Appendix O

Biological Assessment

SOUNDTRANSIT
RIDE THE WAVE

Lynnwood Link Extension

Biological Assessment

Hydrologic Unit Code (HUC) 17110012 (Lake Washington-Sammamish River)

401 South Jackson Street
Seattle, WA 98104-2826

December 2014

North Corridor Transit Partners
PARAMETRIX + PARSONS BRINCKERHOFF

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Acronyms and Abbreviations

BA	biological assessment
BMPs	best management practices
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
dB	decibels
dBA	A-weighted decibels
DNR	Department of Natural Resources
DPS	distinct population segment
Ecology	Washington State Department of Ecology
EFH	essential fish habitat
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESU	evolutionarily significant unit
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
HPA	Hydraulic Project Approval
HUC	hydrologic unit code
I-5	Interstate 5
Leq	equivalent sound level
LID	low-impact development
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
PCBs	polychlorinated biphenyls
PGIS	pollutant-generating impervious surface
Services	NMFS and USFWS
Sound Transit	Central Puget Sound Regional Transit Authority
SPCC	spill prevention, control, and countermeasures
SR	State Route
TESC	temporary erosion and sediment control
USFWS	U.S. Fish and Wildlife Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resources Inventory Area
WSDOT	Washington State Department of Transportation

EXECUTIVE SUMMARY

The Central Puget Sound Regional Transit Authority (Sound Transit) is proposing to build and operate the Lynnwood Link Extension, which will expand the regional light rail system from Seattle to Lynnwood, Washington. The proposed project will be in the cities of Seattle and Shoreline in King County and in Mountlake Terrace and Lynnwood in Snohomish County. The light rail system will provide improved travel times and will increase transportation capacity in the heavily congested Interstate 5 (I-5) corridor. By 2035, approximately 68,000 transit trips are expected on the Lynnwood Link Extension each day, compared to about 34,000 trips using buses in the corridor north of Northgate if the project were not completed.

This biological assessment (BA) evaluates the potential effects of the Lynnwood Link Extension on listed species that might occur in the action area. The Lynnwood Link Extension will involve constructing approximately 8.5 miles of light rail from Seattle to Lynnwood. The proposed project includes guideways, stations, overhead electrification systems, traction power substations, parking structures, at-grade crossing improvements, modified roadways and interchanges, utilities, stormwater management facilities, and other associated new or modified structures to support the light rail system. The route is divided into the following three geographic segments:

- Segment A: Northgate to Shoreline
- Segment B: Shoreline to Mountlake Terrace
- Segment C: Mountlake Terrace to Lynnwood

Sound Transit has prepared this BA to facilitate consultation between the Federal Transit Administration (FTA) and the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) of 1973 (16 United States Code §§ 1531-1544). The primary federal nexus for this project is federal-aid funding provided by FTA, although other federal approvals by the Federal Highway Administration (for modifications to the Interstate system) and the U.S. Army Corps of Engineers are also anticipated. Project activities with the potential to affect ESA-listed animal species include those at locations where the elevated and at-grade alignment crosses streams or wetlands or their buffers. Listed species are not present at all stream crossings because, in most cases, fish access is blocked by impassable culverts downstream.

Potential construction-related (short-term) effects on ESA-listed species include the introduction of sediment or pollutants into surface waters, temporary loss or degradation of riparian habitat, and disturbance of fish in waters where in-water work occurs.

Potential operational (long-term) effects include permanent loss of wetland, riparian, and buffer areas resulting from the placement of elevated guideways and support columns, and increased velocities and durations of peak flows in action area streams due to increases in the amount of impervious surface in the action area. Beneficial long-term effects may include improvements to wetland, riparian, and buffer vegetation because many areas to be cleared for construction have been overtaken by invasive species, and these areas will be replanted with native species. Beneficial long-term effects will also result from improved stormwater treatment and reduced growth in automobile traffic.

The species covered in this BA are Chinook salmon (*Oncorhynchus tshawytscha*), steelhead (*O. mykiss*), and bull trout (*Salvelinus confluentus*). No designated or proposed critical habitat for any of these species occurs in the action area of the project. Table ES-1 summarizes the effects determination of the Lynnwood Link Extension for each of these species. No effects on critical habitat are expected because no designated or proposed critical habitat is present in the action area for the Lynnwood Link Extension. The nearest designated critical habitat for all three species is in Lake Washington, which is more than 3 miles downstream of the action area.

The project was also evaluated for potential effects on essential fish habitat (EFH). Based on the finding that project construction, including implementation of the conservation measures identified in this analysis, is not expected to result in any permanent reduction of quantity or quality of EFH, there will be no adverse effect on EFH for Pacific salmon, groundfish, or coastal pelagic species covered in the fisheries management plans applicable to this region.

Table ES-1. Effects Determinations for ESA-Listed Species and Critical Habitat

Species	Status	Federal Jurisdiction	Effects Determination
Chinook salmon, Puget Sound ESU	Threatened	NMFS	NLAA
Chinook salmon critical habitat	Designated	NMFS	NE
Steelhead, Puget Sound DPS	Threatened	NMFS	NLAA
Steelhead critical habitat	Proposed	NMFS	NE
Bull trout	Threatened	USFWS	NE
Bull trout critical habitat	Designated	USFWS	NE

ESU–Evolutionarily Significant Unit
DPS–Distinct Population Segment
NE–No Effect
NLAA–Not Likely to Adversely Affect
NMFS–National Marine Fisheries Service
USFWS–United States Fish and Wildlife Service

1 INTRODUCTION AND PROJECT DESCRIPTION

The Central Puget Sound Regional Transit Authority (Sound Transit) has prepared this biological assessment (BA) to facilitate consultation between the Federal Transit Administration (FTA) and the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) under Section 7 of the Endangered Species Act (ESA) of 1973 (16 United States Code §§ 1531-1544). The primary federal nexus for this project is federal aid funding provided by FTA, although the Federal Highway Administration (FHWA) also must approve any modifications to Interstate 5, which this project generally follows. This BA also supports ESA Section 7 compliance for the U.S. Army Corps of Engineers' (Corps) issuance of a permit under Section 404 of the federal Clean Water Act.

Sound Transit and FTA prepared a Draft Environmental Impact Statement (Draft EIS) that evaluated a No Build Alternative and several build alternatives (Sound Transit and Federal Transit Administration 2013). Through that analysis process, Sound Transit identified a Preferred Alternative, which is evaluated in this document and the Final EIS.

The ESA Section 7 requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of listed species or species proposed for listing as endangered or threatened under the ESA or result in the destruction or adverse modification of critical habitat for those species. This BA evaluates the potential direct and indirect effects of the Lynnwood Link Extension on species that are listed, or proposed to be listed, as endangered or threatened under the ESA, and that are regulated by NMFS or USFWS (collectively referred to as the Services). Analyses in this document also address potential effects on designated or proposed critical habitat for ESA-listed species. Effects on essential fish habitat (EFH), as defined by NMFS (2004), are also examined in this document (Appendix A).

This BA addresses direct and indirect project-related impacts on Chinook salmon, steelhead, and bull trout. Effects analyses address potential effects on individuals, habitat, and the foraging base for each species. The effects determinations are based on life history analysis, habitat requirements, literature review, agency consultation, and field reconnaissance studies conducted by biologists. Biological information for species covered in this BA can be found in Appendix B.

The proposed project involves constructing approximately 8.5 miles of light rail from Seattle to Lynnwood (Figure 1-1), generally along I-5. The Lynnwood Link Extension includes guideways, stations, traction power substations, parking structures, at-grade crossing improvements, and other associated structures to support the light rail system. The route is divided into three geographic segments, as follows:

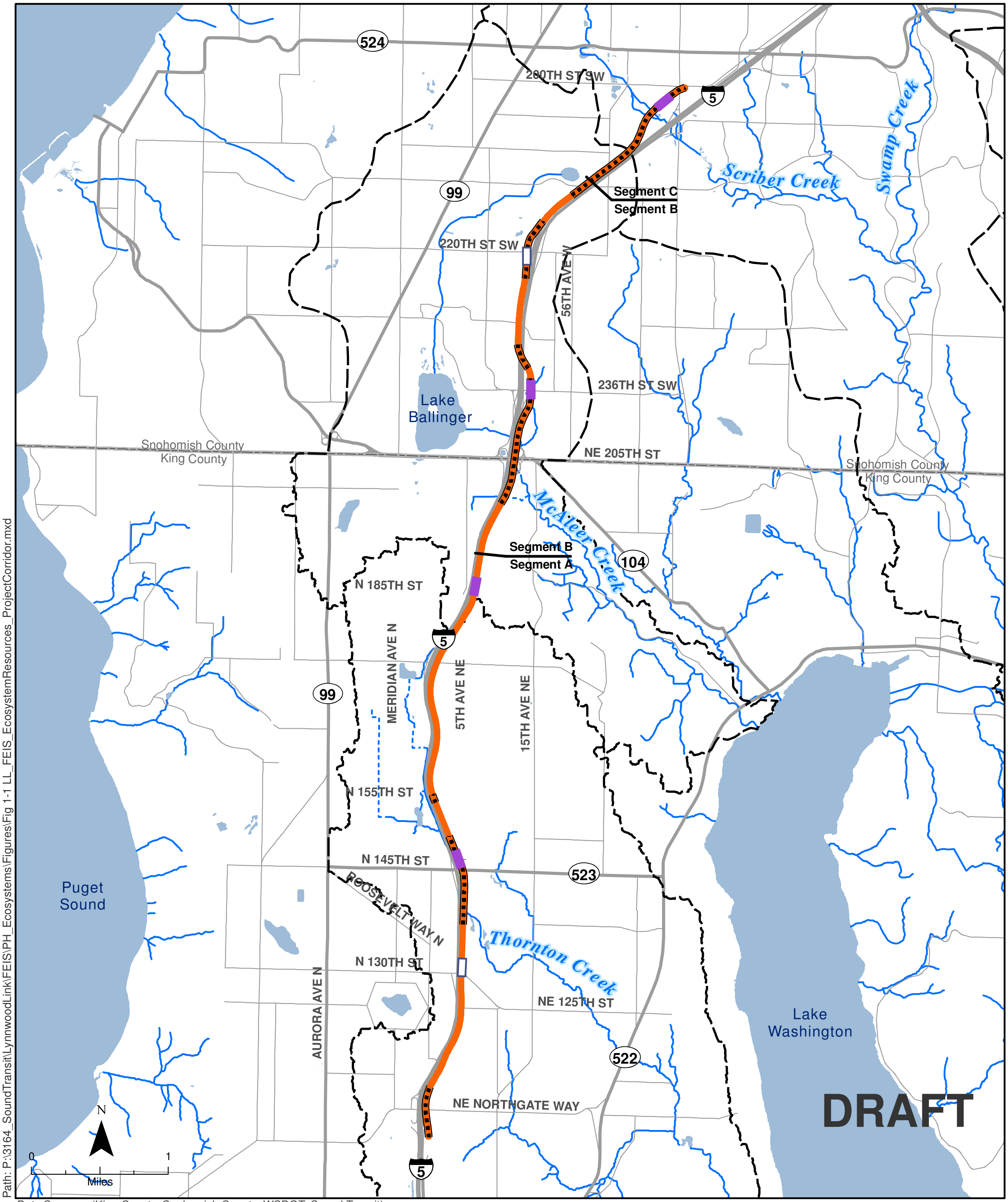
- Segment A: Northgate to Shoreline (Figures 1-2 and 1-3)
- Segment B: Shoreline to Mountlake Terrace (Figures 1-3 and 1-4)
- Segment C: Mountlake Terrace to Lynnwood (Figure 1-4)

Construction methods and structures being proposed in each segment will be similar. The first part of this chapter describes common construction methods and proposed structure types. Subsequent sections in this chapter describe activities where each rail segment intersects with sensitive areas that could potentially support ESA-listed species in the action area.

The project area is in Water Resources Inventory Area (WRIA) 8 (Lake Washington/Cedar/ Sammamish). Most of the project area is in Hydrologic Unit Code (HUC) number 171100120400, Lake Washington-Sammamish River; the northern end of the project area is in HUC number 171100120303, Swamp Creek.

The Lynnwood Link Extension is part of the implementation of Puget Sound Regional Council's VISION 2040 and the Sound Transit 2005 Regional Transit Long-Range Plan. The purpose of the Lynnwood Link Extension is to expand the Sound Transit Link light rail system from Northgate in Seattle north into Shoreline, Mountlake Terrace, and Lynnwood in Snohomish County in order to:

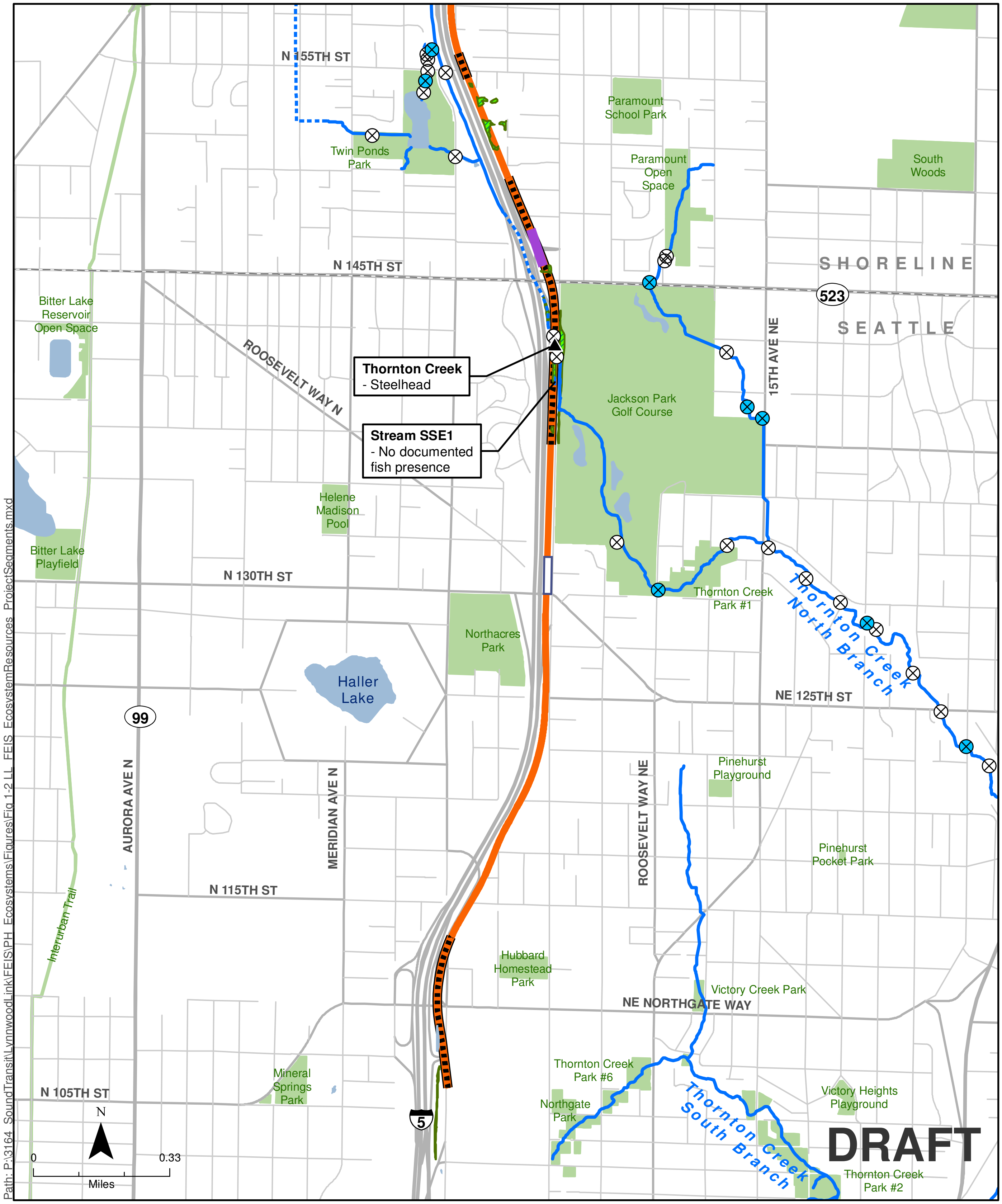
- Provide reliable, rapid, and efficient peak and off-peak transit service of sufficient capacity to meet the existing and projected demand for travel to and from the corridor communities and other urban centers in the Central Puget Sound area.
- Create an alternative to travel on congested roadways, and improve connections to the regional multimodal transportation system.
- Support the adopted land use, transportation, and economic development plans of the region and the corridor communities.
- Advance the long-range vision, goals, and objectives for transit service established by the Sound Transit Long-Range Plan for high-quality regional transit service connecting major activity centers in King, Pierce, and Snohomish counties.
- Implement a financially feasible system that seeks to preserve and promote a healthy environment.



Data Sources: (King County, Snohomish County, WSDOT, Sound Transit)

Proposed Alignment (At Grade)
Proposed Alignment (Elevated)
Proposed Station
Optional Station
Open Stream
Piped Stream
Waterbody
Stream Basin

Figure 1-1
Project Corridor



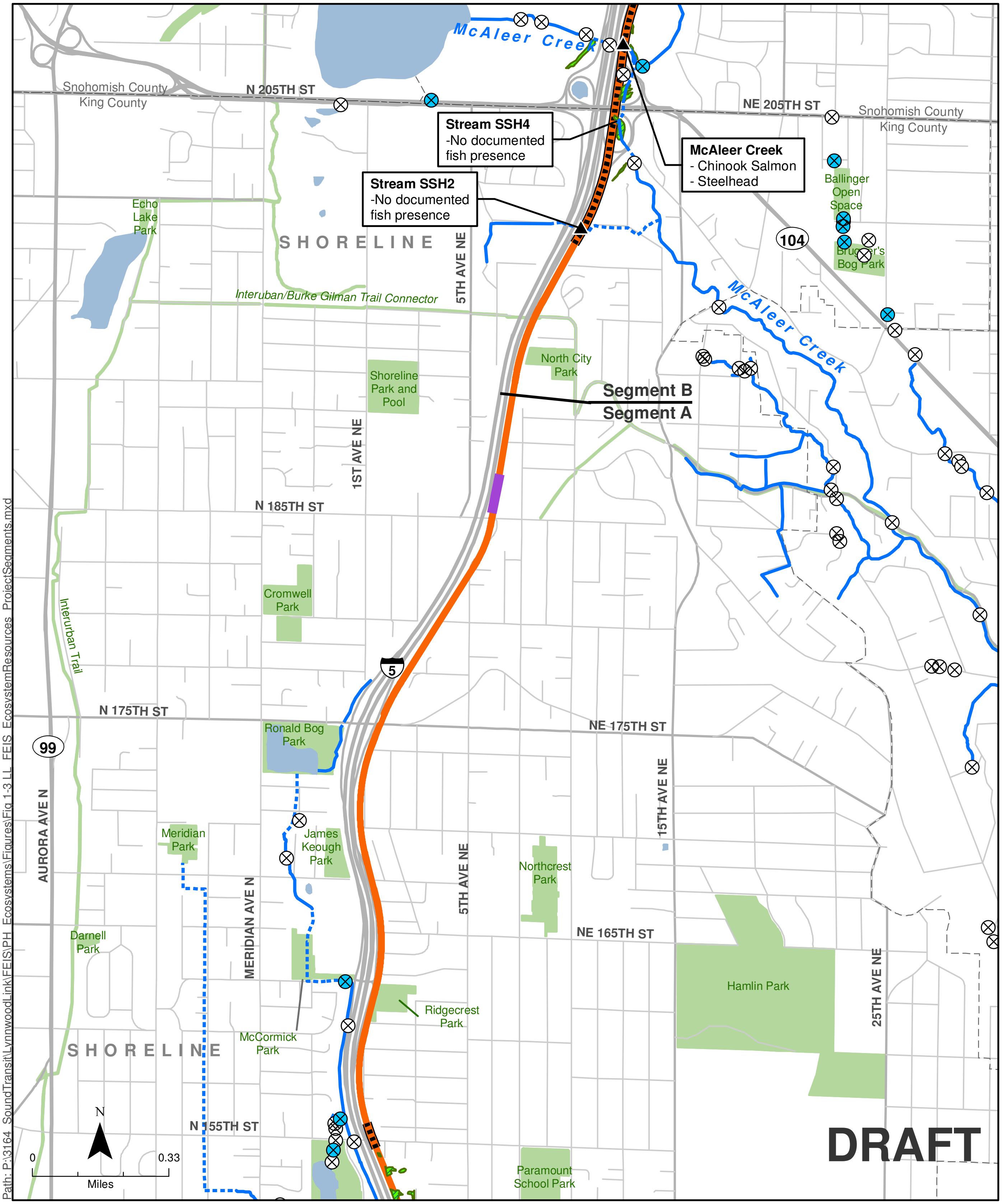
Data Sources: (King County, Snohomish County, WSDOT, Sound Transit, StreamNet)

- Proposed Alignment (At Grade)
- Proposed Alignment (Elevated)
- Proposed Station
- Optional Station
- Open Stream
- Piped Stream
- Total Fish Barrier
- Partial or Unclassified Fish Barrier
- Stream Crossing
- Wetland
- Waterbody
- Park
- City Boundary
- County Boundary

Figure 1-2
Southern End of the Project Corridor

Lynnwood Link Extension

Note: Text boxes where the proposed alignment crosses or passes near streams identify the ESA-listed species known or expected to occur at those specific locations, and are not intended to depict upstream limits of fish distribution.



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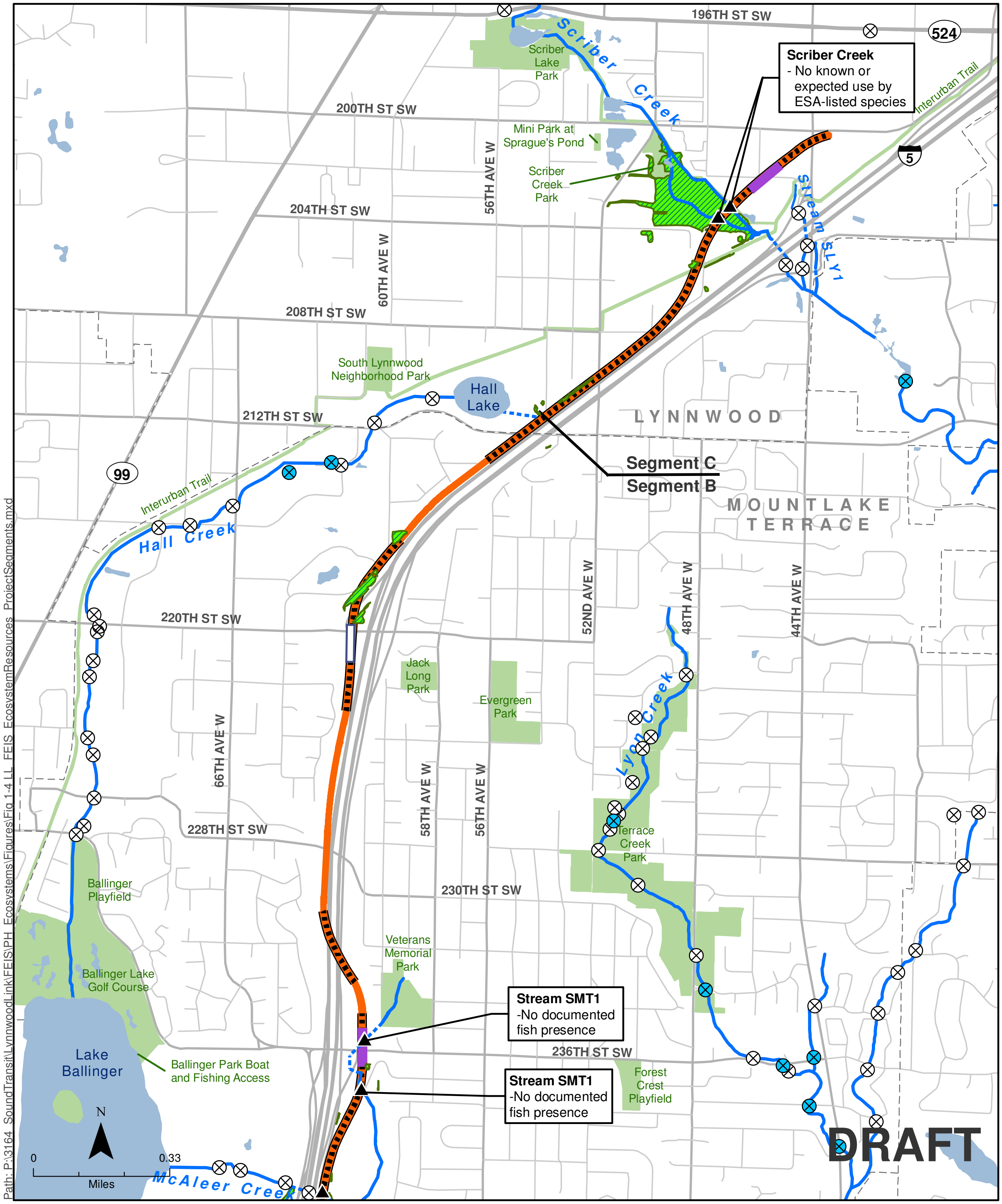
Data Sources: (King County, Snohomish County, WSDOT, Sound Transit, StreamNet)

- Proposed Alignment (At Grade)
- Proposed Alignment (Elevated)
- Proposed Station
- Optional Station
- Open Stream
- Piped Stream
- Total Fish Barrier
- Partial or Unclassified Fish Barrier
- Stream Crossing
- Wetland
- Waterbody
- Park
- City Boundary
- County Boundary

Note: Text boxes where the proposed alignment crosses or passes near streams identify the ESA-listed species known or expected to occur at those specific locations, and are not intended to depict upstream limits of fish distribution.

Figure 1-3
Middle Portion of the Project Corridor

Lynnwood Link Extension



Data Sources: (King County, Snohomish County, WSDOT, Sound Transit, StreamNet)

- Proposed Alignment (At Grade)
- Proposed Alignment (Elevated)
- Proposed Station
- Optional Station
- Open Stream
- Piped Stream
- Total Fish Barrier
- Partial or Unclassified Fish Barrier
- Stream Crossing
- Wetland
- Waterbody
- Park
- City Boundary
- County Boundary

Figure 1-4
Northern End of the Project Corridor

Lynnwood Link Extension

Note: Text boxes where the proposed alignment crosses or passes near streams identify the ESA-listed species known or expected to occur at those specific locations, and are not intended to depict upstream limits of fish distribution.

1.1 General Construction Activities

The construction methods discussed below represent construction techniques and operations identified during preliminary engineering design. Specific construction methods will vary depending on site conditions and final design of the structures proposed. Construction of linear projects is typically divided into various segments or line sections based on similarities in configurations such as at-grade, elevated structures, or retained-cut/fill sections. Typical construction activities include:

- Demolition (buildings, pavement)
- Clearing and vegetation removal
- Fill and excavation
- Installing drainage systems, electrical systems, and communication systems
- Elevated structure construction
- At-grade track construction
- Retained cut construction
- Station and park-and-ride construction
- Roadway construction, sidewalk construction, and landscaping
- Utility relocation
- Retaining wall construction
- Driving or augering piles
- Deep shaft drilling
- Truck hauling and delivery of materials and equipment
- Dewatering
- Use of concrete batch plant
- Remediating any unexpected hazardous material areas
- Planting and revegetation

Typical construction equipment used to complete the Lynnwood Link Extension will include:

- Trucks (e.g., haul, service, delivery, and tractor trailers)
- Cranes
- Backhoes, loaders, compactors, and excavators
- Grading and paving equipment
- Vibratory equipment
- Drilling rigs and pile driving equipment

- Forklifts and manlifts
- Jackhammers
- Pumps (e.g., concrete, dewatering)
- Compressors, generators and welding equipment
- Demolition equipment
- Gantries

1.2 Construction Schedule

The construction duration will be approximately 6 years, including civil construction, systems installation (e.g., power and communications), testing, and startup activities. The schedule calls for a period of civil construction during which site preparation, primary construction, and final construction will take place. Construction durations will range from approximately 2 to 5 years in any given portion of the corridor. However, most ground-disturbing activities and heavy construction (development of structures, etc.) will occur in the initial phases of construction, with station completion and systems installation occurring in subsequent construction phases. Construction is scheduled to begin in 2018, with service commencing in 2023.

Typical construction for at-grade and elevated guideways and stations will occur on a 5- to 6-day work week schedule, primarily between 7 a.m. and 10 p.m. In some locations (primarily when existing traffic lanes may be affected) additional shifts, all-week, nighttime, or 24-hours/day construction activities may be implemented.

1.3 Structure Types

The proposed route and station configurations vary in profile, sometimes constructed at-grade, in a retained cut or fill, or elevated on columns. Because each of the three Lynnwood Link Extension segments includes similar structure types and construction methods, these structure types are described below.

Safety considerations require that vegetation be cleared near all guideways, necessitating a tree-clear zone within 20 feet of the structure at the time of construction. After construction, low-growing vegetation such as native shrubs can be planted within the tree-clear zone. The tops of mature plants are required to be at least 5 feet clear from the bottom of the structure. Where trees are planted outside the guideway, permanent vegetation will be pruned back to a clear zone between the edge of the guideway and the edge of the tree canopy for trees with mature heights less than the top of the safety railing. Where tree heights will reach above the height of the safety railing, a larger clear zone from the edge of the guideway to the edge of the tree canopy must be provided.

1.3.1 At-Grade

The term “at-grade” means that the rail line is located at street or surface level; for this project, an at-grade alignment is usually at the same level as the I-5 traffic lanes. At-grade guideways are typically

30 to 40 feet wide, with room for two sets of tracks. This width also includes room for the poles and overhead catenary wires needed to power trains. Light rail operating at grade is best suited in areas where the grade is 5 to 6 percent or less and there is adequate room within street rights-of-way or off-street corridors.

At-grade light rail construction methods and impacts are similar to typical road construction. Shallow, near-surface excavations will be required to construct the subgrade and track and station platform slabs for at-grade segments. In areas where access is not available from existing roads, a temporary construction road will be built. During the grading phase, the contractors will install drainage structures and below-grade light rail infrastructure.

1.3.2 Retained Cut and Retained Fill

Variants of the at-grade profile are retained cut, where the guideway is cut into the ground with a retaining wall on one or both sides, and retained fill, where the guideway is constructed on fill material supported by retaining walls. Retained cut and retained fill will be used where necessary to meet train operation grade requirements or to separate the grade below heavily traveled roadways. Construction of retained cut structures will consist of excavation of soil and sidewall stabilization, and construction of the bottom grade and guideway and sidewalls. Excavation depth is expected to vary based on topography of the area. Some dewatering may be required during excavation and construction. Construction of retained fill structures will include construction of retaining walls and placement of fill material between the walls to provide a surface for the guideway. As with other at-grade segments, retained cut and retained fill structures are typically 30 to 40 feet wide.

1.3.3 Elevated Profile

Elevated guideways and stations for light rail, similar to structures such as highway bridges, are generally constructed with reinforced concrete, steel, or combinations of both. Elevated guideways are typically about 30 feet wide and can vary in height. Light rail on elevated structures works well where the system must be grade-separated to cross over geographic or physical barriers, or accommodate higher train frequencies.

Construction will begin with preparation work to build foundations that may consist of shallow spread footings, drilled shafts, or deep-driven (augered) piles. Construction varies with type of foundation needed, which is based on soil conditions and the height of the structure. Spread footings require excavation, backfilling, and compaction, followed by installation of reinforcing steel and pouring of concrete. Drilled shafts are constructed using a vibratory or rotating drill rig to advance a permanent casing (steel or concrete) into the ground while soil from inside the casing is excavated. During excavation, a bentonite or synthetic polymer slurry is sometimes added to stabilize the walls of the shaft. When the shaft is of the desired depth, rebar reinforcement is placed in the shaft and concrete is poured with a tremie hose. Depending on location, dewatering of the shafts may be required before concrete is poured. With deep-driven piles, an auger is used that has a hollow center for pumping concrete. The auger is driven to a specified depth, then as it is pulled back up, concrete is pumped into the void. Rebar reinforcement is placed into the concrete before it sets. This method is used in areas with drier soils.

Transitions between at-grade and elevated profiles are typically supported by compacted fill ramps. An elevated profile must have a minimum clearance of at least 16.5 feet over roadways, but topography and other consideration may result in a profile as high as 50 feet or more. Pier supports are typically 6 feet by 9 feet square at the ground, although the support structure below the ground may be larger. Just as for at-grade routes, the elevated guideway can travel either in the median of existing roadways, along the side of the roadway, or in off-street corridors.

Construction of an elevated guideway involves demolition of infrastructure in the project area, relocating utilities, and preparing necessary construction access. In undeveloped or other open areas, clearing, grubbing and grading will be needed. A temporary construction road will typically be built (in this corridor, generally along I-5) when constructing an elevated guideway in undeveloped areas or where access is not available from existing roads.

Falsework may need to be constructed in some areas where concrete is cast in place or to stabilize balanced cantilevered sections. Falsework may consist of pile-supported work platforms, which in turn support scaffolding and concrete forms.

Temporary work trestles will be needed for equipment access during construction of the elevated guideway where the proposed alignment crosses the Scriber Creek wetland complex. Trestles will consist of pile-supported platforms, one extending from upland areas southwest of the wetland complex and the other extending from the Lynnwood Transit Center northeast of the complex. The temporary work trestles will be about 30 feet wide, with heavy timber decking supported by steel beams. Pile bents (lateral rows of three to four piles) will be spaced at 30- to 50-foot intervals, with each pile driven below the mudline to a depth sufficient to support the large cranes and other equipment needed for construction of the elevated guideway. The spacing of the pile bents will be optimized to reduce the number of piles needed while providing sufficient structural support.

A vibratory hammer will be used for initial installation of most piles. If substrates preclude the use of a vibratory hammer, an impact hammer will be used. For all piles, an impact hammer will be used to complete the installation and to confirm the load-bearing capacity of each pile. Any work below the ordinary high water mark of Scriber Creek will be conducted in accordance with the terms of the Hydraulic Project Approval (HPA) and other applicable permits obtained for this project.

1.3.4 Stations

The project design includes four stations, with options to develop two others. Stations are designed according to the profile of the route. Depending on the location, stations are designed with center or side platforms. A station platform is typically 400 feet long to accommodate a four-car train but varies in width depending on the location of the platform, passenger volumes, vertical and horizontal circulation needs, and the track profile. The size of each station is determined by the site-specific access and parking requirements.

Escalators, elevators, and stairs will provide access to station platforms. Stations will include pedestrian and bicycle access to and from feeder bus lines, park-and-ride facilities, and surrounding streets. The station plans also include proposed bus stops, paratransit stops, and handicapped-accessible areas. Most of the stations will have parking areas for transit patrons in either a structure or a surface lot. At several station locations, the existing transit facilities already include park-and-ride lots that will be expanded or reconfigured. Two of the stations are at existing transit centers with major park and ride facilities. One is at an existing freeway flyer transit stop with an adjacent parking lot, and the fourth would create a new station and park-and-ride.

1.3.5 Traction Power Substations

Electric power for the trains will be provided from an overhead catenary system connected to the existing electrical grid through traction power substations. The traction power substations are completely enclosed small buildings, about 20 feet by 60 feet in size, with an additional 10 to 20 feet required around each unit. These electric substations will be installed at about 2-mile intervals. Automobile access is also required for each traction power substation for maintenance. When possible, they will be placed in the footprint of a light rail station or trackway or adjacent to the track where remaining right-of-way is available.

Traction power substations in Segment A will likely be installed at 120th Street NE and near the stations at NE 145th Street and NE 185th Street. The option for a station at NE 130th Street would also involve a traction power substation. In Segment B, substation are proposed at the Mountlake Terrace Transit Center and near 212th Street SW. Segment C includes one substation at the Lynnwood terminus.

1.3.6 Staging Areas and Construction Easements

Construction staging areas are needed before, during, and for a short time after construction work occurs. Staging areas will be used for construction equipment storage, construction materials delivery and storage, demolition materials or spoils handling (in accordance with applicable regulations), contractor trailers, access roads, and construction crew parking. At-grade, elevated, and retained cut-and-fill line sections will have construction staging areas along the routes. Where roadway right-of-way does not already exist, a corridor (encompassing the permanent light rail right-of-way) approximately 70 feet wide may be needed to construct the route, although narrower corridors can be used for construction to help minimize impacts or avoid other constraints. Contractors will generally use the property in which the facility is being constructed and property that has been acquired for right-of-way or other properties as negotiated by the contractor.

Construction easements are obtained for temporary use of property during construction and will be required in numerous locations along the route. In undeveloped land areas, easements up to 70 feet wide may be necessary to maneuver equipment and materials along the corridor during construction.

1.4 Description of Route and Project Activities by Segment

The following sections describe specific alignments and construction techniques for each segment. Photos of work areas within each segment, including proposed stream crossing areas, can be found in Chapter 4, Environmental Baseline.

1.4.1 Segment A: Northgate to Shoreline

Segment A (Figures 1-2 and 1-3) will extend approximately 4.2 miles, from the tail tracks for the Northgate Link Extension in Seattle north to NE 185th Street in Shoreline. The segment will include approximately 1.4 miles of elevated guideway and 2.8 miles of at-grade guideway. Alignment construction will entail reconstruction of both the off-ramp from northbound I-5 to NE 130th Street and the NE 130th Street overpass over I-5, along with a short section of 5th Avenue NE. The existing northbound on-ramp to I-5 at NE 145th Street will be relocated to the north, and the existing transit ramps at that interchange will be closed. Project construction will entail the reconstruction of several roadways, including 3rd Avenue NE, 1st Avenue NE, and 5th Avenue/7th Avenue NE.

Two stations are currently planned within this segment: an elevated station with a new 500-car parking garage at NE 145th Street and an at-grade station with a new 500-car parking garage at NE 185th Street. Sound Transit is also reviewing options for a third station at NE 130th Street, but a new parking facility is not included.

The route will cross the North Branch of Thornton Creek as an elevated guideway near the Jackson Park Golf Course, where the stream emerges from a pair of 1,500-foot-long culverts under I-5 before entering a pair of 48-foot-long culverts under 5th Avenue NE, approximately 4.2 miles upstream of the mouth of Thornton Creek. According to the Washington Department of Fish and Wildlife (WDFW), no ESA-listed species are known or expected to be present in this reach of Thornton Creek (WDFW 2014b). However, based on the observation of an adult steelhead near Twin Ponds upstream of the proposed crossing site (Tetra Tech/KCM 2004b), it is possible that steelhead may use stream habitats in that area.

No in-water work will be needed in Thornton Creek because all guideway support columns will be located above the ordinary high water mark of the stream. One support column will be placed approximately 40 feet from the stream (south of where the stream enters the culverts under 5th Avenue NE) and one straddle bent, with two support columns, will be placed approximately 20 feet north of where the stream emerges from the culverts under I-5. The elevated guideway will run parallel to the stream, partially spanning a surface-flowing segment of Thornton Creek approximately 100 feet long. Approximately 0.4 acre of the riparian buffer for Thornton Creek (as defined by the City of Seattle Critical Areas Ordinance, Seattle Municipal Code 25.09) falls within the guideway footprint.

Approximately 300 feet south of Thornton Creek's crossing under 5th Avenue NE, the elevated guideway will run parallel to a tributary to Thornton Creek (called Stream SSE1 for this analysis) but will not cross the watercourse. Two support columns will be placed approximately 30 feet from the watercourse, one at either end of the surface-flowing segment. Approximately 0.2 acre of the riparian buffer for Stream SSE1 (provided the watercourse is classified as a potentially fish-bearing stream by the City of Seattle) falls within the guideway footprint.

1.4.2 Segment B: Shoreline to Mountlake Terrace

Segment B (Figures 1-3 and 1-4) will extend approximately 3.2 miles, from NE 185th Street in Shoreline north to 212th Street SW in Mountlake Terrace. The segment will include approximately 1.7 miles of elevated guideway and 1.5 miles of at-grade guideway. An elevated station with reconfigured surface parking is planned at the Mountlake Terrace Transit Center (236th Street SW), with another optional elevated station and 200-space surface parking area at 220th street SW. North of the transit center, the route will cross over I-5 and continue along the west side of the freeway.

The route will cross McAleer Creek as an elevated guideway where the stream emerges from a 400-foot culvert under I-5, approximately 3.5 miles upstream of the stream's mouth at Lake Washington. The elevated guideway will cross through the riparian buffers of two segments of McAleer Creek where it flows at the surface through cloverleaf interchanges between I-5 and State Route (SR) 104. Both Chinook salmon and steelhead may use stream habitats in these stream reaches (WDFW 2014b).

The elevated guideway will also cross through the riparian buffer of a small watercourse (provisionally called Stream SSH4) that emerges from a culvert in the cloverleaf interchange between eastbound SR 104 and northbound I-5, flows approximately 30 feet, and then joins McAleer Creek. The SSH4 riparian buffer is entirely contained within the McAleer Creek buffer. No in-water work will be needed in McAleer Creek because all guideway support columns will be located above the ordinary high water mark of the stream. Three support columns will be placed within 100 feet of surface-flowing segments of the stream: one approximately 70 feet from the ordinary high water mark and two approximately 100 feet from the ordinary high water mark. Approximately 0.6 acre of the riparian buffer for McAleer Creek (as defined by the critical areas ordinances of Shoreline [Shoreline Municipal Code 20.80.470] and Mountlake Terrace [Mountlake Terrace Municipal Code 16.15.080]) falls within the guideway footprint.

South of the McAleer Creek crossing, the route crosses a non-fish-bearing tributary to McAleer Creek (Stream SSH2). The entire length of this watercourse through the project area is contained in a culvert. Construction of the elevated guideway at this location will not entail any in-water work, nor will it affect any vegetation within the riparian buffer of any surface-flowing segments of the stream.

North of the McAleer Creek crossing, a short distance south of the Mountlake Terrace Transit Center, the route crosses an intermittently flowing, non-fish-bearing tributary to McAleer Creek (Stream SMT1). The alignment will be elevated at the crossing location. A portion of one guideway support column will be below the ordinary high water mark of the watercourse. All work within the stream channel will be conducted in accordance with the HPA and other permits that will include provisions designed to avoid or minimize the potential for adverse effects on habitat in receiving waters. Such provisions could include restrictions on construction periods below the ordinary high-water mark and/or other measures designed to avoid or minimize the potential for construction activities to deliver sediment or pollutants to streams. Another support column will be placed approximately 40 feet from the ordinary high water mark. Approximately 0.5 acre of the riparian buffer for Stream SMT1 (as defined by Mountlake Terrace Municipal Code 16.15.080) falls within the guideway footprint.

1.4.3 Segment C: Mountlake Terrace to Lynnwood

Segment C (Figure 1-4) will extend approximately 1.0 mile, from 212th Street SW in Mountlake Terrace north to the Lynnwood Transit Center. The segment will include approximately 0.7 mile of elevated guideway and 0.3 mile of at-grade guideway. The alignment will be on the west side of I-5, leaving the right-of-way near 208th Street SW and then heading generally northward to an elevated station at the south side of the existing Lynnwood Transit Center. Existing surface parking areas displaced by station construction will be replaced by a new parking garage that will accommodate an additional 500 vehicles. Sound Transit is considering an option that would maintain 400 spaces on the existing surface parking lot to the south of the transit center, rather than converting the area for bus layover and circulation.

The route will cross Scriber Creek as an elevated guideway in the wetland complex immediately west of the Lynnwood Transit Center, approximately 2.6 miles upstream of the stream's confluence with Swamp Creek. No ESA-listed species are known or expected to use habitats in this stream reach (WDFW 2014b), which is approximately 2,900 feet upstream of a total barrier to fish passage.

The guideway will require 3 pairs of columns to cross the wetland complex. Some work below the ordinary high water mark of Scriber Creek may be required to construct the elevated guideway. Work areas where surface water is present will be isolated from other surface waters using a coffer dam or similar system to prevent suspended sediment or pollutants from leaving the work area. Approximately 0.6 acre of the riparian buffer Scriber Creek (as defined by the City of Lynnwood Critical Areas Ordinance, Lynnwood Municipal Code 17.10.060, based on the preliminary determination that the ordinary high water mark of the stream coincides with the outer boundary of the Scriber Creek wetland complex) falls within the guideway footprint.

As described in Section 1.3.3 (Elevated Profile), temporary work trestles will be needed for equipment access during construction of the elevated guideway where the proposed alignment crosses the Scriber Creek wetland complex. It is estimated that the total length of the temporary work trestles will be no more than 420 feet (one 100-foot-long trestle from the west, one 200-foot-long trestle from the east, and three 40-foot-long transverse trestles). Based on those length estimates, a maximum of 88 30-inch diameter steel piles may be installed in the Scriber Creek wetland complex while project construction is underway. Any in-water work for temporary work trestle construction (including impact pile driving, if necessary, as well as pile removal) will be conducted in accordance with the terms of the HPA and other applicable permits obtained for this project.

A non-fish-bearing tributary to Scriber Creek (Stream SLY1) flows through a narrow wooded area immediately east of the proposed location of the station at the Lynnwood Transit Center. The project footprint does not intersect this stream. All project construction activities within 200 feet of Stream SLY1 will occur in currently paved portions of the transit center and therefore will not have any potential to affect the stream or its riparian buffer. It is possible, however, that the volume and pollutant loading levels of stormwater discharges to the stream could decrease when elevated light rail facilities are built above existing surface parking areas at the transit center (see Section 1.5.2, Pollutant-Generating Impervious Surface).

1.5 Stormwater Management for all Segments

For water quality protection, the project will obtain a construction stormwater general permit under the National Pollutant Discharge Elimination System (NPDES) permit program to reduce or eliminate stormwater pollution and other impacts on surface waters. The project will also develop a construction stormwater pollution prevention plan that implements best management practices (BMPs) for identifying, reducing, eliminating, or preventing sediment and erosion problems on site. The construction stormwater pollution prevention plan will include a temporary erosion and sediment control (TESC) plan; spill prevention, control, and countermeasures (SPCC) plan; concrete containment and disposal plan; dewatering plan; and a fugitive dust plan.

Conceptual engineering has been completed for the major stormwater detention and treatment facilities necessary for the Preferred Alternative. Sound Transit used a conservative approach in developing drainage concepts. Sound Transit applied the Western Washington Hydrology Model, Version 3.0, to analyze project hydrology and to determine sizing of the facilities. Detention facilities were designed to achieve post-project stormwater flows equivalent to forested conditions, as required by the Washington State Department of Ecology (Ecology). Most stormwater is expected to be discharged to existing city drainage facilities that discharge to water bodies from existing permitted municipal discharge locations.

1.5.1 Impervious Area

New impervious areas resulting from the Lynnwood Link Extension will include tracks and guideways, stations, park-and-ride lots, and roads (Table 1-1). Ballasted (i.e., gravel) track sections were counted as impervious areas by definition in accordance with the *Stormwater Management Manual for Western Washington* (Volume 1, Section 2.3). Relocated roads to accommodate the Lynnwood Link Extension were also counted as project-associated impervious area because the new and replaced pavement will require stormwater treatment and detention. For those cases where elevated track will overlay a relocated road, the underlying impervious area of the road was not counted in the impervious area numbers (to avoid double-counting). Existing impervious area of 226 acres was obtained from new surveyed base maps. The project will increase the amount of impervious surface in the action area by 52 acres (approximately 26 percent), mostly as a result of the new guideway covering existing grassy right-of-way areas.

Table 1-1. Existing and Proposed Amounts of Total and Pollutant-Generating Impervious Surface (acres)

Segment	Existing Impervious Area	Proposed Impervious Area	Net Change	Existing PGIS	Proposed PGIS	Net Change
A	90	121	+ 31	79	83	+ 4
B	69	86	+ 17	64	63	- 1
C	67	71	+ 4	55	53	- 2
Total	**226**	**278**	**+ 52**	**198**	**199**	**+ 1**

PGIS = pollutant-generating impervious surface

1.5.2 Pollutant-Generating Impervious Surface

Project pollutant-generating impervious surface (PGIS) is composed primarily of frontage roads and intersections near the project route that will need to be reconstructed to accommodate the light rail tracks. PGIS also includes bus holding areas, access roads, and parking areas at the park-and-ride lots constructed for the project.

Light rail guideways and stations have no motor vehicle traffic or other sources of pollutant-generating activities and are therefore classified as non-PGIS. Small amounts of non-toxic lubricant may be used on sections of light rail track in order to prevent operational noise from wheel squeal. Given the non-toxic nature of this product and small quantities anticipated to be used, track lubricant activities are not considered pollutant-generating. No stormwater treatment facilities are required in the non-PGIS areas.

In some areas, especially in Segment C, existing pollutant-generating segments of I-5 and commercial parking areas will be spanned by elevated portions of light rail. In these areas, precipitation that might otherwise have fallen on PGIS will fall instead on the non-pollutant-generating surface of the elevated guideway. The result will, in effect, be a conversion from pollutant-generating to non-pollutant-generating impervious surface, thus reducing the overall amount of PGIS in some portions of the project area (Table 1-1). Overall, project construction will result in a minimal change in the amount of PGIS in the action area because most of the proposed road segments and parking lots will be located in areas with similar existing uses.

1.5.3 Stormwater Flow Control and Treatment

The Lynnwood Link Extension will comply with the following local design manuals:

- Washington State Department of Transportation (WSDOT) 2014 Highway Runoff Manual
- City of Seattle: City of Seattle Flow Control and Water Quality Treatment Technical Requirements Manual, Volume 3
- City of Shoreline: Stormwater Management Manual for Western Washington (Ecology 2012a); City of Shoreline 2012 Engineering Development Manual; Low Impact Development, Technical Guidance for Puget Sound (Hinman 2012)
- City of Mountlake Terrace: Stormwater Management Manual for Western Washington (Ecology 2012a)

- City of Lynnwood: Stormwater Management Manual for Western Washington (the City currently uses the 2005 manual but is expected to adopt the 2012 manual by the time project design is underway)

Sound Transit's preliminary engineering for the Lynnwood Link Extension includes development of a conceptual layout for major stormwater facilities that are sized to comply with Sound Transit's 2012 *Design Criteria Manual*, which requires stormwater facilities for Sound Transit projects to conform to the requirements of local jurisdictions. Based on the guidance provided in Sound Transit's *Design Criteria Manual*, low-impact development (LID) is a preferred method of stormwater management and will be employed wherever possible. In addition, Ecology's 2012 *Stormwater Management Manual for Western Washington* requires LID approaches to stormwater management to the extent feasible. Stormwater management facilities will be designed using sustainable, LID approaches where possible, referencing the above manuals and the *Puget Sound LID Manual* (Hinman 2012) as guidance. However, in areas where use of LID measures is not feasible due to physical site constraints, other techniques will be used. A detailed discussion of the requirements applied and the proposed facilities is presented in the Lynnwood Link Extension Conceptual Design Report - Appendix G: Drainage Plan Report Technical Memorandum (Sound Transit 2012).

To minimize the potential impacts of increased impervious surface, stormwater detention facilities will be constructed as part of the Lynnwood Link Extension. The volume detained will be sufficient to offset any increase in impervious surface area in each segment. Based on the implementation of these BMPs, combined with compliance with the guidance documents identified above, peak flows are not expected to increase in any of the streams in the study area as a result of the project; moreover, base flows will be expected to remain similar to current conditions. Stormwater from all project-related impervious surface will receive appropriate flow control where required. Stormwater flow control techniques may include detention ponds, infiltration ponds, vaults, and dispersion.

Runoff from PGIS areas will typically require basic water quality treatment, with a goal to remove at least 80 percent of total suspended solids. Water quality treatment techniques may include bioretention, ecology embankments, and media filter vaults. Treatment to remove metals, oil, and grease will be provided at parking lots and roadway areas where required. Roadways where average daily traffic volume exceeds 7,500 vehicles will receive enhanced treatment, as will drainage outfalls that do not discharge to basic treatment water bodies. The specific stormwater management facilities used will depend on the conditions at the site. Typical facilities will likely consist of media filters or bioinfiltration facilities (i.e., rain gardens), but some stormwater wetlands may be installed where feasible.

All runoff is considered PGIS except for runoff from light-rail-only impervious surface (such as at-grade or elevated guideways and stations), sidewalks, and roofs. All PGIS will receive on-site water quality and flow control treatment before being discharged into municipal storm sewer systems. LID treatment methods will be encouraged and used wherever feasible. Some LID methods may include permeable pavement, rain gardens, bioretention planters, and dispersion/infiltration.

Where practical, non-PGIS runoff will be conveyed separately from PGIS runoff because it does not require water quality treatment. Non-PGIS runoff from elevated guideways will be dispersed over permeable areas where infiltration could occur. This will help to reduce the volume of runoff to be detained, thereby reducing the size of the detention facilities. Dispersion is practical in areas where permeable surfaces exist below the guideway and there is little human activity (because water dripping from the guideway above would be bothersome to people below). Where non-PGIS and PGIS runoff is conveyed jointly, the stormwater management facility will be designed to detain the joint flow and to provide required treatment for the PGIS flow in accordance with Ecology standards.

The following sections describe proposed stormwater treatment for each segment of the corridor.

Segment A: Northgate to Shoreline

Segment A lies within the Thornton Creek and McAleer Creek drainage basins. Most of the segment, from Northgate to NE 180th Street, is within the Thornton Creek basin. The northern end of the segment, from NE 180th Street to the NE 185th Street Station, is within the McAleer Creek basin.

Within the Seattle city limits, management of stormwater from the track in Segment A will be subject to the guidelines of the City of Seattle Flow Control and Water Quality Treatment Technical Requirements Manual, Volume 3. North of Seattle, stormwater from the track will be managed according to the WSDOT 2014 Highway Runoff Manual. The park-and-ride facilities are typically located outside of the WSDOT right-of-way and will require a permit from the City of Shoreline.

The portion of the track south of Northgate Way will drain into the existing stormwater system. Flow control required for new impervious surface will be provided by the Sound Transit Northgate Link Extension.

Proposed flow control facilities for runoff from guideways in Segment A include detention ponds, detention vaults, and infiltration facilities. Overflow from the facilities will drain to existing drainage systems and ultimately to Thornton Creek (except to the northernmost facility, which is within the McAleer Creek basin and which will overflow to the WSDOT trunk line east of I-5). Downstream analyses will be conducted at each flow control facility outfall to evaluate whether the conveyance system has adequate capacity for additional stormwater flows. Some systems may require upgrading.

All surfaces subject to vehicular traffic within park-and-ride facilities are considered PGIS and will require water quality treatment. A water quality facility and detention pond for stormwater runoff from the reconstructed NE 130th Street bridge will be located west of I-5. Stormwater from the NE 145th Street Station will be treated in a bioretention facility and detained in an underground vault that discharges to an enclosed conveyance system leading to Thornton Creek. Stormwater from the NE 185th Street Station, adjacent parking and bus lanes, and the parking garage will be treated in three separate infiltration ponds. Ponds receiving runoff from pollution-generating surfaces will have treatment liners installed in the bottom of the pond to remove pollutants prior to infiltration into the ground.

The optional station at NE 130th Street will have no parking facilities; therefore, there will be no PGIS and water quality treatment will not be required. The runoff from the station will be combined with the track runoff and conveyed to an infiltration facility.

Opportunities for LID are limited in much of Segment A. Till soils underlie the track alignment, limiting infiltration. Much of the track will be in a retained cut, making dispersion infeasible. Additionally, much of the area is highly developed and space is limited adjacent to the track, which also deters the use of dispersion. Nevertheless, guideway dispersion (allowing water to flow off the guideway in a dispersed fashion) may be feasible for some portions of the elevated guideway, provided the vegetation beneath the guideway can be maintained to minimize erosion. Using dispersion would likely eliminate the need for some detention facilities.

Segment B: Shoreline to Mountlake Terrace

Segment B lies entirely within the McAleer drainage basin. The proposed guideway alignment falls within the WSDOT right-of-way; stormwater from the track will therefore be managed according to the WSDOT 2014 Highway Runoff Manual.

The Mountlake Terrace Transit Center and the optional 220th Street SW station are both within the city of Mountlake Terrace. Runoff from these facilities will be subject to the guidelines of the 2012 Ecology Manual. Surfaces to be treated as PGIS include the reconfigured surface parking at Mountlake Terrace Transit Center, the new surface parking at the optional SW 220th Street station, and the reconstructed off-ramps from southbound I-5 at SW 220th Street.

Flow control for runoff from guideways in Segment B will be provided by detention ponds, detention vaults, and infiltration facilities. Overflow from the facilities will drain to existing drainage systems and to McAleer Creek. The portion of the track and station over existing impervious surface at the Mountlake Terrace Transit Center will not require flow control or water quality treatment. Runoff will be directed to the existing detention pond that manages stormwater from the transit center.

Segment C: Mountlake Terrace to Lynnwood

The southern portion of Segment C lies within the McAleer Creek basin and the northern portion is in the Scriber Creek basin. The guideway for Segment C is partially within the WSDOT right-of-way and partially within the city of Lynnwood; stormwater management will follow the WSDOT 2014 Highway Runoff Manual and Ecology's *Stormwater Management Manual for Western Washington*. The City of Lynnwood currently uses the 2005 manual but is expected to adopt the 2012 manual by the time project design is underway.

The soils in Segment C consist of till with young alluvium in the vicinity of Scriber Creek and its associated wetland complex. Infiltration is assumed not to be feasible in this segment. Runoff from the guideway in the southernmost portion of the segment will be directed to the detention vault in the northern portion of Segment B. Flow control for the middle portion of the segment will be provided by a detention vault that will drain to the Scriber Creek wetlands.

The northern end of the alignment passes over the Scriber Creek wetland complex. Runoff from the portion of the guideway directly above the wetlands will be dispersed from the guideway into the wetland. North of the wetland complex, the alignment passes over existing impervious surfaces at the Lynnwood Transit Center. Two existing stormwater vaults in the transit center will be replaced with new vaults that are large enough to accommodate runoff from the new garage and access roads at the redesigned transit center.

2 BEST MANAGEMENT PRACTICES AND MINIMIZATION MEASURES

To avoid and/or minimize potential impacts from construction and operation of the Lynnwood Link Extension, the following conservation measures will be implemented.

2.1 Water Quality Protection During Construction

- A TESC plan will be developed and implemented for all project activities requiring clearing, vegetation removal, grading, ditching, filling, embankment compaction, demolition, and/or excavation. BMPs defined in the TESC plan will be used to control sediments from all vegetation removal or ground-disturbing activities.
- The contractor will implement the TESC plan before discharging or allowing runoff from the site. Monitoring requirements specified in the TESC will provide feedback to ensure that the erosion control practices are operating properly and effectively.
- An SPCC plan will be developed prior to beginning construction. The SPCC plan will identify the appropriate spill containment measures to be employed during construction.
- The contractor will adhere to water quality standards as stated in the 401 Water Quality Certificate and NPDES permit issued for the project.
- Erosion control devices (e.g., silt fences) will be installed, as needed, to protect surface waters and other critical areas.
- Erosion control blankets or an equally effective BMP will be installed on steep slopes that are susceptible to erosion and where ground-disturbing activities have occurred. This will prevent erosion and assist with establishment of native vegetation.
- Material that may be temporarily stored for use in project activities will be covered with plastic or other impervious material during rain events to prevent sediments from being washed from the storage area to surface waters.
- All temporary and permanent erosion and sedimentation control measures will be inspected on a regular basis, maintained, and repaired to ensure continued performance of their intended function.
- Silt fences will be inspected after each rainfall, and at least daily during prolonged rainfall.
- Turbid water (including untreated water from dewatering activities) will be prevented from discharging to streams and wetlands. Turbid wastewater may be routed to temporary or permanent detention facilities, or to upland areas that provide adequate infiltration.
- Any water having direct contact with uncured concrete will be contained and treated or removed from the site (as appropriate) to prevent discharge to streams or wetlands.
- All equipment to be used for construction activities will be cleaned and inspected prior to arriving at the project site to ensure no potentially hazardous materials are exposed, no leaks are present, and the equipment is functioning properly. Should a leak be detected on heavy

equipment used for the project, the equipment will be repaired before use. Wash water will not be discharged directly into any water body without pretreatment.

- Construction equipment and vehicles will be maintained to prevent them from leaking fuel or lubricants.
- Equipment (excluding track-mounted equipment, large cranes, and other relatively immobile equipment) will be refueled and maintenance activities conducted at a distance from the nearest wetlands, ditches, and flowing or standing water approved by regulatory permits.
- Heavy equipment used during the course of in-water work will operate from above the ordinary high water mark of streams wherever possible. Use of equipment below the ordinary high water mark will be limited to that necessary to gain position for work. Drive mechanisms will not enter or operate below the ordinary high water mark, except under the terms of the HPA issued by WDFW.
- If any permanent footings or drilled or pile-driven shafts are installed below the ordinary high water mark, installation will be conducted in a manner consistent with Section 404 and other permits issued for the project by the Corps and other parties (as applicable). When constructing drilled shafts, the contractor will ensure that all drilling equipment, drill recovery and recycling pits, and any waste or spoil produced are properly contained to prevent discharge of drill wastes or fluids to any surface water or wetlands.
- Any materials placed below the ordinary high water mark (e.g., cobble or boulders for energy dissipation at culvert ends, streambed gravel or other substrates) will be relatively clean and will be handled in a way to minimize turbidity. When flow is restored to any such work sites, methods will be employed to minimize turbidity; based on the implementation of these measures, the project is not expected to result in the exceedance of state water quality standards at the point of compliance (as defined in WAC 173-201A) in any affected watercourses.
- Uncured concrete and/or concrete byproducts will be prevented from coming in contact with streams or water conveyed directly to streams during construction in accordance with Washington Administrative Code (WAC) Section 220-110-270(3).
- A concrete truck chute cleanout area or equally effective BMP shall be established to properly contain wet concrete.

2.2 General Best Management Practices for Construction Near All Sensitive Areas

- Sound Transit will ensure compliance with all local, state, and federal permits received for the project.
- Revegetation of construction easements and other areas will occur either during or immediately after the project is completed. All disturbed riparian vegetation will be replanted. Trees will be planted when consistent with light rail safety standards. Riparian areas will be replanted with native species.
- The project will delineate the construction limits for vegetated and habitat areas to prevent unintended effects to riparian vegetation, wetlands, woodlands, and other sensitive sites

outside of the construction limits. The construction limits will be clearly marked with high-visibility construction fencing prior to any ground-disturbing or construction-related activities, and no work in these sensitive areas will occur. There will be no direct site disturbance outside of the construction limits.

- All work will comply with the terms and conditions set forth in the HPA and other permits (such as the Clean Water Act Section 404 permit) issued for the project, including provisions designed to avoid or minimize the potential for adverse effects on habitat in receiving waters. Such provisions could include restrictions on construction periods below the ordinary high-water mark and/or other measures designed to avoid or minimize the potential for construction activities to deliver sediment or pollutants to streams.
- In accordance with typical requirements of an HPA, when large woody debris must be moved to allow the reasonable use of an over-water or in-water facility, the large woody debris will be returned to the water downstream, where it can continue to provide aquatic habitat function.
- Work areas below the ordinary high water mark will be isolated from other surface waters with a coffer dam or similar system to prevent suspended sediment or pollutants from leaving the work area.
- Heavy equipment will operate from above the ordinary high water mark wherever possible.
- Soil or rock stockpiles, excavated materials, and excess soil materials will be prevented from eroding into sensitive habitats, including water channels, wetlands, and riparian areas outside of the construction limits by high water or storm runoff.
- To reduce the risk of adverse effects on migrating salmonids during project construction, Sound Transit will require construction contractors to direct lighting away from fish-bearing waters and to place hoods or shields on lights, as needed, to minimize the amount of backlight or dispersed light cast toward the water's surface.
- If any culverts need to be installed or extended on fish-bearing or potentially fish-bearing streams, design and construction will comply with WAC 220-110-070 regarding fish passage requirements. Any affected streambeds, stream banks adjacent to culverts, and stream relocation reaches will be permanently restored after in-water work with plantings of native or approved woody and herbaceous species within 1 year of completion of each phase of construction.
- Bank protection will follow the guidelines set forth in WDFW's *Integrated Streambank Protection Guidelines*.

2.3 Mitigation for Wetland, Wetland Buffer, and Stream Impacts

- Sound Transit is coordinating with resource agencies on identifying compensatory mitigation sites for wetland and wetland buffer impacts.
- A monitoring plan and adaptive management plan will be implemented for revegetated sensitive areas or buffers. The plans will verify 100 percent survival of all installed native trees and shrubs 1 year after installation. The performance criteria will be met if all dead plants are replaced at the end of the first year. Native woody species (planted and volunteer) will maintain, on average, a density of four plants per 100 square feet in each plant

community by the end of the 3-year period. Plant communities will be identified in the mitigation plan.

2.4 Design and Operation Best Management Practices

- Permanent stormwater runoff treatment and flow control facilities will be installed to meet the requirements of the Sound Transit's 2012 Design Criteria Manual.
- Stormwater conveyance and management facilities that promote infiltration will be incorporated where applicable and permittable.
- Runoff treatment BMPs that are best suited to the site conditions and best capable of achieving the required levels of treatment will be selected, designed, and installed. These may include natural or engineered dispersion BMPs; biofiltration BMPs such as vegetated filter strips, rain gardens, biofiltration swales, or media filters; wet-pool BMPs; and infiltration BMPs.
- Existing drainage configurations will not be rerouted to the extent that stormwater from one basin or subbasins is conveyed and discharged to another unless no other practical option is available.
- Operations will not cause impacts from overwater lighting, because the tracks will have no overhead lighting and the train headlights will point parallel to the tracks.

Examples of design measures on light rail vehicles to prevent pollution resulting from mechanical lubricants include the following:

- Sealed housing roller bearings for all axle bearings
- Enclosed and sealed motor bearings
- Enclosed truck bearings designed to exclude dirt
- Sealed door mechanisms
- Enclosed, sealed electrical conduits
- On-board batteries contained within sealed enclosures
- Air conditioners with refrigerant enclosed in sealed system and motors with sealed bearings

2.5 Weed Control

- Per federal, state, and local requirements and guidance, Sound Transit will implement appropriate measures to minimize risk of introduction and spread of noxious and invasive species.
- The project will implement pesticide application techniques, in accordance with current Ecology water quality agreements, to minimize the impact on aquatic and terrestrial environments.
- To minimize use of herbicides and fertilizers, restoration of disturbed areas will include the use of mulching, ground cover, and other planting strategies that discourage growth of undesirable species.

3 ACTION AREA

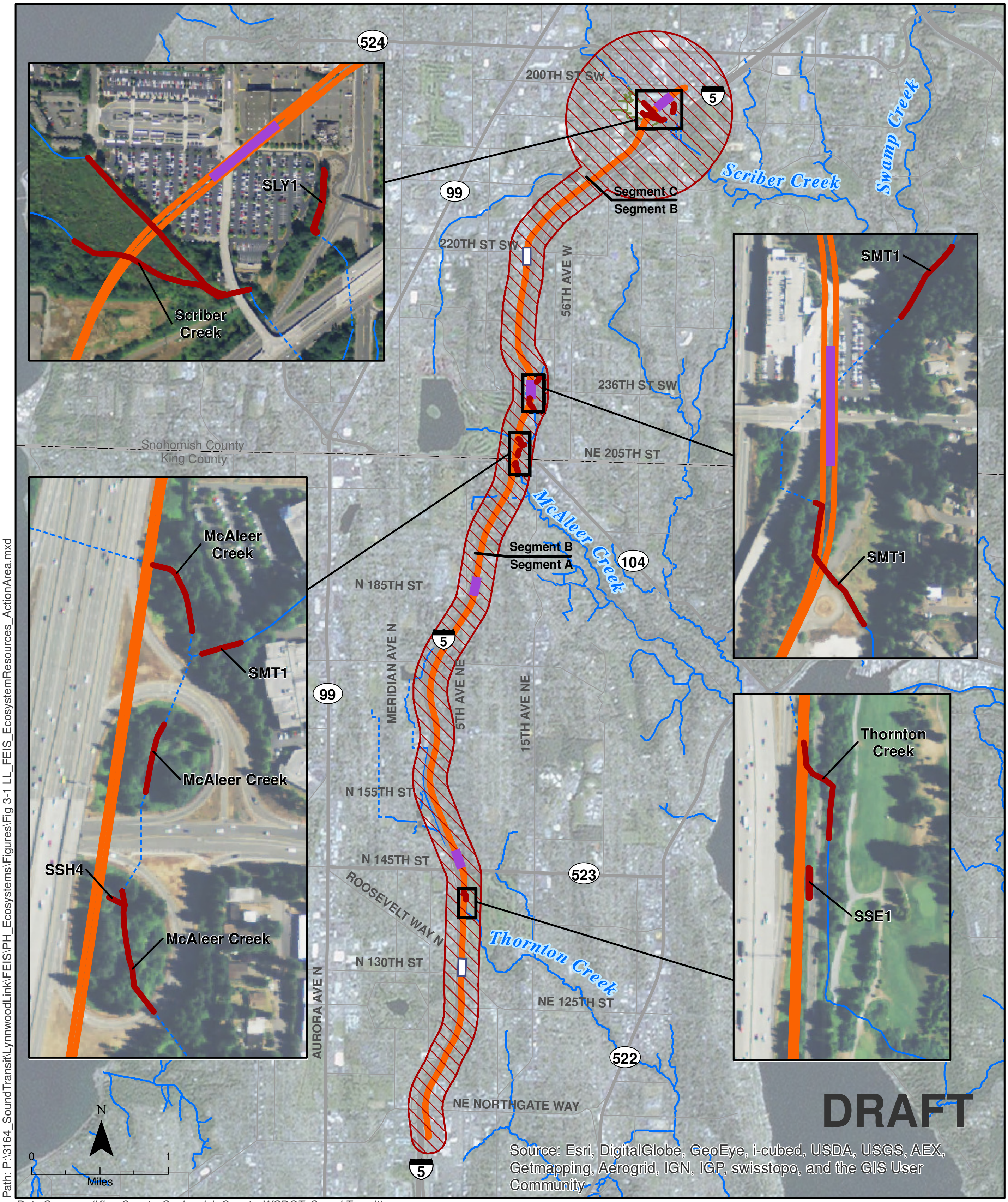
The action area is defined as the area with the potential to be affected directly or indirectly by the project actions. Project components with the potential to affect the species addressed in this analysis species include construction activities (which may contribute to increased turbidity and sedimentation in project area water bodies and elevated noise levels in terrestrial and aquatic areas), increases in the amount of impervious surface area (which may affect the quality and quantity of stormwater discharges to project area water bodies), and changes in the condition of riparian habitat. The action area for this project includes all aquatic habitats extending from the upstream extent of the project footprint, downstream to points 100 to 200 feet from the project footprint (varying by water body; see discussion below), the surface-flowing extent of streams within 200 feet of ground-disturbing activities in contiguous vegetated areas, and all terrestrial habitats within a 650- to 3,100-foot radius of the project footprint (Figure 3-1). The following subsections describe the basis for these determinations.

3.1 Terrestrial Considerations

Project components with the potential to affect the terrestrial environment include construction activities that generate noise levels that could potentially disturb sensitive wildlife species. Other sources of potential effects in terrestrial areas include vegetation removal and disturbance, habitat alteration, soil compaction, shading, and potential introduction of invasive species. All of these effects will be contained within the area potentially affected by noise from construction activities; therefore, the area potentially affected by construction noise was used as the basis for defining the terrestrial portion of the action area.

Baseline noise levels along the proposed project alignment are dominated by traffic noise from I-5 and major arterial roadways. Under current conditions, noise levels at locations near all three segments of the proposed project generally range between 60 and 70 decibels on the A-weighted scale (dBA) when averaged over the 1-hour period with peak noise levels (i.e., peak-hour Leq) (Sound Transit 2013).

Construction noise is expected to exceed noise generated from operation of the Lynnwood Link Extension; therefore, construction noise was used as a basis for defining the action area. Construction activities in most portions of all three segments are expected to result in maximum noise levels of approximately 88 dBA (Sound Transit 2013). Sound levels attenuate (i.e., lose intensity and become less audible) with increasing distance from the source of the noise. Buildings, vegetation, and noise walls absorb and deflect noise along all portions of the proposed alignment, resulting in an attenuation rate of 7.5 dBA per doubling of distance. Using that attenuation rate and a conservative estimate of 60 dBA for background noise levels, project-related construction noise will attenuate to the background levels approximately 650 feet from the project footprint.



Data Sources: (King County, Snohomish County, WSDOT, Sound Transit)

Terrestrial Portion of the Action Area
Aquatic Portion of the Action Area
Proposed Alignment
Proposed Station
Optional Station

Figure 3-1
Action Area

Impact pile driving will likely be required for the construction of temporary work trestles across the Scriber Creek wetland complex near the Lynnwood Transit Center. Impact pile driving can produce maximum short-term noise levels of 99 dBA to 105 dBA at 50 feet (Sound Transit 2013). Using a conservative estimate of 105 dBA, project-related construction noise will attenuate to background levels approximately 3,100 feet from the project footprint.

These two distances—650 feet from most portions of the project footprint and 3,100 feet from locations where impact pile driving may occur—define the geographic extent of project effects relating to noise disturbance. Notably, no ESA-listed species that are sensitive to airborne noise are known or expected to use terrestrial habitats within 5 miles of the project footprint.

3.2 Aquatic Considerations

Project activities in or adjacent to water bodies and wetlands, including earthwork and construction, have the potential to introduce and transport sediment into the aquatic environment at and downstream of the immediate construction or work area. Project activities near water bodies also have the potential to affect riparian habitat, possibly resulting in indirect effects on fish species and habitat.

Sedimentation and turbidity could potentially affect all streams in the project area, with the exception of McAleer Creek tributary SSH2, which is entirely contained in culverts within the action area. The risk of increased sediment input to project area water bodies will be minimized by the use of conservation measures described in Chapter 2. In addition, Sound Transit must comply with water quality mixing zone requirements established by Ecology. For streams with flows of 10 cubic feet per second (cfs) or less during construction the water quality mixing zone is 100 feet downstream of project activities (WAC 173-201A-200-1[e]). For streams with flows between 10 and 100 cfs during construction, the water quality mixing zone is 200 feet.

Construction activities below the ordinary high water mark of water bodies in the action area will comply with the terms and conditions set forth in the HPA and other permits (such as the Clean Water Act Section 404 permit) issued for the project, including provisions designed to avoid or minimize the potential for adverse effects on habitat in receiving waters. Such provisions could include restrictions on construction below the ordinary high-water mark intended to minimize the risk of adverse effects on fish during highly sensitive life history stages (e.g., spawning, rearing). Permits for work in tributaries to Lake Washington commonly require in-water work to be conducted during the summer (likely July and August). During those months, mean daily flows in McAleer Creek are consistently less than 10 cfs (King County 2014a). Flows in Thornton Creek and Scriber Creek are generally less than 10 cfs during July and August, but Snohomish County (2014) and King County (2014a) have reported mean daily flows exceeding 10 cubic feet on a few occasions during those months (less than 5 percent of the July and August dates in the data record for either stream). No monitoring data are available for the tributaries to these streams in the action area, but flows in the tributary streams are substantially lower than flows in the main stem streams; therefore, the potential for any of the tributary streams to support flows exceeding 10 cfs during July or August is negligible. For this analysis, therefore, the mixing zones for Thornton Creek and Scriber

Creek are conservatively estimated to be 200 feet downstream of proposed stream crossings, and the mixing zones for all other potentially affected streams are estimated to be 100 feet downstream of proposed stream crossings. This defines the downstream extent of the aquatic portion of the action area as it relates to potential construction-related increases in turbidity. The only streams where work is proposed below the ordinary high water mark are Scriber Creek and Stream SMT1.

Changes in riparian habitat condition have the potential to affect habitat quality in surface-flowing streams up to 200 feet from the location of ground-disturbing activities. This distance is based on potential effects on riparian functions such as the provision of shade and the recruitment of large woody debris. Stream reaches that are separated from project activities by interruptions in surface flow (e.g., culverts) or vegetative cover (e.g., roadways and maintained clearings wider than 20 feet) are not likely to be affected.

Based on these considerations, the aquatic portion of the action area includes (1) the mixing zones defined above and (2) the surface-flowing extent of streams within 200 feet of ground-disturbing activities in contiguous vegetated areas. This defines the aquatic portion of the action area as it relates to potential construction-related increases in turbidity and potential effects on riparian habitat.

No in-water pile driving will occur in waters that are known or expected to support ESA-listed fish species. In-water pile driving may occur in Scriber Creek, where the stream has an ill-defined channel through the wetland complex west of the Lynnwood Transit Center, upstream of a total barrier to fish passage. Based on the sinuous, braided, and indistinct form of Scriber Creek's channel in the project area, sound energy from any in-water pile driving will not extend more than a few hundred feet upstream or downstream of the location of the activity, and will be blocked by the bends in the stream before it reaches the culvert under I-5 immediately downstream of the location of construction activities. The outlet of that culvert is more than 2,000 feet upstream of any stream reaches that are known or expected to support ESA-listed fish.

4 ENVIRONMENTAL BASELINE

The action area for the Lynnwood Link Extension is dominated by urban development where aquatic habitats have been subjected to moderate to high degrees of alteration. The degree of alteration varies from stream to stream, with the greatest alteration occurring where urban development is the greatest. Some of the smaller streams and headwater reaches have been placed in conveyance systems consisting of pipes and ditches, interfering with natural flow patterns and processes such as groundwater recharge.

The action area for the Lynnwood Link Extension is drained by three stream systems: Thornton Creek, McAleer Creek, and Scriber Creek (Figure 1-1). All three streams drain to Lake Washington. Thornton and McAleer creeks drain directly to the lake, while water from Scriber Creek flows to the lake via Swamp Creek and the Sammamish Slough. Table 4-1 summarizes information about streams in the action area.

Table 4-1. Summary of Streams in the Lynnwood Link Extension Action Area

Stream Name [a]	Stream Index No. [b]	Fish Habitat Status [c]	Local Jurisdiction	Local Jurisdiction Classification [d]	Local Jurisdiction Buffer Width (feet)
Thornton Creek, North Branch	08.0030	Documented	Seattle	Type 3	75
Thornton Creek Tributary (SSE1)	NA	Potential	Seattle	Type 3	75
McAleer Creek Tributary (SSH2)	NA	Unknown (Presumed Potential)	Shoreline	Piped	10
McAleer Creek Tributary (SSH4)	NA	Potential	Shoreline	Type III	65
McAleer Creek	08.0049	Documented	Shoreline	Type II	115
			Mountlake Terrace	Class II	100
McAleer Creek Tributary (SMT1)	08.0050	Potential	Mountlake Terrace	Class III	65
Scriber Creek	08.0061	Documented	Lynnwood	Category I	100
Scriber Creek Tributary (SLY1)	08.0064	Potential	Lynnwood	Category III	35

[a] Streams other than Thornton Creek, McAleer Creek, and Scriber Creek are identified with alphanumeric codes: SYYn. S stands for stream; YY = two-letter code for local jurisdiction (SE = Seattle, SH = Shoreline, MT = Mountlake Terrace, LY = Lynnwood); n = sequential identification number.

[b] Water Resource Inventory Area (WRIA) identification numbers according to Williams et al. (1975). 'NA' indicates watercourses that are not identified in that inventory.

[c] Documented = Fish have been observed in the action area; Potential = Potential fish habitat is present, based on field assessment of stream width and gradient, but stream segments in the action area are upstream of human-caused fish passage barriers; Unknown = No fish presence data are available and stream segments are contained within culverts in the action area.

[d] Identification and classification of streams for this analysis represent conservative estimates, based on available information and the provisions of local critical areas rules. Some of the watercourses identified in this analysis may not actually be defined as streams by the local jurisdictions, or they may be assigned smaller buffers. Actual impacts would be analyzed and mitigated as appropriate through local permitting processes.

Sound Transit identified 37 wetlands in the action area (Table 4-2). All wetlands within 100 feet of the footprint of the proposed alignment were formally delineated and rated according to local regulations and the *Washington State Wetland Rating System for Western Washington* (Hruby 2004). Other wetlands within public rights-of-way near the proposed alignment were mapped and rated as well.

Table 4-2. Summary of Wetlands in the Lynnwood Link Extension Action Area

Wetland[a]	Size (acres)	USFWS Class[b]	HGM Class[c]	City with Jurisdiction	Local Rating[d]	Buffer Width (feet)
Segment A						
WSE1	0.42	PFO	Riv	Seattle	III	60
WSE3	0.25	PFO,PEM	Dep,Slope	Seattle	III	60
WSE4	0.11	PFO	Dep	Seattle	III	60
WSE5	0.26	PFO	Dep	Seattle	III	60
WSE6	0.08	PSS	Dep	Seattle	III	60
WSE7	0.19	PSS,PEM	Dep	Seattle	III	60
WSE8	0.66	PFO,PSS	Dep	Seattle	III	60
WSH1	0.08	PFO,PSS,PEM	Dep,Slope	Shoreline	III	65
WSH2	0.36	PEM	Dep,Slope	Shoreline	IV	35
WSH3	0.03	PEM	Slope	Shoreline	IV	35
PWSH3	0.10	PFO,PEM	unknown	Shoreline	III	65
PWSH4	0.19	PFO	Slope	Shoreline	III	65
PWSH5	0.07	PEM	Slope	Shoreline	III	65
Segment B						
WSH4	0.10	PFO,PEM	Dep,Slope	Shoreline	III	65
WSH5	0.48	PFO	Dep	Shoreline	III	65
WMT1	0.49	PFO	Dep	Mtlk. Terrace	III	65
WMT2	0.11	PFO	Riv,Slope	Mtlk. Terrace	III	65
WMT3	0.07	PFO	Dep	Mtlk. Terrace	III	65
WMT4	0.43	PFO,PSS	Dep,Slope	Mtlk. Terrace	III	65
WMT5	0.34	PFO,PEM	Dep	Mtlk. Terrace	III	65
WMT6	1.12	PFO	Dep	Mtlk. Terrace	III	65
WMT7	0.42	PFO	Dep	Mtlk. Terrace	IV	50
WMT8	0.01	PFO	Slope	Mtlk. Terrace	IV	50
WMT9	0.03	PEM	Dep	Mtlk. Terrace	IV	50
WMT10	0.03	PSS	Dep	Mtlk. Terrace	III	65
WMT11[e]	0.07			Mtlk. Terrace		
PWMT2	0.02	PFO	Dep	Mtlk. Terrace	III	65
Segment C						
WLY3	0.26	PSS	Dep	Lynnwood	III	75
WLY4	16.59	PFO,PSS,PEM	Riv, Dep	Lynnwood	II	110
WLY6	0.04	PFO	Dep	Lynnwood	III	75
WLY7	0.15	PSS	Dep	Lynnwood	III	75
WLY8	0.08	PEM	Dep	Lynnwood	III	75
PWLY1	0.07	PSS	Dep	Lynnwood	III	75
PWLY2	0.26	PFO	Dep	Lynnwood	III	75
PWLY3	0.07	PEM	Dep	Lynnwood	III	75
PWLY4	0.03	PFO	Dep	Lynnwood	III	75
PWLY5	0.03	PUB	Dep	Lynnwood	III	75

[a] Wetlands are identified with alphanumeric codes; WYYn, W stands for wetland; PW stands for potential wetland; YY = two-letter code for local jurisdiction (SE = Seattle, SH = Shoreline, MT = Mountlake Terrace, LY = Lynnwood); n = sequential identification number.

[b] Cowardin et al. (1979); USFWS = U.S. Fish and Wildlife Service. PEM = palustrine emergent; PFO = palustrine forested; PSS = palustrine scrub-shrub; PUB = palustrine unconsolidated bottom.

[c] Brinson (1993). HGM = Hydrogeomorphic; Dep = Depressional; Riv = Riverine; Slope = Slope

[d] Seattle Municipal Code 25.09.160.A , only applicable to development on publicly or privately owned parcels; Shoreline Municipal Code 20.80.320, Mountlake Terrace Municipal Code 16.15.080; and Lynnwood Municipal Code 17.10.050

[e] Classification and rating are not yet complete for Wetland WMT11; based on preliminary data, it will likely be rated as Category III or Category IV.

Wetlands outside of public rights-of-way and more than 100 feet from the footprint of the proposed alignment were identified via existing documentation and public vantage points, and are identified as potential wetlands for this analysis. Sound Transit will request jurisdictional determinations of those wetlands that are likely to be affected along the proposed alignment during the permitting phase of this project.

All wetlands in the action area are in areas where the natural environment has been altered by urban development. Many are within maintained rights-of-way where they receive stormwater runoff from pipes, ditches, or overland flow. Other sources of hydrology include a shallow groundwater table, precipitation, and overbank flow from adjacent streams. With one exception, all of the wetlands in the study area have relatively low quality ratings (Category III or IV), indicating moderate to low levels of wetland function and moderate to high levels of disturbance. The exception is a Category II wetland (Wetland WLY4) associated with Scriber Creek. This large wetland/stream complex located near the Lynnwood Transit Center provides multiple water quantity, water quality, and habitat functions. In addition, WLY4 is the only wetland in the action area that is accessible to fish.

The following sections describe the streams and wetlands present in the action area and provide information about fish use[1], fish habitat quality, and riparian habitat conditions in the streams. Anthropogenic factors that influence habitat quality for each stream are also identified. Summary information about wetlands in the action area is also provided. Information is organized by the three project segments, progressing from south to north.

4.1 Segment A: Northgate to Shoreline

Segment A of the Lynnwood Link Extension alignment crosses Thornton Creek and runs parallel to Stream SSE1 (Figure 1-2). Construction and operation of light rail facilities for Segment A also have the potential to affect several wetlands and wetland buffers in the cities of Seattle and Shoreline.

4.1.1 Streams

Thornton Creek

The 7,200-acre Thornton Creek basin drains a substantial portion of northeastern Seattle and most of Shoreline. The stream flows generally south and east before discharging to Lake Washington. Land elevations range from 18 feet at the stream's mouth at Lake Washington to more than 500 feet in the northwestern portions of the basin.

[1] Note that in addition to providing information about known or expected occurrence, WDFW's SalmonScape fish database and mapping application (WDFW 2014b) also identifies stream segments with the potential to support salmonid use, based on stream gradient. Areas with a gradient of 12 percent or greater are considered to be natural barriers to access by most salmonids, including Chinook salmon and steelhead. Stream segments upstream of areas with known species presence but downstream of gradient-based barriers are categorized as 'modeled' habitat for these species. The 'modeled' category does not factor habitat quality, flow, or any other natural or human-caused conditions (including barriers to fish passage) that would otherwise prevent habitat use. For this analysis, a species is presumed to be absent from areas categorized as modeled habitat unless documented observations indicate otherwise.

Thornton Creek drains the southern half of the action area (south of NE 185th Street, approximately). Segments of the North Branch of Thornton Creek (WRIA No. 08.0030) within and immediately upstream of the Jackson Park Golf Course fall within the action area. The South Branch of Thornton Creek, also known as Maple Leaf Creek, originates in wetlands near Northgate, North Seattle Community College, and I-5 (City of Seattle 2007). The two branches join to form the 1.4-mile-long main stream near the Meadowbrook stormwater detention pond in northeast Seattle. The action area does not include any portions of the South Branch or the main stem of Thornton Creek.

The North Branch of Thornton Creek originates near Ronald Bog in Shoreline and flows 5 miles before joining the South Branch, draining an area of approximately 7 square miles (City of Seattle 2007). The only surface-flowing reach of Thornton Creek within the action area is a 100-foot-long segment that flows out of a pair of 1,500-foot-long, 72-inch-diameter culverts under I-5 and into a pair of 48-foot-long, 40-inch-diameter culverts under 5th Avenue NE. After emerging from the culverts under 5th Avenue NE, the stream flows in a ditch between the street and the Jackson Park Golf Course for approximately 700 feet before veering east into the golf course (Tetra Tech/KCM 2004b).

Anthropogenic Factors

Overall, approximately 59 percent of the Thornton Creek basin is covered by impervious surfaces such as roads, buildings, and parking lots (City of Seattle 2007). In portions of the basin north of the Seattle city limits, the City of Shoreline calculated existing impervious area values ranging between 45 and 48 percent (Tetra Tech/KCM 2004b). Kerwin (2001) estimated the effective impervious area in the basin at 31.9 percent. The City of Seattle (2007) identified the following problematic conditions in the system, due primarily to urban development in the basin:

- Altered hydrology, with high and flashy flows
- Degraded water quality, with temperatures and fecal coliform bacteria frequently at levels above state standards
- Excess nutrients under non-storm flow conditions
- Channel incision and degraded in-stream habitat, due to restricted channel width and loss of hydrologic connectivity to the floodplain
- Depressed levels of coarse sediment, in-stream wood, and riparian forest
- Fish passage barriers that limit anadromous fish to 30 percent of the watercourse length
- High pre-spawn mortality rates of coho salmon

Fish Use

The lower reaches of Thornton Creek support spawning anadromous salmonids. Chinook, coho, and sockeye salmon redds have been observed in the North Branch as far upstream as 35th Avenue NE and NE 115th Street, approximately 3 miles downstream of the action area (City of Seattle 2007, WDFW 2014b). Individual chum salmon (likely strays from other basins [Kerwin 2001]) have also been sighted in the lower portions of the stream (McMillan 2007 in City of Seattle 2007), and steelhead have been observed throughout much of the system (WDFW 2014b).

Chinook salmon have been documented in the North Branch of Thornton Creek as far upstream as the confluence with Littlebrook Creek, approximately 2.5 miles downstream of the action area; the nearest stream reach where Chinook spawning has been documented is in the main stem of Thornton Creek, another 0.5 mile downstream (WDFW 2014b).

According to WDFW (2014b), steelhead are present in the North Branch of Thornton Creek as far upstream as the Jackson Park Golf Course, approximately 1,600 feet downstream of the action area. Based on the observation of an adult steelhead near Twin Ponds upstream of the action area (Tetra Tech/KCM 2004b), however, it is possible that steelhead may use stream habitats in the action area.

Resident salmonids are also present in the Thornton Creek system, including reaches that are within or upstream of the action area. Cutthroat trout (*Oncorhynchus clarki*) have been observed as far upstream as the Jackson Park Golf Course and rainbow trout have been observed another mile upstream, near Twin Ponds (City of Seattle 2007). According to WDFW (2012), resident cutthroat trout are expected to be present in Thornton Creek as far upstream as Ronald Bog. Native non-salmonid species that use Thornton Creek include threespine stickleback (*Gasterosteus aculeatus*), prickly sculpin (*Cottus asper*), coast-range sculpin (*C. aleuticus*), and lamprey (*Lampetra* sp.) (Tabor et al. 2010). Non-native fish species that have been introduced to Thornton Creek, either intentionally or unintentionally, include rock bass (*Ambloplites rupestris*), pumpkinseed (*Lepomis gibbosus*), largemouth bass (*Micropterus salmoides*), and oriental weatherfish (*Misgurnus anguillicaudatus*) (Tabor et al. 2010).

Migratory cutthroat trout are the most abundant salmonid in Thornton Creek, with an average annual adult count of more than 200 live fish on spawning grounds (City of Seattle 2007). Based on carcass counts from 1999 through 2005, the average annual anadromous run size in Thornton Creek is 33 coho, 7 sockeye, and 4 Chinook salmon (City of Seattle 2007).

WDFW (2014a) classified three of the culverts in Thornton Creek downstream of the action area as total barriers to fish passage. An additional 18 structures, including 7 culverts, 5 streambed control structures, 3 recreational dams, 2 bridges, and 1 artificial waterfall, are partial barriers (WDFW 2014a). Within the action area, the culverts under I-5 and 5th Avenue NE are also partial barriers (WDFW 2014a). However, the observation in 2004 of an adult steelhead upstream of Twin Ponds suggests that none of these structures, including the culvert under I-5, may present an absolute barrier to fish passage (Tetra Tech/KCM 2004b). Notably, steelhead are renowned for their ability to negotiate what would be considered barriers for most other salmonids (Tetra Tech/KCM 2004b).

Water Quality

No portions of Thornton Creek within the action area are listed as impaired water bodies under CWA Section 303(d) (Ecology 2012b). The main stem and the lower portions of the North and South Branches are listed as impaired, based on demonstrated exceedances of state water quality standards for temperature and dissolved oxygen (Ecology 2012b). The lowest reaches of the main stem are also listed for fecal coliform bacteria. In addition, Ecology (2012b) has identified portions of Thornton Creek as a water of concern for both pH and mercury.

Since 1971, King County has monitored water quality in Thornton Creek at a station located near the stream's mouth. Results from a trend analysis of water quality data from 1971 to 2007 indicated that water quality might have declined during that 37-year analysis period, with statistically significant increases in water temperatures, total phosphorus, turbidity, and conductivity, as well as decreased concentrations dissolved oxygen (King County 2014a). Decreased levels of ortho-phosphorus, nitrate-nitrogen, and total nitrogen indicate some improvements in water quality during that period. In its most recent (2013) water quality report for Thornton Creek, King County assigned the stream a water quality index score of 45, indicating a moderate level of concern for water quality (King County 2014c). In general, scores between 40 and 80 indicate a moderate level of concern and scores below 40 indicate a high level of concern. The water quality index score for Thornton Creek was greater than 40 in only 2 of the 14 years from 2000 to 2013 (King County 2014c).

In-stream Habitat

In-stream habitat quality of the North Branch of Thornton Creek within the action area is rated as low, based on channel morphology, sediment regime, and existing physical habitat conditions (City of Seattle 2007). The stream valley in most of the action area has been modified by grading, fill, and excavation, particularly near I-5, where the stream has been straightened and confined. The channel has more sinuosity within the golf course (downstream of the action area), but the banks in many areas are hardened by riprap and the stream cannot migrate. Note that this description is based on surveys that were completed between 1999 and 2004, before stream restoration work was completed within the Jackson Park Golf Course. The habitat benefits of that effort are not reflected in the description (City of Seattle 2007).

Thornton Creek near 5th Avenue NE, looking upstream toward the outlets of the twin culverts under I-5

Throughout the segment of Thornton Creek within the action area, the channel is mostly eroding and degrading or has been locked into place through bank armoring. Gradients range between 1 and 2 percent. Gravel and sand are the dominant sediment types, and riffles and glides are the dominant habitat types; little in-stream structure is present to contribute to pool formation. This dearth of in-stream structure also reduces the channel's capacity to trap and store sediment (City of Seattle 2007). Based on the predominance of fine sediments, spawning habitat quality is considered poor. Based on the presence of overhanging vegetation and relatively deep water, portions of the stream within the action area likely provide suitable rearing habitat for juvenile fish (Tetra Tech/KCM 2004b).

Upstream of the I-5 culvert, Thornton Creek lies outside of the action area and on the opposite side of I-5 from the proposed alignment.

Riparian Habitat

Riparian habitat quality of Thornton Creek within the action area is rated low, based on riparian area width, connectivity, understory and canopy composition, canopy density, and the percentage of the stream shaded by vegetation (City of Seattle 2007). Stream banks in most portions of the action area are dominated by Himalayan blackberry (*Rubus armeniacus*). The riparian buffer within the footprint of the project alignment consists of a 40- to 50-foot-wide strip of trees (primarily red alder [*Alnus rubra*] and young Douglas-fir [*Pseudotsuga menziesii*]) between 5th Avenue NE and the off-ramp from I-5 to NE 130th Street.

On the opposite side of 5th Avenue NE from the project footprint, a 50- to 70-foot-wide strip of vegetation along the stream includes red alder, black cottonwood (*Populus balsamifera*), and scattered patches of immature western redcedar (*Thuja plicata*). This overstory canopy provides shade for the stream during spring and summer (when the deciduous trees have leaves), as well as the potential for contributing some woody debris. Within the golf course, the dominant riparian vegetation along Thornton Creek consists of non-native plants, turf, and landscaping.

Aerial view of riparian habitat along Thornton Creek and SSE1 in the action area

Thornton Creek Tributary SSE1

Approximately 300 feet south of Thornton Creek's crossing under 5th Avenue NE, a watercourse emerges from a culvert in the I-5 right-of-way, flows southward in the ditch on the west side of 5th Avenue NE for approximately 100 feet, and then drains eastward to Thornton Creek via a culvert under 5th Avenue NE. The watercourse was not catalogued as a stream by Williams et al. (1975), the source of the water in the ditch is not known, and historic maps of the area do not indicate the presence of a tributary to Thornton Creek at this location. However, field observations of flowing water during the summer months suggest the possibility that some flow may be derived from groundwater. For this analysis, this watercourse is provisionally identified as a stream (SSE1) and classified as Type 3, based on the presence of a 2-foot-wide channel and a gradient less than 16 percent. A formal determination of whether the watercourse is a stream (and if so, how it is classified) will occur through the process of project permitting with the City of Seattle. Riparian habitat for the surface-flowing segment of the watercourse consists of a strip of red alder and Himalayan blackberry in the I-5 right-of-way between 5th Avenue NE and the off-ramp from I-5 northbound to NE 145th Street.

4.1.2 Wetlands

None of the 13 wetlands identified in Segment A has a surface water connection to any streams that support ESA-listed fish. Collectively, however, the ecological functions of these wetlands (e.g., water quality maintenance, stormwater detention, groundwater recharge) likely contribute to the maintenance of fish habitat conditions in the Thornton Creek basin.

Seven of the wetlands fall within the Seattle city limits and six are within Shoreline (Table 4-2). All seven of the Seattle wetlands are rated as Category III, indicating moderate levels of wetland function. Four of these seven wetlands provide only one habitat class (forested or shrub); the other three provide combinations of two habitat classes (forested, scrub-shrub, or emergent). In Shoreline, four of the wetlands are rated as Category III and two are rated as Category IV (indicating low levels of wetland function). One of the Category III wetlands provides three different habitat classes (forested, scrub-shrub, and emergent), one provides two classes (forested and emergent), and each of other two provides one class (emergent or forested). The two Category IV wetlands provide only one habitat type (emergent). Vegetation in all of the wetlands is a mix of native and non-native species, many of which are disturbance-tolerant. Surrounding buffers range from forested to herbaceous cover; disturbance-tolerant species are common.

4.2 Segment B: Shoreline to Mountlake Terrace

Segment B of the Lynnwood Link Extension alignment crosses three streams: McAleer Creek, Stream SSH2, and Stream SMT1 (see Figures 1-3 and 1-4). Streams SSH2 and SMT1 are non-fish-bearing tributaries to McAleer Creek. Stream SSH2 is entirely contained in culverts through the action area. Construction and operation of light rail facilities for Segment B also have the potential to affect several wetlands and wetland buffers in the cities of Shoreline and Mountlake Terrace.

4.2.1 Streams

McAleer Creek

McAleer Creek (WRIA No. 08.0049) originates at Lake Ballinger and flows roughly 6 miles to the northeast corner of Lake Washington. The 5,300-acre drainage basin includes portions of Lynnwood, Edmonds, Mountlake Terrace, Shoreline, and Lake Forest Park. Land elevations range from 18 feet at the stream's mouth in Lake Washington to more than 500 feet north of the Mountlake Terrace Transit Center. Most of the northern portion of the action area (from NE 185th Street in Shoreline, north to about 208th Street SW in Lynnwood) drains to the McAleer Creek system. Areas north of 224th Street SW drain to Lake Ballinger, which empties to McAleer Creek.

Much of McAleer Creek within the action area is contained within culverts. The stream enters the action area from an open channel through the Nile Golf Course west of I-5. The stream segments in the action area are as follows, progressing from upstream to downstream:

- Culvert under I-5 (440 feet)
- Open channel adjacent to the on-ramp from SR 104 westbound to I-5 northbound (240 feet) (photo at right)
- Culvert under the cloverleaf interchange between I-5 northbound and SR 104 westbound (280 feet)
- Open channel in the area enclosed by the off-ramp from I-5 northbound to SR 104 westbound (200 feet) (photo below, left)
- 4-foot by 6-foot box culvert under SR 104 (320 feet)
- Channelized open water course in the area enclosed by the on-ramp from SR 104 eastbound to I-5 northbound (200 feet) (photo below, right)
- 66-inch-diameter culvert beneath the cloverleaf interchange between I-5 northbound and SR 104 eastbound (280 feet)

McAleer Creek near the outlet of the culvert under I-5, looking downstream (culvert at right is not the I-5 culvert)

McAleer Creek in the cloverleaf interchange between westbound SR 104 and northbound I-5, looking upstream near the middle of the segment

McAleer Creek in the cloverleaf interchange between eastbound SR 104 and northbound I-5, looking upstream from the downstream end of the segment

Anthropogenic Factors

In addition to the extensive portions of the stream that are contained within culverts, McAleer Creek has been affected by urban development throughout its basin. Kerwin (2001) estimated the effective impervious area in the basin at 30.5 percent. Tetra Tech/KCM (2004a) calculated the total impervious area for portions of the McAleer Creek basin within the city of Shoreline to be 46 percent. Forested areas provide shade and other vital functions in some areas; in most of the basin, however, riparian habitat includes single-family homes, apartments, and lawns.

Fish Use

McAleer Creek supports anadromous fish as far upstream as Lake Ballinger. The presence of Chinook salmon has been documented approximately 1,000 feet downstream of the action area and spawning has been documented approximately 4,800 feet further downstream (WDFW 2014b). WDFW (2014b) has documented the presence of steelhead as far upstream as the mouth of the tributary (Stream SMT1) near the on-ramp from SR 104 westbound to I-5 northbound, within the action area. Tetra Tech/KCM (2004a) reported observations of steelhead spawning in McAleer Creek approximately 200 feet downstream of the action area, although WDFW (2014b) does not identify any parts of McAleer Creek as spawning habitat for steelhead. King County (2012) reported that volunteers with the Salmon Watcher Program have consistently seen Chinook, coho, and sockeye salmon in the stream but did not specify the upstream extent of observations or whether any spawning activity was observed.

Other salmonids known or expected to be present in the action area are coho salmon and cutthroat trout. Portions of McAleer Creek downstream of the confluence with Stream SMT1 provide spawning habitat for coho salmon, while those upstream of that point provide rearing habitat (WDFW 2014b). Resident cutthroat trout are present throughout the stream, even upstream of Lake Ballinger (WDFW 2012), and have been observed spawning in McAleer Creek immediately outside of the action area (Tetra Tech/KCM 2004a). The lower reaches of the stream provide spawning habitat for sockeye salmon (WDFW 2014b). Kokanee salmon and rainbow trout have also been observed in McAleer Creek, but locations for those observations have not been specified (Kerwin 2001).

WDFW (2014a) classified four culverts in McAleer Creek downstream of the project action as partial barriers to fish passage and one culvert as a possible barrier. Within the action area, the culverts under I-5 and under the off-ramp from I-5 northbound to SR 104 westbound are also partial barriers (WDFW 2014a). The culvert under I-5 may be a migration barrier to juvenile salmonids that prevents the use of Lake Ballinger for rearing (Kerwin 2001).

Water Quality

No portions of McAleer Creek within the action area are listed as impaired or waters of concern under the Clean Water Act (CWA) Section 303(d). The lower portions of McAleer Creek are listed as impaired water bodies, based on demonstrated exceedances of state water quality standards for fecal coliform and dissolved oxygen (Ecology 2012b). Lake Ballinger upstream of the action area is on the list for contaminants, including polychlorinated biphenyls (PCBs), dieldrin, and 2,3,7,8-TCDD, which have been detected in fish tissue samples (Ecology 2012b).

Sediment samples collected at a site approximately 1 mile upstream of the action area had chemical compounds at concentrations likely to cause adverse effects in aquatic animals living in the sediments (King County 2012). Sediment samples from a site approximately 0.25 mile downstream of the action area contained pyrene and nickel, but the potential for chemical effects is uncertain due to the contaminant levels (King County 2012).

Since 1976, King County has monitored water quality in McAleer Creek at a station located near the stream's mouth. Results from a trend analysis of water quality data from 1979 to 2004 did not indicate any significant changes in temperature; concentration of dissolved oxygen; or levels of bacteria, nitrogen, and total phosphorus (King County 2012). However, conductivity increased significantly during the analysis period, suggesting the presence of dissolved charged substances in the water, possibly related to metal concentrations in sediments (King County 2012). Decreasing levels of total suspended solids and decreased concentrations of ortho-phosphorus indicate some improvements in water quality during that 25-year period. In its most recent water quality report for McAleer Creek, King County assigned the stream a water quality index score of 74, indicating a moderate level of concern for water quality (King County 2014b). In general, scores between 40 and 80 indicate a moderate level of concern and scores above 80 indicate a low level of concern. Water quality index scores for McAleer Creek generally ranged between 50 and 60 from 2000 to 2008, dropping below 40 in two years (King County 2014b).

In-stream Habitat

Immediately downstream of the action area, the in-stream habitat of McAleer Creek has been rated as poor, based on the preponderance of fine sediments, as well as scouring and incision resulting from bank hardening (Tetra Tech/KCM 2004a). The channel provides poorly defined pool-riffle complexes; the only pool habitat consists of step-pools formed by weirs. The gravel/cobble stream substrate is heavily cemented with sediment, which reduces its spawning suitability (Tetra Tech/KCM 2004a). Based on benthic invertebrate samples collected in 2002 and 2003, King County (2012) rated conditions in McAleer Creek as poor for benthic invertebrates.

Riparian Habitat

Riparian habitat quality along the open-channel segments of McAleer Creek in the action area is generally good and is dominated by forest canopy that provides shade and the potential for recruitment of woody debris that contributes to channel complexity. The value of the riparian habitat is limited, however, by a lack of connectivity. The open-channel habitat and associated riparian areas of McAleer Creek occur in three discrete segments in the action area, separated by segments that are contained within culverts.

McAleer Creek Tributary SSH2

Approximately 1,800 feet south of the I-5/SR 104 interchange, a tributary to McAleer Creek (Stream SSH2) has been identified as passing under I-5 (Tetra Tech/KCM 2004a). This tributary was not catalogued by Williams et al. (1975). The stream enters a culvert just west of I-5, is contained within culverts through the action area, and resurfaces approximately 1,500 feet later, shortly before its confluence with the main stem near a wastewater pumping station upstream of 15th Avenue NE (Tetra Tech/KCM 2004a). The open-water portions of the stream west of I-5 are within concrete-lined ditches along NE 200th Street. During site visits conducted for this analysis, flowing water was observed in this watercourse only during and immediately after rainfall.

Stream SSH2 in ditch along NE 200th Street, immediately upstream (west) of I-5

Based on the presence of human-created barriers to fish passage, no fish are known or expected to use Stream SSH2 in the action area (WDFW 2014b, 2012). In addition, all portions of the stream within and adjacent to the footprint of the Lynnwood Link Extension are contained within culverts. However, the basin size, channel width, and stream gradient of the tributary indicate the potential to support fish use in the future.

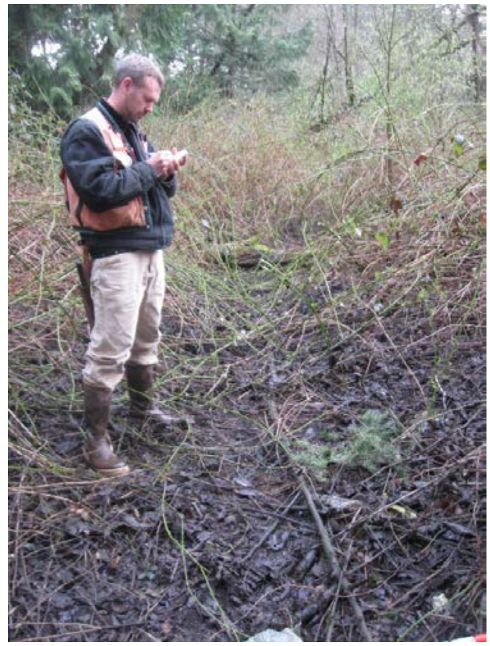
McAleer Creek Tributary SSH4

Within the cloverleaf interchange between eastbound SR 104 and northbound I-5, a watercourse emerges from a culvert under the roadway, flows approximately 30 feet, and then joins McAleer Creek. The watercourse was not catalogued as a stream by Williams et al. (1975), the source of the water is not known, and historic maps of the area do not indicate the presence of a tributary to McAleer Creek at this location. However, field observations of flowing water during the summer months suggest the possibility that some flow may be derived from groundwater. For this analysis, this watercourse is provisionally identified as a stream (SSH4) and classified as Type III, based on the presence of a 2-foot-wide channel and a gradient less than 16 percent. A formal determination of whether the watercourse is a stream (and if so, how it is classified) will occur through the process of project permitting with the City of Shoreline. If the watercourse is classified as a Type III stream, its regulatory buffer will be contained entirely within the larger regulatory buffer for McAleer Creek. Riparian habitat conditions for Stream SSH4 are therefore as described for McAleer Creek, above.

McAleer Creek Tributary SMT1

North of the I-5/SR 104 interchange, a tributary (WRIA No. 08.0050; Stream SMT1) joins McAleer Creek in the wooded area adjacent to the on-ramp from SR 104 westbound to I-5 northbound. The tributary originates in Veterans Memorial Park northeast of the Mountlake Terrace Transit Center, then flows south through a series of open watercourses and culverts east of I-5. During site visits conducted for this analysis, flowing water was observed in this watercourse only during and immediately after rainfall. Farther downstream, along the eastern border of the Edmonds School

District property south of 236th Street SW, water from a culvert under the school property contributes flow on a more regular basis. The City of Mountlake Terrace has identified the uppermost reaches of this watercourse in the study area as a Class V (seasonal, non-fish-bearing) stream. City staff have not yet made a determination concerning the classification of the downstream reaches that have more consistent flow. The segment that is crossed by the proposed light rail alignments is upstream of the water source in the Edmonds School District property and is likely to be considered a Class V stream.



Ill-defined channel of Stream SMT1 south of the off-ramp from I-5 to South 236th Street

Culvert at confluence of Stream SMT1 with McAleer Creek

WDFW (2014a) identified the culvert at the mouth of Stream SMT1 as a total barrier to fish passage. Based on the presence of human-created barriers to fish passage, no fish are known or expected to use Stream SMT1 in the action area (WDFW 2014b, 2012). However, the basin size, channel width, and stream gradient of the tributary indicate the potential to support fish use in the future. Riparian habitat quality along the open-channel segments of Stream SMT1 in the action area is generally good and dominated by forest canopy that provides shade and the potential for recruitment of woody debris that contributes to channel complexity. The stream reach that falls within the footprint of the elevated guideway is contained within an ill-defined channel that shows minimal traces of surface flow.

4.2.2 Wetlands

None of the 14 wetlands identified in Segment B has a surface water connection to any streams that support ESA-listed fish. Collectively, however, the ecological functions of these wetlands (e.g., water quality maintenance, stormwater detention, groundwater recharge) likely contribute to the maintenance of fish habitat conditions in the McAleer Creek basin.

Two of the wetlands fall within the Shoreline city limits and twelve are within Mountlake Terrace (Table 4-2). Both of the Shoreline wetlands are rated as Category III, indicating moderate levels of wetland function. One has two habitat classes (forested and emergent) and the other has one (forested). In Mountlake Terrace, eight of the wetlands are rated as Category III and three are rated as Category IV (indicating low levels of wetland function). Classification and rating are not yet complete for one of the Mountlake Terrace wetlands; based on preliminary data, it will likely be rated as Category III or Category IV. Two of the Category III wetlands in Mountlake Terrace provide two different habitat classes (combinations of forested and scrub-shrub or emergent). The other six Category III wetlands in Mountlake Terrace provide only one habitat class: five are forested and one is scrub-shrub. The three Category IV wetlands in Mountlake Terrace provide only one habitat class (forested or emergent). Vegetation in all of the wetlands is a mix of native and non-native species, many of which are disturbance-tolerant. Surrounding buffers range from forested to herbaceous cover; disturbance-tolerant species are common.

4.3 Segment C: Mountlake Terrace to Lynnwood

Segment C of the proposed Lynnwood Link Extension alignment crosses Scriber Creek within a wetland complex immediately west of the Lynnwood Transit Center (Figure 1-4). Also, a tributary to Scriber Creek (Stream SLY1) west of the transit center may benefit from improvements in flow control and water quality treatment. Construction and operation of light rail facilities for Segment C also have the potential to affect several wetlands and wetland buffers in Lynnwood.

4.3.1 Streams

Scriber Creek

Scriber Creek (WRIA No. 08.0061) drains approximately 4,250 acres, including the extreme northern portion of the action area. Land elevations range from approximately 200 feet at the stream's confluence with Swamp Creek to more than 600 feet at the northwest watershed divide. The stream flows southeast, joining Swamp Creek approximately 2.6 miles downstream of the action area. Swamp Creek flows into the Sammamish River, which empties into the northern end of Lake Washington.

Scriber Creek within the wetland complex, looking downstream

For much of its length in the action area, the stream channel is braided and indistinct as it flows through the large wetland complex (Wetland WLY4) south and west of the Lynnwood Transit Center. The stream forms a defined channel as it exits the action area, flowing southeast and under I-5. Based on input provided by Ecology staff who collaborated on field delineations in July 2014, the ordinary high water mark of Scriber Creek through the wetland complex is defined as encompassing the entire breadth of the complex. At most times of year, flowing water is confined to a few channels that make up a small portion of total wetland complex area. The locations of these channels likely change from year to year.

Anthropogenic Factors

Scriber Creek subbasin is the most highly developed of the Swamp Creek subbasins. Commercial development and transportation corridors account for approximately 40 percent of the subbasin, and medium-density, single-family development covers another approximately 30 percent (Snohomish County 2002). The effective impervious area in the subbasin is approximately 40 percent (Snohomish County 2002). Jones and Stokes (2000) identified untreated runoff from roads and new construction as a likely source of excessive fine sediment in the portion of Scriber Creek that falls within the action area. Street runoff from roads upstream of the action area also conveys oil and other pollutants to the stream system.

Fish Use

Anadromous salmonids have been observed in Scriber Creek, but sources differ about their habitat use as far upstream as the action area. WDFW (2014a) identified a total barrier to anadromous fish passage in a wooded area near 209th Place SW, approximately 2,900 feet downstream of the action area. According to WDFW (2014b), however, the upstream extent of anadromous salmonid presence in Scriber Creek is approximately 500 feet downstream of the action area, where coho salmon have been observed below the culvert under I-5. The picture is further complicated by reports from the City of Lynnwood (2004) of adult coho salmon in Scriber Creek as far upstream as Highway 99, approximately 1 mile above the action area.

Chinook salmon have been documented in Scriber Creek just upstream of Larch Way, approximately 3,100 feet downstream of the action area; the nearest stream reaches that provide spawning habitat for Chinook salmon are in Swamp Creek, approximately 2.6 miles downstream (WDFW 2014b). Steelhead are not currently known or expected to use habitats in Scriber Creek, although winter-run steelhead have been observed in Swamp Creek, to which Scriber Creek is a tributary (Snohomish County 2002, WDFW 2014b). There are no recent validated reports of bull trout in any of the subbasins of Swamp Creek (Snohomish County 2002, WDFW 2014b).

Along with the coho salmon noted above, the other salmonid species that has been documented in Scriber Creek is resident cutthroat trout, which is present throughout the action area and as far upstream as Scriber Lake Park (WDFW 2012). Other species in the stream include largemouth bass and yellow perch, which have been observed in Scriber Lake upstream of the action area (Jones and Stokes 2000).

WDFW (2014a) classified the culvert under I-5 immediately downstream of the action area as a partial barrier to fish passage, and identified a total barrier another 2,100 feet downstream (i.e., 2,900 feet downstream of the action area). As noted above, however, the classification of the latter site as a total barrier is not consistent with reported sightings of adult coho salmon as far as 1 mile upstream of the action area. Based on the lack of reported observations of other salmonid species in the action area, combined with the presence of multiple barriers to fish passage downstream, it is assumed for this analysis that the information from WDFW (2014b) accurately reflects fish use, and that the only salmonids potentially present in Scriber Creek in the action area are coho salmon and cutthroat trout.

Water Quality

Scriber Creek is not on the 303(d) list of impaired waters in the State of Washington. Possible water quality problems may be indicated, however, by evidence of hydrocarbon pollution (oily sheen and odor) and the abundance of pollutant-tolerant stream invertebrates (Jones and Stokes 2000). Stream temperatures measured in the action area fall within the acceptable range for salmonid fish use, but the lack of shade-producing vegetation increases the risk of elevated temperatures (Jones and Stokes 2000).

In-stream Habitat

The main stem reach in the action area is dominated by the large scrub/shrub wetland adjacent to the Lynnwood Transit Center. Salmon spawning habitat conditions within this reach are poor due to limited canopy and vegetative cover, the presence of bank armoring, and the abundance of silt and other fine substrates (Jones and Stokes 2000). Side channels and other low-velocity areas may provide good rearing habitat, however (City of Lynnwood 2004).

Riparian Habitat

Riparian vegetation in the action area consists of a dense growth of salmonberry (*Rubus spectabilis*) and Himalayan blackberry, with a few red alder, western redcedar, bigleaf maple (*Acer macrophyllum*), and Pacific flowering dogwood (*Cornus nuttallii*). Jones and Stokes (2000) found little to no large woody debris in the stream and determined that the potential for large woody debris recruitment is low.

Scriber Creek riparian area, looking west from the Interurban Trail

Scriber Creek Tributary SLY1

Stream SLY1 near the culvert under the I-5 on-ramp, looking upstream

Stream SLY1 (WRIA No. 08.0064) is an unnamed, intermittent tributary that flows southward along the eastern edge of the Lynnwood Transit Center. The channel within the action area passes through a small patch of forest vegetation (the upper part has been recently planted) before the stream enters a culvert under the I-5 on-ramp and joins Scriber Creek southeast of I-5.

Stream SLY1 is not known or expected to support fish (Snohomish County 2002, WDFW 2014b). Channel morphology and hydrology have been altered by urban development throughout the stream basin (City of Lynnwood 2004). The stream channel in the action area is a channelized, straight ditch. The primary source of flow in the stream is urban runoff. Habitat quality, particularly in the lower reaches in the action area, is generally poor. Stormwater runoff from impervious surfaces likely contributes to a flashy flow regime during the fall and winter months (City of Lynnwood 2004). Almost the entire length of Stream SLY1 is enclosed within culverts. The exceptions are the short segments within and downstream of the action area, and a segment on the Lynnwood Civic Center campus approximately 0.6 mile north of the action area.

The portion of Stream SLY1 in the action area is separated from known fish-bearing waters by culverts under the off-ramp from I-5 northbound to 44th Avenue West, I-5 itself, and the on-ramp from 44th Avenue West to I-5 southbound. WDFW (2014a) has not evaluated the fish passage potential of these culverts because Stream SLY1 is considered a non-fish-bearing stream. Based on its basin size, channel width, and stream gradient, the stream may have the potential to support fish use in the future.

4.3.2 Wetlands

One of the ten wetlands in Segment C has a surface water connection to a fish-bearing stream. This is Wetland WLY4, the Scriber Creek wetland complex. However, based on the presence of a total barrier to fish passage about 2,900 feet downstream of the action area, no ESA-listed fish are expected to use habitats in the Scriber Creek wetland complex. None of the other nine wetlands identified in Segment C has a surface water connection to any streams that support ESA-listed fish. Collectively, however, the ecological functions of these wetlands (e.g., water quality maintenance, stormwater detention, groundwater recharge) likely contribute to the maintenance of fish habitat conditions in the Scriber Creek basin.

All 10 wetlands fall within the Lynnwood city limits (Table 4-2), and all but the Scriber Creek wetland complex (discussed below) are rated as Category III, indicating moderate levels of wetland function. Each of the Category III wetlands has only one habitat class: three are forested, three are shrub-scrub, two are emergent, and one is unconsolidated bottom. Vegetation in the Category III wetlands is a mix of native and non-native species, many of which are disturbance-tolerant. Surrounding buffers range from forested to herbaceous cover; disturbance-tolerant species are common.

Wetland WLY4 is a large wetland/stream complex associated with Scriber Creek, located southwest of the Lynnwood Transit Center and northeast of 204th Street SW (see Figure 1-4). The wetland is classified as palustrine forested/palustrine scrub-shrub/palustrine emergent under the USFWS system, and riverine/depressional under the hydrogeomorphic system. Wetland WLY4 is rated as Category II according to the City of Lynnwood and Ecology.

The hydrology of Wetland WLY4 is supported primarily by Scriber Creek, which enters the wetland from the north. A high groundwater table and stormwater runoff likely contribute to the hydrology as well. Saturation of soils, inundation, a permanently flowing stream, and open water ponds were observed in areas of the wetland. The channel of Scriber Creek is well-defined near the northern and southern boundaries, becoming distinct in between. The wetland and Scriber Creek drain southeast, out of the study area.

Wetland WLY4 contains forested, scrub-shrub, and emergent communities. The forested areas are dominated by black cottonwood, Pacific willow (*Salix lucida*), and reed canarygrass (*Phalaris arundinacea*), with lesser amounts of western redcedar, Sitka spruce (*Picea sitchensis*), and salmonberry. The shrub community consists primarily of rose spirea (*Spiraea douglasii*), red-osier dogwood (*Cornus sericea*), twinberry honeysuckle (*Lonicera involucrata*), and Sitka willow (*Salix sitchensis*). Indian plum (*Oemleria cerasiformis)*, western skunk cabbage (*Lysichiton americanus*), and water parsley (*Oenanthe sarmentosa*) are also present. Reed canarygrass dominates the emergent community. The southern portion of the wetland adjacent to the Interurban Trail is actively maintained.

Soil was examined to a depth of 20 inches and consists of one layer. The soil is a black (10YR 2/1) mucky silt. High levels of organic content in various stages of decomposition were observed in the soil.

The wetland is in an urban setting and much of the buffer is a narrow line of trees located between the wetland and developed areas, such as parking lots, trails, or residential and commercial structures. Buffer vegetation includes Douglas-fir, western redcedar, red alder, black cottonwood, Himalayan blackberry, red-osier dogwood, English holly (*Ilex aquifolium*), Portugal laurel (*Prunus lusitanica*), western swordfern (*Polystichum munitum*), English ivy (*Hedera helix*), maintained grasses, and other disturbance-tolerant species. Plantings, a split rail fence, and Native Growth Protection Area signs were observed in the vicinity of the private property to the south along the wetland edge.

4.4 Mitigation Site(s)

Sound Transit is working with resource and regulatory agencies to develop a mitigation plan to offset the impacts of construction and operational effects on wetland and riparian habitat and buffers. Impacts to wetlands and wetland buffers will be mitigated through the use of available approved mitigation banks, the King County in-lieu fee program, or project-specific wetland mitigation developed by Sound Transit. Compensatory mitigation will be implemented in accordance with applicable federal, state, and local requirements and guidelines. Mitigation for unavoidable impacts on riparian habitat will also be provided in accordance with the requirements of local critical areas ordinances. Current potential sites under consideration for project-specific mitigation are described below.

North Seattle Community College Campus

Various opportunities may be present on the North Seattle Community College Campus for wetland restoration and enhancement, although other projects proposed in the vicinity may reduce the area available.

Jackson Park Golf Course/5th Avenue NE

Potential wetland and riparian mitigation could be constructed along the east side of the 5th Avenue NE right-of-way and the Jackson Park Golf Course, particularly along North Branch Thornton Creek.

NE 145th Street Vicinity

Two potentially available parcels near Paramount Park in Shoreline may provide opportunities for wetland protection and restoration.

NE 155th Street Vicinity

Wetland creation may be possible south NE 155th Street near the locations of two wetlands identified near the I-5 right-of-way.

Ballinger Lake Golf Course

The City of Mountlake Terrace will be transitioning the Ballinger Lake Golf Course to a passive park/open space, which could create wetland restoration opportunities.

Scriber Creek Wetland Complex (Wetland WLY4)

Wetland and stream mitigation opportunities are present in the Scriber Creek vicinity near the Lynnwood Transit Center. These parcels are under both public and private ownership, including parcels that could be acquired by Sound Transit because they intersect with areas needed for the light rail right-of-way. A private parcel on Cedar Valley Road, along the western edge of the wetland complex, could also provide an opportunity for mitigation. These mitigation opportunities may include wetland creation, restoration, or enhancement.

5 SPECIES AND CRITICAL HABITAT STATUS AND OCCURRENCE

Species covered in this BA are Chinook salmon, steelhead, and bull trout. Although none of these species has a high likelihood of occurrence in any of the stream reaches that are crossed by the proposed Lynnwood Link Extension alignment, all three are known to use habitats in downstream reaches that receive stormwater runoff from the project area. In addition, it is possible that Chinook salmon and steelhead may venture into Thornton Creek and McAleer Creek in the action area. Table 5-1 identifies the ESA-listed species that are known or expected to be present in the stream reaches with the potential to be affected by project activities. No designated or proposed critical habitat for any species occurs in the action area.

Table 5-1. Presence of ESA-listed Species at Sites with Potential Impacts on Fish

Stream	ESA-Listed Species Potentially Affected	Comments
Project Segment A		
Thornton Creek, North Branch	Steelhead	Access to action area impeded by several total and partial barriers to fish passage downstream; however, a single adult steelhead was observed upstream of the action area in 2004.
Thornton Creek Tributary (SSE1)	None	Small, intermittent stream with no known or expected fish use; high levels of urban development likely contribute to flashy flow regime.
Project Segment B		
McAleer Creek Tributary (SSH2)	None	Entirely contained within pipes in action area; no known or expected use by fish.
McAleer Creek	Chinook Steelhead	Downstream barriers to access likely impede but do not necessarily preclude access to action area.
McAleer Creek Tributary (SMT1)	None	Small, intermittent stream with no known or expected fish use; high levels of urban development likely contribute to flashy flow regime.
Project Segment C		
Scriber Creek	None	Total barrier to fish passage approximately 2,900 feet downstream of action area.
Scriber Creek Tributary (SLY1)	None	Small, intermittent stream with no known or expected fish use; high levels of urban development likely contribute to flashy flow regime.

Species lists from the USFWS and the NMFS were obtained from the agencies' Web sites in March 2014. The lists are provided in Appendix C. In addition to the three species listed above, the USFWS species lists for King and Snohomish counties identify five ESA-listed wildlife species (Canada lynx, gray wolf, grizzly bear, marbled murrelet, and northern spotted owl), two species that are proposed for listing (North American wolverine and Oregon spotted frog), and two candidates for listing (Pacific fisher and yellow-billed cuckoo) that may occur in the two counties (USFWS 2014). None of these species is expected to occur in the action area, however, for the following reasons:

- Canada lynx, gray wolf, grizzly bear, and North American wolverine – The action area is in a lowland setting with relatively high levels of human activity and no nearby roadless areas and does not, therefore, provide suitable habitat for any of these species. No observations of any of these species have been documented within 5 miles of the action area (WDFW 2012).
- Marbled murrelet and northern spotted owl – Both of these species require old-growth forest for breeding, and marbled murrelets require marine habitat for foraging. No breeding or foraging habitat for either species is present in the action area, and no observations of either species have been documented within 5 miles (WDFW 2012).
- Oregon spotted frog – This species is known to occur in Washington only at large wetland complexes in Klickitat, Skamania, and Thurston counties. Oregon spotted frogs depend on perennial bodies of water and associated wetlands. No such habitat is present in the action area. The nearest location where Oregon spotted frog critical habitat has been proposed for designation is more than 50 miles from the action area.
- Pacific fisher – This species requires forests with diverse successional stages containing a high proportion of mid- and late-successional characteristics. No such habitat is present in or near the action area, and no observations of this species have been documented within 5 miles (WDFW 2012).
- Yellow-billed cuckoo – This species requires large blocks of riparian habitat for breeding. No such habitat is present in or near the action area. WDFW (2012) reports a single observation of a bird matching the description of a yellow-billed cuckoo flying across an on-ramp to I-5 in 2000. Based on the lack of suitable nesting habitat and the absence of any other documented sightings within 5 miles, yellow-billed cuckoos are not expected to breed or forage in the action area.

In addition, the action area contains no designated or proposed critical habitat for any of these species (USFWS 2014). Based on the above, the Lynnwood Link Extension has no potential to affect any of these species, and they will not be addressed further in this analysis.

Information from the Washington Department of Natural Resources (DNR) Natural Heritage database indicates that no threatened or endangered plants are known to occur within 5 miles of the project area (DNR 2014). The only ESA-listed plant with the potential to occur in King County is golden paintbrush (*Castilleja levisecta*), which is known from historical observations in the region. Suitable habitat for golden paintbrush (open grasslands in glacial outwash prairies) is not present at any locations where project–related actions will occur. For these reasons, the proposed project has no potential to affect this species.

5.1 Chinook Salmon

Puget Sound Chinook salmon were listed as threatened by NMFS on August 2, 1999 (64 Federal Register [FR] 41835). The Puget Sound evolutionarily significant unit (ESU) includes all naturally spawned Chinook salmon spawned in tributaries to the Puget Sound. The ESU also includes Chinook salmon from 26 artificial propagation programs, including the Issaquah Creek hatchery program in the Lake Washington system (79 FR 20802, April 14, 2014). Fish that use stream habitats in the Lake Washington system belong to the Sammamish population. The most recent 5-year (2005 to 2009) estimate of spawning abundance for the Sammamish population was 249 fish, making up less than 1 percent of the total number of spawning fish in the ESU (Ford 2011).

Chinook salmon have been documented in the lower reaches of Thornton, McAleer, and Scriber creeks. In all three streams, the reaches where Chinook salmon have been observed are separated from the action area by total or partial fish passage barriers. It is possible, however, that Chinook salmon may use habitat in McAleer Creek within the action area. None of the tributaries to Thornton, McAleer, and Scriber creeks in the action area are known or expected to support fish use. The known distribution of Puget Sound Chinook salmon in the vicinity of the action area is as follows:

- **Thornton Creek:** Chinook salmon presence has been documented approximately 2.5 miles downstream of the action area; spawning has been documented approximately 3 miles downstream of the action area (City of Seattle 2007, WDFW 2014b). WDFW (2014a) identified 3 total barriers and 15 partial barriers to fish passage between the action area and the downstream reaches where Chinook salmon presence has been documented. Based on the lack of observations and the presence of multiple total and partial barriers to fish passage downstream of the action area, Chinook salmon are not expected to use habitats in Thornton Creek or its tributaries in the action area.
- **McAleer Creek:** Chinook salmon presence has been documented approximately 1,000 feet downstream of the action area; spawning has been documented approximately 1.1 miles downstream of the action area (WDFW 2014b). WDFW (2014a) has identified a partial barrier to fish passage immediately downstream of the action area, where the stream passes through an approximately 60-foot-long culvert under Forest Park Drive NE. Although this structure likely impedes access into the action area by Chinook salmon, it cannot be considered an absolute barrier. Therefore, Chinook salmon may use habitat in McAleer Creek in the action area. Both of the tributaries to McAleer Creek in the action area (SSH2, SMT1) are separated from fish-bearing waters by total barriers to fish passage and are therefore not expected to support use by Chinook salmon.
- **Scriber Creek:** Chinook salmon presence has been documented approximately 3,100 feet downstream of the action area. No spawning has been documented in Scriber Creek, but spawning has been documented in Swamp Creek, approximately 2.6 miles downstream of the action area (WDFW 2014b). WDFW (2014a) has identified a partial barrier to fish passage in Scriber Creek immediately downstream of the action area, where the stream passes through a 360-foot-long culvert under I-5. In addition, there is a total fish passage barrier at a beaver pond approximately 2,900 feet downstream of the action area (WDFW 2014a). Based on the lack of observations and the presence of total and partial barriers to fish passage downstream of the action area, Chinook salmon are not expected to use habitats in Scriber Creek or its tributaries in the action area.

Adult Chinook salmon enter the Lake Washington system from Puget Sound through the Ballard Locks in July through September (Celedonia et al. 2011). Adult Chinook salmon begin entering the spawning streams in September and continue until November. Spawning occurs from October to December, with peak spawning activity usually in the first few weeks of October (Burton et al. 2009). Fry emerge from redds between January and early April (Kiyohara and Zimmerman 2009). Juvenile Chinook salmon in the Lake Washington system appear to have two rearing strategies:

some rear in their natal streams and emigrate to the lake as pre-smolts in May, June, or July; others emigrate as fry between January and mid-May and rear in the south or north end of Lake Washington or in Lake Sammamish for several months (Celedonia et al. 2011). All Lake Washington Chinook migrate to marine habitats during their first year.

Based on the above, Chinook salmon may be present in the action area from September through December. During these months, adult salmon spawning in downstream reaches of McAleer Creek may venture upstream into the action area. No other stream reaches in the action area are accessible to Chinook salmon. Juvenile Chinook salmon are not expected to be present in any streams in the action area at any time because no spawning is known or expected to occur in stream reaches within or upstream of the action area.

5.2 Chinook Salmon Critical Habitat

The final rule designating critical habitat for Puget Sound Chinook salmon (70 FR 52630, September 2, 2005) included habitat areas in Lake Washington and the Cedar River but excluded other tributaries to Lake Washington. Thus, the water bodies in the action area are not designated as critical habitat for Puget Sound Chinook salmon.

5.3 Steelhead

The Puget Sound steelhead distinct population segment (DPS) is listed as a threatened species (72 FR 26722, May 11, 2007). The DPS includes all naturally spawned anadromous *Oncorhynchus mykiss* originating below natural and manmade impassable barriers from rivers flowing into Puget Sound (79 FR 20802, April 14, 2014). The DPS also includes steelhead from six artificial propagation programs, none of which operate in the Lake Washington system. Fish that use stream habitats in the Lake Washington system belong to the Lake Washington population. The number of naturally spawned steelhead in this population is very low. The most recent 5-year (2005 to 2009) estimate of spawning abundance for the Lake Washington population was 12 fish (Ford 2011).

Steelhead have been documented in Thornton Creek and McAleer Creek in the action area. Steelhead are not currently known or expected to use habitats in Scriber Creek. None of the tributaries to Thornton, McAleer, and Scriber creeks in the action area are known or expected to support fish use. The known distribution of Puget Sound steelhead in the vicinity of the action area is as follows:

- **Thornton Creek:** According to WDFW (2014b), steelhead are present in the North Branch of Thornton Creek as far upstream as the Jackson Park Golf Course, approximately 2,100 feet downstream of the action area. Based on the observation of an adult steelhead near Twin Ponds upstream of the action area (Tetra Tech/KCM 2004b), however, it is possible that steelhead might use stream habitats in the action area. The tributary to Thornton Creek in the action area (Stream SSE1) is neither known nor expected to support fish use (WDFW 2014b, 2012).
- **McAleer Creek:** According WDFW (2014b), steelhead are present in McAleer Creek as far upstream as the mouth of the tributary (Stream SMT1) near the on-ramp from SR 104

westbound to I-5 northbound, within the action area. Tetra Tech/KCM (2004a) reported observations of steelhead spawning in McAleer Creek approximately 200 feet downstream of the action area, although WDFW (2014b) does not identify any parts of McAleer Creek as spawning habitat for steelhead. The site where Tetra Tech/KCM (2004a) reported observations of steelhead spawning is separated from the action area by a culvert under Forest Park Drive NE that has been identified by WDFW (2014a) as a partial barrier to fish passage. Based on this information, steelhead may use stream habitats in McAleer Creek in the action area, but they are not expected to spawn there. Both of the tributaries to McAleer Creek in the action area (SSH2, SMT1) are separated from fish-bearing waters by total barriers to fish passage and are therefore not expected to support use by steelhead.

- **Scriber Creek:** Steelhead are not currently known or expected to use habitats in Scriber Creek, although winter-run steelhead have been observed in Swamp Creek, which is approximately 2.6 miles downstream of the action area (Snohomish County 2002, WDFW 2014b). There is a total barrier to fish passage at a beaver pond approximately 2,900 feet downstream of the action area (WDFW 2014a). Based on the lack of observations and the presence of total and partial barriers to fish passage downstream of the action area, steelhead are not expected to use habitats in Scriber Creek or its tributaries in the action area.

Adult steelhead begin entering rivers and streams in the Lake Washington system in November; spawning occurs from March through June of the following year (WDFW 2002). After hatching, Puget Sound steelhead typically mature by 18 months of age and migrate to sea at age 2, with smaller numbers of fish emigrating to the ocean between 1 and 3 years of age. Seaward migration by juveniles commonly occurs from April to mid-May, with fish typically spending 1 to 3 years in the ocean before returning to fresh water (Busby et al. 1996). In some populations, not all adult steelhead die immediately after spawning. These surviving adults (kelts) migrate back to marine environments, possibly returning to freshwater habitats to spawn again in future years. Most kelts move downstream immediately after spawning (Shapovalov and Taft 1954, Null et al. 2013, Johnson and Jones 2000). A small proportion of kelts may remain in freshwater habitats for longer periods. Such emigration delays are associated with late snow pack and cold water temperatures (Johnson and Jones 2000)—conditions that are not likely to occur in the action area.

Based on the above, steelhead may be present in the action area from November through June. During these months, adult steelhead spawning in downstream reaches of Thornton Creek and McAleer Creek may venture upstream into the action area in both streams. Based on the low number of naturally spawned (i.e., ESA-listed) steelhead in the Lake Washington system, the probability that any of the fish that spawn in these streams may belong to the Puget Sound DPS is very low. No other stream reaches in the action area are accessible to steelhead. Juvenile fish are not expected to be present in any streams in the action area at any time because no spawning is known or expected to occur in stream reaches within or upstream of the action area. The presence of residual kelts in the action area outside of the months of November through June is extremely unlikely because (1) the number of fish in the Lake Washington population is extremely small, (2) kelts generally make up a small proportion of any population, (3) only a small proportion of kelts may remain in freshwater habitats beyond the typical spawning period, and (4) emigration delays are associated with climatic conditions that are not likely to occur in the action area.

5.4 Steelhead Critical Habitat

Critical habitat for Puget Sound steelhead was proposed for designation in 2013 (78 FR 9 2726, January 14, 2013). Habitat areas in the Lake Washington system were proposed for exclusion from designation due to economic impacts. None of the water bodies in the action area was included in the proposed designation.

5.5 Bull Trout

Bull trout is listed as a threatened species (64 FR 58910, November 1, 1999). All bull trout in the coterminous United States, including the Coastal-Puget Sound DPS, are included in the listing. Bull trout have been observed entering Lake Washington in small numbers, but none of the streams in the action area is known or expected to support bull trout spawning or rearing. The only spawning population of bull trout documented in the Lake Washington system is in the upper Cedar River above Chester Morse Lake, which is upstream of a natural barrier to upstream migration (Shared Strategy for Puget Sound 2007). No spawning activity or juvenile rearing has been observed anywhere else in the basin. No bull trout have been documented in any of the tributaries to Lake Washington within the action area (WDFW 2014b).

WDFW (1999) determined that successful spawning by bull trout occurs only upstream of the winter snow line (i.e., the elevation at which snow is present on the ground for much of the winter). No such areas are found in the Thornton Creek, McAleer Creek, or Scriber Creek basins. There is no potential, therefore, for the streams in the action area to be used by spawning or rearing bull trout.

USFWS (2004) has identified bull trout foraging, migration, and overwintering habitat in the Lake Washington basin in the lower Cedar River, Sammamish River, Lake Washington, Lake Sammamish, Lake Union, the Lake Washington Ship Canal, and all accessible tributaries. However, based on the number of fish passage barriers between the action area and Lake Washington (where bull trout have been observed), the streams in the action area are unlikely to be accessible tributaries. In addition, habitat conditions in these streams are not expected to support use by bull trout. Stream temperatures in Thornton Creek, McAleer Creek, and Scriber Creek exceed the optimal requirements for all life stages of bull trout (less than 15 degrees Celsius) for much of the year. Any fish attempting to gain access to any of the streams in the action area would have to negotiate several miles of stream habitat with elevated temperatures and multiple barriers. In light of these impediments, the potential for bull trout to use habitats in the action area for foraging, migration, or overwintering is negligible.

5.6 Bull Trout Critical Habitat

Critical habitat was designated for bull trout in 2005 and redesignated in 2010 (75 FR 63898, October 18, 2010). The final rule identified Lake Washington as designated critical habitat for bull trout but excluded tributary streams to Lake Washington (75 FR 63898, October 18, 2010). The action area thus does not include any designated critical habitat for bull trout.

6 EFFECTS ANALYSIS AND EFFECTS DETERMINATIONS

6.1 Direct Effects

Direct effects are defined as direct or immediate effects of the project on the species or its habitat. Potential direct effects of the Lynnwood Link Extension include short-term construction impacts and effects from operation of the light rail system.

6.1.1 Direct Effects from Construction Activities

Construction effects are considered short term, meaning the ecological functions of affected area are expected to return to pre-impact performance within about 1 year or one growing season of the completion of construction activities. Project activities with the potential for direct effects on ESA-listed species include ground-disturbing work and equipment use near streams. In addition, it is possible that some in-water work may take place within the wetland complex surrounding Scriber Creek near the Lynnwood Transit Center. Potential effects of these activities include temporary loss or degradation of in-stream or riparian habitat (including hydrology or water quality), and disturbance of fish in waters where in-water work occurs. Table 6-1 provides an overview summary of effects.

Table 6-1. Summary of Potential Impacts from Construction Activities

Segment	Stream	ESA-Listed Species Potentially Present	Construction Activities	Potential Impacts
A–C	All streams	Chinook salmon, steelhead	Earthwork and grading	Potential release of turbid water or pollutants. Temporary disturbance of riparian vegetation, wetlands, and wetland buffers.
A	Thornton Creek	Steelhead	Elevated crossing, grading and earthwork	Potential release of turbid water or pollutants, temporary disturbance of riparian vegetation, wetlands, and wetland buffers.
A	Stream SSE1	None	Elevated guideway through stream buffer	Potential release of turbid water or pollutants, temporary disturbance of riparian vegetation, wetlands, and wetland buffers.
B	Stream SSH2	None	Elevated crossing of piped stream	None: No potential for runoff from construction areas to reach surface-flowing reaches.
B	McAleer Creek	Chinook salmon, steelhead	Elevated crossing, grading and earthwork	Potential release of turbid water or pollutants, temporary disturbance of riparian vegetation, wetlands, and wetland buffers.
B	Stream SSH4	None	Elevated guideway through stream buffer	Potential release of turbid water or pollutants, temporary disturbance of riparian vegetation, wetlands, and wetland buffers.
B	Stream SMT1	None	Elevated crossing, grading and earthwork	Potential release of turbid water or pollutants, temporary disturbance of riparian vegetation, wetlands, and wetland buffers.
C	Scriber Creek	None	Elevated crossing, possible in-water construction	Potential release of turbid water or pollutants, temporary disturbance of riparian vegetation, wetlands, and wetland buffers.
C	Stream SLY1	None	Earthwork and grading in paved areas nearby	Potential release of turbid water or pollutants.

Construction-related Sedimentation, Turbidity, and Pollutants

Project activities, including clearing, grading, excavation, and other earthwork in the action area (including construction of stormwater detention facilities), could result in increased sediment loads entering streams and other water bodies. Any earthwork conducted within a basin has the potential to cause sedimentation and turbidity that would adversely affect the streams in the basin downstream of the work activity. The most obvious situation in which this could occur is where earthwork construction occurs in or next to a stream channel. However, any earthwork in a basin might contribute to the already serious sedimentation problems that exist in the streams in the project vicinity. This is because most stormwater in urban settings is collected in a system of pipes or ditches and conveyed directly to the nearest stream. An exception to this practice is in newer developments, where stormwater detention facilities trap much of the sediment carried by upstream sources before discharging into streams. But even in these developments, some of the finer sediments might be discharged to streams as the ponds fill with stormwater and overflow.

Where drilled shafts are used to support elevated guideways, shafts may need to be dewatered before concrete is poured. Drilling spoils may also need to be dewatered. Water recovered during the dewatering process can cause increased turbidity in receiving waters if it is not properly detained and treated. Recovered water will be treated to meet the appropriate permit requirements before being discharged.

As discussed in Chapter 3, Action Area, construction-related sedimentation and turbidity could extend downstream to points 200 feet from the stream crossings of Thornton Creek and Scriber Creek, and 100 from the crossings of the other surface-flowing streams in the action area (McAleer Creek and Stream SMT1). Any fish present in those areas would be exposed to an elevated risk of adverse effects, such as gill abrasion, interference with vision, and decreased availability of food sources. However, BMPs will be implemented during project construction to reduce the potential for the introduction of sediment into water bodies (including wetlands) in the action area. BMPs recommended for the project are identified in Chapter 2, Best Management Practices and Minimization Measures.

Potential effects will be substantially minimized or eliminated because work near or within streams (such as for the construction of the elevated guideway across Scriber Creek) will comply with the terms of permits obtained from federal, state, and local agencies. All work below the ordinary high water mark of any waterbodies will be conducted in accordance with the HPA issued by WDFW and by the Clean Water Act Section 404 permit issued by the Corps. Such permits typically include seasonal restrictions and/or other measures intended to minimize the risk of adverse effects on fish during highly sensitive life history stages (e.g., spawning, rearing). Permits for work in tributaries to Lake Washington commonly require in-water work to be conducted during the summer (likely July and August). During those months, no ESA-listed fish species are expected to be present in any of the streams in the action area. Permits required under local critical areas ordinances typically include provisions for the protection of water quality and riparian habitat, further reducing the potential for adverse effects on fish and fish habitat. In addition, BMPs such as silt fences and erosion control devices will reduce the risk of sediment delivery. Although ESA-listed fish species could occasionally occur in water bodies within or downstream of the action area, the timing of construction activities and the implementation of BMPs are expected to minimize or possibly eliminate the potential for any adverse effects of construction-related sedimentation or turbidity on these species.

Project activities in or adjacent to water bodies also have the potential to introduce pollutants through spills of fuel, hydraulic fluid, or other substances. As discussed above, all work in or near water bodies in the action area will comply with the terms of federal, state, and local permits, minimizing the potential for pollutants to be carried from work sites to water bodies by stormwater. In addition, all work will be conducted in compliance with the SPCC plan for the project, and BMPs will be implemented to prevent construction-related pollutants from entering streams. Based on these factors, the potential for construction activities to result in the introduction of pollutants into waters that support ESA-listed fish is extremely low.

Where the proposed alignment crosses Scriber Creek, construction of the elevated guideway will entail the placement of support columns below the ordinary high water mark, which is currently defined as encompassing the entire wetland complex that surrounds the creek. Temporary work trestles will be constructed for equipment access. Trestle construction will require the use of impact pile driving. However, no ESA-listed species occur in this area. The potentially affected reach of Scriber Creek is approximately 2,900 feet upstream of a barrier that prevents access to the action area by ESA-listed fish species. In addition, work will take place in accordance with federal and state permits that will likely limit work below the ordinary high water mark to periods when water levels are at their lowest. During these periods, surface water in the wetland complex is generally found only in the actively flowing stream channels of Scriber Creek, which make up only a small portion of total wetland complex area. Most work below the ordinary high water mark will take place in areas where no standing or flowing water is present. Any work areas where surface water is present will be isolated from other surface waters with a coffer dam or similar system to prevent suspended sediment or pollutants from leaving the work area. For these reasons, in-water work in Scriber Creek, if it occurs, is not expected to contribute to elevated levels of sediment or pollutants in waters that support ESA-listed fish.

In-water Work

No in-water work is proposed in streams where ESA-listed species are known or expected to occur (Thornton and McAleer creeks). As noted above, some work will occur below the ordinary high-water mark of Scriber Creek where the stream has an ill-defined channel through the wetland complex west of the Lynnwood Transit Center. However, no ESA-listed species occur in this area, and most work below the ordinary high water mark will take place in areas where no standing or flowing water is present. A vibratory hammer will be used for initial installation of most piles. If substrates preclude the use of a vibratory hammer, an impact hammer will be used. For all piles, an impact hammer will be used to complete the installation and to confirm the load-bearing capacity of each pile. Any work below the ordinary high water mark of Scriber Creek will be conducted in accordance with the terms of the HPA and other applicable permits obtained for this project.

Potential effects of in-water work in Scriber Creek include the delivery of sediment and pollutants (discussed in Section 6.1.1.1) and the disturbance or injury of fish due to elevated sound energy levels. If any vibratory or impact pile driving occurs in wetted areas, sound energy will travel in straight lines and not follow the contours of the stream channel. Based on the sinuous, braided, and indistinct form of Scriber Creek's channel in the action area, sound energy from any in-water pile driving will not extend more than a few hundred feet upstream or downstream of the location of the activity and will be blocked by the bends in the stream before it reaches the culvert under I-5 immediately downstream of the action area. The outlet of that culvert is more than 2,000 feet upstream of any stream reaches that are known or expected to support ESA-listed fish. Therefore, noise from in-water work will have no potential to adversely affect ESA-listed fish species.

Temporary Loss of Riparian and Wetland Vegetation

Project construction will result in the temporary loss of riparian vegetation adjacent to Thornton Creek, Stream SSE1, Stream SSH4, McAleer Creek, Scriber Creek, and Stream SMT1 (tributary to McAleer Creek). The other two watercourses in the action area (SSH2 and SLY1) will not be affected. Stream SSH2 will not be affected because it has no surface-flowing segments within 200 feet of ground-disturbing activities. All project construction activities within 200 feet of SLY1 will occur in currently paved areas and therefore will not affect the condition of the stream's riparian buffer.

Riparian vegetation may need to be cleared for site access to construct sections of elevated guideway that cross over streams. Short-term clearing may result in reduced shading, potentially leading to elevated stream temperatures until vegetation becomes reestablished in disturbed areas. Riparian vegetation removal can also reduce insect recruitment to the water bodies below and limit recruitment of large woody debris. In addition, existing trees will be replaced with lower-growing native vegetation.

The project will result in the temporary disturbance of up to 0.7 acre of wetland buffer and up to 0.5 acre of wetland habitat (see Table 6-2). These areas will be cleared to access the work areas where support column foundations will be placed. Wetlands and buffers will be avoided to the extent possible when placing support columns. Temporary fill may be placed for equipment access; this fill will be removed when construction is complete. All cleared areas will be revegetated after construction. In some of the potentially affected areas, existing vegetation is dominated by non-

Table 6-2. Temporary Direct Impacts on Riparian Areas, Wetlands, and Wetland Buffers

Segment	Riparian Area Affected (acres) [1]	Wetland Area Affected (acres) [1]	Wetland Buffer Area Affected (acres) [1]	Comments
A	0	0	0	Impacts will be permanent, not temporary
B	0.6	0.2	0.6	McAleer Creek riparian area: 0.4 acre. Stream SMT1 riparian area: 0.2 acre.
C	0.4	0.3	0.1	Scriber Creek riparian area impacts estimated as sum of wetland and wetland buffer impacts.
Total	1.0	0.5	0.7	

[1] All values in this table are estimates based on preliminary surveys conducted before formal delineations were complete.

native and invasive plant species. Sound Transit anticipates that replanted vegetation will result in improved habitat function where non-native species are replaced with native plants.

6.1.2 Direct Effects from Operation Activities

Permanent effects of Lynnwood Link Extension operations include long-term effects for which habitat functions will not be restored over time. Permanent effects include permanent loss of vegetation, new impervious area, and shading from elevated structures (see Table 6-3).

Table 6-3. Summary of Potential Permanent Operational Impacts

Segment	Stream	ESA-Listed Species Potentially Present	Operation/Structure	Potential Impacts (*Will Be Mitigated*)
A–C	All streams	Chinook salmon, steelhead	New impervious area from guideway and other light rail facilities	Permanent loss of riparian vegetation, wetlands, and wetland buffer vegetation. Overall increase in impervious surface area, slight decrease in total PGIS.
A	Thornton Creek	Steelhead	Elevated crossing	New impervious surface. Permanent loss of riparian vegetation, wetlands, and wetland buffer vegetation.
A	Stream SSE1	None	Elevated guideway through stream buffer	New impervious surface. Permanent loss of riparian vegetation, wetlands, and wetland buffer vegetation.
B	Stream SSH2	None	Elevated crossing of piped stream	None: No modifications to riparian habitat within 200 feet of surface-flowing reaches, no discharges to stream from new impervious surfaces.
B	McAleer Creek	Chinook salmon, steelhead	Elevated crossing	New impervious surface. Permanent loss of riparian vegetation, wetlands, and wetland buffer vegetation.
B	Stream SSH4	None	Elevated guideway through stream buffer	New impervious surface. Permanent loss of riparian vegetation, wetlands, and wetland buffer vegetation.
B	Stream SMT1	None	Elevated crossing	New impervious surface. Permanent loss of riparian vegetation, wetlands, and wetland buffer vegetation. Potential for guideway support columns to interfere with possible future habitat restoration projects.
C	Scriber Creek	None	Elevated crossing, possible in-water construction	New impervious surface. Permanent loss of riparian vegetation, wetlands, and wetland buffer vegetation.
C	Stream SLY1	None	Additional facilities in paved areas nearby	Potential for stormwater discharge.

Operation of the Lynnwood Link Extension is not expected to result in any increases in nighttime illumination of fish-bearing waters (which could increase the risk of predation on juvenile salmonids) because the tracks will have no overhead lighting and the train headlights will be directed parallel to the tracks. Lighting at light rail stations is not expected to result in any adverse effects because no stations are proposed within 200 feet of surface-flowing streams that are known or expected to support ESA-listed fish. No impacts on fish passage are anticipated because no new culverts will be added in streams with documented or potential fish habitat and no existing culverts in such streams will be extended. Construction of at-grade or elevated guideways, stations, and ancillary features above streams in culverts (i.e., Stream SSH2) is not expected to affect stream habitat.

Stormwater Management

Sound Transit has a written stormwater policy that guides site selection, design, and operation of stormwater facilities. Sound Transit's policy requires that project managers and engineers first consider low-impact stormwater management (e.g., infiltration, permeable pavements, rain gardens, and engineered soils) before traditional stormwater design options. If LID techniques are not proposed, a written justification must be provided for agency review. Currently, only preliminary stormwater design has been completed. Analyses in this BA incorporate conservative assumptions about stormwater design details. However, it is likely that at least some of the traditional stormwater treatment methods described below will be replaced with LID options with equal or greater treatment and detention benefit.

Overall, the project will increase the amount of impervious surface in the action area by 52 acres (approximately 26 percent). Impervious surfaces can increase stormwater runoff rates, volumes, and pollutant loads. Without mitigation measures such as detention and treatment facilities, these can cause higher flows and degraded water quality in storm sewers and streams. Project impervious areas include new tracks and guideways, stations, park-and-ride lots, maintenance facilities, and new or relocated roads. Project-related parking lots and road realignments are subject to motor vehicle traffic and are considered to be PGIS. The guideway and stations will not be subject to motor vehicle traffic or other sources of potential pollution and will therefore be classified as non-PGIS.

Stormwater from project-related PGIS will be treated to at least basic treatment levels (i.e., a goal of removal of at least 80 percent of suspended solids) and be infiltrated or routed to existing municipal stormwater systems wherever possible. Roadways relocated as a result of the rail alignment will be treated even though the pollutant loading will not be increased, resulting in a modest increase in stormwater treatment in the area. Roadways where average daily traffic volume exceeds 7,500 vehicles will receive enhanced treatment, as will drainage outfalls that do not discharge to basic treatment water bodies. Where enhanced treatment is implemented, it will reduce heavy metal and hydrocarbon contaminants in stormwater. Basic treatment will reduce hydrocarbon contaminants.

The WSDOT Highway Runoff Dilution and Loading (HI-RUN) model was used to assess the potential for project-related changes in PGIS to affect water quality in streams where ESA-listed fish may be present. The results of this exercise are summarized below and presented in greater detail in Appendix D.

In most areas where the Lynnwood Link Extension will change the amount of PGIS draining to streams where ESA-listed fish may be present, model results indicate that pollutant loading will decrease under proposed conditions, suggesting probable improvements in water quality. Therefore, stormwater runoff from the Lynnwood Link Extension will not have any adverse effects on ESA-listed fish in nearly all portions of the action area.

At one location, model results indicate a probable increase in pollutant loadings in receiving waters, necessitating additional analysis of the potential for adverse effects on ESA-listed fish. The area in question is in the vicinity of the NE 185th Street Station, where construction of the station and associated parking areas, combined with the relocation of 5th Avenue NE, will result in the creation of 2.45 acres of new PGIS, all of which will be treated in new facilities. These facilities include two enhanced treatment facilities for the parking garage and relocated portions of 5th Avenue NE, and an infiltration facility for the bus turnaround area east of I-5 and north of NE 185th Street. The increase in PGIS will be offset partially but not entirely by decreases resulting from the relocation of 5th Avenue NE south and east of I-5. None of the existing PGIS currently receives water quality treatment.

Under most conditions, there will be no surface connection between the infiltration facility and any streams in the action area. However, the emergency overflow from the facility, as well as treated water from the other two facilities, will drain north in an existing stormwater trunk line, emptying to a non-fish-bearing tributary to McAleer Creek (Stream SSH2) approximately 3,500 to 4,200 feet away. The treated water will then travel another 1,400 feet, mostly in pipes, before emptying to a reach of McAleer Creek where steelhead and Chinook salmon may be present. Neither species is known or expected to use that reach for spawning.

Because the HI-RUN model results indicate a high likelihood of increased pollutant loadings at this location, additional modeling (the HI-RUN dilution subroutine) was conducted to investigate the potential for adverse effects on ESA-listed fish in McAleer Creek. The output of the dilution subroutine presents a conservative distance (mixing zone) downstream of the outfall, where there is a 5 percent chance that pollutant concentrations will exceed thresholds for effects on fish. The effects thresholds are based on potential increases of dissolved copper and dissolved zinc above background concentrations.

Results of the HI-RUN dilution subroutine showed mixing zone distances less than 1 foot under both baseline and proposed conditions, indicating a minimal risk of adverse effects. These results suggest an extremely low probability for stormwater runoff from the Lynnwood Link Extension to result in adverse effects on ESA-listed fish in McAleer Creek.

Sound Transit's preliminary engineering for the Lynnwood Link Extension includes development of a conceptual layout for major stormwater facilities to comply with the *Stormwater Management Manual for Western Washington* (Ecology 2012a). These facilities include stormwater ponds and underground vaults. Additional measures to reduce stormwater runoff, such as LID or other on-site measures, will be considered in accordance with Sound Transit's stormwater policy.

Peak stream flows in the action area are not expected to increase substantially because the stormwater systems built for the project will be designed to simulate predevelopment hydrology. As stated in the *Stormwater Management Manual for Western Washington*, "The Manual is intended to provide project proponents, regulatory agencies and others with technically sound stormwater management practices which are presumed to protect water quality and in-stream habitat – and meet the stated environmental objectives of the regulations described in this chapter." It is possible, however, that discharges from detention facilities could result in increased velocities and durations of peak flows in receiving waters, potentially reducing the availability of forage and displacing juvenile salmonids from cover (Tschaplinski and Hartman 1983).

In addition, impervious surfaces preclude natural infiltration of precipitation into the ground, which decreases groundwater recharge. Less precipitation entering groundwater aquifers might decrease dry-season base flows by decreasing water inputs to streams from groundwater sources such as springs. Dry-season base flows have been identified as one of the most important natural limiting factors controlling salmonid production in lowland Puget Sound streams (Mathews and Olson 1980).

Where low-impact development measures are implemented, some stormwater runoff from project-related impervious surfaces will be collected and infiltrated into the ground. In some areas, this could result in increased groundwater recharge compared to existing conditions (under which stormwater runoff is managed mainly through vaults and ponds that do not infiltrate). However, some soil types in the project area are not conducive to infiltration of precipitation into the ground.

Permanent Impacts to Riparian and Wetland Areas

Permanent impacts could occur where the project limits cross streams, riparian areas, wetlands, or wetland buffers. The project limits include the guideway, station footprints (including parking), roadway improvements, storm drainage ponds, and other ancillary features. In addition, a 15-foot clear zone will be maintained on either side of the guideway to prevent damage to catenary wires from falling vegetation. Existing trees in this zone will be cleared and replaced with lower-growing native shrubs or trees. Also, some trees in areas beyond the 15-foot clear zone may need to be removed to protect light rail safety and reliability. Removal of such hazard trees may continue as a maintenance activity throughout the operational life of project facilities.

Where existing riparian and wetland vegetation will be cleared at the elevated stream crossing sites, there are many areas where the existing vegetation consists of invasive species, especially Himalayan blackberry and reed canarygrass. These areas will be cleared of invasive species and replanted with native vegetation after construction.

Up to 2.3 acres of riparian area, 2.4 acres of wetlands, and 3.0 acres of wetland buffers will be affected by the project (see Table 6-4). Much of the affected area falls within the footprint of elevated guideways and thus may not be subject to long-term impacts (see below for additional discussion of long-term effects of elevated guideways). Sound Transit will use compensatory mitigation to replace the area and functions lost for any riparian areas, wetlands, and wetland buffers that cannot be avoided or adequately minimized. Mitigation for impacts to wetlands and wetland buffers that are also within riparian areas will meet the local and federal mitigation requirements for wetlands or wetland buffers because those requirements are more stringent and specific than those for riparian mitigation. As appropriate, Sound Transit will apply the federal Final Compensatory Mitigation Rule (40 CFR Part 230); appropriate current available agency regulations; guidelines established jointly by Ecology, the Corps, and U.S. Environmental Protection Agency in *Wetland Mitigation in Washington State* (Ecology et al. 2006); and local critical areas ordinances for the cities of Seattle, Shoreline, Mountlake Terrace, and Lynnwood.

Table 6-4. Permanent Direct Impacts on Riparian Areas, Wetlands, and Wetland Buffers

Segment	Riparian Area Affected (acres) [1]	Wetland Area Affected (acres)[1]	Wetland Buffer Area Affected (acres) [1]	Comments
A	0.7	0.9	0.4	Thornton Creek riparian area: 0.5 acre. Stream SSE1 riparian area: 0.2 acre.
B	1.1	0.8	1.6	McAleer Creek riparian area: 0.5 acre. Stream SMT1 riparian area: 0.5 acre. SSH2 and SSH4 riparian areas: <0.1 acre each.
C	0.5	0.7	1.0	Scriber Creek riparian area impacts are estimated as the area of the project footprint overlapping the Scriber Creek wetland complex.
Total	2.3	2.4	3.0	

[1] Values in this table are estimates based on preliminary surveys conducted before formal delineations were complete. In addition, estimates of riparian area impacts are based on the total area within riparian buffers, including road surfaces and other areas that do not currently provide riparian functions. Moreover, these estimates include all areas within the project limits, including both at-grade and elevated guideways. Based on factors such as the structure's height, width, and orientation, some areas within the footprint of elevated guideways may not be subject to long-term impacts. As such, values in this table are likely overestimates of the extent of potential impacts on riparian areas, wetlands, and wetland buffers. Also, as noted above, mitigation for overlapping impacts will be based on local and federal mitigation requirements for wetlands or wetland buffers rather than requirements for riparian areas.

For this analysis, estimates of the amount of potentially affected riparian habitat area are based on the amount existing vegetation within the regulatory buffer that each local jurisdiction requires for each potentially affected stream. These buffer distances were selected because little functional riparian habitat currently exists or is likely to persist outside of these buffers. In addition, most riparian functions are provided by vegetation within the areas defined by these buffers. For example, studies conducted in western Washington, western Oregon, and southeast Alaska indicate that more than 90 percent of large woody debris input to streams from riparian areas is recruited from the areas within one-half of a site's potential tree height[2] (Murphy and Koski 1989, McDade et al. 1990, McKinley 1997, Martin et al. 1998). Based on an estimated site potential tree height of 200 feet, most potential recruitment of large woody debris to streams in the action area would be expected to come from the areas within regulatory buffers, and nearly all recruitment would come from within 100 feet. Construction of at-grade facilities outside of regulatory buffers, therefore, is expected to result in minimal (if any) reductions in wood recruitment to action area streams.

No construction of at-grade guideways, stations, or ancillary features will occur within the regulatory buffers of any surface-flowing streams in the study area. The only permanent project-related impacts on riparian habitat will occur where elevated guideways span areas of riparian vegetation. Within the Scriber Creek wetland complex, placement of guideway support columns will result in the permanent loss of some riparian habitat for that stream. Trees and other tall vegetation underneath and within 15 feet of all elevated guideways will be permanently cleared for safety. In addition, construction of elevated guideways above vegetation will reduce the amount of water the vegetation receives from precipitation. In addition, guideways with low clearance (generally, less than 15 feet) may limit sunlight. In some areas, vegetation cleared from beneath

[2] Site potential tree height is the average maximum height of the tallest dominant trees (200 years or older) at a given location, based on the soil and climatic conditions at that site. Site potential tree heights in the Puget Sound lowlands can extend up to 200 feet.

elevated guideways may not grow back. The presence of elevated guideways will preclude the development of mature forest habitat in such areas, reducing the potential for the recruitment of large woody debris to nearby streams.

Because the elevated guideway structures will be relatively narrow (31 feet wide) and generally more than 15 feet above the ground surface, shading impacts on riparian vegetation would be limited in most areas, although some impacts would result from shading and water interception. As learned from the Sound Transit Central Link project, herbaceous plants and shrubs are generally able to grow beneath narrow guideways that are at least 15 feet above the ground (Sound Transit 2011). Based on the nature and location of buffer impacts, as well as the current condition of vegetation within the buffers, no substantial degradation of riparian functions (e.g., fish and wildlife habitat, food chain support, or water temperature maintenance) or processes is expected to result from project-related clearing. The riparian processes not expected to be affected include water flow; erosion and accretion; infiltration; groundwater recharge and discharge; sediment delivery, transport, and storage; organic matter input; nutrient and pathogen removal; and stream channel formation and maintenance.

Another factor influencing the potential effects of elevated guideways on vegetation is the orientation of the guideway relative to the path of the sun across the sky. Over the course of a day, the sun appears to travel from east to west. If a relatively narrow feature such as a guideway is oriented north-to-south, most areas under the feature will receive sunlight during the morning and afternoon hours, when the sun is in the eastern and western sectors of the sky. The potential for sunlight to reach areas underneath a feature that is oriented east-to-west is much more limited.

The potential for the project to result in long-term effects on ESA-listed species in specific areas of each project segment is discussed further in the following subsections.

Segment A: Northgate to Shoreline

Thornton Creek

The elevated guideway will be approximately 40 feet above the surface-flowing segment of Thornton Creek in the action area. Based on the observation of a single adult steelhead upstream of this location in 2004, it is possible that steelhead could use stream habitats in this reach. Most or all trees currently in this riparian area will likely be removed and replaced with shrubs and other lower-growing native vegetation. The guideway will be oriented north-to-south, allowing sunlight to reach the new vegetation. Both the guideway and the new vegetation will provide shade to the stream. The loss of riparian trees could reduce the potential for delivery of large woody debris to the stream. Only the reach immediately beneath the guideway will be affected, however, because the culverts under 5th Avenue NE and other physical barriers already prevent large woody debris from being carried to other reaches downstream. Impacts to wetlands and wetland buffers will be mitigated as required by local and federal agencies.

Stream SSE1

The elevated guideway will be approximately 40 feet above the vegetated area adjacent to the surface-flowing segment of this non-fish-bearing watercourse in the action area. Some existing trees in the riparian area of this watercourse will likely be removed and replaced with shrubs and other lower-growing native vegetation. The guideway will be oriented north-to-south, allowing sunlight to reach the new vegetation. Both the guideway and the new vegetation will provide shade to the water. The loss of riparian trees could reduce the potential for delivery of large woody debris to the watercourse. Only the 100-foot-long reach immediately adjacent to the project alignment will be affected, however, because several culverts in the project area already prevent large woody debris from being carried to other reaches downstream. Impacts to wetlands and wetland buffers will be mitigated as required by local and federal agencies.

Segment B: Shoreline to Mountlake Terrace

McAleer Creek and Stream SSH4

The elevated guideway will pass through the riparian buffers of two segments of McAleer Creek where it flows at surface through cloverleaf interchanges between I-5 and SR 104; vegetation in the southeastern cloverleaf also provides riparian habitat for Stream SSH4. Both Chinook salmon and steelhead may use stream habitats in McAleer Creek in the action area. The route will also cross McAleer Creek as an elevated guideway where the stream emerges from a 400-foot culvert under I-5. The guideway will be approximately 60 feet above the stream at that location.

Some existing trees in the riparian areas of the surface-flowing segments in the two cloverleaf interchanges will likely be removed and replaced with shrubs and other lower-growing native vegetation. The guideway will be oriented north-to-south, allowing sunlight to reach the new vegetation. Both the guideway and the new vegetation will provide shade to the stream. The loss of riparian trees could reduce the potential for delivery of large woody debris to the stream. Only the reaches immediately adjacent to the Lynnwood Link Extension alignment will be affected, however, because the culverts under SR 104 and the I-5 on-ramps and off-ramps already prevent large woody debris from being carried to other reaches downstream. Impacts to wetlands and wetland buffers will be mitigated as required by local and federal agencies.

Stream SSH2

The entire length of this non-fish-bearing watercourse through the action area is contained in a culvert. Construction of the elevated guideway at the crossing location will not affect any vegetation within the riparian buffer of any surface-flowing segments of the stream.

Stream SMT1

The elevated guideway will be approximately 60 feet above this non-fish-bearing intermittent stream. Some existing trees in the riparian area of this stream will likely be removed and replaced with shrubs and other lower-growing native vegetation. The guideway will be oriented north-to-south, allowing sunlight to reach the new vegetation. Both the guideway and the new vegetation will provide shade to the stream. The loss of riparian trees could reduce the potential for delivery of large woody debris to the stream. Only the reaches immediately adjacent to the project alignment will be affected, however, because several culverts in the project area already prevent large woody debris from being carried to other reaches downstream. Impacts to wetlands and wetland buffers will be mitigated as required by local and federal agencies.

Segment C: Lynnwood

Scriber Creek

The elevated guideway will be approximately 50 to 60 feet above this stream where it flows through the Scriber Creek wetland complex. No ESA-listed species are known or expected to use habitats in this stream reach, which is approximately 2,900 feet upstream of a total barrier to fish passage.

Most existing vegetation in the riparian area consists of willows and other low-growing species that may not need to be removed for safety reasons. However, some cottonwoods and other tall trees at the southern periphery of the wetland complex may be removed and replaced with shrubs and other lower-growing native vegetation. The guideway orientation in this area will be northeast-to-southwest, meaning sunlight will be able to reach new vegetation but possibly not to as great an extent as in the riparian areas of Thornton Creek and McAleer Creek. Both the guideway and the new vegetation will provide shade to the stream. The loss of riparian trees could reduce the potential for delivery of large woody debris to the stream. Only the reaches immediately adjacent to the project alignment will be affected, however, because several culverts in the action area already prevent large woody debris from being carried to other reaches downstream. As noted in Chapter 4, Environmental Baseline, Jones and Stokes (2000) found little to no large woody debris in the stream and determined that the potential for large woody debris recruitment is low. Impacts to wetlands and wetland buffers will be mitigated as required by local and federal agencies.

Stream SLY1

No portions of the project footprint intersect the vegetated area of the riparian buffer of this non-fish-bearing stream. All project construction activities within 200 feet of the stream will occur in currently paved portions of the transit center and therefore will not have any potential to affect the stream or its riparian buffer.

6.2 Indirect Effects

Indirect effects are defined as those that are caused by the proposed action and are later in time, but still are reasonably certain to occur (50 CFR § 402.02).

The Lynnwood Link Extension light rail system is projected to be used for approximately 68,000 trips per day in 2035, more than double the bus ridership that would be expected in the absence of the project (Sound Transit and Federal Transit Administration 2013). This is expected to reduce vehicle miles traveled by approximately 270,000 to 290,000 miles per day, and vehicle hours traveled by approximately 23,000 to 25,000 per day, with corresponding reductions in energy use, emissions, and related pollutants from vehicular traffic. A substantial portion of the anticipated reduction is expected to occur within the project corridor as new riders shift from automobiles to transit.

During the scoping process and preparation of the Lynnwood Link Extension Draft EIS (Sound Transit and Federal Transit Administration 2013), Sound Transit gathered information from other agencies and the public to identify proposed development projects that are reasonably certain to occur and that are contingent upon or caused by the project. Examples of information sources include land use plans, transportation plans, neighborhood plans, major transportation and land use proposals, and growth management plans from local municipalities, the Puget Sound Regional Council, and other organizations and the public.

Based on the information reviewed, no proposed development projects contingent upon or caused by the Lynnwood Link Extension are reasonably certain to occur. Light rail transit may contribute to existing market forces that can increase the potential for transit-oriented development. The experience of other U.S. communities has shown that, although light rail transit may not by itself create new development, with transit-supporting plans and policies in place, it can influence where development would occur and the types of development that occur. The Lynnwood Link Extension will provide mobility options that could help achieve higher land use densities, thereby encouraging reduction of land development area in ways that are consistent with regional and local plans and policies. Density will increase without construction of light rail; however, light rail will help achieve goals that encourage high-density, transit-oriented development (Sound Transit and Federal Transit Administration 2013).

6.3 Interrelated/Interdependent Actions

Interrelated actions are defined as actions that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR § 402.02). The Lynnwood Link Extension light rail line is part of a regional transportation improvement plan, but it does not depend on any other portion of the plan for its justification. The Lynnwood Link Extension is a stand-alone project that has independent utility, and no other proposed actions depend upon the Lynnwood Link Extension for their utility.

6.4 Effects Determinations

Table 6-5 summarizes the effects determinations for each species and critical habitat considered in this analysis. The rationale for each determination is provided in the following subsections.

6.4.1 Puget Sound Chinook Salmon

Project activities with the potential to affect Chinook salmon include construction and operation of light rail facilities near streams where this species might occur, as well as changes in runoff rates, volumes, and pollutant loads in water bodies that receive discharge from stormwater treatment facilities associated with the project.

The project may affect Puget Sound Chinook salmon for the following reasons:

- Adult Chinook salmon may occur in reaches of McAleer Creek within the action area.

Table 6-5. Effects Determinations for ESA-Listed Species and Critical Habitat

Species	Status	Federal Jurisdiction	Effects Determination
Chinook salmon, Puget Sound ESU	Threatened	NMFS	NLAA
Chinook salmon critical habitat	Designated	NMFS	NE
Steelhead, Puget Sound DPS	Threatened	NMFS	NLAA
Steelhead critical habitat	Proposed	NMFS	NE
Bull trout	Threatened	USFWS	NE
Bull trout critical habitat	Designated	USFWS	NE

ESU–Evolutionarily Significant Unit
DPS–Distinct Population Segment
NE–No Effect
NLAA–Not Likely to Adversely Affect
NMFS–National Marine Fisheries Service
USFWS–United States Fish and Wildlife Service

- Sediment or pollutants generated by construction activities could be released into surface waters.
- Increases in the amount of impervious surface in the action area could result in increased velocities and durations of peak flows in receiving waters.
- Removal of riparian vegetation due to project construction could disrupt riparian functions in stream reaches where Chinook salmon may be present.

The project is not likely to adversely affect Puget Sound Chinook salmon for the following reasons:

- None of the streams in the action area provide spawning habitat for Chinook salmon; therefore, potential impacts to that life stage are considered discountable.
- The potential for stream reaches in the action area to provide suitable rearing, foraging, or refuge habitat for Chinook salmon is low, based on limited access and poor habitat quality.
- All work below the ordinary high water mark of any waterbodies will be conducted in accordance with the HPA issued by WDFW and with the Clean Water Act Section 404 permit issued by the Corps. Such permits typically include provisions designed to avoid or minimize the risk of adverse effects on fish during sensitive life history stages. Provisions could include restrictions on construction periods below the ordinary high-water mark and/or other measures to avoid or minimize the potential for construction activities to deliver sediment or pollutants to streams.
- Work near streams will comply with permits obtained under local critical areas ordinances, which will likely include provisions for the protection of water quality and riparian habitat, further reducing the potential for adverse effects on fish and fish habitat.
- BMPs will be employed to prevent sediment and pollutants from entering any water body.
- Stormwater runoff from all new PGIS in the action area will receive water quality treatment, minimizing the risk of degradation of water discharged to action area streams.
- To minimize the potential impacts of increased impervious surface, stormwater detention facilities will be constructed as part of the project; the volume detained will be sufficient to offset any increase in impervious surface area in each segment.

- Native riparian vegetation will be replanted immediately after construction. Monitoring and adaptive management will ensure survival of plants in revegetated areas.
- Impacts to wetlands and riparian areas will be mitigated in accordance with regulatory requirements.
- The project is not expected to result in induced growth that would adversely affect habitat for Chinook salmon.

6.4.2 Puget Sound Chinook Salmon Critical Habitat

The areas potentially affected by construction and operation of the Lynnwood Link Extension do not overlap any areas of designated critical habitat for Puget Sound Chinook salmon. The nearest designated critical habitat is in Lake Washington, which is more than 3 miles downstream of the action area. Therefore, the project will have no effect on designated critical habitat for Puget Sound Chinook salmon.

6.4.3 Steelhead

Project activities with the potential to affect steelhead include construction and operation of light rail facilities near streams where this species may occur, as well as changes in runoff rates, volumes, and pollutant loads in water bodies that receive discharge from stormwater treatment facilities associated with the project.

The project may affect Puget Sound steelhead for the following reasons:

- Adult steelhead may occur in reaches of Thornton Creek and McAleer Creek within the action area.
- Sediment or pollutants generated by construction activities could be released into surface waters.
- Increases in the amount of impervious surface in the action area could result in increased velocities and durations of peak flows in receiving waters.
- Removal of riparian vegetation due to project construction could disrupt riparian functions in stream reaches where steelhead may be present.

The project is not likely to adversely affect Puget Sound steelhead for the following reasons:

- None of the streams in the action area provide spawning habitat for steelhead; therefore, potential impacts to that life stage are considered discountable.
- The potential for stream reaches in the action area to provide suitable rearing, foraging, or refuge habitat for steelhead is low, based on limited access and poor habitat quality.
- Based on the low abundance of spawning steelhead in the Lake Washington population (approximately 12 fish), combined with the large amount of readily accessible spawning habitat in the many tributary streams to Lake Washington, the possibility of adult steelhead returning to stream reaches in the action area is very remote.

- All work below the ordinary high water mark of any waterbodies will be conducted in accordance with the HPA issued by WDFW and with the Clean Water Act Section 404 permit issued by the Corps. Such permits typically include provisions designed to avoid or minimize the risk of adverse effects on fish during sensitive life history stages. Provisions could include restrictions on construction periods below the ordinary high-water mark and/or other measures to avoid or minimize the potential for construction activities to deliver sediment or pollutants to streams.
- Work near streams will comply with permits obtained under local critical areas ordinances, which will likely include provisions for the protection of water quality and riparian habitat, further reducing the potential for adverse effects on fish and fish habitat.
- BMPs will be employed to prevent sediment and pollutants from entering any water body.
- Stormwater runoff from all new PGIS in the action area will receive water quality treatment, minimizing the risk of degradation of water discharged to action area streams.
- To minimize the potential impacts of increased impervious surface, stormwater detention facilities will be constructed as part of the project; the volume detained will be sufficient to offset any increase in impervious surface area in each segment.
- Native riparian vegetation will be replanted immediately after construction. Monitoring and adaptive management will ensure survival of plants in revegetated areas.
- Impacts to wetlands and riparian areas will be mitigated in accordance with regulatory requirements.
- The project is not expected to result in induced growth that would adversely affect habitat for steelhead.

6.4.4 Steelhead Critical Habitat

The areas potentially affected by construction and operation of the Lynnwood Link Extension do not overlap any areas of proposed critical habitat for Puget Sound steelhead. The nearest proposed critical habitat is in Lake Washington, which is more than 3 miles downstream of the action area. The project will not destroy or adversely modify any proposed critical habitat for steelhead because no such areas occur in locations that may be affected by project activities.

If steelhead critical habitat is designated before completion of this project, a provisional effect determination for critical habitat is as follows: the project will have no effect on designated critical habitat for Puget Sound steelhead.

6.4.5 Bull Trout

Project activities are expected to have no effect on bull trout because bull trout are neither known nor expected to use habitats in the streams in the action area. None of the streams in the action area has been documented as supporting spawning or rearing by bull trout. Any fish attempting to gain access to any of the streams in the action area would have to negotiate several miles of stream habitat with elevated temperatures and multiple physical barriers. In light of these impediments, the potential for bull trout to use habitats in the action area for spawning, rearing, foraging, migration, or overwintering is negligible.

6.4.6 Bull Trout Critical Habitat

The areas potentially affected by construction and operation of the Lynnwood Link Extension do not overlap any areas of designated critical habitat for bull trout. The nearest designated critical habitat is in Lake Washington, which is more than 3 miles downstream of the action area. Therefore, the project will have no effect on designated critical habitat for bull trout.

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APPENDIX A

Essential Fish Habitat Consultation

ESSENTIAL FISH HABITAT CONSULTATION

Public Law 104-297, the Sustainable Fisheries Act of 1996, amended the Magnuson-Stevens Fishery Conservation and Management Act to establish new requirements for Essential Fish Habitat (EFH) descriptions in federal fishery management plans and to require federal agencies to consult with the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH.

The Magnuson-Stevens Act requires all fishery management councils to amend their fishery management plans to describe and identify EFH for each managed fishery. The Pacific Fishery Management Council (1999) has issued such an amendment in the form of Amendment 14 to the Pacific Coast Salmon Plan, and this amendment covers EFH for the Pacific salmon (Chinook salmon, coho salmon, and pink salmon) under NMFS jurisdiction that would potentially be affected by the proposed action.

EFH for Pacific salmon in freshwater includes all streams, lakes, ponds, wetlands, and other currently viable bodies of freshwater and the substrates within those water bodies accessible to Pacific salmon. Activities occurring above impassable barriers that are likely to adversely affect EFH below impassable barriers are subject to the consultation provisions of the Magnuson-Stevens Act.

EFH for groundfish and coastal pelagic species includes all waters from the mean high water line along the coasts of Washington upstream to the extent of saltwater intrusion and seaward to the boundary of the U.S. exclusive economic zone (370.4 km.) (PFMC 1998a and 1998b). Designated EFH for salmonid species in estuarine and marine areas includes nearshore and tidally submerged environments within state territorial water out to the full extent of the exclusive economic zone (370.4 km) offshore of Washington (PFMC 1999). No such areas are present in the action area,

The Magnuson-Stevens Act requires consultation for all federal agency actions that may adversely affect EFH. EFH consultation with NMFS is required by federal agencies undertaking, permitting, or funding activities that may adversely affect EFH, regardless of its location. Under Section 305(b)(4) of the Magnuson-Stevens Act, NMFS is required to provide EFH conservation and enhancement recommendations to federal and state agencies for actions that adversely affect EFH. Wherever possible, NMFS uses existing interagency coordination processes to fulfill EFH consultations with federal agencies. For the proposed action, this goal is being met by incorporating EFH consultation to the Endangered Species Act (ESA) Section 7 consultation, as represented by this Biological Assessment (BA).

The following guilds may be affected by project activities:

☒ Pacific Salmon ☐ Groundfish ☐ Coastal Pelagic Species

Location

In the Lake Washington-Sammamish basin, EFH includes Lake Washington and all of its tributaries currently or historically accessible to salmon, including Thornton Creek, McAleer Creek, and Scriber Creek.

Chinook Salmon

As discussed in Chapter 5, Species and Critical Habitat Status and Occurrence, adult Chinook salmon may use habitat in McAleer Creek within the action area but not for spawning. Access by Chinook salmon to other streams in the action area is blocked by impassable culverts downstream, and flow regimes and substrate structure are not conducive to spawning.

Coho Salmon

Coho salmon have been observed in the action area, within Thornton Creek, McAleer Creek, and Scriber Creek. Portions of McAleer Creek downstream of the confluence with Stream SMT1 provide spawning habitat for coho salmon, while those upstream of that point provide rearing habitat (WDFW 2014b). None of the other streams in the action area is considered to be accessible to coho salmon.

Pink Salmon

Pink salmon are not known or expected to use Lake Washington or its tributaries (WDFW 2014b).

Description of Project Activities

The project activities covered by this BA are described in Chapter 1, Introduction and Project Description. Potential effects of the project to salmonids are discussed in detail in Chapter 6, Effects Analysis and Effects Determination.

Conservation Measures and Best Management Practices

Conservation measures and best management practices (BMPs) are included for project activities and are described in Chapter 2 of this BA. Notably, no work will occur within stream reaches where salmon use has been documented, and project construction is not expected to result in any adverse effects on any salmon species. The project alignment at the crossings of Thornton Creek and McAleer Creek will be elevated, thereby avoiding any direct impacts on stream habitat and minimizing the potential for adverse effects on riparian habitat. WDFW (2014b) has not documented any observations of any salmon species in the action area. Conservation measures will avoid or minimize potential effects to existing habitat conditions, including EFH, within the action area.

Conclusions

In accordance with the EFH requirements of the Magnuson-Stevens Fishery Conservation and Management Act, it has been determined that the project will have the following effect on EFH for the guilds identified below:

☒ Pacific Salmon	☒ No Adverse Effect	☐ Adverse Effect
☐ Groundfish	☒ No Adverse Effect	☐ Adverse Effect
☐ Coastal Pelagic Species	☒ No Adverse Effect	☐ Adverse Effect

The project will have no adverse effects on EFH for groundfish or coastal pelagic species because they do not occur in the areas directly or indirectly affected by the project.

The project will have no adverse effects on EFH for Pacific salmon (including Chinook, coho, and pink salmon) because project construction, including implementation of the conservation measures identified above, is not expected to result in any permanent reduction of quantity or quality of EFH.

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APPENDIX B

Biology of Species Addressed in this Analysis

BIOLOGY OF SPECIES ADDRESSED IN THIS ANALYSIS

This appendix details the life history of the species covered in this Lynnwood Link Extension Biological Assessment (BA).

Puget Sound Chinook Salmon (*Oncorhynchus tshawytscha*)

The Puget Sound Chinook salmon evolutionarily significant unit (ESU) encompasses all runs of Chinook salmon from the Elwha River in the Strait of Juan de Fuca eastward, including rivers and streams flowing into Hood Canal, Puget Sound, and the Strait of Georgia in Washington. Of an estimated 31 original populations, there are 22 extant geographically distinct populations representing the primary historical spawning areas of Chinook salmon in the ESU (Good et al. 2005). Of the nine extinct populations, eight were spring Chinook salmon. The extinct spring Chinook salmon populations represented a significant portion of the historical life history diversity and spatial structure of the ESU. Their loss has increased the ESU's risk of extinction.

Long-term trends in abundance and median population growth rates for naturally spawning populations of Puget Sound Chinook salmon indicate that approximately half of the populations are declining and the other half are increasing in abundance. Eight of the 22 populations are declining over the short term, and 11 or 12 populations are experiencing long-term declines (Good et al. 2005). Factors contributing to the downward trends are widespread blockages of streams, degraded freshwater and marine habitat, poor forest practices in upper river tributaries, and urbanization and agriculture in lower tributaries and main stem rivers.

Chinook salmon spawning areas are generally characterized by stream gradients of less than 2 percent, velocities between 1.0 and 3.6 feet per second, depths greater than 0.8 feet, and gravel and cobble substrates as large as 4 inches. Chinook salmon favor the head of riffles and side channels for their redd locations (Healey 1991). The eggs are deposited in gravel that has well-oxygenated water percolating through it (Healey 1991). The eggs overwinter and hatch in the gravel to become juveniles with a yolk-sac. Juveniles emerge from the gravel (usually in late winter), begin to forage on their own, and move downstream into estuaries, where they continue to forage before moving into the North Pacific Ocean and reside for 1 to 5 or more years (Healey 1991).

Stream-type Chinook salmon (spring-run Puget Sound Chinook salmon) migrate into nearshore waters and return to natal streams in spring to early summer. They usually spawn greater distances from salt water than the ocean-type stocks. Ocean-type Chinook salmon (commonly called the fall-run) move to their natal streams in late summer and early fall. These individuals usually spawn lower in rivers than the stream-type stocks. Spring-run Puget Sound Chinook salmon spawn in late August through early October, while fall-run Puget Sound Chinook salmon spawn in late September through October (Healey 1991).

Spring-run Chinook salmon return to rivers when they are reproductively immature and typically hold in deep pools with flowing water for summer holding prior to spawning. Suitable holding pools have depths greater than 5 feet; contain cover from undercut banks, overhanging vegetation, boulders, or woody debris (Lindsay et al. 1986); and have water velocities ranging from 0.5 to 1.2 feet per second (Marcotte 1984). In the summer, Chinook salmon juveniles prefer areas with water velocities less than 0.7 feet per second, depths between 0.7 and 2.6 feet, and cover (Hillman et al. 1987).

Adult Chinook salmon enter the Lake Washington system from Puget Sound through the Ballard Locks in July through September (Celedonia et al. 2011). Adult Chinook salmon begin entering the spawning streams in September and continue until November. Spawning occurs from October to December, with peak spawning activity usually in the first few weeks of October (Burton et al. 2009). Fry emerge from redds between January and early April (Kiyohara and Zimmerman 2009). Juvenile Chinook salmon in the Lake Washington system appear to have two rearing strategies: some rear in their natal streams and emigrate to the lake as pre-smolts in May, June, or July; others emigrate as fry between January and mid-May and rear in the south or north end of Lake Washington or in Lake Sammamish for several months (Celedonia et al. 2011). All Lake Washington Chinook migrate to marine habitats during their first year.

The largest run of naturally produced Chinook salmon in the Lake Washington basin occurs in the Cedar River. Large numbers of adult fish also spawn in Bear Creek. Small numbers of Chinook salmon spawn in several tributaries to Lake Washington and Lake Sammamish. Most hatchery production occurs at the Washington Department of Fish and Wildlife's Issaquah Creek Hatchery.

The size of historical runs of the ESU were estimated at 670,000. During a recent 5-year period, the geometric mean of natural spawners in populations of Puget Sound Chinook salmon ranged from 222 to just over 9,489 fish. The historical estimates of spawner capacity are several orders of magnitude higher than spawner abundances currently observed throughout the ESU (Good et al. 2005). The NMFS Biological Review Team identified the following risks: (1) the concentration of the majority of natural production in just two basins; (2) high levels of hatchery production in many areas of the ESU; and (3) widespread loss of estuary and lower floodplain habitat diversity. Populations in this ESU have not experienced the sharp increases in the late 1990s seen in many other ESUs, though more populations have increased than decreased since the last Biological Review Team assessment (Good et al. 2005).

Habitat requirements for Chinook salmon are listed by the NMFS in terms of Primary Constituent Elements (PCEs), which include sites that are essential to supporting one or more life stages of the ESU and which contain physical or biological features essential to the conservation of the ESU.

Specific sites and features designated for Puget Sound Chinook salmon include the following:

1) Freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning incubation and larval development

2) Freshwater rearing sites with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks

3) Freshwater migration corridors free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival
4) Estuarine areas free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between freshwater and saltwater, natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels, and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation
5) Nearshore marine areas free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation, and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels
6) Offshore marine areas with water quality conditions and forage, including aquatic invertebrates and fishes supporting growth and maturation

Puget Sound Steelhead (*Oncorhynchus mykiss*)

Steelhead are the anadromous form of freshwater resident rainbow or redband *O. mykiss* trout species. The present distribution of steelhead extends from Asia to Alaska, and south to the U.S.-Mexico border (Busby et al. 1996; 67 FR 21586, May 1, 2002). Unlike many salmonid species, *O. mykiss* exhibits extremely complex and plastic life history characteristics, such that their offspring can exhibit different life history forms from the parental generation. For example, offspring of resident fish may migrate to sea, and offspring of anadromous steelhead may remain in streams as resident fish (Burgner et al. 1992).

Those that are anadromous can spend up to 7 years in freshwater prior to smoltification (the physiological and behavioral changes required for the transition to salt water), and then spend up to 3 years in salt water before returning to freshwater to spawn. However, they typically return to their natal stream to spawn as 4- or 5-year-old fish. Unlike Pacific salmon, steelhead trout are iteroparous, meaning they are capable of spawning more than once before they die. However, it is rare for steelhead to spawn more than twice before dying, and those that do are usually females (Busby et al. 1996).

Over their entire range, West Coast steelhead spawning migrations occur throughout the year, with seasonal peaks of migration activity varying by location. However, even in a given river basin there might be more than one seasonal migration peak, typically referred to as winter, spring, summer, or fall steelhead runs. Although there are generally four migration seasons, steelhead are typically divided into two basic reproductive ecotypes (summer and winter), based on the state of sexual maturity at the time they enter freshwater and the duration of spawning migration (Burgner et al. 1992). The summer or stream-maturing type enters fresh water in a sexually immature condition between May and October, and sexually matures in freshwater over several months. In contrast, the winter or ocean-maturing type enters fresh water in a sexually mature condition between November and April, and spawns shortly thereafter. In basins with ecotypes, the summer run generally spawns farther upstream than winter run fish. However, the winter run of steelhead is the predominant run in Puget Sound.

Depending on water temperature, fertilized steelhead eggs may incubate in redds for 1.5 to 4 months before hatching as alevins. Following yolk sac absorption, young juveniles (fry) emerge from the gravel and begin active feeding. As they grow, steelhead move to deeper parts of the stream and establish territories and diet changes from microscopic aquatic organisms to larger organisms such as isopods, amphipods, and aquatic and terrestrial insects, primarily associated with the stream bottom (Wydoski and Whitney 1979). Riparian vegetation and submerged cover (logs, rocks, and aquatic vegetation) are important for providing cover, food, temperature stability, and protection from predators. As a result, densities of juvenile steelhead are highest in areas containing in-stream cover (Reiser and Bjornn 1979; Johnson and Kucera 1985).

Bull Trout (*Salvelinus confluentus*)

Bull trout are members of the family Salmonidae and are char native to Washington, Oregon, Idaho, Nevada, Montana, and western Canada. Compared to other salmonids, bull trout have more specific habitat requirements that appear to influence their distribution and abundance. They need cold water to survive, so they are seldom found in waters where temperatures exceed 59 to 64 degrees Fahrenheit (°F). They also require stable stream channels, clean spawning and rearing gravel, complex and diverse cover, and unblocked migratory corridors.

Bull trout exhibit a number of life history strategies. Stream-resident bull trout complete their entire life cycle in the tributary streams where they spawn and rear. Migratory bull trout spawn in tributary streams. Juvenile fish from migratory populations usually rear from 1 to 4 years in natal streams before migrating (typically downstream) to either a larger river (fluvial form) or lake (adfluvial form), where they spend their adult life, returning to the tributary stream to spawn (Fraley and Shepard 1989). These migratory forms occur in areas where conditions allow for movement from upper watershed spawning streams to larger waters that contain greater foraging opportunities (Dunham and Rieman 1999). Resident and migratory forms may be found together, and either form can produce resident or migratory offspring (Rieman and McIntyre 1993). An anadromous form of bull trout also exists in the Coastal-Puget Sound population, which spawns in rivers and streams but rears young in the ocean. Unlike strictly anadromous species, such as Pacific salmon, bull trout can also exhibit an amphidromous life form, meaning they return seasonally to fresh water as subadults, sometimes for several years, before returning to spawn (Wilson 1997; Brenkman and Corbett 2005). The amphidromous life history form of bull trout is unique to the Coastal Puget Sound population (64 FR 58921, November 1, 1999).

Bull trout have more specific habitat requirements than most other salmonids (Rieman and McIntyre 1993). Habitat components that particularly influence their distribution and abundance include water temperature, cover, channel form, spawning and rearing substrate conditions, and migration habitat (Fraley and Shepard 1989; Goetz 1989; Watson and Hillman 1997).

Watson and Hillman (1997) concluded watersheds must have specific physical characteristics to provide the necessary habitat requirements for bull trout spawning and rearing, and that these characteristics are not ubiquitous throughout the watersheds in which bull trout occur. The preferred spawning habitat of bull trout consists of low-gradient stream reaches with loose, clean gravel (Fraley and Shepard 1989). Bull trout typically spawn in a narrow time window of a couple weeks during periods of decreasing water temperatures, but spawning ranges from August to November depending on local conditions (Swanberg 1997). However, migratory forms are known to begin spawning migrations as early as April and to move upstream as much as 250 km (155 mi) to spawning areas (Fraley and Shepard 1989; Swanberg 1997).

Fraley and Shepard (1989) reported that the initiation of spawning by bull trout in the Flathead River system appeared to be related to water temperature, with spawning generally initiated when water temperatures dropped below 50°F). Goetz (1989) reported a spawning temperature range from 39°F to 50°F, but the range could be wider in some areas (Howell et al. 2010). Selection of spawning habitat by bull trout is also influenced across multiple spatial scales by hyporheic flow (Baxter and Hauer 2000), defined as a mixing of shallow groundwater and surface water beneath and lateral to a stream bed. Hyporheic flow is influenced by geomorphic complexity of the streambed and recognized to be important for surface water/groundwater interaction. Spawning areas are often associated with cold-water springs, glacial and snow melt, or groundwater upwelling (Rieman et al. 1997; Baxter et al. 1999). Fraley and Shepard (1989) also found groundwater influence and proximity to cover are important factors influencing spawning site selection. They reported the combination of relatively specific requirements resulted in a restricted spawning distribution in relation to available stream habitat. While bull trout are critically dependent on large, cold-water habitats, individuals can range widely through stream networks and use habitat that may have limited amounts of cold-water refuge (64 FR 58921, November 1, 1999).

Depending on water temperature, egg incubation is normally 100 to 145 days (Pratt 1992). Water temperatures of 34°F to 42°F have been reported for incubation, with an optimum (best embryo survivorship) temperature reported to be from 36°F to 39°F (Fraley and Shepard 1989; McPhail and Baxter 1996). Juveniles remain in the substrate after hatching. The time from egg deposition to emergence of fry can exceed 200 days. During the relatively long incubation period in the gravel, bull trout eggs and embryos are especially vulnerable to fine sediments (i.e., fine silt to coarse sand) and water quality degradation (Fraley and Shepard 1989). Increases in fine sediment appear to reduce egg survival and emergence (Pratt 1992) by restricting intragravel circulation and/or causing entombment of newly hatched alevins (young salmon that have the yolk sac still attached). Juveniles are likely also affected by reduced interstitial habitat and cover. High juvenile densities have been reported in areas characterized by a diverse cobble substrate and a low percentage of fine sediments (Shepard et al. 1984).

Habitat requirements for bull trout are listed by the U.S. Fish and Wildlife Service (USFWS) in terms of functions and PCEs. Bull trout require the following habitat functions:

1) Spawning, rearing, foraging, or over-wintering habitat to support essential existing local populations

2) Movement corridors necessary for maintaining essential migratory life history forms
3) Suitable habitat that is considered essential for recovering existing local populations that have declined or that need to be re-established to achieve recovery

These functions are provided by areas containing these PCEs:

1) Water temperatures ranging from 36°F to 59°F, with adequate thermal refugia available for temperatures at the upper end of this range. Specific temperatures within this range will vary depending on bull trout life history stage and form, geography, elevation, diurnal and seasonal variation, shade such as that provided by riparian habitat, and local groundwater influence.
2) Complex stream channels with features such as woody debris, side channels, pools, and undercut banks to provide a variety of depths, velocities, and in-stream structures.
3) Substrates of sufficient amount, size, and composition to ensure success of egg and embryo overwinter survival, fry emergence, and young-of-the-year and juvenile survival. A minimal amount of fine substrate less than 0.25 inch (0.63 centimeter) in diameter and minimal substrate embeddedness are characteristic of these conditions.
4) A natural hydrograph, including peak, high, low, and base flows within historic ranges or, if regulated, a hydrograph that demonstrates the ability to support bull trout populations by minimizing daily and day-to-day fluctuations and minimizing departures from the natural cycle of flow levels corresponding with seasonal variation.
5) Springs, seeps, groundwater sources, and subsurface water connectivity to contribute to water quality and quantity.
6) Migratory corridors with minimal physical, biological, or water quality impediments between spawning, rearing, overwintering, and foraging habitats, including intermittent or seasonal barriers induced by high water temperatures or low flows.
7) An abundant food base including terrestrial organisms of riparian origin, aquatic macroinvertebrates, and forage fish.
8) Permanent water of sufficient quantity and quality such that normal reproduction, growth, and survival are not inhibited.
9) Few or no nonnative predatory species (e.g., lake trout, walleye, northern pike, smallmouth bass); inbreeding (e.g., brook trout); or competitive (e.g., brown trout) species present.

Lake Washington provides PCEs 1, 4, 5, 6, 7, and 8 for bull trout critical habitat. Lake Washington provides a stable water body with few obstacles to fish passage and an abundant food base. Lake Washington is hydrologically connected to a network of streams, associated wetlands, and subsurface water. Water temperatures in Lake Washington are generally warmer than 15° C during the summer (King County Department of Natural Resources 2000). Non-native smallmouth bass, which are potential bull trout predators, are present in Lake Washington (WDFW 2014).

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APPENDIX C

Species Lists

Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead

Puget Sound Domain

- Puget Sound Chinook (T) [FCH 9/2/05]
- Hood Canal Summer Chum (T) [FCH 9/2/05]
- Ozette Lake Sockeye (T) [FCH 9/2/05]
- Puget Sound Steelhead (T) [CH under dev.; ANPR 1/10/11]

Willamette/Lower Columbia Domain

- Columbia River Chum (T) [FCH 9/2/05]
- Lower Columbia River Coho (T) [CH Under dev.; ANPR 1/10/11]
- Lower Columbia River Chinook (T) [FCH 9/2/05]
- Lower Columbia River Steelhead (T) [FCH 9/2/05]
- Upper Willamette River Chinook (T) [FCH 9/2/05]
- Upper Willamette River Steelhead (T) [FCH 9/2/05]

Oregon Coast Domain

- Oregon Coast Coho (T) [FCH 2/11/08]

Southern Oregon/Northern California Coast Domain

- Southern Oregon/Northern California Coast Coho (T) [FCH 5/5/99]

North-Central California Coast Domain

- Central California Coast Coho (E) [FCH 5/5/99]
- California Coastal Chinook (T) [FCH 9/2/05]
- Northern California Steelhead (T) [FCH 9/2/05]
- Central California Coast Steelhead (T) [FCH 9/2/05]

South-Central/Southern California Coast Domain

- South-Central California Coast Steelhead (T) [FCH 9/2/05]
- Southern California Coast Steelhead (E) [FCH 9/2/05]

Interior Columbia Domain

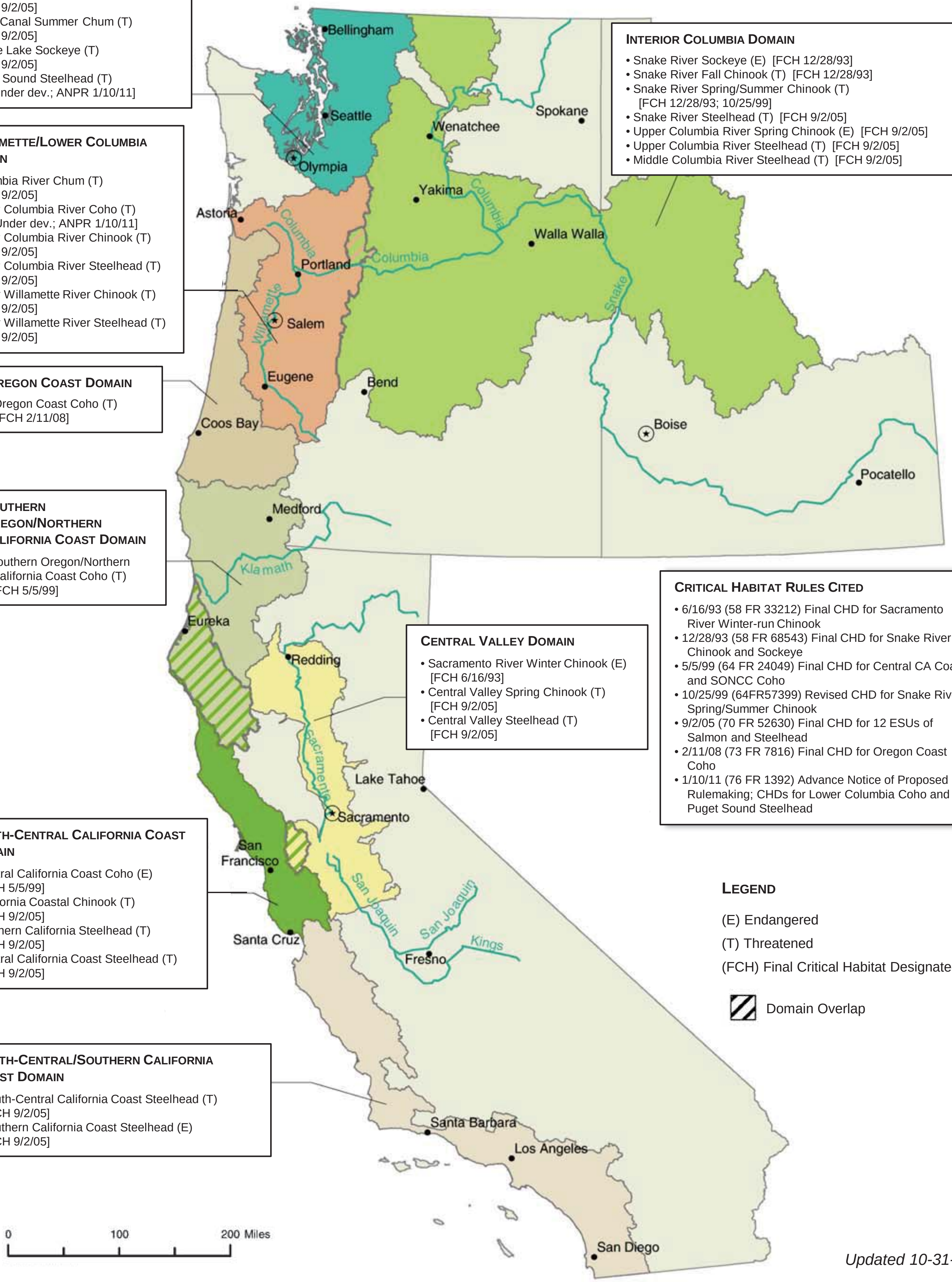
- Snake River Sockeye (E) [FCH 12/28/93]
- Snake River Fall Chinook (T) [FCH 12/28/93]
- Snake River Spring/Summer Chinook (T) [FCH 12/28/93; 10/25/99]
- Snake River Steelhead (T) [FCH 9/2/05]
- Upper Columbia River Spring Chinook (E) [FCH 9/2/05]
- Upper Columbia River Steelhead (T) [FCH 9/2/05]
- Middle Columbia River Steelhead (T) [FCH 9/2/05]

Central Valley Domain

- Sacramento River Winter Chinook (E) [FCH 6/16/93]
- Central Valley Spring Chinook (T) [FCH 9/2/05]
- Central Valley Steelhead (T) [FCH 9/2/05]

Critical Habitat Rules Cited

- 6/16/93 (58 FR 33212) Final CHD for Sacramento River Winter-run Chinook
- 12/28/93 (58 FR 68543) Final CHD for Snake River Chinook and Sockeye
- 5/5/99 (64 FR 24049) Final CHD for Central CA Coast and SONCC Coho
- 10/25/99 (64FR57399) Revised CHD for Snake River Spring/Summer Chinook
- 9/2/05 (70 FR 52630) Final CHD for 12 ESUs of Salmon and Steelhead
- 2/11/08 (73 FR 7816) Final CHD for Oregon Coast Coho
- 1/10/11 (76 FR 1392) Advance Notice of Proposed Rulemaking; CHDs for Lower Columbia Coho and Puget Sound Steelhead



Legend

(E) Endangered

(T) Threatened

(FCH) Final Critical Habitat Designated

Domain Overlap

Updated 10-31-12

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN IN KING COUNTY AS PREPARED BY THE U.S. FISH AND WILDLIFE SERVICE WASHINGTON FISH AND WILDLIFE OFFICE

(Revised September 3, 2013)

LISTED

Bull trout *(Salvelinus confluentus)*
Canada lynx *(Lynx canadensis)*
Gray wolf *(Canis lupus)*
Grizzly bear *(Ursus arctos = U. a. horribilis)*
Marbled murrelet *(Brachyramphus marmoratus)*
Northern spotted owl *(Strix occidentalis caurina)*

Major concerns that should be addressed in your Biological Assessment of project impacts to listed animal species include:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

Castilleja levisecta (golden paintbrush) [historic]

Major concerns that should be addressed in your Biological Assessment of project impacts to listed plant species include:

1. Distribution of taxon in project vicinity.

2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.

1. Changes in hydrology where taxon is found.

DESIGNATED

Critical habitat for bull trout
Critical habitat for the marbled murrelet
Critical habitat for the northern spotted owl

PROPOSED

North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS
Oregon spotted frog *(Rana pretiosa)* [historical]

CANDIDATE

Fisher *(Martes pennanti)* – West Coast DPS
Yellow-billed cuckoo *(Coccyzus americanus)*
Pinus albicaulis (whitebark pine)

SPECIES OF CONCERN

Bald eagle *(Haliaeetus leucocephalus)*
Beller's ground beetle *(Agonum belleri)*
Cascades frog *(Rana cascadae)*
Hatch's click beetle *(Eanus hatchi)*
Larch Mountain salamander *(Plethodon larselli)*
Long-eared myotis *(Myotis evotis)*
Long-legged myotis *(Myotis volans)*
Northern goshawk *(Accipiter gentilis)*
Northern sea otter *(Enhydra lutris kenyoni)*
Northwestern pond turtle *(Emys (= Clemmys) marmorata marmorata)*
Olive-sided flycatcher *(Contopus cooperi)*
Pacific lamprey *(Lampetra tridentata)*
Pacific Townsend's big-eared bat *(Corynorhinus townsendii townsendii)*
Peregrine falcon *(Falco peregrinus)*
River lamprey *(Lampetra ayresi)*
Tailed frog *(Ascaphus truei)*
Valley silverspot *(Speyeria zerene bremeri)*
Western toad *(Bufo boreas)*
Aster curtus (white-top aster)
Botrychium pedunculosum (stalked moonwort)
Cimicifuga elata (tall bugbane)

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN IN SNOHOMISH COUNTY AS PREPARED BY THE U.S. FISH AND WILDLIFE SERVICE WASHINGTON FISH AND WILDLIFE OFFICE

(Revised September 3, 2013)

LISTED

Bull trout (*Salvelinus confluentus*)
Canada lynx (*Lynx canadensis*)
Gray wolf (*Canis lupus*)
Grizzly bear (*Ursus arctos = U. a. horribilis*)
Marbled murrelet (*Brachyramphus marmoratus*)
Northern spotted owl (*Strix occidentalis caurina*)

Major concerns that should be addressed in your Biological Assessment of project impacts to listed species include:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

DESIGNATED

Critical habitat for bull trout
Critical habitat for the marbled murrelet
Critical habitat for the northern spotted owl

PROPOSED

North American wolverine *(Gulo gulo luteus)* – contiguous U.S. DPS
Oregon spotted frog (*Rana pretiosa*) [historical]

CANDIDATE

Fisher *(Martes pennanti)* – West Coast DPS
Yellow-billed cuckoo (*Coccyzus americanus*)
Pinus albicaulis (whitebark pine)

SPECIES OF CONCERN

Bald eagle (*Haliaeetus leucocephalus*)
Beller's ground beetle (*Agonum belleri*)
Cascades frog (*Rana cascadae*)
Long-eared myotis (*Myotis evotis*)
Long-legged myotis (*Myotis volans*)
Northern goshawk (*Accipiter gentilis*)
Olive-sided flycatcher (*Contopus cooperi*)
Pacific lamprey (*Lampetra tridentata*)
Pacific Townsend's big-eared bat (*Corynorhinus townsendii townsendii*)
Peregrine falcon (*Falco peregrinus*)
River lamprey (*Lampetra ayresi*)
Tailed frog (*Ascaphus truei*)
Western toad (*Bufo boreas*)
Botrychium pedunculosum (stalked moonwort)

APPENDIX D

Stormwater Analysis Memorandum

DETAILED STORMWATER ANALYSIS

This appendix presents the results of modeling conducted to support the analysis of stormwater-related impacts of the Lynnwood Link Extension. As requested by NMFS staff during pre-consultation meetings for this BA, the WSDOT Highway Runoff and Dilution Loading (HI-RUN) model was used to generate estimates of current and anticipated future loadings and concentrations of dissolved copper and dissolved zinc in runoff from the Lynnwood Link Extension. This appendix also presents additional information about the path traveled by water after it leaves proposed stormwater treatment facilities, the traffic volumes on roadways that will be new PGIS, and the sources of existing stormwater runoff in the analysis area.

Table D-1 on the following page presents detailed information about the areas of new PGIS that will result from the Lynnwood Link Extension, including estimates of the average daily number of vehicles on each roadway or parking area. The table also describes the path traveled by water discharged from the facilities that Sound Transit proposes creating to provide water quality treatment for the runoff from new areas of PGIS.

Consistent with the requirements of the Washington Department of Transportation's Highway Runoff Manual, threshold discharge areas (TDAs) were delineated in the analysis area. Four of these TDAs have outfalls to streams (Thornton Creek and McAleer Creek) at locations where ESA-listed species may be present (Table D-1).

In all TDAs, runoff from PGIS that will be created or removed by the Lynnwood Link Extension will comingle with runoff from numerous other sources. The greatest contributor is I-5, which has traffic volumes of approximately 150,000 to 200,000 vehicles per day in the analysis area. In contrast, more than 95 percent of the new PGIS created by the project will be used by 10,000 or fewer vehicles per day (Table D-1).

Treated water discharged from TDA 7 North and from the NE 130th Street overpass in TDA 3 will travel a substantial distance (between 1,500 and 2,600 feet) through vegetated ditches before entering any fish-bearing waters. Concentrations of dissolved metals traveling in ditches will be reduced through uptake by vegetation growing in the ditches and through chemical reactions with negative ions in the soils that support the vegetation.

Treated water discharged from TDA 4 and from portions of TDA 3 other than the NE 130th Street overpass will travel primarily through pipes before entering Thornton Creek. Notably, these outfalls discharge more than 3,000 feet upstream of any reaches where ESA-listed species are known or expected to be present. As a result, runoff discharged from those areas is highly unlikely to affect ESA-listed species.

Table D-1. Acreage and Approximate Traffic Volumes on PGIS Areas To Be Added by the Lynnwood Link Extension, and the Routes Traveled by Water Discharged from New Stormwater Treatment Facilities

PGIS Source	Traffic Volume [1]	PGIS Area (acres)	Post-treatment Path
TDA 3			
NE 130th	20,000	0.28	Water leaving the facility will flow approximately 2,600 feet through vegetated ditches along the west side of I-5 before entering a culvert under the freeway, joining Thornton Creek approximately 1,700 feet upstream of where steelhead are known or expected to be present. (Sub-basin 1)
NE 145th Station Parking	500	0.33	Water leaving the facility will enter an existing pipe that discharges to Thornton Creek approximately 3,000 feet upstream of where steelhead are known or expected to be present. (Sub-basin 2)
I-5 onramp	10,000	0.26	Water leaving the facility will enter an existing enclosed pipe system that discharges to the culverts containing Thornton Creek approximately 3,500 feet upstream of where steelhead are known or expected to be present. (Sub-basin 3)
NE 148th	100	0.08	As above (Sub-basin 3)
NE 145th Station Parking	500	0.64	As above (Sub-basin 3)
TDA 4			
1st Ave NE	500	0.21	Water leaving the facility will flow approximately 1,500 feet, mostly in pipes, before entering Thornton Creek approximately 1 mile upstream of where steelhead are known or expected to be present.
TDA 7 South			
5th Ave NE east of I-5	3,000	0.33	Water leaving the facility will flow approximately 4,900 feet, mostly in pipes, before entering McAleer Creek where steelhead and Chinook salmon may be present; the nearest spawning habitat (for Chinook salmon only) is approximately 1 mile downstream.
Parking	500	0.74	As above
5th Ave NE west of I-5	2,000	0.59	As above
Bus Turnaround	300	0.79	Infiltration facility (emergency overflow will follow the path described above)
TDA 7 North			
Southbound I-5 onramp at 220th Street	8,000	0.40	Water leaving the facility will flow approximately 7,000 feet, including approximately 1,500 feet in vegetated ditches, before entering a vegetated stormwater detention pond at the I-5/SR 104 interchange. Water from the pond discharges onto a riprap pad then flows at surface approximately 100 feet before joining McAleer Creek where steelhead salmon may be present but approximately 1,600 feet upstream of where Chinook salmon are known or expected to occur.

[1] Average annual daily traffic, vehicles per day

Treated water discharged from TDA 7 South will travel primarily through pipes before entering McAleer Creek, limiting opportunities for infiltration and other types of incidental improvements to water quality between the treatment facilities and fish-bearing waters.

Because most of the stormwater runoff from PGIS in the project area comes from sources other than the Lynnwood Link Extension, NMFS suggested that Sound Transit employ a "pipe-within-a-pipe" approach when using the HI-RUN model to analyze project-related stormwater impacts. This approach assumes that stormwater from the new PGIS resulting from the Lynnwood Link Extension will not combine with water from other sources before reaching the discharge point. In other words, the pipe-within-a-pipe approach recognizes the need to consider the project's contribution to water quality independently of the much greater contribution of contaminants from I-5 and other sources. The results of these model runs are presented on the following pages and summarized below.

The model results using this approach show that pollutant loading in TDAs 3, 4, and 7 North will decrease compared to current conditions. This conclusion is based on the P(exceed) values generated by the model (WSDOT 2008). P(exceed) values less than 0.50 represent conditions under which runoff quality is expected to improve. Given the inherent uncertainty and variability in the data, a P(exceed) threshold value of 0.45 was selected to provide a level of confidence that proposed conditions would not be degraded when compared to background conditions (WSDOT 2008). The P(exceed) values for dissolved copper in these three TDAs range from 0.00 to 0.34 and the values for dissolved zinc range from 0.00 to 0.25. These results are consistent with expectations based on the combined effects of treating all new PGIS and removing some areas of existing PGIS in these TDAs, and of treating an additional 0.83 acre of existing PGIS in TDA 3, sub-basin 1.

In TDA 7 South, the HI-RUN model results indicate the potential for increased pollutant loadings, with P(exceed) values of 0.74 and 0.61 for dissolved copper and dissolved zinc, respectively, necessitating the use of the dilution subroutine for a closer look at the potential for adverse effects on ESA-listed fish. The output of the dilution subroutine presents a conservative distance (mixing zone) downstream of the outfall, where there is a 5 percent chance that pollutant concentrations will exceed thresholds for effects on fish. The established thresholds are based on potential increases of 2.0 μg/L above background concentrations of dissolved copper and 5.6 μg/L above background concentrations dissolved zinc.

The dilution subroutine showed mixing zone distances less than 1 foot under both baseline and proposed conditions, indicating a minimal risk of adverse effects. During the November 19, 2014, meeting with representatives of Sound Transit and FTA, NMFS noted that modeled mixing zone distances less than 5 to 10 feet are typically considered to be consistent with an effects determination of "not likely to adversely affect."

Based on these results, the potential for stormwater runoff from the Lynnwood Link Extension to result in adverse effects on ESA-listed fish will be insignificant and discountable. The model results support the determination in the draft biological assessment that construction and operation of the Lynnwood Link Extension may affect but is not likely to adversely affect Puget Sound Chinook salmon and Puget Sound steelhead.

Literature Cited

WSDOT (Washington State Department of Transportation). 2008. Highway runoff dilution and loading model user's guide: analysis of highway stormwater water quality effects for Endangered Species Act consultations. Prepared by Herrera Environmental Consultants, Inc. Seattle, WA. October 6, 2008.

HI-RUN Pollutant Loading Subroutine Modeling (Pipe-Within-Pipe) Input and Results for the Lynnwood Link Extension

TDA 3

Input Summary

Outfall ID: LLE TDA 3
Rain Gauge: Puget East 36
Description:

Discharge Areas
    Subbasin 1 - Baseline Conditions - 1.29 acres
        no treatment - 0% infiltration - 1.29 acres

    Subbasin 1 - Proposed Conditions - 1.11 acres
        enhanced treatment - 20% infiltration - 1.11 acres
            (includes 0.28 acre of new PGIS and 0.83 acre of existing PGIS)

    Subbasin 2 - Baseline Conditions - 0.26 acres
        no treatment - 0% infiltration - 0.26 acres

    Subbasin 2 - Proposed Conditions - 0.33 acres
        enhanced treatment - 20% infiltration - 0.33 acres

    Subbasin 3 - Baseline Conditions - 0.44 acres
        no treatment - 0% infiltration - 0.44 acres

    Subbasin 3 - Proposed Conditions - 0.98 acres
        enhanced treatment - 20% infiltration - 0.98 acres

Load Analysis

	Dissolved Copper Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	**Proposed**	**Baseline**	**Proposed**
Max	1.43	0.54	24	3.1
75th Percentile	0.083	0.047	0.672	0.25
Median	0.047	0.03	0.351	0.16
25th Percentile	0.026	0.02	0.183	0.099
Min	0.002	0.001	0.006	0.01
P (exceed)		**0.342**		**0.247**

TDA 4

```
Input Summary
-------------------------------------------------------------------------------------
Run Date/Time: 11/25/14 15:30
Outfall ID: LLE TDA 4 pipe-within-pipe
Rain Gauge: Puget East 36
Description:
-------------------------------------------------------------------------------------
Discharge Areas

    Subbasin 1 - Baseline Conditions - 0.14 acres
        no treatment - 0% infiltration - 0.14 acres

    Subbasin 1 - Proposed Conditions - 0.21 acres
        enhanced treatment - 80% infiltration - 0.01 acres
        infiltration bmp  - 100% infiltration - 0.2 acres
```

Load Analysis

	Dissolved Copper Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	**Proposed**	**Baseline**	**Proposed**
Max	0.1	0	1.69	0.001
75th Percentile	0.006	0	0.047	0
Median	0.003	0	0.025	0
25th Percentile	0.002	0	0.013	0
Min	0	0	0	0
P (exceed)		**0**		**0**

(Note that all new PGIS in this TDA will be treated in an infiltration facility; in order for the HI-RUN model to accept the input values, it was necessary to model 0.01 acre of the new PGIS as receiving enhanced treatment rather than being infiltrated.)

TDA 7 North

Input Summary

Run Date/Time: 12/1/14 16:03
Outfall ID: LLE TDA 7 North
Rain Gauge: Puget East 36
Description:

Discharge Areas

Subbasin 1 - Baseline Conditions - 0.69 acres
no treatment - 0% infiltration - 0.69 acres

Subbasin 1 - Proposed Conditions - 0.4 acres
enhanced treatment - 20% infiltration - 0.4 acres

Load Analysis

	Dissolved Copper Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	**Proposed**	**Baseline**	**Proposed**
Max	0.516	0.085	6.88	0.54
75th Percentile	0.029	0.008	0.233	0.041
Median	0.016	0.005	0.122	0.026
25th Percentile	0.009	0.003	0.063	0.016
Min	0	0	0.002	0.001
P (exceed)		**0.132**		**0.094**

TDA 7 South

Input Summary

Run Date/Time: 12/1/14 16:12
Outfall ID: LLE TDA 7 South
Rain Gauge: Puget East 36
Description:

Baseline conditions - 0.44 acres
no treatment - 0% infiltration - 0.44 acres

Proposed Conditions - 2.45 acres
Enhanced - 20 % Infiltration - 1.22 acres with detention
Enhanced - 20 % Infiltration - 0.44 acres
infiltration bmp - 100 % infiltration - 0.79 acres

Load Analysis

	Dissolved Copper Load (lb/yr)		Dissolved Zinc Load (lb/yr)	
	Baseline	Proposed	Baseline	Proposed
Max	0.372	0.41	6.06	2.6
75th Percentile	0.018	0.032	0.147	0.17
Median	0.01	0.021	0.077	0.11
25th Percentile	0.006	0.013	0.041	0.068
Min	0	0	0.001	0.004
P (exceed)		**0.742**		**0.609**

HI-RUN Dilution Subroutine Modeling (Pipe-Within-Pipe) Input and Results for TDA 7 South

Project: LLE TDA 7 South
Precipitation Series: Puget East 36
Description:

Background Concentrations (mg/L)
Dissolved Copper: 0.001
Dissolved Zinc: 0.003

Baseline Conditions:
No Treatment Infiltration 0% - 0.44 acres

Proposed Conditions:
Enhanced Treatment Infiltration 20% - 1.22 acres with detention
Enhanced Treatment Infiltration 20% - 0.44 acres
Infiltration BMP - 100% infiltration - 0.79 acres

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	Depth (ft)	1	0.93	0.93	0.86	0.78	0.72			0.73	0.81	0.97	1.02
	Velocity (fps)	1.48	1.39	1.38	1.28	1.16	1.07			1.09	1.21	1.44	1.52
	Width (ft)	11	10.4	10.3	9.5	8.6	7.9			8.1	9	10.7	11.3
	Manning Roughness	0.035	0.035	0.035	0.035	0.035	0.035			0.035	0.035	0.035	0.035
	Discharge Distance (ft)	0	0	0	0	0	0			0	0	0	0
Distance Downstream in feet to Meet Biological Threshold													
Dissolved Copper	Baseline	< 1	< 1	< 1	< 1	< 1	< 1			< 1	< 1	< 1	< 1
	Proposed	< 1	< 1	< 1	< 1	< 1	< 1			< 1	< 1	< 1	< 1
Dissolved Zinc	Baseline	< 1	< 1	< 1	< 1	< 1	< 1			< 1	< 1	< 1	< 1
	Proposed	< 1	< 1	< 1	< 1	< 1	< 1			< 1	< 1	< 1	< 1