish Waterway.
Pacific eulachon [a]	*Thaleichthys pacificus*	Federal Threatened	Unlikely; closest documented spawning is in southern British Columbia.
Green sturgeon [a]	*Acipenser medirostris*	Federal Threatened	Unlikely; could occur in Elliott Bay but no spawning occurs in Puget Sound rivers.
Southern resident killer whale [a]	*Orcinus orca*	Federal Endangered	Documented in Elliott Bay; critical habitat in Elliott Bay.
Humpback whale [a]	*Megaptera novaeangliae*	Federal Endangered, State Endangered	Documented in Elliott Bay.
Steller sea lion	*Eumetopias jubatus*	Federal Species of concern	Documented in Elliott Bay; potential in Duwamish Waterway.
Marbled murrelet	*Brachyramphus marmoratus*	Federal Threatened; State Threatened	Occur in Elliott Bay and the Duwamish Waterway.

Sources: U.S. Fish and Wildlife Service 2019; NOAA Fisheries 2019b, 2019c, 2020; Washington Department of Fish and Wildlife 2018a

[a] Listed marine species found in Elliott Bay but not the Duwamish Waterway are included here because in-water construction noise could reach the bay.

Yelloweye and bocaccio rockfish (*Sebastes ruberrimus* and *S. paucispinis*) occur in Elliott Bay and may enter the tidally influenced portions of the Duwamish Waterway. Listed whale species (humpback whale and southern resident killer whale) occurring in Elliott Bay are unlikely to visit the Duwamish Waterway; however, construction noise has the potential to reach these species

in Elliott Bay. Pacific cod and Pacific herring (candidates for federal listing) and river lamprey (*Lampetra ayresii*; federal species of concern) occur in Elliott Bay and have been documented in the Duwamish Waterway. Marbled murrelets (*Brachyramphus marmoratus*) forage in Elliott Bay, and may visit the Duwamish Waterway for foraging or when traveling between their marine foraging habitat and their upland nesting habitat in the Cascades foothills. Steller sea lions (*Eumetopias jubatus*) are much less common in Elliott Bay than the California sea lion but do occur and might join the California sea lions and harbor seals that regularly forage in the lower portion of the Duwamish Waterway.

Two additional federally listed marine species are possible in the study area but are unlikely to occur. Green sturgeon (*Acipenser medirostris*) might enter Puget Sound to forage in the nearshore zones of bays and estuaries; however, no spawning occurs in Puget Sound rivers and green sturgeon is unlikely to be present in the study area. The closest documented Pacific eulachon spawning is in northern Puget Sound (southern British Columbia); therefore, eulachon are unlikely to be present in the study area.

The Duwamish Waterway is designated critical habitat for bull trout, Chinook salmon, and steelhead. NOAA Fisheries maps the Duwamish Waterway as essential fish habitat for all life stages of finfish, groundfish, coastal pelagic species, and Chinook, coho, and pink salmon (NOAA Fisheries 2019c).

The U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife have established work windows for in-water work to protect listed species of salmonids, and NOAA Fisheries or U.S. Fish and Wildlife Service may require additional restrictions to this work window. The standard in-water work window in the Duwamish Waterway is August 1 through February 15.

Recovery plans are in place for Chinook salmon (NOAA Fisheries 2007), bull trout (U.S. Department of Fish and Wildlife 2015), and steelhead trout (NOAA Fisheries 2019c). The Chinook recovery plan focuses on limiting factors for the species, including the following:

- Water quality in the lower 5 miles of the Lower Duwamish River.
- The lack of intertidal habitat in the Duwamish Estuary transition zone where freshwater and saltwater mix (juvenile salmon may linger in this area while adjusting to saltwater).
- Degraded riparian conditions (which occur in portions of Longfellow Creek and on the Lower Duwamish River).

Management actions recommended by the Chinook recovery plan focus on the following:

- Protecting and/or improving riparian conditions.
- Protecting and/or improving natural flows.
- Protecting and/or improving water quality.
- Protecting and/or improving access to tributaries.
- Preventing new bank/shoreline armoring and fill that would reduce habitat for migrating juvenile Chinook.

The steelhead recovery plan states specific strategies for the central and south Puget Sound major population group of steelhead (which includes steelhead passing through the study area in the Duwamish Waterway and in Longfellow Creek). The strategies include improving habitat in lower reaches of rivers (through actions such as improving habitat complexity and shade) and improving juvenile survival in nearshore waters. The bull trout recovery plan includes guidance on recovery of the Coastal Recovery Unit (which includes Puget Sound). However, it does not

identify the Duwamish River as a core recovery area, because no anadromous run of bull trout is established in this drainage.

A recovery plan is also in place for the marbled murrelet (U.S. Fish and Wildlife Service 1997), including recommendations for the Puget Sound area. Ongoing management actions performed under this plan focus on preserving upland habitat (in mature forests, which do not occur in the study area) and preventing injury or death in the marine environment (such as during oil spills). The health of nearshore environment is also a concern for the species, which spends most of its life in marine waters feeding on forage fish.

Recovery plans are also in place for southern resident killer whales (NOAA Fisheries 2008) and humpback whales (NOAA Fisheries 1991). Known or potential impacts to these species, as listed in the plans, include acoustic disturbance (such as from industrial activities) and habitat degradation (including chemical pollution). Management actions identified for recovery of southern resident killer whales include protecting or increasing runs of Chinook salmon, the whales' preferred prey species.

A draft recovery plan is under review for yelloweye rockfish and bocaccio (NOAA Fisheries 2016). Final recovery plans are in place for eulachon and green sturgeon (as noted above, these species are not likely in the Duwamish Waterway or Elliott Bay).

3.1.3 Upland Habitat and Species

3.1.3.1 Vegetation

Land Cover Types

The West Seattle Link Extension study area is in a densely developed city that has been substantially altered from historical conditions. Land cover is primarily urban, with high density buildings and industrial areas in south Seattle and the Duwamish area, and high, moderate, and low density residential areas in West Seattle (Table 3-3). Forested greenbelts and developed open space such as the West Seattle Golf Course are present adjacent to the residential areas. Figure 3-7 shows the land cover types in the West Seattle Link Extension study area.

Most of the highly urban areas, industrial areas, high density housing, and roadways, have low potential for supporting wildlife. The primary cover types that provide any nesting or sheltering habitats for wildlife are non-paved areas in the West Duwamish Greenbelt, the Longfellow Creek Natural Area, the West Seattle Golf Course, in small residential parks, and in landscaping and retained native trees within residential back yards. Wildlife inhabiting these areas are exposed to moderate to high levels of noise associated with traffic and industrial operations.

Heritage and Exceptional Trees

The City of Seattle and PlantAmnesty maintain a cooperative program to protect notable trees in Seattle; a tree is nominated as a heritage tree if it has exceptional size, form, rarity, historic contribution, or is part of a notable collection (City of Seattle 2019a and 2019b). No heritage trees overlap the project's footprint; heritage trees mapped within the West Seattle Link Extension study area consist of an American black walnut tree near the north end of the West Duwamish Greenbelt and a Japanese maple south of the Alaska Junction Station (City of Seattle 2019b).

Table 3-3. Land Cover Types along the West Seattle Link Extension

Land Cover Type	Acres within 200 feet of Project [a]	Percent of Land Cover Type Total	Description
Forest (Greenbelts)	38	5%	Includes deciduous, evergreen, and mixed forest with over 20% total tree cover. Occurs in the West Duwamish Greenbelt and Longfellow Creek Natural Area.
High Density Residential (Includes Industrial)	413	60%	Includes developed areas where people reside or work in high numbers (such as commercial/industrial, apartment complexes, and row houses); 80 to 100% impervious surface.
Medium Density Residential	149	22%	Areas with a mixture of constructed materials and vegetation; 50% to 79% impervious surface (such as single-family housing units).
Low Density Residential	53	8%	Areas with a mixture of constructed materials and vegetation; 20% to 49% impervious surface (such as single-family housing units).
Developed, Open Space	12	2%	Areas with constructed material but dominated by managed vegetation (such as lawn grasses); less than 20% impervious surface. Includes large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes).
Open water	20	3%	Areas of open water; less than 25% cover of vegetation or soil.

Sources: National Land Cover Database 2016 (for residential, developed, and open water cover types); Green Seattle Partnership 2020 (forest-cover types).

[a] The National Land Cover Database is based on a grid system and Green Seattle Partnership data follows more precise forest-cover boundaries. Therefore, combining these datasets creates some small overlaps between the forest acres and other landcover types.

Street trees in the study area include many species of ornamental and native trees, including maples (*Acer* spp.), Callery pear (*Pyrus calleryana*), crabapple (*Malus sp.*), hawthorne (*Crataegus sp.*), ash (*Fraxinus* spp.), linden (*Tilia* spp.), ginko tree (*Ginko biloba*), elm (*Ulmus* spp.) and giant sequoia (*Sequoiadendron giganteum*). The golf course contains mowed fairways, rows of medium-sized deciduous and coniferous trees bordering the fairways, and a few patches of forest with larger, primarily deciduous trees and a mix of native and non-native understory vegetation. Delridge Playfield has lines of trees but is cleared of any understory species (groundcover is primarily mowed lawn). Riparian habitat along Longfellow Creek is fragmented, but stream and riparian restoration projects have increased habitat quality in many sections, including within the study area. Native tree and shrub plantings were added to increase plant diversity and stream shading, and reduce potential erosion. Large woody debris has been anchored in the stream to create pools, shade, and a nutrient source for more complex fish habitat.

Source: Multi-Resolution Land Characteristics (MRLC) - NLCD (2016), City of Seattle, King County (2019, 2020, 2021).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Sound Transit Operations and Maintenance Facility (ST OMF)
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Railroad
- Stream
- Piped Stream
- Park

- Low Density Urban
- Medium Density Urban
- High Density Urban
- Water
- Other
- Green Space

FIGURE 3-7
Cover Types
West Seattle Link Extension
West Seattle and Ballard Link Extensions

0 0.5 1 Mile

N

The City of Seattle also protects "exceptional trees," which include heritage trees as well as additional trees considered rare or exceptional by virtue of their size, species, condition, cultural/historic importance, age, and/or contribution as part of grove of trees as defined by Director's Rule 16-2008 (City of Seattle 2008). Exceptional trees have unique historical, ecological, or aesthetic value (City of Seattle 2008). All trees over a certain diameter threshold for their species are considered exceptional except where they constitute a hazard (City of Seattle 2008). Trees that meet the definition for exceptional are present in the study area and would require protection or mitigation under the City's Tree Protection Ordinance; these trees and trees less than 6 inches in diameter that are within critical areas would require additional protection or mitigation under the City's critical areas regulations.

Rare Plants

Based on the Washington Department of Natural Resources Natural Heritage Program rare plants geographical information system data, no rare plant communities are currently documented in the WSBLE study area (Camp and Gamon 2011, Washington Department of Natural Resources 2019).

Invasive Plants

Invasive species of plants are present throughout the highly modified environment of the West Seattle Link Extension study area. Prominent species are English ivy, Himalayan blackberry, and non-native grasses. Ivy is particularly prevalent as groundcover and on some tree trunks in the West Duwamish Greenbelt and in roadside areas under the West Seattle Bridge. Where heavy infestations occur in the greenbelt forest floor, it is currently slowing the regeneration of young trees in the forest; the weight of heavy infestations of ivy on tree branches can increase the chances that tree limbs could break during storms.

King County lists several weed occurrences that have been reported in the study area, some successfully controlled and some ongoing. These include Class A weeds (eradication of all infestations is required by law in Washington), and Class B weeds (in which prevention or control is decided at the local level). Weeds recorded in or near the study area include several Class B weeds (tansy ragwort [*Senecio jacobaea*]; dalmatian toadflax [*Linaria dalmatica*], rush skeletonweed [*Chondrilla juncea*], perennial pepperweed [*Lepidium latifolium*], diffuse knapweed [*Centaurea diffusa*], kochia [*Bassia scoparia*] and spotted knapweed [*Centaurea stoebe*]) and one Class A weed (giant hogweed [*Heracleum mantegassianum*]) (King County 2019a and 2019b, Noxious Weed Control Board 2019).

3.1.3.2 Forested Corridors and Wildlife

The study area includes the northern end of the West Duwamish Greenbelt, which stretches along the steep slope on the east side of West Seattle's Delridge neighborhood and provides roughly 500 acres of forested habitat corridor. It stretches 4 miles (6.4 kilometers) south from the West Seattle Bridge. The study area also includes the forested greenbelt along Longfellow Creek; this greenbelt is a narrow corridor of trees about 0.25 mile long. The West Duwamish Greenbelt and the Longfellow Creek Natural Area are both Washington Department of Fish and Wildlife-designated Priority Habitat Biodiversity Area and Corridors, and the City of Seattle defines them as environmentally critical areas.

The West Duwamish Greenbelt and the Longfellow Creek Natural Area provide habitat elements that include deciduous and coniferous forest, snags, downed woody debris, and areas with multi-layered canopy. Tree species include red alder, bigleaf maple, Douglas fir (*Pseudotsuga menzesii*), and Sitka spruce (*Picea sitchensis*). The West Duwamish Greenbelt

provides contiguous habitat for 4 miles, broken only by trails and a few roads. Tree species are primarily native species; the understory is a mix of native and non-native species, with a thick cover of English ivy within the study area. Tall trees within the northern edge of the greenbelt, within the study area, are predominantly bigleaf maples.

The Longfellow Creek Natural Area contains deciduous and coniferous trees, including red alder, Douglas fir, and Sitka spruce, and it is crossed by three two-lane roads. Its understory along the Longfellow Creek Legacy Trail within the natural area has been improved with native species during restoration programs along the creek (Green Seattle Partnership 2019). Clumps and lines of trees in the West Seattle Golf Course are more fragmented but might be used by wildlife to travel from the Longfellow Creek Natural Area to additional greenbelts to the southwest and south of the golf course. The northern edge of the golf course, along Southwest Genesee Street, contains a line of trees, including ornamental conifers, Western red cedars, and several dozen Douglas firs with trunks ranging from 6 inches to 20 inches in diameter.

These greenbelts provide shelter for mammals tolerant of proximity to urban areas, including mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), squirrel species, and opossum (*Didelphis virginiana*). Salamanders and frogs have been found in the Longfellow Creek Natural Area. Trees in the natural area and the West Seattle Golf Course provide roosting and nesting habitat for raptors such as the red-tailed hawk (*Buteo jamaicensis*), barred owl (*Strix varia*), kestrel (*Falco sparverius*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperii*), and great horned owl (*Bubo virginianus*). Red-tailed hawks and other raptors prey on voles that are found in the grassy vegetation of parks and the golf course areas. Denser trees within the golf courses could provide habitat for state candidate species such as Townsend's big-eared bat (*Corynorhinus townsendii*), pileated woodpecker (*Dryocopus pileatus*), or Vaux's swift (*Chaetura vauxi*). Prominent trees within the West Duwamish Greenbelt may provide perching opportunities for bald eagles).

The Migratory Bird Treaty Act, administered by the U.S. Fish and Wildlife Service, makes it unlawful to take, import, export, possess, sell, purchase, or barter any migratory bird, with the exception of the taking of game birds during established hunting seasons. Nearly all bird species that might occur in the study area are protected under the Migratory Bird Treaty Act. The greenbelts described above, and trees in the golf course and residential backyards and parks could support many migratory songbird species during wintering, migration, or nesting. Osprey may use trees or utility poles in the study area for nesting; an artificial platform for nesting osprey is present on a parcel adjacent to Sound Transit's existing Operations and Maintenance Facility Central, on the eastern edge of the Duwamish Segment. In addition to the raptor and woodpecker species mentioned above, bird species that might breed in the study area include American robin (*Turdus migratorius*), song sparrow (*Melospiza melodia*), Steller's jay (*Cyanocitta stelleri*), American crow (*Corvus brachyrhynchos*), spotted towhee (*Pipilo maculates*), dark-eyed junco (*Junco hyemalis*), black-capped chickadee (*Poecile atricapillus*), northern flicker (*Colaptes auratus*), Bewick's wren (*Thryomanes bewickii*), and red-breasted nuthatch (*Sitta canadensis*), Anna's hummingbird (*Calypte anna*), and great blue heron (Opperman et al. 2006, Audubon Society 2018).

3.1.3.3 Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance – Upland Species

No federally listed upland plant or wildlife species or designated critical habitat under the jurisdiction of the U.S. Fish and Wildlife Service occurs in the urban environment of the study area. The federally threatened yellow-billed cuckoo (*Coccyzus americanus*) requires extensive hardwood-dominated riparian areas with at least 300 contiguous acres; its designated critical habitat does not overlap the study area. The federally threatened streaked horned lark

(*Eremophila alpestris strigata*) uses habitat such as prairies, dune habitats, and sandy beaches, which are also not present in the study area; nor does its designated critical habitat overlap with the study area. The federally threatened northern spotted owl (*Strix occidentalis caurina*) requires mature coniferous forest, which is not present in the study area, nor does the species' designated critical habitat overlap the study area. The federally threatened marbled murrelet forages in Elliott Bay but requires mature coniferous forest for its nesting habitat; as none is present in the study area, this species is discussed only in the aquatic species section of this document (U.S. Fish and Wildlife Service 2019).

Table 3-4 presents potential species of concern that might use upland habitats in the study area. Townsend's big-eared bat, pileated woodpecker, and Vaux's swift could occur in the West Duwamish Greenbelt. Peregrine falcons (*Falco peregrinus*) are known to use urban buildings and other structures for nesting habitat, including on the West Seattle Bridge (Urban Raptor Conservancy 2019). The West Seattle Bridge nesting site was active as recently as 2020.

Table 3-4. Species of Federal or State Concern with Potential to Occur in West Seattle Link Extension Study Area – Upland Habitat

Common Name	Scientific Name	Status	Occurrence in Study Area
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Federal Species of Concern; State Species of Concern	Possibly present in study area; forages over and near forests; may use bridges for day roosts.
Great blue heron	*Ardea herodias*	Washington Department of Fish and Wildlife Priority species; City of Seattle Species of Local Importance	Nesting colonies present within the West Duwamish Greenbelt, including within the study area and the construction footprint of some Duwamish Segment alternatives.
Bald Eagle	*Haliaeetus leucocephalus*	Federal Species of Concern; State Species of Concern	Nests in prominent trees in wooded areas within 0.5 mile of water; may forage in study area's waters.
Peregrine Falcon	*Falco peregrinus*	Federal Species of Concern; State Species of Concern	Yes; nesting known at West Seattle Bridge nest box and on Downtown Seattle buildings.
Pileated Woodpecker	*Dryocopus pileatus*	State Species of Concern	Possibly present in greenbelts; uses both mature/old-growth forests, and secondary forests.
Vaux's Swift	*Chaetura vauxi*	State Species of Concern	Possibly present for foraging; breeds in mountains and foothills; forages over wooded areas including in towns.
Band-tailed Pigeon	*Patagioenas fasciata*	Washington Department of Fish and Wildlife priority species	Possibly present in greenbelts.

Sources: Washington Department of Fish and Wildlife 2018a, 2019a.

The City of Seattle has mapped bald eagle management areas within West Seattle. These management areas fall outside the study area for this project. However, as the City of Seattle mapping may be outdated, surveys were performed in July 2018 and May 2019. No bald eagles were present during these surveys, nor were they observed during the spring and summer 2020 heron surveys in the vicinity, and no bald eagle nests or potential roosting trees were found within the study area.

Purple martins (*Progne subis*) have recently been removed from the Washington Department of Fish and Wildlife priority list, but are still federally protected as migratory birds. Nesting colonies in built structures occur near the study area; one location of nest boxes is present over water

along the western edge of the Duwamish Waterway, 0.2 mile south of the study area (Tabor et al. 2010, Washington Department of Fish and Wildlife 2019a).

Great blue herons have established nesting colonies (rookeries) within several areas of the West Duwamish Greenbelt. Herons build platform nests high in trees and might use nests for more than one nesting season. Surveys performed for this project yielded the following results:

- In July 2018, active nesting was confirmed at known nesting sites, and also nest trees farther north than mapped by the City of Seattle (and within the study area). One active heron rookery was observed on the north end of the greenbelt. The rookery included at least nine nests interspersed in three bigleaf maple trees. Most nests were empty; however, two nestlings were observed in nests. Two great blue herons (one juvenile and one adult) were observed foraging across the Duwamish Waterway at the Harbor Island Marina.
- In May 2019, biologists identified two new nest trees in the study area, in addition to the three previously observed during the May 2019 visit, with 15 nests total observed (Jacobs Engineering 2019).
- In January through August 2020, biologists performed nest monitoring at the colony. By May 2020, there were at least 19 active nests in the colony. These nests occurred in 7 nest trees, all within the study area. Eighteen of these nests were monitored through July (one nest could not be observed after tree leaf-out), and 15 produced at least one fledgling heron, with an average of 1.9 fledglings per nest.

The U.S. Fish and Wildlife Service protects the great blue heron under the Migratory Bird Treaty Act. Great blue heron is a Washington Department of Fish and Wildlife priority species (Washington Department of Fish and Wildlife 2019a), and it is also regulated by the City of Seattle as a designated species of local importance (Seattle Municipal Code 25.09.200(C)(5)). While there is no state-level permit associated with the protection of this species, Washington Department of Fish and Wildlife recommends that great blue heron colonies receive a 60-meter (197-foot) buffer year-round in an urban environment and a seasonal buffer of 200 meters (656 feet) for activities generating sound exceeding 92 decibels by the time the sound attenuates to the outer boundary of a nesting colony (Azerrad 2012). The City of Seattle requires that projects taking place within the 197-foot year-round buffer (or in an additional 300-foot buffer in the nesting season [February 1 through August 31] apply a standard great blue heron management plan (or a Washington Department of Fish and Wildlife-approved alternate plan). The year-round buffer is measured from the outermost nests (collectively referred to as the Great Blue Heron Management Core Zone), while the seasonal buffer is measured from the outer edge of the year-round buffer (great blue heron management area). Key components of a habitat management plan normally include avoiding development in the colony itself; retaining trees that screen the colony; mitigating for development in the year-round buffer; and avoiding construction noise during the nesting season (City of Seattle 2018c).

3.2 Ballard Link Extension

An overview of the wetlands, aquatic habitat and terrestrial habitat within the Ballard Link Extension study area is shown on Figure 3-8 as a project overview and on Figures 3-9 through 3-13 by segment.

3.2.1 Wetlands

Six wetlands were identified in the Ballard Link Extension study area (Table 3-5). The wetlands are in the Southwest Queen Anne Greenbelt (wetlands WSE5, WSE6, WSE7, and WSE10) and along the southern (wetland WSE8) and western (wetland WSE9) slopes bordering the Interbay Golf Center. All of the wetlands are in areas altered by human development. Wetland WSE9 is a Category IV wetland flanking the golf center. The other five wetlands are Category III wetlands. All have limited habitat complexity; however, four have some habitat connectivity because they are all within a biodiversity corridor (the greenbelt), and thus may provide some limited habitat for wetland-associated wildlife such as amphibians or small mammals. Each wetland is relatively small and primarily dominated by non-native vegetation (such as Himalayan blackberry, English ivy, and reed canarygrass).

In addition, a jurisdictional ditch is present parallel to wetland WSE9, on the boundary between the Interbay Golf Center and the BNSF Railway property. This ditch drains to a stormwater feature.

Details on each wetland are provided in Table 3-5. Wetland determination data forms and wetland rating forms are provided in Attachments N4.B and N4.C. Photographs of the individual wetlands are included in Attachment N4.D. Detailed wetland descriptions are provided in Attachment N4.E.

3.2.2 Aquatic Habitat and Species

The Ballard Link Extension Build Alternatives would pass through urban and industrial areas where stormwater flows have been highly modified and are primarily channeled through ditches and pipes. The Build Alternatives would not cross any streams and would stay more than 200 feet from the Elliott Bay shoreline; therefore, they would not affect the bay's 200-foot shoreline buffer.

The Build Alternatives would cross aquatic habitat in Salmon Bay. Salmon Bay is the waterbody between the Hiram M. Chittenden Locks and the Fremont Cut and is within the study area for the Ballard Link Extension. The Lake Washington Ship Canal passes though Salmon Bay.

Table 3-5. Wetlands in the Ballard Link Extension Study Area

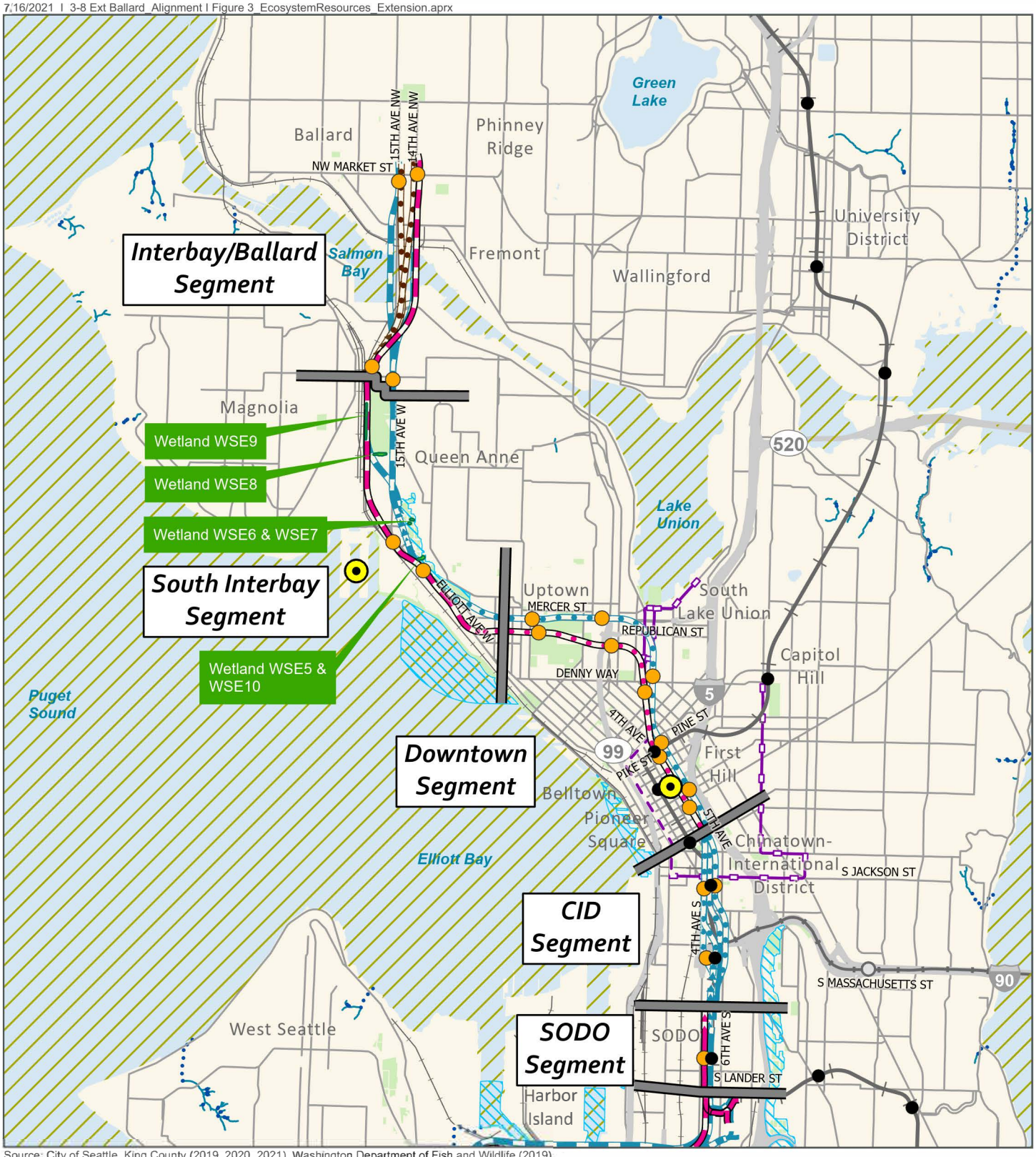
Wetland Identification	Estimated Size (acres) [a]	Cowardin Class	Hydrogeomorphic Class	Rating [b]	Function Score [b, c]	Buffer Width [d]	Location
Wetland WSE5	0.20	palustrine emergent	Slope	III	4 (low)	60 feet	Behind Super Supplements, in Southwest Queen Anne Greenbelt.
Wetland WSE6	0.02	palustrine emergent	Depressional	III	4 (low)	60 feet	Southwest Queen Anne Greenbelt.
Wetland WSE7	0.04	palustrine emergent	Slope	III	4 (low)	60 feet	Southwest Queen Anne Greenbelt.
Wetland WSE8	0.29	palustrine scrub-shrub	Depressional	III	3 (low)	60 feet	Along south boundary of Interbay Golf Center.
Wetland WSE9	0.34	palustrine emergent, palustrine scrub-shrub	Depressional	IV	3 (low)	50 feet	Along west boundary of Interbay Golf Center.
Wetland WSE10	0.01	palustrine scrub-shrub	Slope	III	4 (low)	60 feet	Behind Super Supplements, in Southwest Queen Anne Greenbelt.

[a] Based on field reconnaissance and ArcGIS estimates; wetlands will be fully delineated prior to the Final Environmental Impact Statement.

[b] Ecology 2014.

[c] Seattle Municipal Code 25.09.160 classifies habitat function score (Ecology 2014) of 3 to 4 as low, 5 to 7 as moderate, and 8 to 9 as high.

[d] Seattle Municipal Code 25.09.160: Category IV wetlands over 1,000 square feet receive a 50 foot buffer. Category III wetlands over 100 square feet (or of any size abutting a Type S, F, Np, or Ns water) with a low habitat score receive a 60-foot buffer.



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Existing Streetcar
- Center City Connector Streetcar (Construction Paused)
- Railroad
- Stream
- Piped Stream
- Park

- Other Seabird Sighting
- Critical Habitat
- WDFW Priority Habitat
- Wetland
- Wetland Buffer

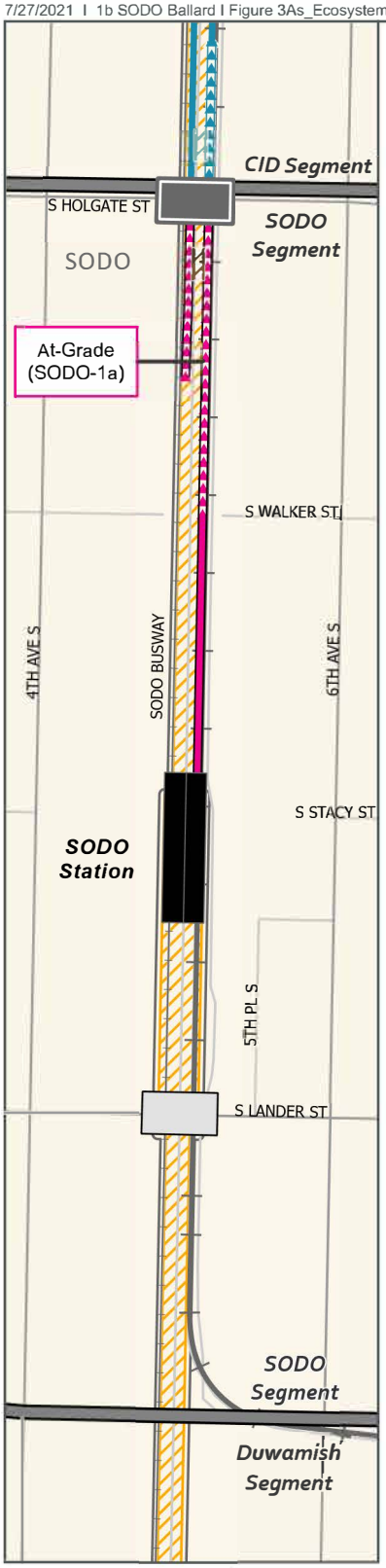
Notes: 1) Critical habitat species identified on Figures 3-10b, 3-11b, 3-12b and 3-13. 2) City and federal mapping of wetlands was reviewed and field verified where possible. Mapping may differ from other public wetland mapping sources.

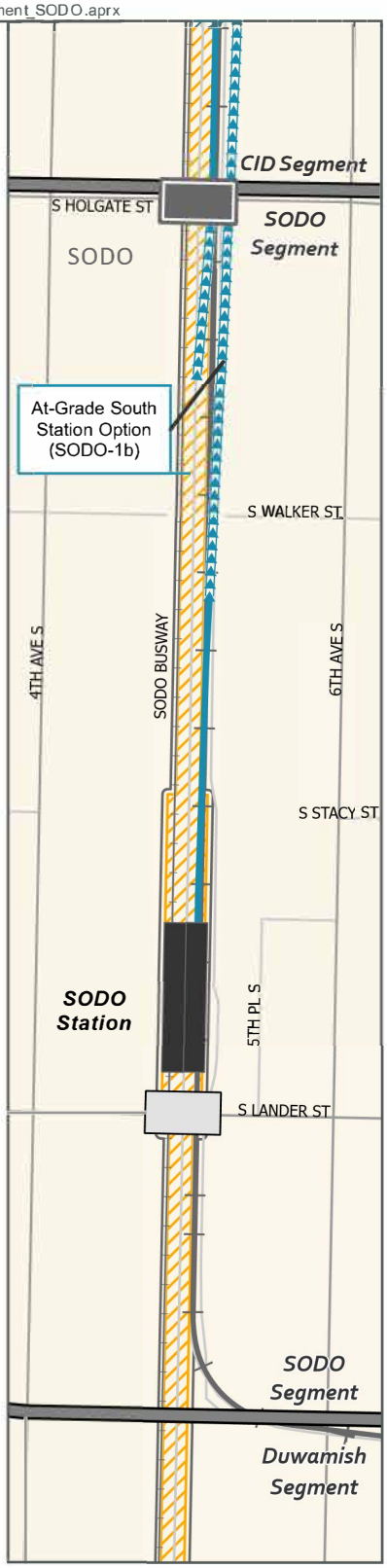
0 0.5 1 Mile

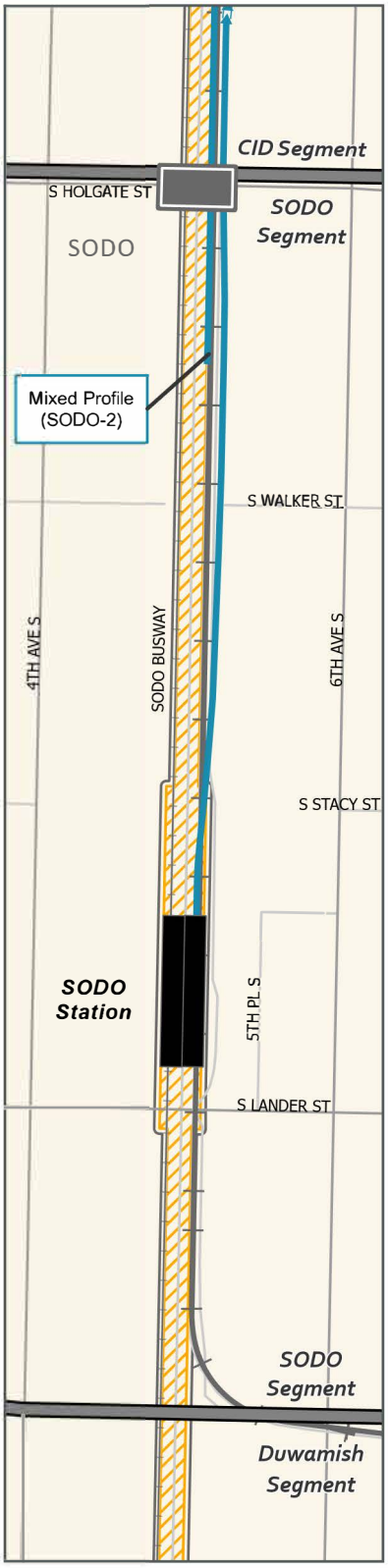
N

FIGURE 3-8
Ecosystem Resources
Ballard Link Extension

West Seattle and Ballard Link Extensions







Source: City of Seattle, King County (2019, 2020, 2021).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- Existing

- Segment Line
- Existing Link Light Rail
- Railroad
- SODO Busway
- Existing Overpass
- Proposed Overpass

Notes: 1) USFWS, NOAA, WDFW, and the City of Seattle do not map any critical areas or priority habitats in this map view. 2) No wetlands are present along the SODO alignment.

FIGURE 3-9
Ecosystem Resources
Ballard Link Extension - SODO Segment

West Seattle and Ballard Link Extensions

0 300 600 Feet

N

Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Existing Streetcar
- Center City Connector Streetcar (Construction Paused)
- Railroad
- SODO Busway
- Proposed Overpass
- Park
- WDFW Priority Habitat

Note: No wetlands are present along the Chinatown-International District alignment.

FIGURE 3-10a
Priority Habitat/Species
Ballard Link Extension - Chinatown-International District Segment
West Seattle and Ballard Link Extensions

0 700 1,400 Feet

N

Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

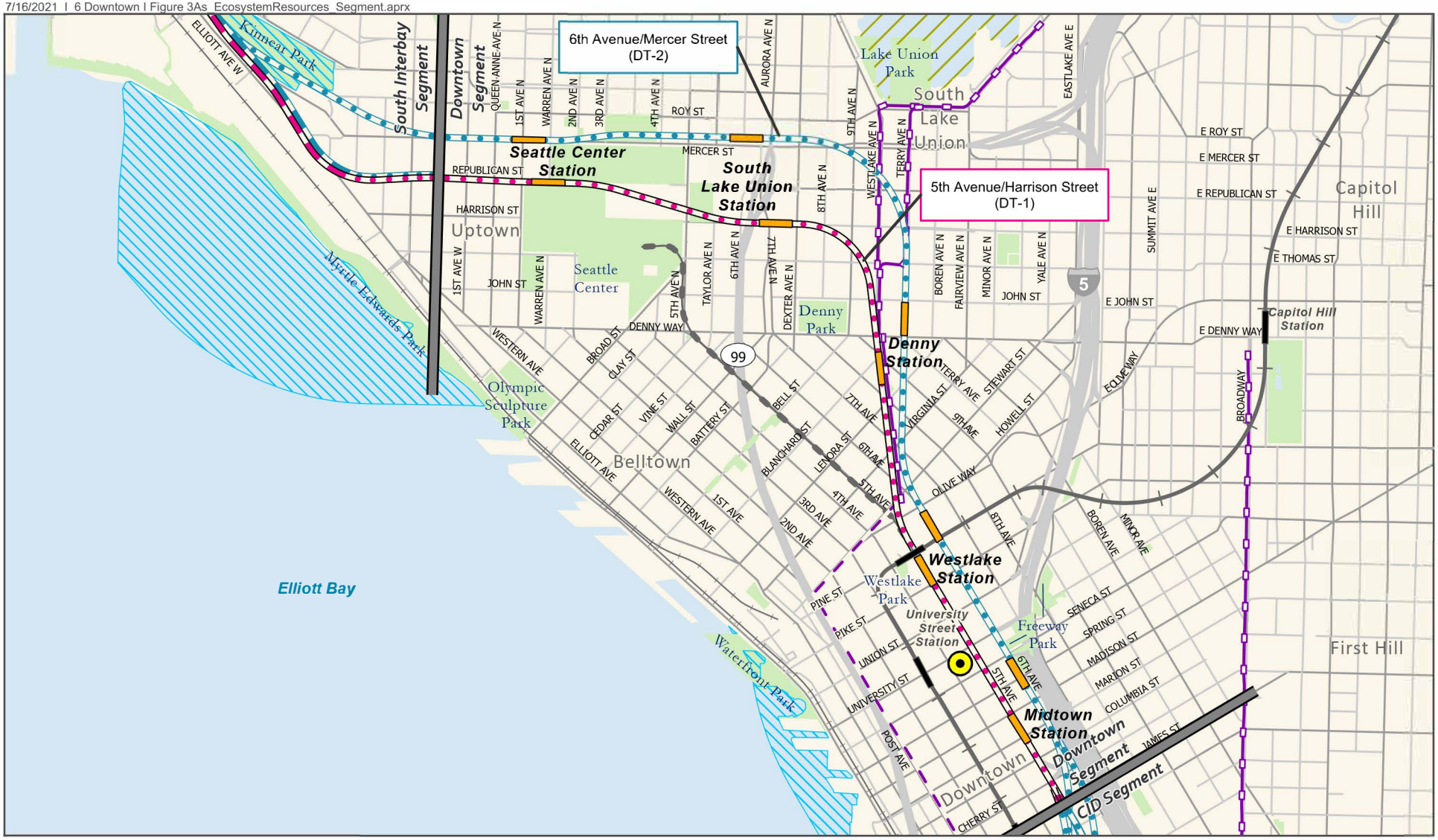
- Segment Line
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Existing Streetcar
- Center City Connector Streetcar (Construction Paused)
- Railroad
- SODO Busway
- Proposed Overpass
- Park
- Critical Habitat

Notes: 1) The critical habitat shown is for Chinook salmon, killer whale, and bocaccio. 2) Bull trout critical habitat follows the shoreline. [Yelloweye rockfish critical habitat is farther offshore outside this map's view]

FIGURE 3-10b
Endangered Species Critical Habitat
Ballard Link Extension - Chinatown-International District Segment
West Seattle and Ballard Link Extensions

0 700 1,400 Feet

N



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Existing Link Light Rail
- Monorail
- Existing Streetcar
- Center City Connector Streetcar (Construction Paused)
- Railroad
- Park

- Other Seabird Sighting
- WDFW Priority Habitat

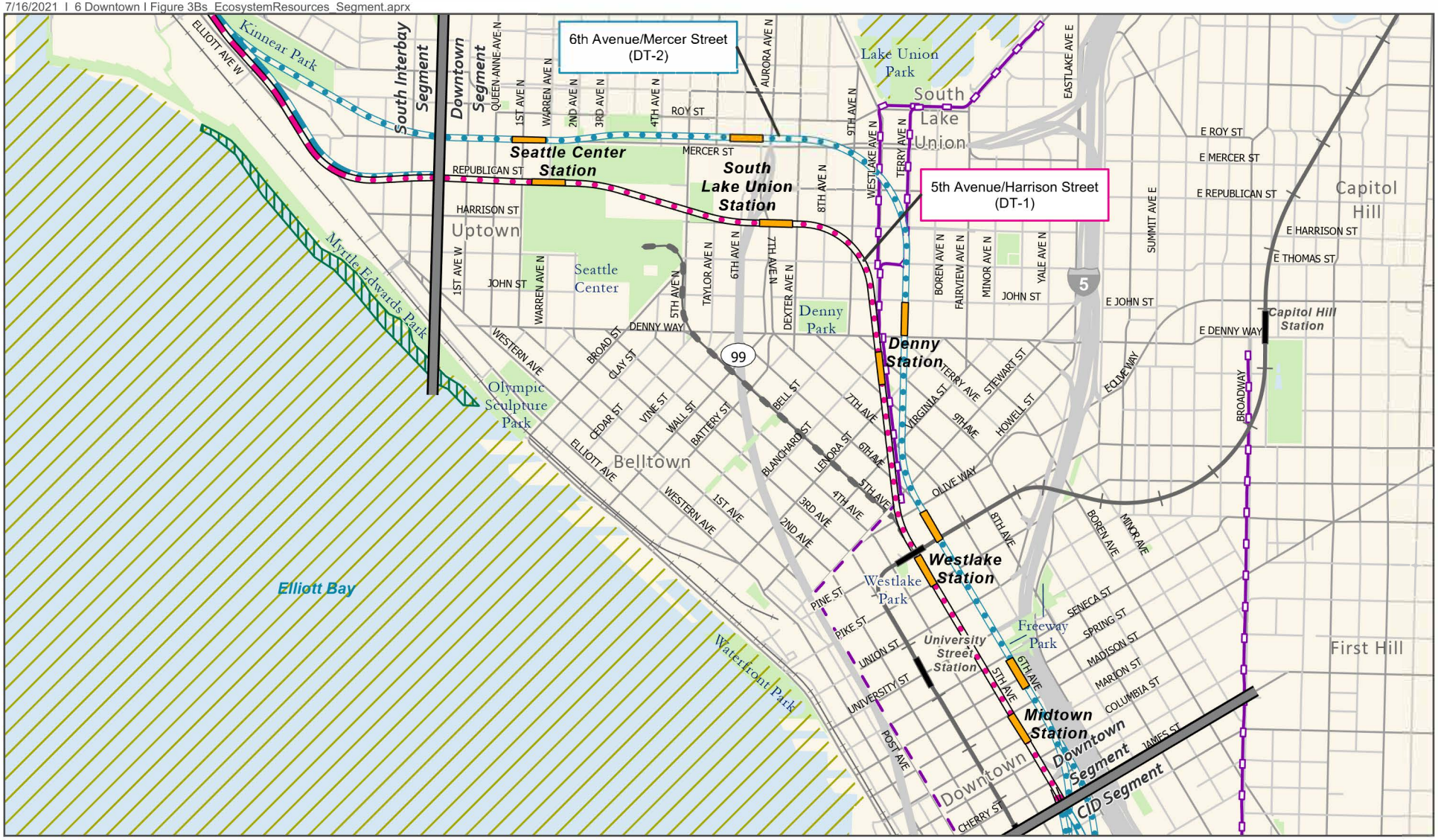
Note: No wetlands are present along the Downtown alignment.

FIGURE 3-11a
Priority Habitat/Species
Ballard Link Extension - Downtown Segment

West Seattle and Ballard Link Extensions

0 1,000 2,000 Feet

N



Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Existing Link Light Rail
- Monorail
- Existing Streetcar
- Center City Connector Streetcar (Construction Paused)
- Railroad
- Park

- Herring Spawning Site
- Critical Habitat

Notes: 1) The critical habitat shown is for Chinook salmon, killer whale, bocaccio, and yelloweye rockfish. 2) Bull trout critical habitat follows the shoreline.

FIGURE 3-11b
Endangered Species Critical Habitat
Ballard Link Extension - Downtown Segment

West Seattle and Ballard Link Extensions

0 1,000 2,000 Feet

N

Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Railroad
- Park

- Purple Martin Colony/Nest
- Other Seabird Sighting
- Wetland
- Wetland Buffer
- WDFW Priority Habitat

Note: City and federal mapping of wetlands was reviewed and field verified where possible. Mapping may differ from other public wetland mapping sources.

FIGURE 3-12a
Wetlands and Priority Habitat/Species
Ballard Link Extension - South Interbay Segment
West Seattle and Ballard Link Extensions

0 800 1,600 Feet

N

Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Railroad
- Park
- Herring Spawning Site
- Critical Habitat

Notes: 1) The critical habitat shown is for Chinook salmon, killer whale, bocaccio, and yelloweye rockfish. 2) Bull trout critical habitat follows the shoreline.

FIGURE 3-12b
Endangered Species Critical Habitat
Ballard Link Extension - South Interbay Segment
West Seattle and Ballard Link Extensions

0 800 1,600 Feet

N

Source: City of Seattle, King County (2019, 2020, 2021), Washington Department of Fish and Wildlife (2019).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New

- Segment Line
- Railroad
- Stream
- Park
- Critical Habitat

Notes: 1) The critical habitat shown is for Chinook salmon and bull trout. 2) The WDFW Salmon Stock Inventory maps wild populations of salmon in Salmon Bay. 3) No wetlands are present along the Interbay/Ballard alignment.

0 800 1,600 Feet

N

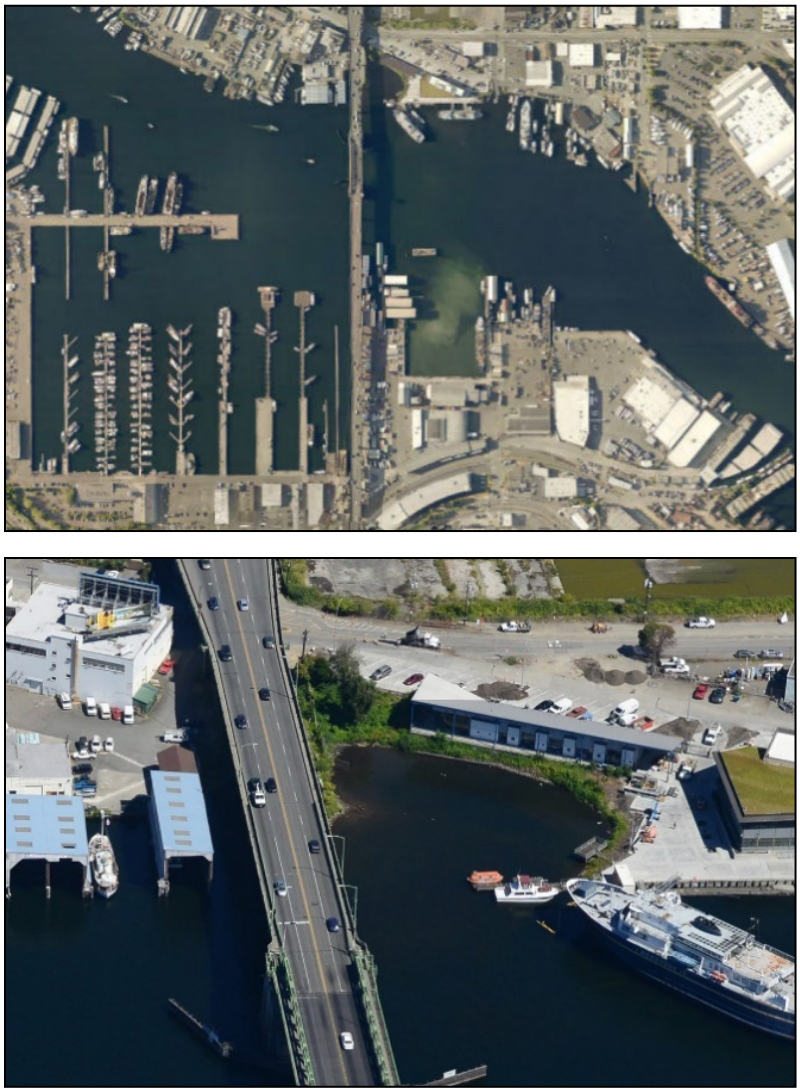
FIGURE 3-13
Endangered Species Critical Habitat
Ballard Link Extension - Interbay/Ballard Segment

West Seattle and Ballard Link Extensions

3.2.2.1 Salmon Bay/Lake Washington Ship Canal

The shoreline habitat in Salmon Bay in the study area is urban and industrial (Figure 3-14).

Figure 3-14. Shoreline Habitat at Salmon Bay at Ballard Bridge, Overhead View (Top) and North Side (Bottom)



Much of the shoreline is covered by piers, including over-water parking areas, industrial yard space, and the Fishermen's Terminal piers and drydocks. Where daylighted, the shoreline has rock armoring, with some gravel or cobble substrate. Below the waterline, substrates are gravel/cobble close to shore, then silty sediment farther from shore. Invasive aquatic plants grow extensively in shallow waters outside the navigable channel. The bay is about 0.2 to 0.3 mile across, from the north shore to the south shore, within the study area.

East of Ballard Bridge, there are many old pilings present in the Salmon Bay sediment, cut off at or near the mudline. At the Seattle Maritime Academy (on the northeastern side of the Ballard Bridge), unarmored shoreline is present in a constructed cove and restoration area. A narrow beach with woody debris is backed by native and non-native shoreline vegetation. Plants there

include native red osier dogwood (*Cornus sericea*), grasses, yellow flag iris (*Iris pseudacorus*), and morning glory species.

Native shoreline vegetation is also present at the 11th Avenue Northwest Street-end on the northern side of Salmon Bay. This patch of shoreline has a beach below the armored riprap and was restored with native plantings in 2015 by the Seattle Department of Transportation and the University of Washington (City of Seattle 2020a).

Salmon Bay provides habitat for several salmonid fish species, including anadromous species heading upstream from Puget Sound into Lake Washington and its tributaries to spawn, and younger salmonids passing through from Lake Washington to saltwater. Washington Department of Fish and Wildlife documents the presence of coho, Chinook, and sockeye salmon; steelhead; bull trout; and resident coastal cutthroat trout in the bay. Habitat for aquatic species here is low quality due to the industrialized shoreline. The shoreline is highly altered from its historic state, most riparian habitat is non-functional for providing benefits to fish, and dredging and bank hardening have simplified the channel (Kerwin 2001). Exceptions are habitat restoration sites, such as at Seattle Marine Academy's cove and the 11th Avenue Northwest Street-end. These parks provide habitat for resting or foraging for waterfowl, shorebirds, and great blue herons. Shallow areas at the Seattle Marine Academy's cove could provide limited rearing for smolts (juvenile salmon). The benthic habitat in this waterway provides nutrient cycling services and niches for macroinvertebrates, which are prey for many of the species mentioned above.

Multiple water quality issues are present in Salmon Bay and the Lake Washington Ship Canal. Ecology has classified the bay as a Category 5 waterbody since 2014. A Category 5 waterbody means that Ecology has data showing that the water quality standards have been violated for one or more pollutants, that there is no pollution-control program in place, and it requires a water quality improvement project. The pollutants that exceed state water quality standards in Salmon Bay are lead, pH, Aldrin, and bacteria (Ecology 2019). Some portions of the surrounding urban area drain directly to the bay by untreated storm drains. Other stormwater is routed into the combined sewer system and routed to the West Point Treatment Plant rather than into the bay. However, occasional overflows from combined sewers during storm events have allowed fecal coliform and other stormwater contaminants to enter the bay from this system. Seattle Public Utilities and King County Wastewater Treatment Division are currently building an underground storage tunnel to significantly reduce these overflows into the bay (City of Seattle 2020b).

Water temperatures in the bay are also a concern; high temperatures and related low dissolved oxygen levels can occur in the canal in late spring and summer due to solar heating. The warm, poorly oxygenated water can reach levels that affect the behavior and survival of migrating salmon. The layer of warm, oxygen-poor water can reach to the sediment level such that salmon cannot avoid these layers by swimming deeper. These conditions can affect the salmon by reducing their overall health, causing fatalities, or blocking or delaying passage through the canal. These conditions can also force juvenile salmon from sheltered areas of the shoreline into deeper water, increasing their susceptibility to being predated by larger fish.

Applicable City of Seattle Shoreline Habitat Regulations

Salmon Bay and the Lake Washington Ship Canal are Type S (Shoreline of the State) waters with buffers of 200 feet. Shorelines are covered under Seattle's Shoreline Master Program, which specifies shoreline zones, permitted uses, and development standards. The northern shoreline of Salmon Bay, as well as the southern shoreline east of the Ballard Bridge, is zoned

Urban Industrial. The southern shoreline west of the Ballard Bridge is zoned as urban maritime (City of Seattle 2018b).

Applicable Tribal Treaty Rights

The Muckleshoot Indian Tribe has treaty-protected fishing rights and Usual and Accustomed Areas in the Puget Sound region, including Salmon Bay. The Suquamish Tribe uses Salmon Bay to access its Usual and Accustomed Areas. The Muckleshoot Indian Tribe is signatory to the Treaty of Point Elliott and the Treaty of Medicine Creek. The Suquamish Tribe is signatory to the Treaty of Point Elliott.

3.2.2.2 Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance – Aquatic Species

Table 3-6 summarizes the presence of federally listed species and species of concern in the aquatic habitat of the Ballard Link Extension.

Table 3-6. Federally Listed Species and Species of Concern in Aquatic Habitat – Ballard Link Extension

Common Name	Scientific Name	Status	Occurrence in Study Area
Puget Sound/Coastal Distinct Population Segment bull trout	*Salvelinus confluentus*	Federal Threatened; State Candidate	Documented in Salmon Bay/Lake Washington Ship Canal. Critical habitat in Salmon Bay/Lake Washington Ship Canal.
Puget Sound Evolutionarily Significant Unit Chinook salmon	*Oncorhynchus tshawytscha*	Federal Threatened; State Candidate	Documented in Salmon Bay/Lake Washington Ship Canal. Critical habitat and essential fish habitat in Salmon Bay/Lake Washington Ship Canal.
Steelhead trout	*Oncorhynchus mykiss*	Federal Threatened	Documented in Salmon Bay/Lake Washington Ship Canal.
Puget Sound Distinct Population Segment steelhead trout	*Oncorhynchus mykiss*	Federal Threatened	Documented in Salmon Bay/Lake Washington Ship Canal.
Coho salmon	*Onchorhynchus kisutch*	Federal Species of Concern	Documented in Salmon Bay/Lake Washington Ship Canal; essential fish habitat in Salmon Bay/ Lake Washington Ship Canal.
Marbled murrelet	*Brachyramphus marmoratus*	Federal Threatened; State Threatened	Possible; could land or forage in Salmon Bay/Lake Washington Ship Canal when transiting between inland nesting sites and foraging areas in Puget Sound.

Sources: U.S. Fish and Wildlife Service 2019; NOAA Fisheries 2019b, 2019c, 2020; Washington Department of Fish and Wildlife 2018a

Salmon Bay and the Lake Washington Ship Canal are part of the migration route for Chinook and coho salmon and steelhead as they travel from Puget Sound to their spawning areas (or hatcheries) by Lake Washington, Lake Sammamish, the Cedar River, or other tributaries to these waterbodies. Young salmon must pass through the study area as they out-migrate back to sea. Some young salmon (smolts) linger in the Salmon Bay area during outmigration, foraging along the shoreline. Bull trout have the potential to also be present in Salmon Bay. A self-sustaining population of bull trout is not currently known in waters upstream of Salmon Bay, but incidental observations occur in Lake Washington, Lake Sammamish, and tributaries to these lakes, and bull trout may enter the lake system through the Hiram M. Chittenden Locks (King

County Department of Natural Resources 2000). Marbled murrelets could be present in Salmon Bay during transits between their inland nesting habitat and marine foraging habitat.

The bay is mapped by NOAA Fisheries as essential fish habitat for all life stages of groundfish. Water Resource Inventory Area 8 (which includes Salmon Bay) is listed as essential fish habitat for all Puget Sound salmon species. Groundfish are unlikely to occur here but could be present near the Hiram M. Chittenden Locks where salt water intrudes into Salmon Bay.

As noted in Section 3.1.2.3, Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance – Aquatic Species, recovery plans are in place for Chinook salmon, steelhead, and bull trout. The Chinook and steelhead recovery plans include recommendations for the runs of Chinook and steelhead that pass through Salmon Bay and the Lake Washington Ship Canal on their way to Lake Washington, Lake Sammamish, and the Cedar River. The Chinook recovery plan stresses the importance of preserving future opportunities to improve shoreline habitat, including in the Lake Washington Ship Canal, as such opportunities are limited along these developed urban and suburban shorelines.

For the Lake Washington area, the steelhead recovery plan prioritizes the quality of upstream spawning areas, adequate fish passage in the Hiram M. Chittenden Locks (adjacent to Salmon Bay), and water quality/shoreline habitat in transitional areas used by juveniles. The bull trout recovery plan does not specifically address this water system.

3.2.3 Upland Habitat and Species

3.2.3.1 Vegetation

Land Cover Types

Land use along the Ballard Link Extension is primarily urban, including BNSF Railway right-of-way and piers alongside Salmon Bay and the Lake Washington Ship Canal. The Build Alternatives would also pass through or near residential neighborhoods, a golf center/athletic complex (Interbay Golf Center and Interbay Athletic Complex) and a forested hill (the Southwest Queen Anne Greenbelt/Kinnear Park area). Table 3-7 lists the land cover types found in the study area and Figure 3-15 shows the cover types in the Ballard Link Extension study area.

Forested habitat in the study area is primarily in the Southwest Queen Anne Greenbelt/Kinnear Park complex; managed vegetation is present in the Interbay Golf Center, Interbay Athletic Complex, Interbay P-Patch Community Garden, and backyards of residences. Street trees in the study area include many species of ornamental and native trees, including maples, pear (*Pyrus* spp.), hawthorne, ash, linden, elm (*Ulmus* spp.), hornbeam (*Carpinus* spp.), oak (*Quercus* spp.), birch (*Betula* spp.), and cherry (*Prunus* spp.).

Table 3-7. Land Cover Types along the Ballard Link Extension

Land Cover Type	Acres within 200 Feet of Project [a]	Percent of Land Cover Type Total	Description
Forest (Greenbelts)	38	4	Includes deciduous, evergreen, and mixed forest with over 20% total tree cover.
High Density Residential (Includes Industrial)	748	72	Includes developed areas where people reside or work in high numbers (such as commercial/industrial, apartment complexes, row houses); 80% to 100% impervious surface.
Medium Density Residential	174	17	Areas with a mixture of constructed materials and vegetation; 50% to 79% impervious surface (such as single-family housing units).
Low Density Residential	38	4	Areas with a mixture of constructed materials and vegetation; 20% to 49% impervious surface (such as single-family housing units).
Developed, Open Space	7	<0.1	Areas with constructed material but dominated by managed vegetation such as lawn grasses); less than 20% impervious surface. Includes large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.
Water	36	3	Areas of open water; less than 25% cover of vegetation or soil.

Sources: National Land Cover Database 2016 (for residential, developed, and open water cover types); Green Seattle Partnership 2020 (forest-cover types).

[a] The National Land Cover Database is based on a grid system and Green Seattle Partnership data follows more precise forest-cover boundaries. Therefore, combining these datasets creates some small overlaps between the forest acres and other landcover types.

Heritage and Exceptional Trees

The City of Seattle maps the following heritage trees within 200 feet of the project limits: a Lombardy poplar northeast of the potential Ballard Station is about 170 feet east of the construction footprint, and a large black cottonwood (64 inches in diameter) is upslope of the Smith Cove Station at the edge of (and overlapping) the construction and operation footprint. (City of Seattle 2019a). Trees that meet the definition for exceptional (City of Seattle 2008) are also present in the study area and would require protection or mitigation under the City's Tree Protection Ordinance (refer to Section 3.1.3.1, Vegetation, for additional information).

Rare Plants

Based on the Washington Department of Natural Resources Natural Heritage Program rare plants geographical information system data, no rare plants or communities are currently documented in the Ballard Link Extension study area.

Invasive Plants

Vegetation in the urban and scrub/shrub land cover types includes invasive weeds such as English ivy, Himalayan blackberry, non-native grasses, and butterfly bush along Salmon Bay. Himalayan blackberry is the dominant ground cover along the eastern and southern slopes at the Interbay Golf Center, and is also dominant in areas within the Southwest Queen Anne Greenbelt. King County lists several weed occurrences that have been reported in the study area, some successfully controlled and some ongoing. These occurrences include Class B weeds (tansy ragwort, dalmatian toadflax, poison hemlock [*Conium maculatum*], and spotted knapweed) and two Class A weeds (garlic mustard [*Alliaria petiolate*] and giant hogweed).

Source: Multi-Resolution Land Characteristics (MRLC) - NLCD (2016), City of Seattle, King County (2019, 2020, 2021).

Alternatives
- Preferred Alternative
- Preferred Alternative with Third-party Funding
- Other Alternatives

Alternative Profile
- Elevated
- Tunnel
- At-Grade
- Retained Cut

Station
- New
- Existing

- Segment Line
- Existing Link Light Rail
- East Link Light Rail (Under Construction)
- Existing Streetcar
- Center City Connector Streetcar (Construction Paused)
- Railroad
- Stream
- Piped Stream
- Park

- Low Density Urban
- Medium Density Urban
- High Density Urban
- Water
- Other
- Green Space

0 0.5 1 Mile

N

FIGURE 3-15
Cover Types
Ballard Link Extension

West Seattle and Ballard Link Extensions

3.2.3.2 Forested Corridors and Wildlife

The Southwest Queen Anne Greenbelt complex is an isolated greenbelt that contains primarily deciduous trees, a few conifers, and habitat features, including downed woody debris, multiple vegetation layers (herbs, shrubs, and canopy), and snags. The understory is a mix of native shrubs and non-native vegetation, including Himalayan blackberry and English ivy. The Southwest Queen Anne Greenbelt is a Washington Department of Fish and Wildlife-designated Priority Habitat Biodiversity Area and Corridor, and the City of Seattle defines it as an Environmentally Critical Area.

The Southwest Queen Anne Greenbelt complex provides potential habitat for mammal and bird species typical of residential areas, including potential nesting for raptors such as red-tailed hawk, and nesting for songbirds protected by the Migratory Bird Treaty Act, roosting for bats, and stopover habitat for birds during migration. Snags in the corridor could provide foraging or nesting habitat for woodpeckers, including the pileated woodpecker (Washington Department of Fish and Wildlife priority species and state candidate species). Songbirds present in the Southwest Queen Anne Greenbelt would be similar to those listed for the West Duwamish Greenbelt in Section 3.1.3.2, Forested Corridors and Wildlife.

The Interbay Golf Center provides potential foraging opportunities for raptors and shelter for wildlife typical of urban environments. Open water only occurs in Salmon Bay, which provides limited habitat for waterfowl, and the narrow shoreline along the Seattle Marine Academy's cove provides habitat for migrating shorebirds and foraging great blue herons. The cove's upland vegetation (dogwoods and low trees) provides potential stopover habitat for songbirds during migration.

3.2.3.3 Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance – Upland Species

No federally or state-listed endangered or threatened terrestrial species of plants or wildlife are expected to occur in the Ballard Link Extension study area, nor is there any designated critical habitat for upland species in the study area (see Section 3.1.3.3, Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance – Upland Species, for more details of how there is no suitable habitat in the study area for listed upland species with potential to occur in King County [yellow-billed cuckoo and streaked horned lark]). As noted for the West Seattle Link Extension study area, marbled murrelets (a federally threatened species) might transit through the area between their marine foraging habitat and their nesting habitat in mature forests in the Cascades foothills. However, they would not be using the types of upland habitats available in the Ballard Link Extension study area and would only occur in aquatic environments.

Table 3-8 describes potential species of concern that might use upland habitats in the study area. No bald eagle management areas are mapped in or near the Ballard Link Extension study area, although eagles might forage in Salmon Bay. There are no suitable nest trees eagles in the study area near Salmon Bay. Peregrine falcons are known to use urban buildings and other structures for nesting habitat; five to seven pairs nest in Seattle each year using ledges on buildings, including in Downtown Seattle (Urban Raptor Conservancy 2019). The Seattle nest on 1201 3rd Avenue (about three blocks from the Downtown Segment) was active in 2019.

Great blue herons, a Washington Department of Fish and Wildlife priority species, may forage in Salmon Bay, and herons have a known nesting site to the west in Commodore Park near the Hiram M. Chittenden Locks (about 1 mile west of the Ballard Bridge). No great blue heron management areas are mapped in the Ballard Link Extension study area.

Table 3-8. Species of Federal or State Concern with Potential to Occur in Ballard Link Extension Study Area – Upland Habitat

Common Name	Scientific Name	Status	Occurrence in Study Area
Townsend's Big-eared Bat	*Corynorhinus townsendii*	Federal Species of Concern; State Species of Concern	Possibly present in study area; forages over and near forests; may use bridges for day roosts.
Great blue heron	*Ardea herodias*	Washington Department of Fish and Wildlife Priority species; City of Seattle Species of Local Importance	Nesting colonies present within Commodore Park, near the Hiram M. Chittenden Locks; foraging individuals form this colony likely to occur in the study area on Salmon Bay shorelines.
Bald Eagle	*Haliaeetus leucocephalus*	Federal Species of Concern; State Species of Concern	Nests in prominent trees in wooded areas within 0.5 mile of water; may forage in study area waters.
Peregrine Falcon	*Falco peregrinus*	Federal Species of Concern; State Species of Concern	Yes; nesting known at Downtown Seattle buildings.
Pileated Woodpecker	*Dryocopus pileatus*	State Species of Concern	Possibly present in greenbelts; uses both mature/old-growth forests and secondary forests.
Vaux's Swift	*Chaetura vauxi*	State Species of Concern	Possibly present for foraging; breeds in mountains and foothills; forages over wooded areas including in towns.
Band-tailed Pigeon	*Patagioenas fasciata*	Washington Department of Fish and Wildlife priority species	Possibly present in greenbelts.

4 ENVIRONMENTAL IMPACTS

The impact analysis assesses the potential direct, indirect, and cumulative ecosystem impacts of the WSBLE Project alternatives. The impacts analysis is divided into long-term operation impacts and short-term, temporary construction impacts. The impact analysis describes the extent, magnitude, duration, and character of potential impacts on ecosystem resources for each alternative. Impacts will be quantified where appropriate and possible (such as the area of wetland impacts).

4.1 West Seattle Link Extension

The West Seattle Link Extension would have long-term direct and indirect impacts on ecosystem resources in the study area, as well as temporary impacts during construction. Columns for elevated guideways and at-grade guideways and features would be placed in some areas currently covered with forested or park habitat. Shading from the elevated guideway would change the amount of light reaching street trees and vegetation. Some street trees and greenbelt trees may need to be removed. Disturbance during construction could impact local wildlife and contribute to the spread of noxious or invasive plant species. Wetlands and wetland buffers in the study area may also experience loss of habitat or changed hydrology. Shorelines and benthic habitat could be affected by placement of elevated guideway columns, depending on the bridge type, within waters that are mapped as critical habitat for several fish species. If in-water construction is required for a bridge over the Duwamish Waterway, cofferdams could be placed within the channel during construction. These dams would surround most of the construction area and water would be removed within the dammed area. This process would temporarily exclude salmonids and other aquatic species from a portion of the waterway. In-water construction during dam installation and removal, as well as during installation of temporary work trestles and permanent pier-protection systems, could create underwater noise and turbidity that would affect these aquatic species. Effects could include the suspension of contaminated sediments because the in-water work would occur within a Superfund site.

This impact assessment is based on the information obtained from overlaying the conceptual designs for the light rail Build Alternatives (both construction footprints and operation footprints) onto ecosystem resource base maps. The acreage values resulting from this analytical approach provide an indication of the size and type of potential impacts and reflect differences among the alternatives. Although these analytical buffers represent a conservative estimate of the areas where long-term and temporary impacts may occur, some impacts could take place outside of these areas as well. For example, some trees in areas adjacent to the analytical buffer may need to be removed to protect light rail safety and reliability. Removal of such hazard trees may accompany construction of any of the light rail Build Alternatives, and hazard tree removal would continue as a maintenance activity during project operations.

4.1.1 No Build Alternative

The No Build Alternative would not have direct long-term impacts on ecosystem resources. Conversely, implementing the No Build Alternative would lack the beneficial indirect effects of the Build Alternatives over the long term, such as reduced motor vehicle traffic in the region, or possible improvements for past impacts or poorly functioning environmental features along the project corridor that have degraded water quality, wetlands, streams, and regulatory buffers.

4.1.2 Build Alternatives

4.1.2.1 Wetlands

Long-Term Impacts

SODO Segment

There would be no long-term impacts to wetlands in the SODO Segment, because no wetlands occur within 300 feet of the alternatives in this segment.

Duwamish Segment

One wetland was identified within 300 feet of the project limits in the Duwamish Segment (Table 3-1 and Figure 3-1): wetland WSE4. This wetland is relatively small but provides limited water quality, flood control, and habitat functions.

Table 4-1 lists potential wetland impacts in the Duwamish Segment. Wetland WSE4 within the Duwamish Segment is a 0.08-acre wetland underneath the West Seattle Bridge. Preferred Alternative DUW-1a and Option DUW-1b would have long-term impacts to the wetland buffer (under some options), and Preferred Alternative DUW-1a would fully shade or fill if it connects to either of Alternatives DEL-3 or DEL-4*. Note that this wetland and its buffer are already partially to fully shaded by the West Seattle Bridge, such that it is in a disturbed environment; any additional shading impacts may not change the amount of light and precipitation reaching the wetland. However, groundwater seeps providing this wetland's hydrology may be altered by ground stabilization (such as tie-backs) performed on the steep slope directly south and upslope of the wetland. Alternative DUW-2 would avoid impacts to this wetland and its buffer.

Delridge Segment

Three wetlands were identified within 300 feet of the project limits in the Delridge Segment (Table 3-1 and Figure 3-1). Table 4-2 lists potential impacts to these wetlands: wetland WSE1 (about 0.05 acre in size), WSE2 (about 0.45 acre in size), and WSE3 (about 0.35 acre in size). These wetlands are relatively small but provide multiple water quality, flood reduction, and habitat functions.

Preferred Alternative DEL-1a, Option DEL-1b, Preferred Alternative DEL-2a*, Option DEL-2b*, Alternative DEL-3, and Alternative DEL-4* alignments would follow Southwest Genesee Street, pass between wetlands WSE2 and WSE3, and pass north of WSE1, thus avoiding direct impacts to the wetlands. The elevated guideway would avoid directly impacting these two wetlands because the guideway would pass over Southwest Genesee Street, between and outside of the wetlands.

All of the alternatives following Southwest Genesee Street would have impacts to wetland buffers (Table 4-2). These buffer areas include areas of mowed grass along the roadside, as well as areas where the buffer is currently paved and wetland buffer function is currently not provided. The paved areas may be excluded from total impacts when permitting is complete.

The Delridge Segment alternatives that would follow Southwest Andover Street instead of Southwest Genesee Street, Alternatives DEL-5 and DEL-6*, would avoid all impacts to wetlands and wetland buffers.

Table 4-1. Summary of Impacts to Wetlands – Duwamish Segment

Alternative Name	Alternative Identification	Wetland: Long-term Impacts (acres) [a]	Wetland: Construction Impacts (acres) [b]	Wetland Buffer: Long-term Impacts (acres) [a]	Wetland Buffer: Construction Impacts (acres) [b]	Wetlands Affected
Preferred South Crossing	DUW-1a	0 to 0.1	0 to <0.1 [c]	0.1 to 0.6 [c]	0 to 0.2 [c]	WSE4
South Crossing South Edge Crossing Alignment Option	DUW-1b	0	<0.1	0.2	0.2	WSE4
North Crossing	DUW-2	0	0	0	0	Not applicable

[a] To estimate wetland impacts, the impact analyses for all alternatives assumed that areas under elevated guideways would be permanently impacted.
[b] Construction impacts represent areas temporarily impacted by the project, outside of the long-term project footprint.
[c] This range reflects differences from connecting to different alternatives in adjacent segments.

Table 4-2. Summary of Impacts to Wetlands – Delridge Segment

Alternative Name	Alternative Identification	Wetland: Long-term Impacts (acres) [a]	Wetland: Construction Impacts (acres) [b]	Wetland Buffer: Long-term Impacts (acres) [a, c]	Wetland Buffer: Construction Impacts (acres) [a, b, c]	Wetlands Affected
Preferred Dakota Street Station	DEL-1a	0	0	0.5	0.4	WSE2, WSE3
Dakota Street Station North Alignment Option	DEL-1b	0	0	0.8	0.4	WSE2, WSE3
Preferred Dakota Street Station Lower Height*	DEL-2a*	0	0	0.4	0.4	WSE1, WSE2, WSE3
Dakota Street Station Lower Height North Alignment Option*	DEL-2b*	0	<0.1	0.6	0.4	WSE2, WSE3
Delridge Way Station	DEL-3	0	0	0.6	0.4	WSE2, WSE3
Delridge Way Station Lower Height*	DEL-4*	0	0	0.5	0.4	WSE1, WSE2, WSE3
Andover Street Station	DEL-5	0	0	0	0	0
Andover Street Station Lower Height*	DEL-6*	0	0	0	0	0

* As described in the introduction to Chapter 2, Alternatives Considered, of the Draft Environmental Impact Statement, at the time the Sound Transit Board identified alternatives for study in the Draft Environmental Impact Statement some alternatives were anticipated to require third-party funding based on early cost estimates. The asterisk identifies these alternatives and the alternatives that would only connect to these alternatives in adjacent segments.
[a] To estimate wetland impacts, the impact analyses for all alternatives assumed that areas under elevated guideways would be permanently impacted.
[b] These wetland buffers include paved areas that would be under the elevated guideway. The City of Seattle critical areas code does not exclude paved areas of wetland buffer from mitigation and permitting requirements and determine these on a case-by-case basis; actual impact acreage may be much smaller when permitting is complete.
[c] Construction impacts represent areas temporarily impacted by the project, outside of the long-term project footprint.

West Seattle Junction Segment

There would be no long-term impacts to wetlands in the West Seattle Junction Segment. None of the Build Alternatives in this segment would overlap with wetland WSE1.

Construction Impacts

Construction impacts would be limited to the time of construction and immediately following construction. Construction could last 2 to 3 years for an elevated or at-grade guideway. Materials and equipment in the vicinity of wetlands WSE1, WSE2, WSE3, and WSE4 may need to be staged within the wetland buffers, and some ground disturbance may take place within these buffers. The construction contractor would work within construction limits marked with fencing and signage to prevent unintended impacts on wetlands. Temporarily disturbed sites that are currently vegetated would be replanted immediately following construction to restore or improve on pre-construction conditions (such as replacing non-native weeds with native plants). Herbaceous or shrub vegetation would likely become re-established within a year or two. Some trees within the wetland buffers may need to be disturbed during construction (Tables 4-1 and 4-2).

SODO Segment

There would be no construction impacts to wetlands in the SODO Segment because there are no wetlands in the study area for this segment.

Duwamish Segment

Along the Duwamish Segment, construction of Preferred Alternative DUW-1a or Option DUW-1b would impact wetland WSE4 and its buffer. Alternative DUW-2 would avoid all construction impacts to this wetland (Table 4-1).

Delridge Segment

Along the Delridge Segment, Preferred Alternative DEL-1a, Option DEL-1b, Preferred Alternative DEL-2a*, Alternative DEL-3, and Alternative DEL-4* would avoid impacts to wetlands WSE1, WSE2, and WSE3, but would have some impacts to wetland buffers during construction. Option DEL-2b* would have a small impact to the western corner of Wetland WSE3.

Preferred Alternative DEL-2a* and Alternative DEL-4* are the only alternatives that would affect wetland WSE1's buffer (the buffer here is within a mowed and forested corner of the West Seattle Golf Course) because these two alternatives would include construction of a tunnel portal on the south side of Southwest Genesee Street. Alternatives DEL-5 and DEL-6* would avoid all impacts to wetlands and wetland buffers (Table 4-2).

West Seattle Junction Segment

Along the West Seattle Junction Segment, construction impacts would not affect wetlands. Preferred Alternative WSJ-3a* and Preferred Option WSJ-3b* would include construction staging on a small portion of wetland WSE1's buffer (0.002 acre). This impact would occur on existing paved surfaces that do not provide buffer functions or would occur in unpaved areas separated from the wetland by a paved road.

Indirect Impacts

Indirect impacts to wetlands in the West Seattle Link Extension study area would be limited because all stations and guideways would be in areas that are already densely developed.

Elevated guideways would add impervious surfaces that have the potential to change hydrology at Longfellow Creek and the associated wetlands and at the wetland at the north end of the West Duwamish Greenbelt. The guideways have the potential to intercept and reroute water flow. However, the Longfellow Creek wetlands receive most of their water from the creek itself and are not expected to experience any hydrology or water quality changes from the new guideway.

The West Seattle Link Extension would not interfere with future projects that may provide habitat improvements. Such future projects could include continued restoration efforts along Longfellow Creek or its associated wetlands, or at the City of Seattle's Bluefield Holdings/Wildlands Site 1 on the west side of the West Duwamish Waterway.

Construction could contribute to the spread of invasive plant species within and outside of the study area by transporting them to or from the construction site when moving soil, or by creating bare soil areas that weeds might colonize quickly. However, these are already common in the study area and revegetation with native plants may improve existing conditions in greenbelts and buffers.

4.1.2.2 Aquatic Habitat and Species

Long-Term Impacts

SODO and West Seattle Junction Segments

There are no waterbodies in the SODO or West Seattle Junction segments' study areas. Stormwater in these segments drains to Elliott Bay.

Duwamish Segment

The Duwamish Segment would cross the Duwamish Waterway on a high-level fixed bridge. Depending on the bridge type used, the bridge's minimum clearance over the East Waterway would be 90, 120, or 125 feet, and its minimum clearance over the West Waterway would be 125, 130, or 135 feet.

Sound Transit is evaluating bridge types to cross the waterway. Depending on the bridge type, the water crossing could require bridge guideway columns in the water. Bridge types being analyzed include a balanced cantilever segmental box girder bridge (which would require two in-water guideway columns), an extradosed (which would require one in-water guideway column), a truss bridge or a cable-stayed bridge (these bridge types may not require in-water guideway columns depending on the alternative). Bridge designs that require in-water guideway columns may include pile caps buried under the mud or placed closer the waterline. Pile caps under the mudline would leave more benthic surface for habitat after construction; pile caps near the waterline would create more structures that shade water or alter fish movements.

If the bridge design requires guideway columns to be placed in water, pier-protection systems would also be added to protect the columns from potential vessel strikes. These in-water features could impact up to about 0.5 acre of benthic habitat that is currently available to invertebrates and fish (Table 4-3). This loss of benthic habitat could reduce the amount of productivity in these locations. Fish sheltering or rearing in the study area are already passing through an environment with many manmade pilings and other features and these impacts would further reduce available habitat. Preferred Alternative DUW-1a would impact the habitat enhancements that may occur at the City of Seattle's Bluefield Holdings/Wildlands Site 2, should these enhancements move forward; this alternative could require modifications to the site. Alternative DUW-2 could impact about 600 square feet of the Port of Seattle's proposed

Terminal 25 South habitat restoration project. Sound Transit would coordinate with the Port to identify to identify potential modifications to the restoration site design. The guideway would be at least 90 feet above the Terminal 25 South project site, and no impacts on vegetation from shading are expected.

Table 4-3. Summary of Impacts to Aquatic Resources: In-water Impacts, Duwamish Segment

Alternative Name	Alternative Identification	Number of Permanent In-water Piers	Approximate Area of Construction Impacts in Waterbody (acres) [a]	Over-water Structures (acre) [b]	Permanent Benthic Surface Impacts (acre)
Preferred South Crossing	DUW-1a	0 to 2	0 to 0.3 [c]	0.6 to 0.8	0 to <0.1 [c]
South Crossing South Edge Crossing Alignment Option	DUW-1b	4 to 5	0.2 to 1.0 [c]	0.7 to 0.9	<0.1 to 0.4 [c]
North Crossing	DUW-2	0 to 3	0 to 0.9	0.7 to 0.9	0 to 0.5

Note: The ranges of impacts shown represent impacts from different bridge types; the number and exact location of permanent bridge support columns and temporary cofferdams, piles and work trestles could vary by bridge type, and some bridge types for Preferred Alternative DUW-1a and Alternative DUW-2 could avoid in-water work.

[a] These construction in-water impacts represent the total area of the cofferdam footprints, piles, and work trestle column support footprints that would be placed on the benthic surface, minus the area of guideway columns and pile caps that would remain permanently in the waters. All in-water work would occur in salmonid critical habitat and essential fish habitat.

[b] This area represents the total area of elevated bridge features over the Duwamish Waterway; this does not include bridge guideway columns or pile caps in the water, which are included in the permanent benthic impacts.

[c] Less than 0.1 acre of impact is associated with storm drain outfall relocations during construction and for permanent impacts.

Preferred Alternative DUW-1a would require relocation of an 8-inch Port of Seattle stormwater outfall that discharges to the West Duwamish Waterway. Option DUW-1b would require relocation of the same outfall as Preferred Alternative DUW-1a, as well as two 18-inch Port of Seattle stormwater outfalls, one that discharges to the West Duwamish Waterway and one that discharges to the East Duwamish Waterway. Alternative DUW-2 would not require relocation of any outfalls. All proposed outfall relocations are related to conflicts with bridge column foundation locations.

Shading over water can change fish behavior and the levels of productivity of marine plants and other marine organisms. This is not expected to occur from such a high bridge crossing, as the bottom of the bridge would have a clearance of approximately 90 to 135 feet above the water. The physical design of overwater structures, in particular their height, influences whether their shadow would create enough shade in the water to constitute an impediment to fish movements or cause decreases in productivity of aquatic vegetation (WSDOT 2006). Higher bridges would allow more light and would have more diffuse changes from light to shade. In shade analyses performed for the State Route 520 bridge construction, WSDOT identified a clearance of at least 24 feet over aquatic bed wetlands or shoreline areas as sufficient for most vegetation cover to remain unaffected. Under higher bridges, reflective and diffuse light would be sufficient to support plant growth, though changes in species composition is possible (WSDOT 2009). Sharp contrasts between light and shade appear to influence fish responses more than gradual changes in lighting (NOAA Fisheries 2011). NOAA Fisheries determined that the Montlake

Bridge, with 46 feet of clearance over the Lake Washington Ship Canal, would not produce sharp shade contrasts that would affect salmon behavior or cause delays in their migration (NOAA Fisheries 2011). The Duwamish Waterway bridge would have much more clearance than the State Route 520 or Montlake Bridges, such that its diffuse shade is not expected to have negative impacts to productivity or to aquatic fish species.

In-water pile caps at the waterline (present with some bridge design scenarios) could prevent daylight from reaching the waters and benthic surface below the pile caps; this could reduce productivity and also increase areas for fish to shelter that may prey upon young migrating salmonids.

The new bridge would include navigation lights at the guideway columns to aid their visibility to watercraft in the Duwamish Waterway and with Federal Aviation Administration/WSDOT-regulation lights for airplanes at the top of all towers above the deck. The Duwamish Segment's bridge lighting is not expected to result in any noticeable long-term increases in nighttime illumination of fish-bearing waters because industrial lighting is already present around the Duwamish Waterway and on top of the existing West Seattle Bridge. However, these additional lights have the potential to alter the nighttime swimming behavior of young salmon near the bridge, possibly making them more exposed to predation from other fish (Tabor et al. 2011).

Some of the shoreline habitat around the guideway columns is currently built out with impervious surfaces such as parking lots. Other portions of shoreline that would be changed to guideway columns currently contain steep beaches below bulkheads, with some planted vegetation (including small trees) above the bulkheads. Columns could eliminate a few trees, rock, or wood bulkheads or area of exposed beach. Based on the segmental box design, Preferred Alternative DUW-1a would have slightly more overall linear shoreline converted to guideway columns than Option DUW-1b or Alternative DUW-2 would affect the most amount of shoreline habitat. Table 4-4 presents specific shoreline impacts by Build Alternative.

Table 4-4. Summary of Impacts to Aquatic Resources: Shoreline, Duwamish Segment

Alternative Name	Alternative Identification	Shoreline: Long-term Impacts (linear feet) [a]	Shoreline: Construction Impacts (linear feet) [b, c]	Shoreline Buffer: Long-term Impacts (acres) [a, c]	Shoreline Buffer: Construction Impacts (acres) [b, c]
Preferred South Crossing	DUW-1a	600	400	2	3
South Crossing South Edge Crossing Alignment Option	DUW-1b	500	1,000	2	3
North Crossing	DUW-2	500	700	2	6

[a] To estimate permanent shoreline impacts, the impact analyses for all alternatives assumed a complete loss of habitat within the permanent footprint. Actual impacts may be less where the guideway is elevated or where shoreline is already developed.

[b] These construction impacts represent areas that would be temporarily impacted by the project, outside of the long-term project footprint.

[c] Shoreline buffer includes both paved and unpaved surfaces; paved areas may be eliminated when permitting is complete.

In the Duwamish Segment, some vegetated areas in the West Duwamish Greenbelt would be paved under Preferred Alternative DUW-1a and Option DUW-1b; this could increase stormwater

flows to storm drains that drain to the Duwamish Waterway. These effects would be limited because stormwater from all project-related impervious surfaces would receive appropriate flow control and water quality treatment, and the West Duwamish Greenbelt construction area would include new subsurface drains to manage water flow and groundwater. These alternatives would be designed to meet standards of the City of Seattle and Ecology's 2012 *Stormwater Management Manual for Western Washington*.

Delridge Segment

The Delridge Segment crosses over Longfellow Creek. Preferred Alternative DEL-1a would cross over Longfellow Creek on elevated guideway along Southwest Genesee Street and have no direct impacts to the creek, which flows through a culvert at the crossing location. Elevated guideway columns would be placed on existing impervious surface or vegetated street right-of-way outside of stream boundaries. No project features would be built in the creek, or directly over daylighted portions of the creek. Runoff from project features would discharge to combined sewer overflow basins or downstream of the open creek channel. As the project would not change shading over the creek or drain to the creek, it would not impact water quality factors in the creek such as temperature, dissolved oxygen, or contaminants.

Option DEL-1b, Preferred Alternative DEL-2a*, Option DEL-2b*, Alternative DEL-3, and Alternative DEL-4* that follow Southwest Genesee Street would also have no impacts to the creek. Alternatives DEL-5 and DEL-6* would pass over Longfellow Creek after Andover Street; the creek is also piped here and continues to be piped until its outlet 800 feet farther north. Any of the elevated crossings over Longfellow Creek would not preclude future projects to improve salmonid habitat, such as daylighting portions of the creek currently flowing through culverts, planting additional riparian habitat upstream or downstream of the road prism, or removing fish barriers.

The Build Alternatives would have no direct impacts on Longfellow Creek's 100-foot riparian management area, with the exception of a small impact from Option DEL-1b. The impact would occur where elevated guideway would shade areas that are currently managed vegetation or pavement; the impacted area is also regulated as wetland buffer. The City of Seattle regulates riparian area that is perpendicular to daylighted portions of stream; the management area does not include areas perpendicular from where the creek is piped under Southwest Genesee Street. The Andover Street Station Alternatives DEL-5 and DEL-6* would have no impact on the creek's riparian management area during operation (Longfellow Creek is piped under Andover Street from about 90 feet south of the roadway until its confluence with the Duwamish Waterway; riparian habitat would only be regulated perpendicular to daylighted sections south of Andover Street).

Construction Impacts

SODO and West Seattle Junction Segments

There are no waterbodies in the SODO or West Seattle Junction segments' study areas.

Duwamish Segment

Depending on bridge type, the Duwamish Segment Build Alternatives could require the construction of bridge guideway column foundations in or partially in the Duwamish Waterway. The guideway column foundations would include drilled shafts and cast-in-place concrete pile caps, which are either at the waterline or below the mudline, depending on the bridge design. If in-water foundations are needed, most bridge designs would require a temporary cofferdam system so that the benthic area where the guideway columns would be built could be

dewatered. Temporary piles and sheets for cofferdam walls would be driven or vibrated into place, and the bridge support columns would be installed within dewatered cofferdams. The segmental box design for Preferred Alternative DUW-1a could require piles to be vibrated or drilled into place without a cofferdam for one guideway column. Temporary work trestles would need to be installed as well, outside of cofferdams, which would require additional temporary pilings driven into the sediment for support. Pier-protection systems, which could be in the form of fender walls, would be vibrated into place outside the cofferdams. The cofferdams and work trestles could cover up to 1.4 acres of the waterway depending on the alternative and bridge type chosen (refer to the approximate area of construction impacts in Table 4-3). During the years that the cofferdam is in place, the dewatered areas would exclude habitat from use by aquatic species, including listed fish species and benthic invertebrates.

Along the Duwamish Waterway, construction of Preferred Alternative DUW-1a would require modifications to habitat enhancements that may occur at the City of Seattle's Bluefield Holdings/Wildlands Site 2 along the Duwamish Waterway, if those enhancements move forward. If guideway columns are placed along the Harbor Island shoreline, they would prevent future restoration at those specific locations, though area directly adjacent to the towers would retain opportunities for habitat enhancement. Alternative DUW-2 could temporarily impact about 0.4 acre of the Terminal 25 habitat restoration project during construction if the restoration project is constructed prior to the West Seattle Link Extension.

Barges for material supply and supporting cranes would be moored outside the navigation channels. Barge movement within the navigation channel may be required to lift portions of the bridge; truss or extradosed bridge types would require barge operations for 2 full days within the navigation channel. Barges in the channel would add to the ship traffic already traveling regularly through the channel. Barges stationed at the work site would also create temporary shade over the benthic habitat, which could cause fish to alter their movement patterns through the channel.

Cofferdam placement and removal, pile placement without coffer dams, and installation and removal of support piles for work trestles, would introduce temporary turbidity and sediments into the Duwamish Waterway and temporarily remove aquatic habitat for migrating salmonids. Outfall relocations would also disturb sediments, but to a lesser degree than bridge columns because the area disturbed would be smaller and the construction duration would be less. Impact pile-driving or vibratory driving could create noise at decibels with the potential to injure fish or marine mammal species or change their movements through the area. Vibratory and impact pile-driving could produce sounds that travel unimpeded down the East Duwamish Waterway and are thus audible to sensitive species within Elliott Bay. Construction barges and cranes would cause above-water disturbance and noise as well.

During construction, temporary lighting close to the water will be used on the temporary cofferdams, work trestles, and associated barges. Artificial nighttime lighting may alter juvenile fish behavior in a way that makes them more susceptible to predators and increases the length of time predators actively feed (WRIA 8 Salmon Recovery Council 2017). The sharpness of artificially lit and unlit areas may factor into fish response to the light (Simenstad et al. 1999). Changes in underwater light regimes at night can alter fish movements and can affect predator/prey interactions in complex ways: fish may avoid the areas to avoid potential predation, or seek those areas to feed on prey (Celadonia et al. 2009, Tabor and Piaskowski 2002). In their biological opinion on the State Route 520 bridge's construction in Lake Washington, NOAA Fisheries determined that lighting associated with construction of the bridge would not affect adult Chinook salmon or steelhead, because the adults are too large to be preyed upon by piscivorous fish, but may influence juvenile Chinook behavior, both exposing them to predators and by allowing them to detect more prey (NOAA Fisheries 2011, WSDOT

2009). During construction of the bridge, best management practices will be employed to minimize lighting required over water during construction (e.g., light shielding will be employed where practical), but some changes in the behavior of fish are expected as a result of this lighting. Suspended sediments from construction in the Duwamish Waterway might contain contaminants because this excavation (up to 55,000 cubic yards) would be occurring in the Harbor Island Superfund site. Many contaminants could be resuspended during cofferdam installation, barge movements, some pile-driving, and rewatering of cofferdams, including polychlorinated biphenyls, arsenic, polycyclic aromatic hydrocarbons, and mercury. Exposure to such contaminants could be harmful to the fish and benthic invertebrates that encounter them, as well as to predators such as marine birds and marine mammals that prey on those species. Currents flowing through the area would sweep most suspended sediments downstream and minimize these effects in the immediate vicinity of the construction as well as turbidity.

Sound Transit would follow extensive best management practices to minimize turbidity and prevent accidental fuel leaks or spills. In-water work in the Duwamish Waterway would be scheduled around the work windows established by the U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife, and approved by NOAA Fisheries and U.S. Fish and Wildlife Service. Use of these windows would minimize the effects on salmonids and other fish species, especially during the construction and operation of cofferdams. In-water work in the Duwamish Waterway would also include complying with the Marine Mammal Protection Act; this may entail monitoring during loud construction activities to avoid harassment or injury to marine mammals.

The construction contractor would be required to develop, implement, and monitor a temporary erosion and sediment control plan to address potential erosion for the duration of construction. Best management practices would be employed for fish and aquatic habitat protection. All work below the ordinary high water mark, such as during cofferdam construction, would comply with the terms and conditions set forth in the Hydraulic Project Approval issued by Washington Department of Fish and Wildlife for the project. Most excavation of sediments would occur within a dewatered cofferdam to protect the surrounding waters from contaminated sediments in the riverbed. Contaminated soils would be removed from the site and disposed of in regulated upland disposal sites. Barges would use measures such as containment barriers to prevent any contaminants on board from reaching the waters. There is some risk of mobilizing contaminated sediments during the installation and removal of cofferdams as well as of supports for work trestles if these are built in-water, outside the cofferdam boundaries. All work within the Harbor Island Superfund site would follow the up-to-date processes for remediation and in-water work established in agreement with Ecology and U.S. Environmental Protection Agency. This coordination would avoid conflicts with existing and future cleanup actions at the Superfund site.

For water quality protection, the project would obtain and adhere to a construction stormwater general permit under the National Pollutant Discharge Elimination System permit program to reduce or eliminate stormwater pollution and other impacts on surface waters, and a Section 401 Water Quality Certification indicating that the project would comply with state or federally approved water quality standards and other aquatic resources protection requirements. A construction stormwater pollution prevention plan, approved by Ecology, would also be implemented before the start of construction. The plan would include best management practices to (1) prevent erosion, (2) prevent sedimentation, and (3) identify, reduce, eliminate, or prevent stormwater contamination and water pollution from construction activity.

Delridge Segment

Estimated construction impacts on the riparian management area for the West Seattle Link Extension are summarized in Table 4-5. Some trees or vegetation would need to be cleared

during construction or for construction staging. The Andover Street Station alternatives (Alternatives DEL-5 and DEL-6*) would mostly avoid the Longfellow Creek management area during construction (staging may occur within the limited development zone but would only occur on currently paved surfaces). Most of the Southwest Genesee Street alternatives (Preferred Alternative DEL-1a, Option DEL-1b, Preferred Alternative DEL-2a*, Option DEL-2b*, Alternative DEL-3, and Alternative DEL-4*) all have similar impacts to the management area during construction; most of this impact occurs as vegetation clearing or placement of a work trestle over roadsides that currently provide limited buffer functions to Longfellow Creek. Option DEL-1b's construction disturbance would occur in the same location as its long-term impacts of shading from the overhead guideway.

Under the Delridge Segment alternatives, the potential for impacts on riparian habitat would be minimized by ensuring that work conditions and activities comply with the required project permits, and by implementing best management practices designed to avoid or minimize the delivery of construction-related sediment and pollutant-laden water to streams. Staging areas would be placed outside the Longfellow Creek buffer. The use of artificial lighting for nighttime construction could affect fish using Longfellow Creek, possibly altering their migratory behavior or predation rates of juveniles; lights would be directed away from waters when possible.

Indirect Impacts

The West Seattle Link Extension would not interfere with future projects that may provide habitat improvements at Longfellow Creek, such as the Longfellow Creek culvert replacement. Under some bridge designs, guideway columns would be placed partially onshore along the Duwamish Waterway. These columns could remove small patches of intertidal silt, rock or gravel shoreline from an area with already degraded baseline conditions. The guideway columns would not directly conflict with current projects to restore intertidal habitat under Chinook or steelhead salmon recovery plans, nor would they interfere with any future habitat improvements at Bluefield Holdings/Wildlands Site 1. However, if guideway columns are placed along the Harbor Island shoreline they would prevent these patches from being considered for future restoration efforts, although areas directly adjacent to the guideway columns would retain opportunities for habitat enhancement. Mitigation for benthic impacts from the project could include mitigation elsewhere along the Duwamish Waterway, such as improving or restoring intertidal habitat patches or removing over-water structures; this could lead to improvements of water quality or habitat quality overall along the waterway, outside of the study area.

The introduction of light rail transit to the area would result in a slowdown of growth in the region's motor vehicle traffic and could create a slight reduction in current traffic as people switch from single-occupancy vehicles to transit. This effect in turn would slightly decrease (in the short term) or slow the increase (in the long term) of the expected automotive emissions and pollutant-laden stormwater runoff associated with increased traffic under the No Build Alternative.

Where the elevated guideway would cross the Duwamish Waterway, bridge guideway columns could cover benthic habitat in the waterway that currently provides substrate for invertebrates and aquatic vegetation. Some productivity could be lost, which could in turn affect the availability of prey species for salmonids and marine mammals using the waterway; a change in distribution of the prey species could change the movement patterns of these predators.

Table 4-5. Summary of Impacts to Aquatic Resources, Delridge Segment

Alternative Name	Alternative Identification	Longfellow Creek: Long-term or Construction Impact (acres)	Longfellow Creek Riparian Management Area within 75 Feet [a]: Long-term Impact (acres) [b]	Longfellow Creek Riparian Management Area within 75 Feet [a]: Construction Impact (acres) [c]	Longfellow Creek Limited Riparian Development Area [a]: Long-term Impact (acres) [b]	Longfellow Creek Limited Riparian Development Area [a]: Construction Impact (acres) [b]
Preferred Dakota Street Station	DEL-1a	0	0	<0.1 [c, d]	0	<0.1 [c, d]
Dakota Street Station North Alignment Option	DEL-1b	0	<0.1 [c, d]	0	<0.1 [c, d]	0
Preferred Dakota Street Station Lower Height*	DEL-2a*	0	0	0	0	<0.1 [c, d]
Dakota Street Station Lower Height North Alignment Option*	DEL-2b*	0	0	0	0	<0.1 [c, d]
Delridge Way Station	DEL-3	0	0	0	0	<0.1 [c, d]
Delridge Way Station Lower Height*	DEL-4*	0	0	0	0	<0.1 [c, d]
Andover Street Station	DEL-5	0	0	<0.1 [c]	0	<0.1 [c]
Andover Street Station Lower Height*	DEL-6*	0	0	<0.1 [c]	0	<0.1 [c]

* As described in the introduction to Chapter 2, Alternatives Considered, of the Draft Environmental Impact Statement, at the time the Sound Transit Board identified alternatives for study in the Draft Environmental Impact Statement some alternatives were anticipated to require third-party funding based on early cost estimates. The asterisk identifies these alternatives and the alternatives that would only connect to these alternatives in adjacent segments.

Note: To estimate stream impacts, the impact analyses for all alternatives includes all stream or buffer areas under the guideways, regardless of whether the guideways are elevated or at-grade/retained-cut. All of the long-term impacts shown in this table would be areas shaded by guideway.

[a] The riparian management area is 0 to 100 feet from the stream. The City of Seattle allows some development activities in a subset of the management area (the limited riparian development area) 75 to 100 feet from the stream (Seattle Municipal Code 25.09.).

[b] Riparian management area was calculated for areas perpendicular from daylighted sections of Longfellow Creek; piped stream is excluded from City of Seattle riparian management regulations.

[c] These metrics may include paved areas within 75 feet of the stream; these may be removed from impact metrics following coordination with the City of Seattle.

[d] These impact areas are overlapped by the 110-foot wetland buffers around wetlands WSE2 and WSE3.

4.1.2.3 Upland Habitat and Species

Long-Term Impacts

Based on the urban environment in most portions of the study area, operation of any of the West Seattle Link Extension light rail alternatives would not result in long-term impacts on the viability of local wildlife populations. Currently, the predominant types of land cover in the project footprint are high- or moderate-density buildings and industrial areas. The land cover's vegetation is highly modified from pre-development conditions and dominated in many areas by impervious surface or invasive species. In addition, most habitat in these areas occurs along roads and other areas with low value for wildlife. Because the Build Alternatives would be built alongside existing road corridors and fenced rail corridors (existing barriers to wildlife movements), they would not affect areas that serve as connective corridors to other areas of habitat outside of the study area.

Although the potential for adverse impacts would be low, operation of any of the West Seattle Link Extension alternatives could result in some impacts on vegetation and wildlife over the long term. In some areas, the guideway would be within existing forested habitat. Vegetation and wildlife habitat 15 feet beyond the guideway footprint would be permanently converted from forested vegetation to light rail or herbaceous and shrub vegetation. Herbaceous and shrub vegetation cover may be allowed to grow under the guideway in some areas such as environmentally critical areas or parks, but is assumed to be not be present for the purposes of this analysis. During operation, Sound Transit would continue to remove hazard trees (trees that might cause a hazard to light rail operations) near the operational footprint as needed. This removal of vegetation or structures that support bird nests during the breeding season could impact nests, eggs, or birds protected under the Migratory Bird Treaty Act. At-grade guideways would reduce the amount of habitat for voles and other species that are prey for raptors. Removing any street trees with trunks larger than 6 inches in diameter during maintenance activities would require coordination with the City of Seattle.

Based on the existing high levels of noise and vehicle traffic throughout the study area, as well as human activity associated with industrial, residential, and commercial development, wildlife that use habitats adjacent to the light rail Build Alternatives are likely accustomed to noise and human activity. The potential is therefore low for any of the alternatives to affect the viability of local wildlife populations due to increased human access, noise, and light. Some species may move farther into greenbelt habitat to avoid the immediate area of the light rail, but these minor localized movements to avoid these disturbances would not affect the viability of these species.

SODO Segment

The SODO Segment is within a heavily developed area that is primarily an industrial district. No terrestrial habitat for wildlife is present within this segment. Long-term effects would be limited to removal of street trees.

Duwamish Segment

All the Duwamish Segment alternatives would pass through industrial areas on elevated guideways and cross the Duwamish Waterway on a bridge before passing over or near the West Duwamish Greenbelt. Preferred Alternative DUW-1a and Option DUW-1b would cross the north end of the West Duwamish Greenbelt on a mix of elevated and retained-cut guideway and would require the removal of trees (Table 4-6) and understory vegetation (primarily non-native Himalayan blackberry and English ivy). Tree removal would slightly reduce the amount of trees available for migratory birds and small mammals. Under Preferred Alternative DUW-1a, the

amount of vegetation removed would vary, depending on which Delridge Segment alternative it connects to; the greatest impacts would occur when connecting to Alternative DEL-3. Low-growing vegetation may be replanted after construction to stabilize the slope on the north end of the West Duwamish Greenbelt, but large trees would not be allowed close to the guideway for safety reasons. Long-term impacts to the heron colony under Preferred Alternative DUW-1a and Option DUW-1b are discussed in Section 4.1.2.4.

Table 4-6. Summary of Impacts to Priority Habitats and Critical Habitat, Duwamish Segment

Alternative Name	Alternative Identification	Biodiversity Area Long-term Impacts (acres)	Biodiversity Area Construction Impacts (acres) [a]
Preferred South Crossing	DUW-1a	1.5 to 2.2 [b]	0.2 to 0.4 [b]
South Crossing South Edge Crossing Alignment Option	DUW-1b	1.9	0.6
North Crossing	DUW-2	0	0

Note: To estimate critical area impacts, the impact analyses for upland habitat in all alternatives assumed an at-grade profile that would result in a complete loss of habitat within the permanent footprint.

[a] Construction impacts represent areas only temporarily impacted by the project.

[b] This range reflects differences from connecting to different alternatives in adjacent segments.

Alternative DUW-2 would cross the Duwamish Waterway on the north side of the West Seattle Bridge, avoiding long-term impacts to the greenbelt and the heron colony. This alternative could impact a future potential habitat restoration site planned on the East Waterway, but it is anticipated that the restoration site design could be modified for the project. Alternative DUW-2 may require relocation of an artificial nesting platform near the Operations and Maintenance Facility Central that is used annually by an osprey pair; the platform would be relocated in the vicinity to ensure continued use.

Delridge Segment

The Delridge Segment passes through dense residential areas and parallels existing streets, where the primary direct impacts to upland habitat would be the removal of street trees.

All of the alternatives following Southwest Genesee Street would require some vegetation removal along the southern side of the street at the north boundary of the West Seattle Golf Course. The vegetation here consists of mowed grass areas and small to moderate-height trees, including small coniferous trees (including Douglas fir and western hemlock) and deciduous trees (including ornamental species such as Callery pear). In addition, Options DEL-1b and DEL-2b* would impact roadside vegetation on the northern side of Southwest Genesee Street. Option DEL-1b is farther north at the Longfellow Creek biodiversity area and therefore has the greatest impact to this resource (Table 4-7). Preferred Alternative DEL-1a and Alternative DEL-3 would remain elevated over Southwest Genesee Street but would require column foundations where trees are currently growing along the golf course edge. Preferred Alternative DEL-2a* and Alternative DEL-4* descend to retained-cut guideway in the northwestern corner of the golf course. This would remove some trees and grassy areas; however, these alternatives would avoid impacts to the biodiversity area along Longfellow Creek. Wildlife could continue their current movement under the elevated guideway.

Table 4-7. Summary of Impacts to Priority Habitats and Critical Habitat, Delridge Segment

Alternative Name	Alternative Identification	Biodiversity Area Long-term Impacts (acres)	Biodiversity Area Construction Impacts (acres) [a]
Preferred Dakota Street Station	DEL-1a	0	0.1
Dakota Street Station North Alignment Option	DEL-1b	0.1	<0.1
Preferred Dakota Street Station Lower Height*	DEL-2a*	0	<0.1
Dakota Street Station Lower Height North Alignment Option*	DEL-2b*	<0.1	<0.1
Delridge Way Station	DEL-3	0	<0.1
Delridge Way Station Lower Height*	DEL-4*	0	0
Andover Street Station	DEL-5	<0.1	<0.1
Andover Street Station Lower Height*	DEL-6*	0	0

* As described in the introduction to Chapter 2, Alternatives Considered, of the Draft Environmental Impact Statement, at the time the Sound Transit Board identified alternatives for study in the Draft Environmental Impact Statement some alternatives were anticipated to require third-party funding based on early cost estimates. The asterisk identifies these alternatives and the alternatives that would only connect to these alternatives in adjacent segments.

Note: To estimate critical area impacts, the impact analyses for all alternatives assumed an at-grade alignment that would result in a complete loss of habitat within the permanent footprint.

[a] Construction impacts represent areas temporarily impacted by the project, outside of the long-term project footprint.

Alternatives DEL-5 and DEL-6* would avoid impacts to wetlands and wetland buffers along Genesee Street and would have no impact on Longfellow Creek, because the creek is culverted under Southwest Andover Street. Guideway columns for these alternatives could require removing a few Douglas fir, spruce, or red alder trees in the West Duwamish Greenbelt along Longfellow Creek. The elevated crossings over Longfellow Creek for all alternatives would not preclude future projects to daylight portions of the creek currently flowing through culverts. Wildlife could continue their current movement under the elevated guideway.

West Seattle Junction Segment

The West Seattle Junction Segment Build Alternatives would have no long-term impacts to ecosystems other than removal or removal and replacement of some street trees because this segment does not contain other upland habitat.

Construction Impacts

Construction would last 1 to 5 years at any one location along the alternatives (2 to 3 years for elevated or at-grade guideway, 2 to 5 years for stations, and 3 to 4 years for a bridge over the Duwamish Waterway). The estimated durations do not necessarily indicate that continuous intensive construction activity would occur at the areas for the entire duration. It is likely there would be periods when minimal or less intensive construction activity would occur, particularly at cut-and-cover portions and stations when the tunnel boring machine would be operating in the station area.

Ground-disturbing activities could introduce sediment and pollutant-laden water (such as runoff from stockpiled soils or spilled fuels from construction equipment) to aquatic habitat or stormwater features. At most locations, ground-disturbing activities could last between 2 and 3 years. Construction of the light rail guideway and associated features would include clearing

existing vegetation, soil fill, excavation and grading, relocating drainage systems, ground improvement activities, and dewatering. Temporarily disturbed sites that are currently vegetated would be replanted immediately following construction in each project segment to restore or improve upon pre-construction conditions (such as replacing non-native weeds with native plants), and low-growing vegetation would likely become re-established within a year or two. Some areas of currently forested greenbelt would be restored with only herbaceous or shrub species close to the guideway.

All alternatives would require removal of or disturbance to street trees. Removing any street trees with trunks larger than 6 inches in diameter during construction would require coordination with the City of Seattle. Several alternatives would also require removal of native trees and other existing vegetation within habitat biodiversity areas. Some of these trees could be removed entirely; others would need to be replaced with the same or similar trees. Trees classified as heritage or exceptional are regulated further by the City of Seattle under the Tree Protection Ordinance (Seattle Municipal Code 25.11). The nearest heritage trees within the study area (an American black walnut tree near the north end of the West Duwamish Greenbelt and a Japanese maple south of the Alaska Junction Station) are outside the construction footprint.

SODO Segment

The construction taking place at the SODO Segment would have no short-term impacts to ecosystems other than street trees.

Duwamish Segment

In the Duwamish Segment, Preferred Alternative DUW-1a or Option DUW-1b would temporarily impact the West Duwamish Greenbelt, where most terrestrial wildlife habitat occurs on this segment. Construction impacts would occur in the north end of the greenbelt and include disturbance due to the construction footprint, construction noise, and stockpiling of materials. The steep slope at Pigeon Point at the north end of the West Duwamish Greenbelt would need to be stabilized using slope drains, soil nails, and other reinforcement that would require ground disturbance and noise. Vegetation would be cleared within the construction footprint. The amount of greenbelt impact would vary depending on the specific connection to the Delridge Segment, but all connection options for Preferred Alternative DUW-1a or Option DUW-1b would require some tree removal within the great blue heron management area (see Section 4.1.2.4 for further details on construction impacts to the heron colony). Small or large mammals using this habitat would be displaced or could be disturbed by construction noise. Hazard trees would need to be removed in and adjacent to the construction zone; if felled during the spring or summer, this could impact migratory songbirds using the trees for nesting.

Alternative DUW-2 would avoid construction footprint impacts to the greenbelt; however, construction noise could reach the great blue heron colony in the greenbelt, as described further in Section 4.1.2.4. If Alternative DUW-2 requires relocation of the osprey nesting platform near the Operations and Maintenance Facility Central, this would be performed outside the nesting season using standard permits and protocols for osprey nest relocation. No construction disturbance is anticipated to these osprey under any alternative, due to the birds' habituation to the urban environment.

Delridge Segment

In the Delridge Segment, Preferred Alternative DEL-1a, Option DEL-1b, Preferred Alternative DEL-2a*, Option DEL-2b*, and Alternative DEL-3 would have similar impacts to the southern edge of the Longfellow Creek Natural Area during construction. Alternative DEL-4* would avoid

impacts to the natural area during construction. Mowed right-of-way and street trees along the road, along with vegetated areas of the West Seattle Golf Course, could also be disturbed during construction where equipment is staged; construction noise could affect mammals and birds using the natural area. Alternatives DEL-5 and DEL-6* would avoid all construction impacts to the golf course but would add minor disturbance to the trees and vegetation along Longfellow Creek on the southern side of Andover Street.

West Seattle Junction Segment

The construction taking place at the West Seattle Junction Segment would have no short-term impacts to ecosystems other than removal or removal and replacement of street trees because there is no other upland habitat in this segment; vegetation is limited to residential landscaping and street trees. Excavation of tunnel options could require some temporary disturbance to street trees and other ground vegetation if cut-and-cover techniques are required, but these areas would be revegetated and restored after construction.

Indirect Impacts

Disturbance during construction could contribute to the spread of noxious or invasive plant species. However, noxious weeds are already common throughout the study area. In areas of greenbelt where construction disturbance may occur, revegetation would be performed using native vegetation in areas where non-native vegetation currently exists; this could lead to improvements in terrestrial habitat. Indirect impacts would also include increased human activity and light rail train traffic near wildlife habitat and adjacent to biodiversity areas.

The West Seattle Link Extension alternatives would not interfere with future habitat improvement projects such as culvert replacements along Longfellow Creek or habitat restoration efforts along the creek or the Duwamish Waterway. One exception occurs where Alternative DUW-2 could impact a future potential habitat restoration site planned on the East Waterway, as noted under the Long-Term Impacts section above. The project could, under the alternatives for the Duwamish Segment that intersect the West Seattle Greenbelt, limit the extent of future restoration work at the north tip of this greenbelt as the project would permanently remove some trees from this area.

4.1.2.4 Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance

Long-Term Impacts

SODO and West Seattle Junction Segments

The West Seattle Link Extension SODO and West Seattle Junction segments would not have any species of concern or listed species present, as these species and their habitats do not occur in these segments' study areas.

Duwamish Segment

All Duwamish Segment alternatives could result in long-term impacts to the Duwamish Waterway aquatic environment if a bridge type that requires guideway columns placed in and partially in the water is used. As noted in Section 3.1.2, Aquatic Habitat and Species, the Duwamish Waterway supports several listed and priority fish and marine mammals, including Chinook salmon, steelhead, bull trout, coho salmon, Pacific cod, Pacific herring, and river lamprey; sea lions and marbled murrelets may also be present. The waterway has designated

critical habitat for bull trout, steelhead and Chinook salmon as well as essential fish habitat for additional species.

Bridge guideway columns could result in permanent loss of up to 0.7 acre of benthic habitat that might be used by listed fish and fish species of concern for foraging and migration. If used as part of the guideway column construction, above-water pile caps associated could create shade over water, which might reduce productivity in the shaded waters or could provide new habitat for fish species that prey on young salmonids. The bridge itself is not expected to have any shading impacts to the productivity of these waters because it would be 90 feet to 135 feet above the water (as described in Section 4.1.2.2). However, guideway columns and pier-protection systems along the shoreline, as well as navigation lighting on the columns, could change the movement patterns of migrating salmonids, including young salmon sheltering in shallow waters during their passage out to Elliott Bay. Pier-protection systems would be constructed parallel to the shoreline but with extensions angling towards the shore that could temporarily alter the direction of salmon traveling upstream or downstream. Sea lions and marbled murrelets may use the waterway occasionally, but as this not their primary habitat, they are not expected to experience any long-term effects from the addition of features in an already industrialized section of shoreline.

The columns would not directly conflict with current projects to restore intertidal habitat under Chinook or steelhead recovery plans. Where guideway columns would be placed partially on shore, their vertical structure would replace already armored shoreline in most cases, and the overall conditions and shoreline complexity would not change in these locations. However, the guideway columns would increase the steepness of other unarmored shoreline patches. Recovery plans for listed salmon identify shallow areas of shoreline as important to migrating salmonids.

As noted for aquatic habitats, Sound Transit is studying the feasibility of multiple high-level fixed bridge types (including balanced cantilever segmental box girder, extradosed, cable-stayed, and truss bridges). Some bridge types would reduce or eliminate the in-water impact from the bridge depending on the alternative. Please see Tables 4-3 and 4-4 for the range of impacts that could occur by Duwamish Segment alternative based on preliminary review of the potential bridge types. Option DUW-1b would have in-water bridge support columns regardless of bridge type.

All of the Duwamish Segment alternatives would parallel the West Seattle Bridge, where a peregrine falcon nest has been active in a manmade nest box placed on a bridge support column. These birds are already habituated to an urban environment and traffic on nearby roads and bridges; however, light rail trains moving close to the nest could affect their return to this artificial nest location. During operations, light rail trains would pass about 60 feet with Preferred Alternative DUW-1a, 200 feet with Option DUW-1b, or 300 feet with Alternative DUW-2 from the nest box.

As described in Section 4.1.2.3, Upland Habitat and Species, Preferred Alternative DUW-1a and Option DUW-1b would cross the north end of the West Duwamish Greenbelt and require the removal of some deciduous trees from the greenbelt. Low-growing vegetation may be used to stabilize this slope where trees are removed, but large trees would not be allowed above the guideway for safety reasons. This is a Washington Department of Fish and Wildlife priority habitat (biodiversity area and corridor) that contains potential foraging habitat for state species of concern such as the pileated woodpecker, potential roosting habitat for bald eagles, and a documented nesting colony of great blue herons. The trees being removed do not contain prominent roost trees for eagles. The area does contain a few snags that pileated woodpeckers might use for foraging, although other similar snags are available in other areas of the greenbelt.

The tree removal area is also within the core zone of a great blue heron management area (which covers habitat within 60 meters [197 feet] of nests). The removed trees could include trees directly adjacent to the colony if they are determined to be hazard trees based on their proximity to the guideway. The specific boundary of the management area core zone would depend on the specific locations of heron nests during the year(s) of permitting. The herons generally return to the same nest trees each year. However, there are additional suitable nest trees between their current nesting and the project footprint in which they might establish new nests in the future.

Any habitat permanently removed from the great blue heron management area core zone would require coordination with Washington Department of Fish and Wildlife and the City of Seattle to determine permitting and mitigation. Great blue herons can be extremely sensitive to disturbance at their nesting colonies (refer to Vennesland and Norman 2006 for a summary of heron disturbance studies); excessive disturbance can affect the success of nests in the colony. Carlson and McLean (1996) found that the distance of heron colonies from human activity and the quality of the vegetated buffer around the colony was positively related to nest success. The City of Seattle's management area core zone buffer around the nests is intended to protect the great blue heron colony from such disturbance effects. Preferred Alternative DUW-1a and Option DUW-1b would bring elevated structures closer to the nest colony than existing roadways. Currently, the herons are habituated to the urban environment and are choosing nests as close as 50 feet from houses and streets in Pigeon Point, and as close as 150 feet from the West Seattle Bridge. They might tolerate additional structures nearby, given their current habituation to the urban environment. However, it is also possible the new structures could result in them choosing nest sites farther south along the greenbelt.

Alternative DUW-2 would cross the Duwamish Waterway on the north side of the West Seattle Bridge and therefore avoid impacts to the greenbelt habitat and the heron's management area core zone.

Delridge Segment

The Delridge Segment would cross over Longfellow Creek, which is used by listed fish (Chinook salmon and steelhead). However, no project features would be built in the stream and no long-term impacts to fish would occur. As stormwater would be routed to combined sewer rather than discharged to the stream, the project would not have impacts to water quality factors such as temperature, dissolved oxygen, or contaminants that are limiting factors for salmon survival in the creek. The West Seattle Link Extension would not preclude future work to fulfill recommendations under the Chinook or steelhead recovery plans. Such future work could include daylighting portions of Longfellow Creek currently flowing through culverts, adding riparian vegetation or in-water debris, or replacing fish passage barriers.

Construction Impacts

SODO and West Seattle Junction Segments

Construction in the SODO and West Seattle Junction segments would not affect any species of concern, as these species and their habitats do not occur in these segments' respective study areas. Construction noise would also not affect in-water habitat in Elliott Bay, where sensitive listed species of marine mammals occur.

Duwamish Segment

Species of concern would experience construction impacts in the Duwamish Segment. In-water construction in the Duwamish Waterway would directly affect listed species of fish in the

waterway. The listed and sensitive fish species would be excluded from foraging on benthic habitat within the cofferdams for the duration of construction. Salmonids such as Chinook salmon and steelhead might change their behavior or be injured by in-water construction noise such as impact and vibratory pile-driving. Salmon would be routed away from shallow water by cofferdams or work trestles along the shoreline. Salmon might also change their behavior due to shading from trestles and barges, or due to construction lighting at night. As noted in Section 4.1.2.2, juvenile salmon are expected to show more behavior changes to construction lighting than adult salmon.

These species' ability to forage in the area could also be negatively affected by turbidity during the construction. In particular, suspended sediments from construction could contain contaminants because this excavation would be occurring in the Harbor Island Superfund site. During pile-driving, excavation, and rewatering of cofferdams, many contaminants could be resuspended, including polychlorinated biphenyls, arsenic, polycyclic aromatic hydrocarbons, and mercury. Exposure to such contaminants could be harmful to the listed species that encounter them, as well as to predators such as marine birds and marine mammals that prey on those listed species. Currents flowing through the area would disperse some suspended sediments, lessening their effects in the immediate construction vicinity as well as turbidity. However, the sediments would not reach as far as Elliott Bay; Sound Transit would comply with Ecology's water quality standards under the 401 Water Quality Certification the project would require, which would include preventing contaminants from traveling far from the project.

Sensitive marine mammals and the listed marbled murrelet are also a concern during construction. Impact and vibratory pile-driving could create noise that reaches Elliott Bay at levels high enough to change the movements or foraging of whales or sea lions in the bay. Construction would be permitted to comply with the Marine Mammal Protection Act. This would entail monitoring during activities that create noise at levels that could harass seals and sea lions in the waterway. These construction activities could include noise-reduction measures such as bubble curtains that reduce decibels during impact or vibratory pile-driving, to limit harm or harassment to fish in waters near the activities. The construction of Preferred Alternative DUW-1a and Option DUW-1b could directly impact the nesting great blue herons in the West Duwamish Greenbelt, and any other priority species such as pileated woodpeckers using the greenbelt. Vegetation cleared within the construction footprint could occur within 50 to 100 feet of known great blue heron nest trees. The guideway would also pass close to a known peregrine falcon nesting site on the West Seattle Bridge. Preferred Alternative DUW-1a would pass closer to the falcon nest and Option DUW-1b would pass closer to the heron colony.

The amount of greenbelt impact would vary depending on the alternative design option or the specific connection to the Delridge Segment, but all would require some tree removal within the great blue heron management area. Construction equipment and staging could occur in the paved areas directly downslope from the nest trees. Depending on the selected alternative, some trees adjacent to the nest trees could be required to be felled as hazard trees during construction (this could occur if the herons expand their colony northward during the period of construction).

Construction noise for Preferred Alternative DUW-1a and Option DUW-1b could exceed ambient noise levels at the heron colony. The great blue herons using this particular colony are less sensitive to disturbance than would be more isolated colonies. The birds are habituated to an urban environment and are currently choosing nest sites directly over a pedestrian path, near train tracks with loud train horn noise, and close to the West Seattle Bridge (which up until its closure in the spring of 2020 had heavy traffic at the same elevation as the heron nests). Despite this habituation, the herons might not tolerate active construction near the nests if it

occurred during the nesting season. Noise from construction of Preferred Alternative DUW-1a or Option DUW-1b could temporarily exceed existing ambient noise levels at the colony.

Any impact to the heron nesting colony or its management area during construction would require a management proposal based on Washington Department of Fish and Wildlife's recommendations and catered to the project site to meet the City of Seattle's heron management requirements as well. Construction close to the great blue heron colony (including any areas within 600 feet of the nests) would likely be restricted to winter months (October through January) to avoid the nesting season. Construction plans may need to be modified to place staging areas as far from the nesting colony as possible.

Alternative DUW-2 would avoid all physical construction impacts to the West Duwamish Greenbelt but would overlap with the great blue heron management zone's outer area—by City of Seattle requirements, construction noise is restricted during the nesting season in this zone. This area does not contain any habitat for herons and separated from the colony by the West Seattle Bridge. Most construction noise north of the bridge is not likely to reach the colony at levels that would disturb the herons, given the high levels of ambient noise near the colony from trains, traffic, and industrial noise along the Duwamish Waterway. Construction noise from Alternative DUW-2 could also be audible at the heron colony but is not expected to exceed ambient noise levels.

Any of the Duwamish Segment alternatives have the potential to disturb a known pair of peregrine falcons that nest on a placed platform under the West Seattle Bridge. Although the falcons are already habituated to an urban environment and traffic on nearby roads and bridges, under either alternative, the light rail trains moving close to the nest could affect their return to this artificial nest location. Marbled murrelets are not expected to be impacted by the project construction because they are unlikely to use the busy waters of the waterway on a regular basis and are highly mobile. A purple martin colony site in the waterway is also not likely to be disturbed by construction here because it is 0.25 mile from the site and birds using the area are already habituated to construction and industrial boat traffic.

Delridge Segment

Construction of the Delridge Segment is not expected to impact listed species of salmon using the creek. Best management practices would be employed where construction staging occurred within stream buffers, such as silt fences and other devices, to ensure that stormwater runoff or sediments did not reach the creek. Therefore, construction is not expected to exacerbate the current water quality issues in the creek that affect salmonids. Construction lighting would be directed away from the creek to avoid affecting the movements of fish. Priority species such as pileated woodpeckers or other bird species using the greenbelt habitat or West Seattle Golf Course for foraging would be mobile and able to move away from the immediate area of construction.

Indirect Impacts

The West Seattle Link Extension would not interfere with future projects that may provide habitat improvements improving conditions for listed species in Longfellow Creek, such as daylighting culverts or improving riparian vegetation to increase salmonid spawning habitat. Indirect impacts would include increased human activity and light rail train traffic near wildlife habitat and adjacent to biodiversity areas at Longfellow Creek, which in turn could influence the wildlife traveling between the Longfellow Creek Natural Area and greenbelts within and south of the golf course, though as there is already traffic along Southwest Genesee Street, wildlife would already be habituated here to moving through a populated area.

Along the Duwamish Waterway, if guideway columns are placed along the Harbor Island shoreline, they would prevent future restoration at those specific locations, though area directly adjacent to the towers would retain opportunities for habitat enhancement.

As noted for aquatic habitat, above, bridge guideway columns placed in the Duwamish Waterway could cover benthic habitat in the waterway and lead to some lost productivity. This in could in turn affect the availability of prey species for listed salmonids and marine mammals using the waterway; a change in distribution of the prey species could change the movement patterns of these predators. If placed on partially armored shoreline or the small patches of steep intertidal habitat, guideway columns would not directly conflict with current projects to restore intertidal habitat under Chinook or steelhead recovery plans. The baseline conditions along the East and West Waterways, including the unarmored patches, are already degraded with minimal riparian or aquatic vegetation, and are not currently providing quality habitat for migrating or rearing salmonid juveniles in this transitional area between fresh and saltwater.

4.1.2.5 Tribal Treaty Rights Impacts

The Muckleshoot Indian Tribe has treaty-protected rights to fish, hunt, and gather in their Usual and Accustomed Areas in the project corridor. These rights include the waters of the Duwamish Waterway. The Suquamish Tribe has similar treaty-protected rights in these areas. All West Seattle Link Extension work performed in or over the Duwamish Waterway would have the potential to change movements of adult salmonid or obstruct fishing activities. Treaty-protected fishing rights and Usual and Accustomed Areas of the Muckleshoot Indian Tribe may be temporarily affected during in-water construction or permanently affected by placement of guideway columns in the water. Some bridge types could also impact Tribal treaty-protected fishing rights and access to the Usual and Accustomed Areas of the Suquamish Tribe.

4.2 Ballard Link Extension

Overall impacts related to stormwater, vegetation cover in greenbelts, street trees, urban wildlife, and shading below elevated guideways along the Ballard Link Extension would be similar to those described above for the West Seattle Link Extension. Both extensions are planned in urban areas, where land cover is predominantly industrial areas and high density residential areas. The Ballard Link Extension would follow existing roadways and residential areas where wildlife is already habituated to noise and disturbance and where wildlife migration barriers are already present. Key ecosystem resources that would be impacted by the Ballard Link Extension are Salmon Bay, the Southwest Queen Anne Greenbelt and Kinnear Park, and the Interbay Golf Center, as described below.

4.2.1 No Build Alternative

The No Build Alternative would not result in direct long-term impacts on ecosystem resources. Conversely, the No Build Alternative would lack the beneficial indirect effects of the Build Alternatives over the long term, such as reduced motor vehicle traffic in the region or possible improvements for past impacts or poorly functioning environmental features along the corridor that have degraded water quality, wetlands, streams, and regulatory buffers.

4.2.2 Build Alternatives

4.2.2.1 Wetlands

Long-Term Impacts

SODO, Chinatown-International District, and Downtown Segments

There would be no long-term impacts to wetlands in the SODO, Chinatown-International District, or Downtown segments, as no wetlands occur along these segments.

South Interbay Segment

In the South Interbay Segment, project team biologists identified six wetlands (Table 3-9 and Figure 3-12). Impacts to these wetlands are expected to occur and would vary by alternative (Table 4-8). Four wetlands are within the Southwest Queen Anne Greenbelt (wetlands WSE5, WSE6, WSE7, and WSE10), and two wetlands are on slopes flanking the Interbay Golf Center (wetlands WSE8 and WSE9). Two of the greenbelt wetlands (WSE6 and WSE7) are outside the construction and operation footprints of all Build Alternatives.

Table 4-8. Summary of Impacts to Wetlands, South Interbay Segment

Alternative Name	Alternative Identification	Wetland: Long-term Impacts (acres)	Wetlands and Other Waters of the United States: Construction Impacts (acres) [a, b]	Wetland Buffer: Long-term Impacts (acres)	Wetland Buffer: Construction Impacts (acres) [a]	Wetlands Affected
Preferred Galer Street Station/ Central Interbay	SIB-1	0.2	0.2	1.4	0.9	WSE9
Prospect Street Station/15th Avenue	SIB-2	0.1	0	0.5	0	WSE5, WSE10
Prospect Street Station/Central Interbay	SIB-3	0.2	0.2	1.9	0.9	WSE5, WSE8, WSE9, WSE10

Note: To estimate wetland impacts, the impact analyses for all alternatives assumed that areas under elevated guideways would be permanently impacted.

[a] Construction impacts represent areas temporarily impacted by the project, outside of the long-term project footprint.

[b] Construction impacts include impact to a jurisdictional ditch.

Preferred Alternative SIB-1 would avoid all impacts to the greenbelt wetlands (WSE5, WSE6, WSE7, and WSE10); the guideway and guideway columns would be placed exclusively in or over existing impervious surface along the Southwest Queen Anne Greenbelt. However, Preferred Alternative SIB-1 would have permanent impacts to wetland WSE9 in the Interbay Golf Center. The elevated guideway would parallel the western edge of the golf center; the guideway would directly shade part of wetland WSE9 and its buffer, and guideway columns may need to be placed in the wetland or buffer. Preferred Alternative SIB-1 would have no long-term impacts to wetland WSE8 at the south end of the golf center.

Alternative SIB-2 would impact both the buffers and wetlands at wetlands WSE5 and WSE10 along the slope of the Southwest Queen Anne Greenbelt. Guideway and guideway columns would be placed east of the wetland itself but would shade buffer areas (although these shaded areas are currently a paved parking lot with street trees). A retaining wall may need to be placed on or near these wetlands, and ground improvements may need to be installed underneath them, affecting their hydrology or removing portions of the wetland. Impacts could include slope drains installed beneath the surface to dewater and stabilize the hillside. The installation points at the toe of the slope could require some vegetation and soil disturbance within the wetlands but would not directly impact the wetlands farther upslope because the drains would be routed farther underground by directional drilling. Alternative SIB-2 would travel north along 15th Avenue West, avoiding all impacts to the wetlands near the Interbay Golf Center (WSE8 and WSE9). Overall wetland impacts would be less with Alternative SIB-2 than Preferred Alternative SIB-1.

Of the three South Interbay Alternatives, Alternative SIB-3 would have the most impacts to wetlands. This alternative would affect wetlands WSE5 and WSE10 along the greenbelt, then cross over the Interbay industrial area to parallel the west side of the Interbay Golf Center, where guideway columns and shading would affect wetland WSE9.

All wetlands and wetland buffers within the permanent footprint are assumed to be permanently filled. Actual impacts may be less than identified in Table 4-8 where guideways are elevated and would be determine during final design. Impacts to wetland buffers include areas where the buffer is currently paved and wetland buffer function is currently not provided, or where wetland hydrology is provided by groundwater that would not be affected by elevated guideway. These areas may be excluded from total impacts when permitting is complete.

Interbay/Ballard Segment

There would be no long-term impacts to wetlands in the Interbay/Ballard Segment because no wetlands occur along this segment.

Construction Impacts

SODO, Chinatown-International District, and Downtown Segments

There would be no construction impacts to wetlands in these segments because no wetlands occur along these segments.

South Interbay Segment

Construction of Preferred Alternative SIB-1 would directly impact wetland WSE9 along the western edge of the Interbay Golf Center. Alternative SIB-2 would avoid these impacts but would impact wetlands WSE5 and WSE10 in the Southwest Queen Anne Greenbelt within the area that would be permanently shaded by the guideway after construction. Construction of Alternative SIB-3 would impact both the greenbelt wetlands (WSE5 and WSE10) and the wetland west of the golf course (WSE9). Construction of Alternative SIB-3 would also have construction impacts to the western corner of wetland WSE8 (at south end of golf course).

Construction staging would need to occur in the buffers of all of these wetlands as well as construction of a retaining wall and ground stabilization in or under wetlands WSE5 and WSE10. The construction contractor would work within construction limits marked with fencing and signage to prevent unintended impacts on wetlands. Temporarily disturbed sites that are currently vegetated would be replanted immediately following construction to restore or improve upon pre-construction conditions.

Interbay/Ballard Segment

There would be no construction impacts to wetlands in this segment, as no wetlands occur along this segment.

Indirect Impacts

The project's intended slowing of the overall increase of pollutants and traffic in the region would be a benefit for the water quality in wetlands in and outside of the study area. These effects would be limited because all stations and guideways would be in areas that are already densely developed with extensive impervious surfaces.

The Ballard Link Extension would not interfere with future projects that might provide habitat improvements, such as projects to enhance existing wetlands around the Interbay Golf Center or Southwest Queen Anne Greenbelt. Construction could contribute to the spread of invasive plant species; however, these are already common in the study area—wetlands WSE8 and WSE9 are predominantly vegetated with Himalayan blackberry and reed canarygrass—and revegetation may improve existing conditions in greenbelts and buffers. Slope drains installed along the Southwest Queen Anne Greenbelt could reduce the flow of water to the greenbelt's wetlands, which may in turn reduce the size of wetlands WSE5 or WSE10.

4.2.2.2 Aquatic Habitat and Species

Long-Term Impacts

SODO, Chinatown-International District, and Downtown Segments

There are no waterbodies in the Ballard Link Extension SODO, Chinatown-International District, and Downtown segments study areas. Stormwater in these segments' study areas drains to Elliott Bay via a combined sewer system.

South Interbay Segment

Along the South Interbay Segment, vegetated areas would be changed to impervious surfaces for all Build Alternatives, which could increase the stormwater flows in areas that ultimately discharge into Elliott Bay through storm drains or combined sewer systems. These impacts would be limited because stormwater from all project-related impervious surfaces would receive appropriate flow control where required; stormwater from pollutant-generating impervious surfaces would also receive water quality treatment if not already draining to combined sewer systems. Additional technologies are also being considered.

To minimize impacts to groundwater in the project vicinity, Sound Transit would use stormwater management facilities such as ponds and flow-control vaults to infiltrate runoff from the project as much as the soils can accommodate. The Build Alternatives would be designed to meet standards of the City of Seattle and Ecology's *Stormwater Management Manual for Western Washington* (see Sections 4.1.8, 4.2.8, and 4.3.8, the Water Resources sections of the Draft Environmental Impact Statement).

Interbay/Ballard Segment

All Build Alternatives in the Interbay/Ballard Segment would pass through industrial and dense residential areas and would change some small areas of roadside vegetation to impervious surfaces. The change could increase the stormwater flows in areas that ultimately discharge into Salmon Bay through storm drains or combined sewer systems. As noted for the South Interbay Segment, stormwater from all project-related impervious surfaces would receive

appropriate flow control, as well as water quality treatment if not already draining to combined sewer systems. Sound Transit would use stormwater management facilities such as ponds and vaults to infiltrate runoff from the project as much as the soils can accommodate.

All Build Alternatives would avoid the unarmored shorelines of Seattle Maritime Academy's cove and the 11th Avenue Northwest Street-end. The shoreline is otherwise armored and contains terrestrial and aquatic invasive plant species, including butterfly bush, Himalayan blackberry and Eurasian milfoil. However, Preferred Alternative IBB-1a and Option IBB-1b would require guideway columns in the water and in the 200-foot shoreline buffer area, which could eliminate some shoreline habitat. Although this buffer contains very little natural habitat (mostly covered by impervious surfaces), in-water structures could provide shelter for fish species that prey on young salmonids (e.g., bass) and could increase the predation rates on young salmon rearing along the shorelines or migrating out toward the Hiram M. Chittenden Locks.

Tables 4-9 and 4-10 present the estimated impacts to sensitive aquatic habitat in the bay. Two high-level fixed bridge alternatives, Preferred Alternative IBB-1a and Option IBB-1b, would be built east of the Ballard Bridge and would require three in-water guideway columns. Pier-protection systems would also be built on both sides of the navigation channel to protect the guideway columns from potential vessel strikes. The extent of these walls would vary depending on the number of columns in the bridge design, and their proximity to the navigation channel. The guideway columns and pier-protection systems would remove benthic habitat in waters that are essential fish habitat and critical habitat for listed fish species, including salmon and trout. Depending on the bridge type, the benthic habitat, essential fish habitat, and critical habitat impacts vary (Table 4-10). Fish migrating through the bay would also need to change their direction to move around the columns and walls. Alternative IBB-3 would include construction of a movable bridge over Salmon Bay, built to the west of the Ballard Bridge. This alternative would cross a wider part of the bay than the other bridge alternatives (Preferred Alternative IBB-1a and Option IBB-1b) and would require more in-water guideway columns, which would introduce more guideway columns that might change fish movement patterns.

Preferred Alternative IBB-1a, Option IBB-1b, and Alternative IBB-3 would likely create some over-water shading, but would not be expected to noticeably change conditions of productivity or water temperature due to the height of the bridge (70 feet clearance over the navigation channel for Alternative IBB-3 and 136 feet clearance over the navigation channel for Preferred Alternative IBB-1a and Option IBB-1b). As described for the Duwamish Waterway crossing in Section 4.1.2.2, bridges at least 24 feet high are expected to allow sufficient light to support plant growth (WSDOT 2009), and bridges that clear the Lake Washington Ship Canal by 46 feet were determined to not produce enough hard shade that would affect fish movements (NOAA Fisheries 2011). Some limited shading may also occur around bridge guideway columns. The guideway columns could cover or directly shade up to 0.8 acre of bottom habitat that is currently accessible to fish and benthic invertebrates. The covered area of benthic habitat could reduce the amount of productivity (of macroinvertebrates, aquatic vegetation, and potential prey species for larger fish) in these benthic locations.

The new light rail bridge would be outfitted with navigation lights at the guideway columns to aid their visibility to watercraft in Salmon Bay and Federal Aviation Administration/WSDOT-regulation lights for airplanes at the top of all towers above the bridge deck. The bridge-top lighting is not expected to result in any major long-term increases in nighttime illumination of fish-bearing waters because industrial lighting is already present around the bay and on the existing Ballard Bridge. However, the additional lights on the columns could slightly alter the nighttime swimming behavior of young salmon in proximity to the bridge, possibly making them more exposed to predation from other fish (Tabor et al. 2011).

Table 4-9. Summary of Impacts to Aquatic Resources: Shoreline, Interbay/Ballard Segment

Alternative	Alternative Identification	Shoreline: Long-term Impacts (linear feet of shoreline) [a]	Shoreline: Construction Impacts (linear feet of shoreline) [b]	Shoreline Buffer: Long-term Impacts (acres) [a, c]	Shoreline Buffer: Construction Impacts (acres) [b, c]
Preferred Elevated 14th Avenue	IBB-1a	400 [d]	1,000 [e]	1	6
Elevated 14th Avenue Alignment Option (from Prospect Street Station/15th Avenue)	IBB-1b	400 [d]	1,000 [e]	1	6
Preferred Tunnel 14th Avenue*	IBB-2a*	0	0	0	0
Preferred Tunnel 15th Avenue Station Option*	IBB-2b*	0	0	0	0
Elevated 15th Avenue	IBB-3	500	800	1	2

* As described in the introduction to Chapter 2, Alternatives Considered, of the Draft Environmental Impact Statement, at the time the Sound Transit Board identified alternatives for study in the Draft Environmental Impact Statement some alternatives were anticipated to require third-party funding based on early cost estimates. The asterisk identifies these alternatives and the alternatives that would only connect to these alternatives in adjacent segments.

[a] To estimate permanent shoreline impacts, the impact analyses for all alternatives assumed an at-grade profile that would result in a complete loss of habitat within the permanent footprint.

[b] These construction impacts represent areas that would be temporarily impacted by the project, outside of the long-term project footprint.

[c] Shoreline buffer includes both paved and unpaved surfaces; paved areas may be eliminated once permitting is complete.

[d] These shoreline impacts include 74 linear feet of permanent impact from the relocation of the 14th Avenue outfall and 64 linear feet of permanent impact associated with relocation of the 14th Avenue Northwest Boat Ramp.

[e] These shoreline impacts include 116 linear feet of construction impact from the relocation of the 14th Avenue outfall and 91 linear feet of construction impact associated with relocation of the 14th Avenue Northwest Boat Ramp (this project impact would occur even if the boat ramp was not relocated).

Table 4-10. Summary of Impacts to Aquatic Resources: In-water Impacts, Interbay/Ballard Segment

Alternative	Alternative Identification	Number of Permanent In-water Piers	Approximate Area of Construction Impacts in waterbody (acres) [a]	Over-water Structures (acres) [b]	Permanent Benthic Surface Impacts (acre)
Preferred Elevated 14th Avenue	IBB-1a	1 to 3	0.5 to 1.5 [c]	0.7 to 0.9	0.8 to 1.2 [d]
Elevated 14th Avenue Alignment Option (from Prospect Street Station/15th Avenue)	IBB-1b	1 to 3	0.5 to 1.5 [c]	0.7 to 0.9	0.8 to 1.2 [d]
Preferred Tunnel 14th Avenue*	IBB-2a*	0	0	0	0
Preferred Tunnel 15th Avenue Station Option*	IBB-2b*	0	0	0	0
Elevated 15th Avenue	IBB-3	5 to 9	0.7 to 1.7 [e]	1.2 to 1.3	0.2 to 0.8 [e]

* As described in the introduction to Chapter 2, Alternatives Considered, of the Draft Environmental Impact Statement, at the time the Sound Transit Board identified alternatives for study in the Draft Environmental Impact Statement some alternatives were anticipated to require third-party funding based on early cost estimates. The asterisk identifies these alternatives and the alternatives that would only connect to these alternatives in adjacent segments.

Note: The range of impacts shown represent impacts from different bridge types; support guideway column locations would vary by bridge type.

[a] These construction impacts represent the total area of the cofferdam footprints and work trestle column support footprints that would be placed on the benthic surface, minus the area of guideway columns that would remain permanently in the waters.

[b] This area represents the total area of elevated bridge features that would shade Salmon Bay. It does not include the area of bridge guideway columns and pile caps in the water, which are presented as benthic surface impacts. The over-water structures would occur over salmonid critical habitat and essential fish habitat for salmonids and groundfish.

[c] These impacts include 0.1-acre construction impact associated with the replacement of the 14th Avenue outfall and 0.2 acre of impact associated with relocation of the 14th Avenue Northwest Boat Ramp.

[d] These impacts include 0.6-acre permanent impact associated with the replacement of the 14th Avenue outfall and <0.1 acre of impact associated with relocation of the 14th Avenue Northwest Boat Ramp.

[e] Less than 0.1 acre of impact is associated with storm drain outfall relocation during construction and for permanent impacts.

Operation of the Ballard Link Extension could result in long-term increases in nighttime illumination of fish-bearing waters (increased lighting could change the behavior of fish); however, industrial and roadside lighting is already present in this area.

The tunnel alternatives, Preferred Alternative IBB-2a* and Preferred Option IBB-2b*, would avoid all long-term ecosystem impacts to the shoreline and Salmon Bay.

Construction Impacts

SODO, Chinatown-International District, Downtown, and South Interbay Segments

Listed species are present in waters within 0.25 mile of the Ballard Link Extension in Elliott Bay along the SODO, Chinatown-International District, Downtown and South Interbay segments. However, no in-water work would occur on these segments, and due to the urban environment in Downtown Seattle, no above-water construction noise is expected to reach the marine environment. In the South Interbay Segment, Preferred Alternative SIB-1 would pass close to but outside of the 200-foot study area from Elliott Bay's shoreline. The construction footprint is within 220 feet of the shoreline but is separated from it by the BNSF Railway line. No impacts from construction are expected to affect species or habitats along the shoreline.

Interbay/Ballard Segment

In the Interbay/Ballard Segment, the Salmon Bay bridge alternatives (Preferred Alternative IBB-1a, Option IBB-1b, and Alternative IBB-3) would create several types of disturbances within the aquatic habitat and bay shorelines. Cofferdams support piles and sheets would be driven or vibrated into place, and the foundations of the bridge guideway columns would include drilled shafts and cast-in-place concrete pile caps. Pier-protection systems would be installed outside of the dewatered cofferdam areas. Temporary work trestles may also be used during construction; these trestles would need additional guideway columns placed in the water. Cofferdam and trestle placement (and eventual removal) would introduce temporary turbidity and sediments into the waterway, temporarily remove aquatic habitat from fish, and cause mortality of benthic organisms present in the cofferdam area during dewatering. Impact pile-driving or vibratory driving could create noise that could reach levels with the potential to injure fish or change their movements through the area. While the cofferdam is in place, the dewatered areas would temporarily exclude Chinook salmon and bull trout critical habitat from use by these fish species during the construction period. Work barges would also be used during construction to transport supplies or provide work cranes; when anchoring in place or pulling their anchors, they could stir up sediments and during operation, their cranes or other equipment would create construction noise. Barges stationed at the work site would also create temporary shade over the benthic habitat, which could cause fish to alter their movement patterns through the bay. Construction lighting from barges or work trestles may also influence fish movements near the construction area. As described for the Duwamish Waterway crossing in Section 4.1.2.2, juvenile salmon would be expected to show the most behavioral response to this lighting, either avoiding the lit areas or seeking those areas to feed on prey (Celadonia et al. 2009, NOAA Fisheries 2011).

Sound Transit would follow extensive best management practices to minimize turbidity and prevent accidental fuel leaks or spills. The in-water work would be performed within the recommended work window of Salmon Bay to minimize disturbance or injury to listed species of fish. The construction contractor would be required to develop, implement, and monitor a temporary erosion and sediment control plan to address potential erosion for the duration of construction. Best management practices would be employed for fish and aquatic habitat protection. All work below the ordinary high water mark, such as during cofferdam construction,

would comply with the terms and conditions set forth in the Hydraulic Project Approval issued by Washington Department of Fish and Wildlife for the WSBLE Project. For water quality protection, the project would obtain and adhere to a construction stormwater general permit under the National Pollutant Discharge Elimination System) permit program to reduce or eliminate stormwater pollution and other impacts on surface waters, and a Section 401 Water Quality Certification indicating that the project would comply with state or federally approved water quality standards and other aquatic resources protection requirements. A construction stormwater pollution prevention plan, approved by Ecology, would also be implemented before the start of construction. The plan would include best management practices to (1) prevent erosion, (2) prevent sedimentation, and (3) identify, reduce, eliminate, or prevent stormwater contamination and water pollution from construction activity.

While Alternative IBB-3 would have similar types of impacts as Preferred Alternative IBB-1a and Option IBB-1b, it would require construction of more in-water supports and therefore more noise and dewatering activities compared to the other bridge alternatives.

Construction of the Build Alternatives that tunnel under Salmon Bay (Preferred Alternative IBB-2a* and Preferred Option IBB-2b*) would avoid all impacts to aquatic habitat in the bay. Tunnel portals would be placed outside the shoreline buffer area.

Indirect Impacts

Overall impacts of the Ballard Link Extension would include the positive effects of reduced motor vehicle traffic in the region. The introduction of light rail transit to the area would slightly reduce vehicular traffic on nearby roadways compared to the No Build Alternative. This would slightly decrease pollutant-laden stormwater runoff from roadways. The new guideway columns across Salmon Bay would cover some benthic habitat, which could reduce some prey availability within the bay for larger species such as salmon; if it occurs, this prey reduction could alter where fish species concentrate within the bay.

4.2.2.3 Upland Habitat and Species

Long-Term Impacts

Based on the urban environment in most portions of the study area, operation of any of the Ballard Link Extension light rail alternatives would not result in long-term impacts on the viability of local wildlife populations. Currently, the predominant types of land cover in the project footprint are high- or moderate-density buildings and industrial areas. The land cover's vegetation is highly modified from pre-development conditions and dominated in many areas by impervious surface or invasive species. In addition, most habitat in these areas occurs along roads and other areas with low value for wildlife. Because the Build Alternatives would be built alongside existing road corridors and fenced rail corridors (existing barriers to wildlife movements), they would not affect areas that serve as connective corridors to other areas of habitat outside of the study area.

Overall impacts along the Ballard Link Extension would be similar to those described above for the West Seattle Link Extension for vegetation cover in greenbelts, street trees, urban wildlife, and shading below elevated guideways. Vegetation and wildlife habitat 15 feet beyond the guideway footprint would be permanently converted from forested vegetation to herbaceous and shrub vegetation. Herbaceous and shrub vegetation cover may be allowed to grow under the guideway in some areas such as environmentally critical areas or parks, but is assumed to be not be present for the purposes of this analysis. Sound Transit would remove "hazard trees" (trees that may cause a hazard to light rail operations) throughout project operations as needed.

The Ballard Link Extension would similarly follow existing roadways and residential areas where wildlife is already habituated to noise and disturbance, and where migration barriers are already present.

Some of the guideway and other features would be elevated. This reduces the amount of light and rainfall reaching vegetation below the track.

SODO, Chinatown-International District, and Downtown Segments

The SODO, Chinatown-International District, and Downtown segments are in fully developed areas where most surfaces are impervious; the only vegetation that can provide habitat for wildlife persists as street trees and urban vegetation. The Chinatown-International and Downtown segments would be tunneled and only affect street trees where the construction requires cut-and-cover techniques. In construction areas, these trees would be replaced or offset with new tree plantings. Peregrine falcons are known to use downtown buildings for nesting; however, no existing tall buildings be removed.

South Interbay Segment

The South Interbay Segment has upland habitat in the Southwest Queen Anne Greenbelt, Kinnear Park, and in the Interbay Golf Center and Interbay Athletic Complex area.

Impacts to vegetation and biodiversity habitat areas would mainly occur in the Southwest Queen Anne Greenbelt and would range from 0.1 acre to 6.1 acres across the three South Interbay Segment Build Alternatives. Impacts in Kinnear Park would be restricted to the southwestern boundary or northwestern corner, depending on the alternative. Preferred Alternative SIB-1 would avoid direct impacts on habitat in Kinnear Park. Alternative SIB-2 would be on elevated guideway along Kinnear Park's southwestern edge. Although it primarily would cross over existing impervious surface, Alternative SIB-2 would require some tree removal and also shade some vegetation along the western boundary of the park. Alternative SIB-3 would pass through a tunnel under the majority of the park until it reaches Smith Cove Station north of the park. There would be some tree and vegetation removal for the tunnel portal in the northern area of the park.

Preferred Alternative SIB-1 would avoid impacts to the Southwest Queen Anne Greenbelt. Alternatives SIB-2 and SIB-3 would both require retained-cut sections in the greenbelt. These cuts would reduce forested wildlife habitat and introduce train noise that could affect wildlife species in the greenbelt. Alternative SIB-3 would have the greatest impacts to the greenbelt because it would be farther east into the greenbelt and would have a longer length of retained cut.

Preferred Alternative SIB-1 and Alternative SIB-3 would shade the slope on the western edge of the Interbay Golf Center that is currently covered in Himalayan blackberry. A row of deciduous trees along the boundary of the Interbay Athletic Complex would also be removed, thus reducing habitat for birds in the area. Table 4-11 provides a summary of the South Interbay Segment's impacts on greenbelt habitat.

Interbay/Ballard Segment

All Build Alternatives in the Interbay/Ballard Segment would pass through industrial and dense residential areas. Impacts to upland habitat along this segment would consist of the removal of street trees and urban vegetation.

Table 4-11. Summary of Impacts to Upland Priority Habitat, South Interbay Segment

Alternative	Alternative Identification	Biodiversity Area Long-term Impacts (acres) [a]	Biodiversity Area Construction Impacts (acres) [a, b]
Preferred Galer Street Station/Central Interbay	SIB-1	<0.1	<0.1
Prospect Street Station/15th Avenue	SIB-2	3.7 to 3.8	0.3 to 0.5 [c]
Prospect Street Station/Central Interbay	SIB-3	5.5	0.7

[a] Includes both areas where vegetation would be changed by project features and areas that would be shaded under elevated guideway.

[b] Construction impacts represent areas temporarily impacted by the project, outside of the long-term project footprint.

[c] This range reflects differences from connecting to different alternatives in adjacent segments.

Construction Impacts

SODO, Chinatown-International District, and Downtown Segments

The Chinatown-International and Downtown segments would be tunneled and only affect street trees where the construction requires cut-and-cover techniques; these trees may need to be removed during construction and would be replaced after construction. The SODO Segment is primarily paved, urban habitat with little vegetation aside from street trees. Construction would not impact falcons nesting on downtown buildings.

South Interbay Segment

Table 4-10 compares the Build Alternatives' construction impacts along the South Interbay Segment. Construction would take place in Kinnear Park for all three Build Alternatives; construction impacts would be restricted to the park's southwest edge, where there would be minimal change to existing vegetation. Alternative SIB-3 would construct a tunnel under the park before transitioning from a tunnel portal to a retained cut at the north end. The tunnel would require a limited area of cut-and-cover construction in the park, which would remove trees and vegetation.

Alternatives SIB-2 and SIB-3 would pass through portions of the Southwest Queen Anne Greenbelt. Construction would require removing trees and other vegetation, and wildlife would be disturbed by construction noise. Slope drains would be installed beneath the surface of the Queen Anne hillside to dewater and stabilize the hillside. The drain installation points could require some vegetation and soil disturbance along the toe of the slope, where they would initially be only 5 feet to 10 feet underground. However, these drain installations would not impact greenbelt vegetation farther upslope because they would be installed by directional drilling from the bottom of the slope.

Preferred Alternative SIB-1 and Alternative SIB-3 both would have construction impacts to managed vegetation along the Interbay Golf Center and Interbay Athletic Complex. Alternative SIB-2 would avoid impacts to the athletic complex and the west side of the golf center but would require construction along the eastern edge of the Interbay Golf Center and Interbay P-Patch Community Garden in areas with street trees and mowed lawn.

Both Alternatives SIB-2 and SIB-3 would have construction footprint boundaries that might overlap a heritage tree (black cottonwood) within the Southwest Queen Anne Greenbelt; if

determined to be a hazard tree, this tree would need to be removed. Preferred Alternative SIB-1 would avoid this impact.

Interbay/Ballard Segment

The Interbay/Ballard Segment's construction impacts to upland habitat would require removing or replacing some street trees and urban vegetation. No heritage trees would be affected, nor would trees within the shoreline vegetation at the Seattle Maritime Academy. However, birds such as great blue herons, shorebirds, raptors, and migratory songbirds using Seattle Maritime Academy's cove area as well as purple martins using the nest boxes at the 11th Avenue Street-end could be disturbed by noise during construction of Preferred Alternative IBB-1a and Option IBB-1b.

Indirect Impacts

Indirect impacts to upland habitat and wildlife would be limited because the Ballard Link Extension study area is already densely developed. Indirect impacts common to all Build Alternatives (potential spread of noxious weeds, potential to improve vegetation conditions in restored area) would be similar to those under the West Seattle Link Extension. Where areas of the Southwest Queen Anne Greenbelt or Kinnear Park would be disturbed during construction, native vegetation would be used to revegetate the area, limiting the project's potential to spread non-native weeds. In the greenbelt, this would be a likely improvement on the dominant non-native herbaceous and shrub cover.

The introduction of light rail transit to the area could result in a slight reduction in current motor vehicle traffic and a slowdown of growth in the region's motor vehicle traffic over the long term. This effect in turn would slightly decrease (in the short term) or slow the increase (in the long term) of the expected automotive emissions and pollutant-laden stormwater runoff associated with increased traffic under the No Build Alternative.

The presence of a guideway through the West Seattle Greenbelt under Alternatives SIB-2 and SIB-3 would create noise and motion within the West Seattle Greenbelt that could influence the movements of local wildlife using the greenbelt. This wildlife is already habituated to an urban environment, and these effects are expected to be minimal. Guideway built within the greenbelt or along the Interbay Golf Center could influence the selection of future locations of restoration work, should those occur.

4.2.2.4 Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance

Long-Term Impacts

SODO, Chinatown-International District, and Downtown Segments

There would be no species of concern or listed species present within the SODO, Chinatown-International District, and Downtown segments because these species and their habitats do not occur in the study area. One pair of peregrine falcons are known to use downtown buildings for nesting; the type of tall buildings the falcons use would not be removed for the Ballard Link Extension.

South Interbay Segment

Upland species of concern such as pileated woodpecker could be present in the South Interbay Segment. As described in Section 4.2.4, Upland Habitat and Species, some alternatives would impact the Southwest Queen Anne Greenbelt where trees and shrubs would be removed, and

the current greenbelt changed to elevated or retained-cut guideway. This could reduce the habitat of priority species using this area. Table 4-11 presents specific impacts by alternative.

Interbay/Ballard Segment

As described in Section 4.2.3, Aquatic Habitat and Species, Preferred Alternative IBB-1a, Option IBB-1b, and Alternative IBB-3 would have long-term impacts to the aquatic environment of Salmon Bay. These waters are the home of several listed and priority fish species and contain critical habitat and essential fish habitat for fish species. Bridge guideway columns would cover or directly shade (via pile caps) up to 0.8 acre of benthic habitat that might currently be used by these listed fish species for foraging (Table 4-10). Bridge guideway columns built along the shoreline and pier-protection systems near the navigation channel could provide new barriers that could change the movement patterns of migrating salmonids, including young salmon sheltering in shallow waters during their passage out to Puget Sound. If used as part of the column construction, pile caps could create hard shade over water, which may reduce productivity in the shaded waters, or could provide new habitat for fish species such as smallmouth bass that prey on young salmonids. The bridge guideway is not expected to create hard shade over the water because the bridges would pass 70 feet (Alternative IBB-3) to 136 feet (Preferred Alternative IBB-1a and Option IBB-1b) over the navigation channel. The bridge is also not expected to change current conditions of water temperature in the bay.

New guideway columns and a new bridge would not directly conflict with current restoration plans for shoreline habitat in the bay. Where guideway columns would be placed partially on shore, their vertical structure would replace already armored shoreline in most cases, and the overall conditions and shoreline complexity would not change in these locations.

Alternative IBB-3 would require more bridge supports than Preferred Alternative IBB-1a and Option IBB-1b. The additional bridge guideway columns would remove more benthic habitat from Salmon Bay (Table 4-10). Preferred Alternative IBB-2a* and Preferred Option IBB-2b* would avoid all impacts to the critical fish habitat and essential fish habitat within the bay.

Construction Impacts

SODO, Chinatown-International District, and Downtown Segments

Construction noise along most of the Ballard Link Extension is not likely to disturb species of concern, as habitat for the species listed in Section 3.2.2, Aquatic Habitat and Species, and Section 3.3.3, Upland Habitat and Species, only occur in the greenbelt and in Salmon Bay within the study area. None of this habitat occurs in the SODO, Chinatown-International District, or Downtown segments. Any peregrine falcons nesting in Downtown Seattle would be habituated to city noise, and the additional WSBLE Project is not expected to affect their behavior. Construction of the Seattle Center Station entrance for Preferred Alternative DT-1 would impact part of Donnelly Gardens, which provides urban wildlife habitat next to the Seattle Repertory Theatre. Sound Transit would work with the Seattle Center to replace these functions following construction.

South Interbay Segment

Vegetation clearing could disturb and displace Washington Department of Fish and Wildlife priority species inhabiting the Southwest Queen Anne Greenbelt—such as pileated woodpecker—but these mobile species would be able to travel to and use other areas of the greenbelt during the construction period.

Interbay/Ballard Segment

Construction of Preferred Alternative IBB-1a or Option IBB-1b could place construction activities close enough to the Seattle Marine Academy's cove habitat to disturb great blue herons foraging in the area.

Section 4.2.2.2, Aquatic Habitat and Species, lists construction impacts to fish species, in general, in Salmon Bay. These same impacts would apply to listed species of fish and the critical habitat for salmonids in the bay. If a bridge alternative is constructed, in-water construction would directly affect listed species of fish in the waterway. Listed salmonids such as Chinook salmon, bull trout, or steelhead may change their behavior or be injured by in-water construction noise such as pile-driving. These species' ability to forage in the area could also be negatively affected by turbidity during the construction. The listed and sensitive fish species would also be excluded from foraging on benthic habitat within the cofferdams for the duration of construction in an area where this benthic area is listed critical habitat for several salmonid species. Shade or nighttime lighting from barges or work trestles may influence their behavior near the construction area (refer to Section 4.2.2.2, Aquatic Habitat and Species, for additional information). Best management practices would be employed to prevent project-related contaminants to enter the water; this would prevent the project from exacerbating the already-reduced water quality conditions in the bay.

Marbled murrelets could be in Salmon Bay during transits between their inland nesting habitat and marine foraging habitat. However, they are not likely to forage extensively there because they mainly forage in marine waters; therefore, they are unlikely to occur in Salmon Bay during project construction.

Indirect Impacts

In the Interbay/Ballard Segment, a few vegetated areas would be paved, which could increase stormwater flows in areas that directly discharge into Salmon Bay. This has the potential to transport contaminants to the critical fish habitat and essential fish habitat within the bay. These effects would be limited, as stormwater from all project-related impervious surfaces would receive appropriate flow control and water quality treatment. The Build Alternatives would be designed to meet standards of the City of Seattle and Ecology's *Stormwater Management Manual for Western Washington*.

As noted for aquatic habitat, under the bridge alternatives over Salmon Bay, guideway columns could cover benthic habitat and lead to some lost productivity. This in could in turn affect the availability of prey species for listed salmonids using the waterway; a change in distribution of the prey species could change the movement patterns of these predators. As noted under the long-term impact discussion, structures placed on the shoreline would prevent these specific areas from being considered for restoration into vegetated shoreline habitat or improved in the future, as part of salmon recovery efforts to improve habitat and decrease mortality of juvenile Chinook or steelhead passing through the bay.

4.2.2.5 Tribal Treaty Rights Impacts

The Muckleshoot Indian Tribe has treaty-protected rights to fish, hunt, and gather in their Usual and Accustomed Areas in the project corridor. These rights include the waters of Salmon Bay. The Tribe is also established as a co-manager of the salmon and steelhead harvest in the region. The Suquamish Tribe uses Salmon Bay to access its Usual and Accustomed Areas. Construction and long-term presence of guideway columns in the bay have the potential to change movements of adult salmonids or obstruct fishing activities. Tribal treaty-protected fishing rights of the Muckleshoot Indian Tribe may be temporarily affected by construction of all

bridge alternatives over Salmon Bay and could be permanently affected by guideway columns in the water. Tribal treaty-protected access to the Usual and Accustomed Areas of the Suquamish Tribe may be similarly affected. The tunnel alternatives would not impact Tribal treaty protected fishing activity or access.

4.3 Cumulative Impacts

Past projects have contributed to massive changes to the Duwamish River, including channelization for the Duwamish Waterway and development of Harbor Island and industrial properties on both sides of the waterway. Loss of estuarine habitat has occurred as tidelands were dredged and filled for industrial development, and also from construction of existing transportation structures, such as the Spokane Street Bridge and the West Seattle Bridge. Contamination of the waterway from adjacent industrial uses has also adversely affected habitat. Loss of aquatic habitat in Longfellow Creek has occurred from channelization, placement of the creek in culverts under roads and private properties, and encroachment of the stream buffer by development. Natural segments in the study area remain in very few places, such as the protected Longfellow Creek Natural Area. Upland forested habitat throughout the area has been highly fragmented through historical development, and large areas of continuous habitat have been maintained only in protected parks and greenbelts, such as the West Duwamish Greenbelt and the Southwest Queen Anne Greenbelt.

The Salmon Bay area has also been altered substantially by previous projects, including the Hiram M. Chittenden Locks, which raised the water level, and the Lake Washington Ship Canal, which connected Salmon Bay to Lake Union. To accommodate the maritime industry, shoreline habitats have been filled and modified in order to build piers, marinas and other maritime facilities. The Ballard Bridge also modified habitat in this area. Natural shoreline exists only in small pockets, such as the constructed cove and restoration area near Seattle Central College's Seattle Maritime Academy.

The WSBLE alternatives would generally have a low potential to adversely affect the viability of local wildlife populations because of the highly urbanized environment of the study area (see Section 3, Affected Environment). There are a few higher-value habitats that support native fish and wildlife species in the study area, including the Duwamish Waterway, West Duwamish Greenbelt, Longfellow Creek and its associated natural area, Kinnear Park, Southwest Queen Anne Greenbelt, and Salmon Bay. Two golf courses and some small residential parks also provide lower-quality habitat. Loss of higher-value upland habitat from some of the WSBLE Project alternatives would have a cumulative impact on overall loss of forested habitat in the city of Seattle, and would reduce the habitat available for some species, such as the great blue herons in the West Duwamish Greenbelt. These habitats also support several federally and state-listed endangered and threatened species and federal and state species of concern. Some reasonably foreseeable future actions could also contribute to cumulative impacts on terrestrial habitat by removing large trees and increasing the amount of impervious surface in the area. As urban development continues within the study area, changes to the landscape have the potential to further degrade or reduce the few remaining high-quality breeding/nesting and foraging habitats for resident and migratory species.

Some WSBLE alternatives would also result in impacts to aquatic habitat. Preferred Alternative DUW-1a and Alternative DUW-2 could be constructed with bridge types that would avoid in-water impacts to aquatic habitat in the Duwamish Waterway. Option DUW-1b could not be built in a way that would avoid in-water impacts and therefore could have a greater contribution to cumulative impacts to aquatic habitat than the other Duwamish Segment alternatives. All of the bridge alternatives in the Interbay/Ballard Segment would impact aquatic habitat in Salmon Bay.

Impacts from these WSBLE alternatives could contribute to cumulative impacts on the Duwamish Waterway and Salmon Bay when considered with past alterations and ongoing development in shoreline areas. The Muckleshoot Indian Tribe is signatory to both the Treaty of Point Elliott and the Treaty of Medicine Creek; the Muckleshoot Indian Tribe has treaty-protected fishing rights and Usual and Accustomed Areas in the Puget Sound region which includes the Duwamish Waterway and Salmon Bay. The Suquamish Tribe is signatory to the Treaty of Point Elliott and has treaty-protected fishing rights and Usual and Accustomed Areas in the Puget Sound region which includes the Duwamish Waterway and access to Usual and Accustomed Areas through Salmon Bay. Cumulative impacts to aquatic habitat could adversely affect Tribal treaty-protected fishing activity of the Muckleshoot Indian Tribe. Cumulative impacts to aquatic habitat could also adversely affect treaty-protected fishing activity of the Suquamish Tribe. Reasonably foreseeable future actions within the study area could incrementally contribute to the fragmentation, degradation, and/or loss of valuable aquatic habitats and adversely affect wildlife, including fish. Foreseeable future actions that will remove riparian habitat, disturb stream channels, or fill or alter wetland habitat could further impact these habitats. Federal, state, and local permitting requirements would require mitigation for these impacts, which would reduce the potential for cumulative impacts. Some future actions, such as the Waterfront Seattle and Pier 62/63 reconstruction, include components that will positively impact habitats through the creation of new greenspace or restoration of existing habitat in the study area.

Other state and local projects would also benefit terrestrial and aquatic habitat in the study area. Recently, the City of Seattle committed to increasing the city-wide tree canopy cover to 30 percent by 2037 and restoring 2,500 acres of forested parkland by 2025. Through the Green Seattle Partnership, there are active restoration programs within the Longfellow Creek watershed, which remove invasive plants and restore native species. The City has also purchased property to upgrade Duwamish Waterway Park and, through partners, is restoring wetlands in the Delridge neighborhood. These efforts actively work to preserve and enhance existing habitats within the study area, and the WSBLE Project would support those goals by encouraging concentrated development away from these areas and within designated urban centers, thereby reducing the effects of development on existing habitats and resulting in a beneficial cumulative impact for species within the study area. Overall, the potential for cumulative impacts on ecosystems from the project is expected to be minor after mitigation.

Federal, state, and local regulations require the WSBLE Project and other reasonably foreseeable future actions to mitigate any permanent impacts on streams, wetlands, and other high-value habitats. The Washington State Department of Fish and Wildlife and the Washington Hydraulic Code require mitigation for and minimization of any adverse impacts on fish and/or their habitats. In concurrence with the code, any new or replaced culverts must also be designed so as to not impede fish passage. The project would provide water quality treatment for pollution-generating impervious surfaces that are rebuilt as part of the project. Some of these surfaces do not currently receive any treatment; therefore, the project would benefit the water quality of waterbodies in the area and the aquatic habitat in those waterbodies. In addition, Sound Transit's policy on ecosystem mitigation is to avoid impacts on environmentally sensitive resources as much as possible, and to provide adequate mitigation for unavoidable impacts to ensure no net loss of ecosystem function and acreage as a result of agency projects. Possible mitigation measures include restoration or enhancement of degraded streams, wetlands, and wetland buffers; removal of fish passage barriers; and planting disturbed areas with native vegetation. Where instituted, these measures would provide cumulative benefits to fish, wildlife, and their habitats.

Construction associated with all reasonably foreseeable future actions, including the WSBLE Project, would contribute to temporary habitat loss resulting from vegetation removal for construction staging areas and access. Although erosion and sedimentation could temporarily affect water quality in waterbodies, all projects would be required to comply with permit conditions as well as erosion, sedimentation, stormwater pollution, and water quality plans/protections during construction, which would prevent those impacts. Wildlife within the study area is regularly exposed to the noise associated with a highly urbanized environment, and it is unlikely wildlife would experience much, if any, adverse effects related to construction noise. Following construction, cleared areas would be revegetated and all areas would be restored to pre-construction conditions, where possible, thereby reducing any long-term cumulative construction effects. In-water construction activities could contribute to a cumulative impact on aquatic species related to ongoing disruption if other in-water projects are under construction nearby at the same time, or if they are constructed consecutively. Sound Transit would coordinate with the appropriate regulatory agencies during the permitting process to minimize these potential impacts during construction.

5 MITIGATION MEASURES

Sound Transit's policy on ecosystem mitigation is to avoid impacts on environmentally sensitive resources, and to provide adequate mitigation for unavoidable impacts to ensure no net loss of ecosystem function and acreage as a result of agency projects.

Mitigation for ecosystem impacts is based on a hierarchy of avoiding, minimizing, and compensating for unavoidable impacts. The design of the WSBLE Project already incorporates avoidance and minimization techniques. For example, potential bridge designs are being evaluated to minimize placing guideway columns in the water, and project siting avoids placing project elements in or near wetlands or streams where possible. Further avoidance and minimization measures would continue to be pursued as the project enters final design and permitting stages.

To the extent that impacts could not be avoided, Sound Transit would provide compensatory mitigation to achieve no net loss of ecosystem function. This may occur for impacts to greenbelt acreage, wetlands, or benthic habitat in waterways. Sound Transit would comply with all applicable laws. Wherever it is practical, mitigation sites would be placed close to the actual impacts, to compensate in-kind for the lost functions or values.

5.1 Wetlands

5.1.1 Avoidance and Minimization

Avoidance and minimization measures specific to wetlands could include the following design features and construction actions:

- Siting guideway columns to avoid direct placement in wetlands, where possible.
- Minimizing the placement of construction staging areas in buffers, where possible. The construction contractor would work within construction limits marked with fencing and signage to prevent unintended impacts on riparian vegetation and wetlands.

5.1.2 Compensatory Mitigation

To the extent that impacts could not be avoided to wetlands, Sound Transit would provide compensatory mitigation to achieve no net loss of wetland function. For instance, replanting areas currently covered in invasive plants with native vegetation would improve the ability for these wetland buffers to support wildlife. The wetlands along Longfellow Creek could provide opportunities for mitigation where native plantings could improve buffer habitat. Native plantings or weed control in the Southwest Queen Anne Greenbelt could improve wetland buffer habitat where buffers are dominated by non-native plants or where ground cover is sparse.

Sound Transit plans to mitigate long-term impacts on wetlands using one or more of the following methods:

- Approved In-Lieu Fee program such as the King County Mitigation Reserves Program or mitigation bank such as the Port of Seattle mitigation bank (currently in review), if available. The Port's Wetland Mitigation and Habitat Conservation Umbrella Bank Prospectus lists two proposed mitigation sites within about 0.5 mile of all Duwamish Segment alternatives' bridge impacts (Terminal 25 and Terminal 105), and two additional sites about 0.5 mile south of Option DUW-1b, Terminal 107 and Terminal 108 (Port of Seattle and Anchor QEA 2019).
- Advance offsite compensatory mitigation.

- Project-specific mitigation developed by Sound Transit and approved by appropriate regulatory agencies.

Sound Transit would implement compensatory mitigation in accordance with applicable federal, state, and local requirements and guidelines. To the extent practical, wetland mitigation sites would be identified close to impacts and compensated in-kind for lost values. Sound Transit would determine final mitigation actions during final design and permitting.

5.2 Aquatic Resources

5.2.1 Avoidance and Minimization

Avoidance and minimization measures specific to aquatic resources could include the following design features and construction actions:

- Avoiding direct impacts to Longfellow Creek by routing the elevated guideway over culverted areas of the creek.
- Siting guideway columns to avoid direct impacts to shorelines, where practical.
- Pursuing bridge design options that minimize permanent impacts to the waterway.
- Designing stormwater treatment facilities and flow-control measures to minimize impacts on stream water quality and flow or flow to larger waterways (see Appendix L4.8, Water Resources Technical Report). Stormwater flow control might use detention or infiltration facilities such as vaults, or water quality treatment using bioretention or media filter vaults.
- Minimizing construction staging areas in stream buffers or shorelines.
- Directing nighttime construction lighting away from Longfellow Creek or other waterways to avoid possibly altering the migratory behavior of fish or predation rates of juveniles.

In-water work would also be scheduled to occur during the work windows established by U.S. Army Corps of Engineers and Washington Department of Fish and Wildlife in the Duwamish Waterway and Salmon Bay. Use of these windows would minimize the effects on salmonids, especially during the construction and operation of cofferdams. In-water work in the Duwamish Waterway would also include complying with the Marine Mammal Protection Act; this may entail monitoring for these animals during construction to avoid harassment or injury, and using equipment such as bubble curtains around pile-driving to reduce noise by several decibels. Specialized construction techniques would be required during any sediment disturbance in the Duwamish Waterway, such as allowing water discharged from dewatering activities to reduce sediments before their release to an approved outlet or facility, which would avoid resuspending contaminants from the Harbor Island Superfund site.

5.2.2 Compensatory Mitigation

Sound Transit would provide mitigation for unavoidable impacts to benthic habitat, streams, and stream buffers protected under federal, state, and local regulations. This mitigation would address permanent impacts, as well as temporary impacts as required.

Compensatory mitigation within the watershed may be available via a mitigation bank being established by the Port of Seattle (the Umbrella Wetland Mitigation and Habitat Conservation Bank); this mitigation bank would allow mitigation credits to be purchased that would offset environmental impacts within Water Resources Inventory Area 9 (Port of Seattle and Anchor QEA 2019). Potential mitigation sites the Port may establish for the bank are listed in

Section 5.1.2. With the exception of the Duwamish Waterway and Salmon Bay, the project design would avoid impacts on existing streams. The appropriate permitting agencies and jurisdictions would approve mitigation for impacts on shorelines and benthic habitat prior to construction.

Improving stream habitat and riparian function by replanting affected areas with native vegetation could mitigate some unavoidable impacts on stream riparian areas. Replanting near shorelines could also improve conditions for juvenile salmonids in the Duwamish Waterway. Such actions would improve the ability of these mitigation areas to support wildlife. For instance, restoration work in the wetlands in the Longfellow Creek Natural Area could improve over-water shade to the creek, thus improving fish habitat.

5.3 Upland Vegetation and Wildlife Resources

5.3.1 Avoidance and Minimization

Avoidance and minimization measures specific to upland resources could include the following design features and construction actions:

- Avoiding impacts to greenbelts where possible.
- Minimizing the placement of construction staging areas in forested areas where possible.
- Replanting cleared areas and implementing best management practices to minimize the risk of introducing or spreading invasive species.
- Reducing use of herbicides and fertilizers when restoring disturbed areas by using mulching, ground cover, and other planting strategies that discourage growth of undesirable species.
- Restricting clearing activities to outside the active bird nesting period, to the extent possible, to comply with the Migratory Bird Treaty Act, administered by the U.S. Fish and Wildlife Service. If avoidance scheduling is infeasible, Sound Transit would work with staff at the U.S. Fish and Wildlife Service to conduct pre-construction surveys to determine presence or absence of nesting migratory birds and assist Sound Transit in complying with the Migratory Bird Treaty Act.
- Minimizing tree removal along the corridor, where practical, and coordinating with the City of Seattle to minimize tree removal while also minimizing impacts on safety.

Work within the great blue heron management zone would require development of and adherence to a habitat management plan in coordination with City of Seattle, Washington Department of Fish and Wildlife, and U.S. Fish and Wildlife Service. Because this species is protected by the state, the City of Seattle requires a management plan that normally includes a year-round, 197-foot-radius buffer around nesting colonies, with an additional 300-foot buffer during the nesting season (February 1 through August 31). This management plan may include a variety of measures such as retaining trees to screen the colony, work sequencing in the buffers, preventing specific loud activities during the nesting season, monitoring during nesting season, or other measures as developed in coordination with Washington Department of Fish and Wildlife and the City of Seattle.

5.3.2 Compensatory Mitigation

To the extent that impacts cannot be avoided to greenbelt acreage, Sound Transit would provide compensatory mitigation to achieve no net loss of ecosystem function. Sound Transit

would mitigate for impacts on forested vegetation using applicable policy and regulations and would coordinate with the City of Seattle on tree replacement requirements.

5.4 Federally Listed Species, Species of Concern, Priority Species, and Species of Local Importance

5.4.1 Avoidance and Minimization

Avoidance and minimization measures for listed and sensitive species are covered in Sections 5.2, Aquatic Resources, and 5.3, Upland Vegetation and Wildlife Resources. These measures would fulfill key elements of recovery plans for Chinook salmon and steelhead (such as preserving water quality through stormwater control, preventing changes to water quality during construction in the Duwamish Waterway and Salmon Bay, and preserving salmon habitat in Longfellow Creek through avoiding in-water impacts).

5.4.2 Compensatory Mitigation

To the extent that impacts cannot be avoided to benthic habitat or shoreline habitat, or to greenbelt acreage used by priority species, Sound Transit would provide compensatory mitigation to achieve no net loss of ecosystem function, or to improve upon baseline conditions. This mitigation would address both permanent and temporary impacts, as required. Compensatory mitigation for benthic or shoreline impacts would be planned to address limiting factors for salmon listed in the Chinook and steelhead recovery plans for the Duwamish Waterway, Longfellow Creek, and Salmon Bay/Lake Washington Ship Canal. Sound Transit would determine final mitigation actions in coordination with the Muckleshoot Indian Tribe, the Suquamish Tribe, and with federal, state, and local resource agencies during final design and permitting, as appropriate.

6 REFERENCES

Audubon Society. 2018. Database search of Christmas Bird Count data for the Seattle survey area, 2008-2018. http://netapp.audubon.org/CBCObservation/Historical/ResultsByCount.aspx. Accessed November 4, 2019.

Azerrad, J.M. 2012. *Great Blue Heron (*Ardea herodias*). Management Recommendations for Washington's Priority Habitats and Species*. Washington Department of Fish and Wildlife. March. https://wdfw.wa.gov/sites/default/files/publications/01371/wdfw01371.pdf.

Brinson, M.M. 1993. *A Hydrogeomorphic Classification for Wetlands.* Wetlands Research Program Technical Report WRP-DE-4. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Camp, P., and J. Gamon (eds). 2011. *Field Guide to the Rare Plants of Washington*. University of Washington Press. Seattle, Washington.

Carlson, B.A., and E.B. McLean. 1996. Buffer Zones and Disturbance Types as Predictors of Fledging Success in Great Blue Herons, *Ardea herodias*. *Colonial Waterbirds* 19: 124 to 127.

Celedonia, M.T., R.A. Tabor, S. Sanders, S. Damm, D.W. Lantz, T.M. Lee, Z. Li, B.E. Price, W. Gale, and K. Ostrand. 2009. *Movement and Habitat Use of Chinook Salmon Smolts, Northern Pikeminnow and Smallmouth Bass Near the SR 520 Bridge, 2008 Acoustic Tracking Study*. U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office, Fisheries Division, Lacey, Washington.

City of Seattle. 2007. *State of the Waters 2007 Report: Volume 1, Seattle Watercourses*.

City of Seattle. 2008. Director's Rule 16-2008: Designation of Exceptional Trees. City of Seattle – Department of Planning and Development. http://www.seattle.gov/dpd/codes/dr/DR2008-16x.pdf.

City of Seattle. 2018a. Personal communication between Sound Transit and Maggie Glowacki at the City of Seattle. Re: City maps of wetland mitigation sites in the WSBLE vicinity.

City of Seattle. 2018b. Seattle Department of Construction & Inspections GIS. http://seattlecitygis.maps.arcgis.com/apps/webappviewer/index.html?id=f822b2c6498c4163b0cf908e2241e9c2.

City of Seattle. 2018c. Director's Rule 13-2018: Great Blue Heron Management. City of Seattle – Department of Construction and Inspections (SDCI). http://web6.seattle.gov/DPD/DirRulesViewer/Rule.aspx?id=13-2018.

City of Seattle. 2019a. Seattle Open Data. Accessed February 2020. https://data.seattle.gov/.

City of Seattle. 2019b. Street Tree Inventory Map. Seattle Department of Transportation. http://www.seattle.gov/transportation/projects-and-programs/programs/trees-and-landscaping-program/seattle-tree-inventory-map. Accessed February 2020.

City of Seattle. 2020a. Shoreline Street Ends Program. Seattle Department of Transportation. http://www.seattle.gov/transportation/projects-and-programs/programs/public-space-management-programs/shoreline-street-ends. Accessed March 2020

City of Seattle. 2020b. Ship Canal Water Quality Project. Seattle Public Utilities. https://spushipcanal.participate.online/. Accessed July 2020.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States.* FWS/OBS-70/31. U.S. Fish and Wildlife Service. Washington, D.C.

Elliott Bay Trustees (National Oceanographic and Atmospheric Administration, U.S. Department of the Interior, State of Washington, Suquamish Tribe, and the Muckleshoot Indian Tribe). 2019. *Lower Duwamish River Natural Resource Damage Assessment: Injury Assessment Plan*. Prepared by Industrial Economics, Inc. March.

Green Seattle Partnership. 2019. *Habitat Highlight: Longfellow Creek*. https://www.greenseattle.org/habitat-highlight-longfellow-creek/. Accessed December 2019.

Green Seattle Partnership. 2020. GSP Reference Map. GIS Data Layer. https://www.greenseattle.org/information-for/forest-steward-resources/gsp-restoration-map/. Accessed January 2020.

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

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

Jacobs Engineering Group. 2019. Memorandum from Rose Whitson, Biologist, to Alisa Swank, Corridor Environmental Manager, re: Great Blue Heron Rookery Site Visit Summary. June 20.

Johnson, D.H., and T.A. O'Neil. 2001. *Wildlife-habitat Relationships in Oregon and Washington*. Oregon State University Press. Corvallis, Oregon.

Kerwin, J. 2001. *Salmon and Steelhead Habitat Limiting Factors Report for the Cedar-Sammamish Basin* (*Water Resource Inventory Area 8*). Report prepared for the Washington Conservation Commission. Olympia, Washington. September.

Kerwin, J., and Nelson, Tom S. (Eds.). December 2000. *Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound streams-data (Water Resource Inventory Area 9 and Vashon Island)*. Washington Conservation Commission and the King County Department of Natural Resources.

King County. 2016a. *Stream Report – Longfellow Creek*. https://green2.kingcounty.gov/streamsdata/watershedinfo.aspx?locator=J370. Accessed September 2019.

King County. 2016b. Water Quality Index for Stream and Rivers. WY2018:Oct17-Sept18. November 2.

King County. 2019a. King County iMap. Database and mapping application. https://www.kingcounty.gov/services/gis/Maps/imap.aspx. Accessed on January 2020.

King County. 2019b. King County Noxious Weed List. https://www.kingcounty.gov/services/environment/animals-and-plants/noxious-weeds/laws/list.aspx. Accessed December 3, 2019.

King County Department of Natural Resources. 2000. Literature Review and Recommended Sampling Protocol for Bull Trout in King County. Seattle, WA. Final Draft. June 12. https://your.kingcounty.gov/dnrp/library/2000/kcr848.pdf.

King County and the Washington State Conservation Commission. 2000. Habitat Limiting Factors and Reconnaissance Report: Green/Duwamish and Central Puget Sound Watersheds. December 2000. https://www.govlink.org/watersheds/9/reports/Recon.aspx. Accessed July 2020.

McMillan, B. 2007. *The Spawning Survey Findings from Seattle's Thornton, Piper's, Longfellow, Fauntleroy and Taylor Creeks, September 21, 2006 to January 24, 2007*. Also including the cumulative spawning survey data from 1999 to 2006 and Des Moines Creek in 2003 and 2004. Prepared by the Wild Fish Conservancy for Seattle Public Utilities. April.

National Land Cover Database. 2016. *Multi-Resolution Land Characteristics Consortium*. https://www.mrlc.gov/national-land-cover-database-nlcd-2016. Data accessed January 2020.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 1991. Recovery Plan for the Humpback Whale (*Megaptera novaeangliea*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. https://repository.library.noaa.gov/view/noaa/15993.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 1997. *Status Review of Sockeye Salmon from Washington and Oregon.* NOAA-NMFS-NWFSC Technical Memorandum 33. https://repository.library.noaa.gov/view/noaa/3033. Accessed August 2020.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2007. Puget Sound Salmon Recovery Plan. Submitted by the Shared Strategy Development Committee. Plan adopted by the National Marine Fisheries Service (NMFS) January 19, 2007. https://repository.library.noaa.gov/view/noaa/16005.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2008. Recovery Plan for Southern Resident Killer Whales (*Orcinus orca*). January 17, 2008. National Marine Fisheries Service, Northwest Region, Seattle, WA. https://www.fisheries.noaa.gov/resource/document/recovery-plan-southern-resident-killer-whales-orcinus-orca.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2011. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Section 7(a)(2) "Not Likely to Adversely Affect" Determination, Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation. SR 520 Bridge Replacement Project. NMFS Consultation Number: 2010/05723. May 20, 2011.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2013. *Final Lower Duwamish River NRDA Restoration Plan and Programmatic Environmental Impact Statement*. Prepared by the National Oceanic and Atmospheric Administration on behalf of the Lower Duwamish River Natural Resource Damage Assessment Trustee Council. June 2013.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2016. Draft Recovery Plan for Puget Sound/Georgia Basin Yelloweye Rockfish and Bocaccio. https://www.fisheries.noaa.gov/action/draft-recovery-plan-puget-sound-georgia-basin-yelloweye-rockfish-and-bocaccio. August.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2018. Protected Resources App, v1.0. West Coast Region. https://www.webapps.nwfsc.noaa.gov/portal/apps/webappviewer/index.html?id=7514c715b8594944a6e468dd25aaacc9. Accessed February 2020.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2019a. ESA Recovery Plan for the Puget Sound Steelhead Distinct Population Segment (*Onchorynchus mykiss*). National Marine Fisheries Service. Seattle, WA. https://www.fisheries.noaa.gov/resource/document/esa-recovery-plan-puget-sound-steelhead-distinct-population-segment-oncorhynchus.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2019b. *Essential Fish Habitat Mapper*. https://www.habitat.noaa.gov/application/efhmapper/index.html.

National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries). 2019c. Critical Habitat – Salmon and Steelhead (all West Coast). Maps and GIS data.

Noxious Weed Control Board. 2019. *Noxious Weed List for Washington State*. https://www.nwcb.wa.gov/.

Null, W.S., G. Skinner, and W. Leonard. 2000. Wetland functions characterization tool for linear projects. Washington State Department of Transportation, Environmental Affairs Office, Olympia, Washington.

Opperman, H., K.M. Cassidy, T. Aversa, E.S. Hunn, and B. Senturia. 2006. *Sound to Sage: Breeding Bird Atlas of Island, King, Kitsap, and Kittitas Counties, Washington*. Seattle Audubon Society. Version 1.1. http://www.soundtosage.org. September.

Orca Network. 2021. Whale Sighting Reports. https://www.orcanetwork.org/Main/index.php?categories_file=Sightings. Accessed October 27, 2021.

Port of Seattle and Anchor QEA. 2019. *Wetland Mitigation and Habitat Conservation Umbrella Bank Prospectus*. June.

Salmon Conservation and Restoration. 2019. Watershed Search webpage. https://www.govlink.org/watersheds/default.aspx. Accessed December 2019.

Scholz, N.L., M.S. Myers, S.G. McCarthy, J.S. Labenia, J.K. McIntyre, G.M. Ylitalo, L.D. Rhodes, C.A. Laetz, C.M. Stehr, B.L. French, B. McMillan, D. Wilson, L. Reed, K.D. Lynch, S. Damm, J.W. Davis, and T.K. Collier. 2011. *Recurrent die-offs of adult coho salmon returning to spawn in Puget Sound lowland urban streams*. PLoS One. 2011; 6(12). December 4. https://pubmed.ncbi.nlm.nih.gov/22194802/.

Simenstad, C.A., K.L. Fresh, and E.O. Salo. 1982. The role of Puget Sound and Washington coastal estuaries in the life history of Pacific salmon: an unappreciated function. In: Kennedy, V.S. (ed.), *Estuarine Comparisons*. Academic Press, New York, NY, pp. 343 to 364.

Simenstad, Charles A., Barbara J. Nightingale, Ronald M. Thom, and David K. Shreffler. 1999. Impacts of Ferry Terminals on Juvenile Salmon Migrating along Puget Sound Shorelines Phase I: Synthesis of State of Knowledge. https://www.wsdot.wa.gov/research/reports/fullreports/472.1.pdf. June.

Sound Transit. 2016. *Sound Transit 3: The Regional Transit System Plan for Central Puget Sound.* Adopted June 23, 2016. http://soundtransit3.org/document-library. Accessed December 2019.

Sound Transit. 2018. Meeting Summary. Memo summarizing meeting on July 12, 2018 between Sound Transit representatives, Jim Muck of U.S. Fish and Wildlife Service and Scott Anderson of NOAA Fisheries. Re: USFWS and NOAA Fisheries coordination to get input on the alternatives being studied during the Alternatives Development Phase (2017 to 2019).

Sound Transit. 2020. Meeting Summary. Memo summarizing meeting on January 28, 2020 between Sound Transit representatives and Chris Anderson and Laura Arber of Washington Department of Fish and Wildlife. Re: coordinating on the heron colony and falcon eyrie in the West Seattle Link Extension study area.

Spromberg, J., and N. Scholtz. 2011. Estimating the Future Decline of Wild Coho Salmon Populations Resulting from Early Spawner Die-Offs in Urbanizing Watersheds of the Pacific Northwest, USA. *Integrated Environmental Assessment and Management* 7:4 pp. 648-656. National Marine Fisheries Service, Seattle, WA.

Tabor, R.A., G.S. Brown, and V.T. Luiting. 2011. The effect of light intensity on sockeye salmon fry migratory behavior and predation by Cottids in the Cedar River, Washington. *North American Journal of Fisheries Management*. January.

Tabor, R.A., D.W. Lantz, and S.T. Sanders. 2010. *Distribution and Habitat Use of Fish in Seattle's Streams*. Final Report, 2005 and 2006. U.S. Fish and Wildlife Service, Washington Fish and Wildlife Office. Lacey, Washington. https://www.fws.gov/wafwo/fisheries/publications/distributionandhabitatuseoffishinseattlesstreams.pdf.

Tabor, R.A., and R.M. Piaskowski. 2002. *Nearshore Habitat Use by Juvenile Chinook Salmon in Lentic Systems of the Lake Washington Basin*. U.S. Fish and Wildlife Service, Western Washington Fish and Wildlife Office, Lacey, Washington.

Urban Raptor Conservancy. 2019. Urban Raptor Conservancy Annual Report. https://urbanraptorconservancy.org/reports. December.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1952. *Soil Survey, King County, Washington*. https://www.nrcs.usda.gov/Internet/FSE_MANUSCRIPTS/washington/kingWA1952/kingWA1952.pdf.

U.S. Fish and Wildlife Service. 1997. *Recovery Plan for the Threatened Marbled Murrelet (*Brachyramphus marmoratus*) in Washington, Oregon and California*. Portland, OR. https://www.fws.gov/carlsbad/SpeciesStatusList/RP/19970924_RP_MAMU.pdf.

U.S. Fish and Wildlife Service. 2015. Recovery Plan for the Coterminous United States Population of Bull Trout (Salvelinus confluentus). Portland, Oregon. September 2015. https://www.fws.gov/pacific/bulltrout/pdf/Final_Bull_Trout_Recovery_Plan_092915.pdf.

U.S. Fish and Wildlife Service. 2017. Final critical habitat for threatened and endangered species GIS data. Environmental Conservation Online System. Updated September 12.

U.S. Fish and Wildlife Service. 2018. National Wetlands Inventory. Wetlands Mapper. Online database. https://www.fws.gov/wetlands/data/Mapper.html. Accessed April 30, 2018.

U.S. Fish and Wildlife Service. 2019. *Endangered Species List for King County*. https://www.fws.gov/endangered/. Accessed September 2019

U.S. Army Corps of Engineers. 1987. *Corps of Engineers Wetland Delineation Manual*.

U.S. Army Corps of Engineers. 2010. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Version 2.0). U.S. Army Engineer Research and Development Center. Vicksburg, Mississippi.

Vennesland, R.G., and D.M. Norman. 2006. *Survey Protocol for Measurement of Nesting Productivity at Pacific Great Blue Heron Nesting Colonies*. Heron Working Group. November.

Washington Department of Fish and Wildlife. 2018a. *Priority Habitats and Species*, SWIFD and SASI data. Washington Department of Fish and Wildlife provided to Jacobs Engineering on CD Disk.

Washington Department of Fish and Wildlife. 2018b. *Statewide Washington Integrated Fish Distribution*. Digital Data. http://geo.wa.gov/datasets/wdfw::statewide-washington-integrated-fish-distribution.

Washington Department of Fish and Wildlife. 2019a. *Priority Habitats and Species: Maps*. An interactive map of Washington Department of Fish and Wildlife Priority Habitats and Species information for project review. http://wdfw.wa.gov/mapping/phs/.

Washington Department of Fish and Wildlife. 2019b. SalmonScape. Online database. http://apps.wdfw.wa.gov/salmonscape/map.html. Accessed October 2020.

Washington Department of Natural Resources. 2019. *Natural Heritage Program. Database*. https://data-wadnr.opendata.arcgis.com/. Accessed October 2019.

Washington State Department of Ecology (Ecology). 2012. *Stormwater Management Manual Western Washington, Volumes I – V*. Publication Number 12-10-030. Prepared by Washington State Department of Ecology Water Quality Program. Olympia, Washington. August.

Washington State Department of Ecology (Ecology). 2014. *Washington State Wetland Rating System for Western Washington*. Publication 14-06-029. https://fortress.wa.gov/ecy/publications/documents/1406029.pdf. October.

Washington State Department of Ecology (Ecology). 2019. *Water Quality Atlas*. 303(d) listed waters data and maps. https://fortress.wa.gov/ecy/waterqualityatlas/map.aspx?CustomMap=y&RT=0&Layers=23,29&Filters=n,n,n,n.

Washington State Department of Ecology (Ecology), U.S. Army Corps of Engineers Seattle District, and U.S. Environmental Protection Agency Region 10. 2006. *Wetland Mitigation in Washington State – Part 1: Agency Polices and Guidance (Version 1) and Part 2: Developing Mitigation Plans (Version 1).* Washington State Department of Ecology Publication #06-06-011a and b. Olympia, Washington. March.

Washington State Department of Transportation (WSDOT). 2006. Impacts of Ferry Terminals on Juvenile Salmon Movement along Puget Sound Shorelines. Project Number 46820. Battelle Memorial Institute, Pacific Northwest Division. https://www.wsdot.wa.gov/research/reports/fullreports/648.1.pdf.

Washington State Department of Transportation (WSDOT). 2009. Ecosystems Discipline Report. SR 520, I-5 to Medina Bridge: Replacement and HOV Project. Supplemental Draft Environmental Impact Statement and Section 4(f)/6(f) Evaluation. SR 520 Bridge Replacement and HOV Program. WSDOT, Olympia, WA. December 2009.

Williams, R.W., R.M. Laramie, and J.J. Ames. 1975. *A Catalog of Washington Streams and Salmon Utilization, Volume 1, Puget Sound Region*. Washington Department of Fisheries. Olympia, Washington.

Windward Environmental LLC. 2010. *Lower Duwamish Waterway Remedial Investigation Report, Final*. For submittal to the U.S. Environmental Protection Agency and Washington State Department of Ecology. July 9.

WRIA 8 Salmon Recovery Council. 2017. Lake Washington/Cedar/Sammamish Watershed 2017 Chinook Salmon Conservation Plan Update. https://www.govlink.org/watersheds/8/reports/chinook-plan-update.aspx.

GIS References

City of Seattle. 2019. Seattle GIS Data. Data for city boundaries, zoning, land use (existing and future), Seattle transportation network, streetcar line, parks resources, railroad, storm sewer, utilities (stormwater), environmental considerations application (ECA), shorelines and related infrastructure. https://data-seattlecitygis.opendata.arcgis.com/.

EagleView (formerly Pictometry). 2019. Aerial Imagery. https://www.eagleview.com/product/eagleview-reveal/. Accessed January 2020.

King County. 2019. King County GIS Data Portal. Data for aerial imagery, streets, tax parcels, building footprint, zoning, census data, city boundaries, parks and open spaces, transit facilities, slopes, wetlands, wellhead protection areas, streams, waterbodies. https://data.kingcounty.gov/.

Washington State Department of Fish and Wildlife. 2018. Priority Habitats and Species Data (PHS). Data obtained by request at habitatprogram@dfw.wa.gov.

United States Geological Survey (USGS). 2019. National Land Cover Data. https://www.usgs.gov/centers/eros/science/national-land-cover-database?qt-science_center_objects=0#qt-science_center_objects.

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Attachment N.4A
Ecosystems Technical Analysis Methodology

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Attachment N.4B
Wetland Determination Data Forms

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Attachment N.4C
Ecology Wetland Rating Forms

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Attachment N.4D
Ecosystem Photographs

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Attachment N.4E
Wetland and Stream Impacts within the Study Area

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Attachment N.4F
Best Management Practices for Ecosystems Resources

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